ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

ORIGINAL RESEARCH

Study of left ventricular diastolic dysfunction in type 2 diabetes mellitus patients

[1]Dr. Hariprasad. S, [2]Dr. Basavaraj Machnur, [3]Dr. Neha Sukhani

[1-3]Associate Professor, Department of General Medicine, Raichur Institute of Medical Sciences, Raichur, Karnataka, India

Corresponding Author
Dr. Basavaraj Machnoor
Associate Professor, Department of General Medicine, Raichur Institute of Medical Sciences, Raichur, Karnataka, India

Received: 23 April, 2023 Accepted: 25 May, 2023

Abstract

Introduction: Poor glycaemic control is associated with a greater risk of development of heart failure in diabetic patients. This study aimed to analyse the left ventricular dysfunction among type – 2 diabetes mellitus patients.

Materials and Methodology: A total of 50 patients with type-2 Diabetes Mellitus and 50 patients with age and gender matched controls taken for study. Those patients aged between 40 and 75 years, no symptoms or history of overt heart disease (cardiomyopathy, coronary artery disease, or valvular heart disease), no signs and symptoms of any associated cerebrovascular disease and who will voluntarily provide consult for enrolment are included in the present study.

Results: The age of the patients who were included in the study is 40 years and higher with a mean age of 53.75 years. Out of these 50 participants, 36 were reported to be males and 14 were females. Table – 1 revealed that 60% of the total participants have reported to be diagnosed with diabetes with the duration of 2-5 years and the remaining 40% have diabetes mellitus with the duration of 6 – 10 years.

Conclusion: Diastolic dysfunction is relatively higher in prevalence among patients with type – 2diabetes and showed some positive correlation with HbA1c level, obesity and most importantly duration of diabetes.

Keywords: diastolic dysfunction, LVDD, diabetes mellitus

Introduction

Diabetes mellitus could be recognized as a long standing life style related condition that could pose a major health problem having high morbidity and is quite rapidly spreading in nature. It has been estimated that, by the end of 2045, diabetes mellitus affected patients constitute almost around 9.9% of the total world population. Type II diabetes is commonly diagnosed since the high prevalence of obesity and increased sedentary lifestyle in humans.

The unquestionable two-way relationship between type – 2 diabetes mellitus (T2DM) and cardiovascular diseases acts majorly as a critical cycle wherein the former that is T2DM increases the chances of precipitating the cardiovascular risks and illnesses that majorly include various complications, morbidity and even mortality in few cases.[2]T2DM patients might have the increased chances of developing cardiovascular diseases without experiencing or identifying any noticeable or tell-tale signs