A STUDY OF DIASTOLIC DYSFUNCTION IN PATIENTS OF TYPE-2 DIABETES MELLITUS IN RURAL POPULATION OF WESTERN UTTAR PRADESH

Manoj Kumar[1], Rajesh Kumar Gautham[2], Prem S. Singh[3], Granth Kumar[4], Priyesh Kant[5], Himanshu Sharma[6], Tony Pious[7], Sudhir K. Yadav[8]

[1]Associate Professor, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[2]Postgraduate, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[3]Professor, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[4]Assistant Professor, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[5]Senior Resident, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[6]Postgraduate, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[7]Postgraduate, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.
[8]Postgraduate, Department of Medicine, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India.

ABSTRACT

BACKGROUND

Diabetes mellitus is a disease with multisystem involvement. Most common cardiovascular complications of diabetes mellitus is the presence of diabetic cardiomyopathy. Diastolic left ventricular dysfunction may be early sign of diabetic cardiomyopathy, which is easily accessed by echocardiography.

The aim of the study is to study the prevalence of left ventricular diastolic dysfunction (LVDD) in asymptomatic, non-hypertensive patients of diabetes mellitus.

MATERIALS AND METHODS

A study was carried out on 110 diabetic patients. All the patients were subjected to detailed history, physical examination and specific investigations were done to find out the prevalence of diastolic dysfunction.

RESULTS

Diastolic dysfunction was present in 79.10% of patients. Diastolic dysfunction was present more in female than male (52.88% vs. 47.12%). Grade 1 diastolic dysfunction was the commonest form of diastolic dysfunction followed by grade 2 and grade 3. Diastolic dysfunction was positively correlated with HbA1c level (r=0.191, p=0.046), duration of diabetes (p-value <0.05, r=0.651) and advancing age (r=0.505, p<0.05).

CONCLUSION

Echocardiography is a sensitive method to investigate for diastolic dysfunction. There is a high prevalence of diastolic dysfunction in diabetes, which is an early marker of diabetic cardiomyopathy.

KEYWORDS

Diastolic Dysfunction, Diabetes, Echocardiography, Diabetic Cardiomyopathy.

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BACKGROUND

Diabetes Mellitus (DM) is a common endocrine disorder affecting approximately 382 million people worldwide.[1] According to The Indian Council of Medical Research-Indian Diabetes Study (ICMR-INDIAB), India has 62.4 million people with DM.[2] The majority (>90%) of them have Type 2 DM (T2DM).[3]

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Corresponding Author:
Dr. Manoj Kumar,
Associate Professor, Department of Medicine,
U.P. University of Medical Sciences,
Saifai, Etawah, Uttar Pradesh, India.
E-mail: manojdr2006@gmail.com
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Cardiomyopathy is a pathological condition in which the Left Ventricle (LV) progresses to a state of asymptomatic LV Dysfunction (LVD) which is commonly seen in asymptomatic patients with type 2 DM.[4,5] Various studies have shown that the prevalence of asymptomatic Left Ventricular Diastolic Dysfunction (LVDD) in T2DM patients ranges from 25% to 60%.[6,7]

Diabetes is associated with a number of complications such as retinopathy, nephropathy, peripheral neuropathy and cardiovascular disease. Cardiovascular disease is the most common complication of diabetes and is a major risk factor for Heart Failure (HF) with preserved ejection fraction (HFpEF).[8-10] Cardiovascular complications are the leading cause of death in diabetic patients.[11] Diabetes and Heart Failure (HF) commonly coexist. A recent study in Olmsted County, MN, USA, has shown that the prevalence of diabetes

in HF patients has increased markedly over time (3.8% per year).[12] Approximately, 50% cases of Heart Failure (HF) are having Preserved Ejection Fraction (HFpEF).[13] Recent studies suggest that the prevalence of HFpEF relative to HF with Reduced Ejection Fraction (HFrEF) is increasing at a rate of 1% per year. Risk factors for high prevalence of HFpEF are increasing age, hypertension, obesity and Diabetes Mellitus (DM). Similarly, hospitalisations due to HFpEF have been rising relative to HFrEF.[14,15]

Echocardiography with Doppler readily assesses left ventricular (LV) diastolic function. Echocardiography is a noninvasive, portable and readily available investigation, which can provide an accurate and comprehensive assessment of LV systolic and diastolic function. Tissue Doppler Imaging (TDI) has been useful in demonstrating impaired LV relaxation with preserved Left Ventricular Ejection Fraction (LVEF). The LV diastolic function assessed by transmitral flow velocities (E and A, and E/A), Deceleration Time (DT), pulmonary venous Doppler flow pattern, Isovolumetric Relaxation Time (IVRT), left atrial volume and Pulmonary Artery (PA) pressures are accurate assessment of LV filling pressures.[16]

Such type of studies have not been conducted in rural population. The aim of our study is to assess the left ventricular diastolic function in patient with type 2 diabetes mellitus in rural population, so that with the help of early appropriate intervention, cardiac morbidity and mortality can be reduced.

MATERIALS AND METHODS

This cross-sectional study was conducted in UPUMS Hospital, Saifai, Etawah, U.P., India, between June 2015 to May 2016. Study was initiated after taking permission from institute ethical committee. Patients between 18 to 55 years of age with diagnosed type 2 DM within 5 years of duration were included in the study. All patients suffering from cardiac diseases like valvular heart disease, ischaemic and hypertensive heart disease, congestive heart failure, cardiomyopathy of any cause, end-stage renal failure, chronic pulmonary disease, severe anaemia and haemoglobinopathies were excluded from the study. Informed consent was taken from all patients prior to study. Total 110 cases of type 2 DM were studied. The diagnosis of diabetes was made on the basis of American Diabetic Association (ADA) recommendations.[17] A detailed clinical history specially related to cardiovascular symptoms was taken. A complete general and systemic examination was done to exclude the involvement of cardiovascular system.

Investigations like random blood glucose, Fasting Plasma Glucose (FPG), the 2-hrs. Postprandial Plasma Glucose (2-hrs. PPG), glycosylated haemoglobin (HbA1c), renal function tests, Fasting Lipid Profile (FLP) including serum triglycerides level (TG), LDL, HDL, VLDL, ECG, routine urine and microscopic study, fundus copy and chest radiography were done in all patients. Echocardiography was done by "Esaote" echocardiographic machine. Diastolic dysfunction was evaluated according to recommendations of the American Society of Echocardiography and the European Association of Cardiovascular Imaging.[18]

Pulsed-Wave Doppler (PWD) derived transmitral inflow velocities in apical 4 chamber view were obtained by using sample volume placed at the mitral valve leaflet tips. Measurements included the transmitral early diastolic rapid filling (E-wave) and late filling (A-wave) velocities to calculate E/A ratio, Isovolumetric Relaxation Time (IVRT), Deceleration Time (DT) and pulmonary vein flow pattern. The mitral annulus velocity was obtained using Tissue Doppler Imaging (TDI) with a 2-mm sample volume placed at septal and lateral side of the mitral annulus. Left ventricular systolic ejection fraction was calculated by modified Simpson's method and Left Ventricular Ejection Fraction (LVEF) ≥50% was considered as normal. Averages of all measurement over three consecutive cardiac cycles were taken by a single investigator blinded to all other variables. Diastolic dysfunction was labeled according to the standard guidelines.

Grading of Left Ventricular Diastolic Dysfunction

Grade 1- Delayed relaxation time, i.e. E/A <1.
Grade 2- Pseudonormalisation.
Grade 3- Reversible restrictive pattern.
Grade 4- Irreversible restrictive pattern.

Statistical Analysis

Statistical analysis was done using SPSS software version-20 (Statistical Package for the Social Sciences). Continuous variables were presented as mean and standard deviation and categorical variables were presented as percentage. For comparison, t-test and Chi-square test (x^2) was used while for correlation Pearson correlation analysis was used. A p-value <0.05 was considered statistically significant.

RESULTS

General characteristics of the participants are shown in Table 1. Diastolic dysfunction was present in 87 (79.10%) cases among them 41 (47.12%) were males and 46 (52.88%) were females. Out of 87 cases of LVDD, 57.47% cases of grade 1 LVDD (27 males and 23 females) and 34.48% cases of grade 2 LVDD (13 males and 17 females) were found. Grade 3 LVDD were 8.05% (3 males, 4 females). Pattern of diastolic dysfunction is shown in Figure 1. A significant positive correlation between higher HbA1c level and diastolic dysfunction have been found in our Study (r=0.191, p=0.046, Figure 2). Longer duration of diabetes and increasing age of the patients were significantly associated with LVDD ((p=<0.05, r=0.651) (p=<0.05, r=0.505, Figure 3, 4)).

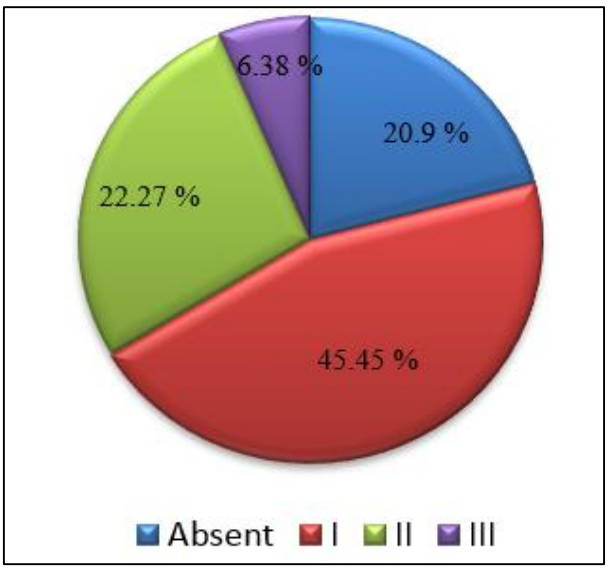

Figure 1. Pie Diagram Showing Prevalence of Grade of Left Ventricular Diastolic Dysfunction (LVDD) in Study Population

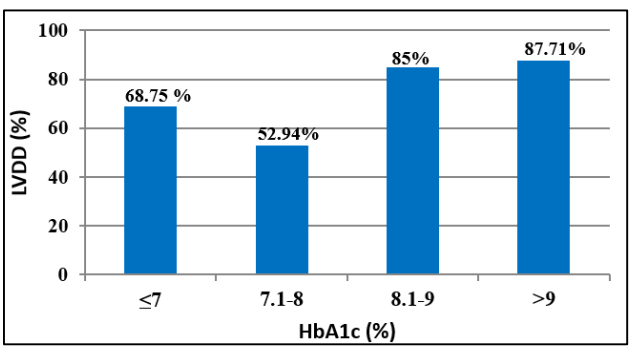

Figure 2. Bar Diagram Showing Analysis of the LVDD with HbA1c Level. The Diastolic Dysfunction was More Prevalent in the Patients with Higher HbA1c Level (r=0.191, p=0.046)

Age, years	47.3364 ± 6.25934
Male, %	43.6
Female, %	56.4
Heart rate, beats per min.	68 ± 12
Systolic BP, mmHg	122 ± 12
Diastolic BP, mmHg	74 ± 8
BMI	23.2936 ± 2.18205
Plasma fasting glucose, gm/dL	203.6818 ± 40.315710
Glycated haemoglobin, %	9.2164 ± 1.76438
Plasma triglycerides	104.0090909 ± 29.68318817
Total cholesterol	186.0545 ± 36.57413
HDL, mg/dL	49.51818 ± 8.426402
LDL, mg/dL	113.0909 ± 25.905
Creatinine, mg/dL	0.4656 ± 0.29555
EF, %	59.9 ± 2.5

Table 1. Baseline Characteristics of Patients

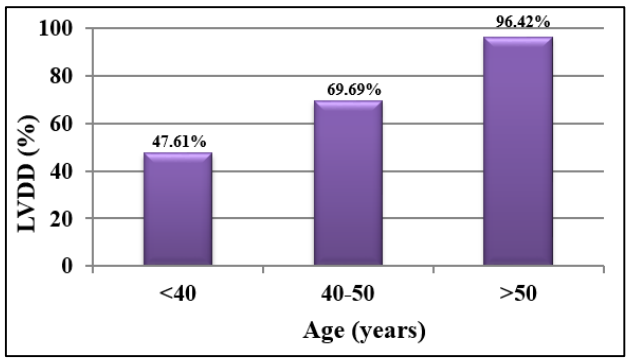

Figure 3. Bar Diagram Shows Correlation of the LVDD with Age. The Diastolic Dysfunction was More Prevalent in Age Group above 50 Years, (r=0.505, p<0.05)

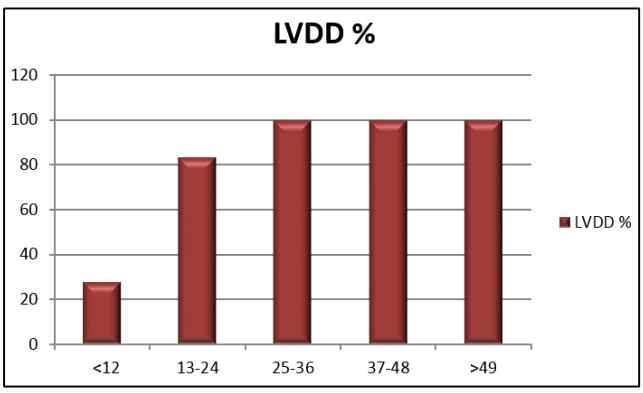

Figure 4. Bar Diagram Shows Correlation of the LVDD with Duration of Diabetes (p-value <0.05, r=0.651)

DISCUSSION

In present study we assessed the pattern of LVDD and its correlation with HbA1C and other parameters like age, duration of diabetes, BMI and total serum cholesterol.

LVDD was found in 79.10% of patients in this study with a predominance of grade I LVDD (57.47%). Study demonstrated high prevalence of diastolic dysfunction in asymptomatic type 2 diabetes patients. However, in a study conducted in 127 asymptomatic subjects Patil et al found that the prevalence of diastolic dysfunction in asymptomatic type 2 diabetics was 54.33%.[19] Higher prevalence in our study could be attributed to lack of awareness about early initiation of antidiabetic therapy in rural population. Chaudhary AK, et al study in a study on 100 diabetic patients found that diastolic dysfunction was present in 41%. Diastolic dysfunction was prevalent in 10% of patients in age group of 30-39 years, 24% of patients with age group 40-49 years. Among the age group of 50-60 years, diastolic dysfunction was most prevalent (66%).[20] The pattern of diastolic dysfunction in different age group in our study is also similar to this study though the prevalence is higher in our study. Study done by Shreshta et al in 100 asymptomatic type 2 diabetes mellitus showed that LVDD was present in 71% subjects.[21] Holzmann et al showed in a middle-aged population without previously diagnosed DM a continuous relationship between concentrations of fasting plasma glucose, HbA1c and LVDD.[22] Earlier studies were also consistent with the findings of our study.

CONCLUSION

This study has shown that higher HbA1C level (>7.5) is associated with higher prevalence of LVDD. HbA1c has emerged as an important indicator of diastolic dysfunction in diabetic population, whereas age and duration of diabetes are also important risk factors for LVDD in these patients.

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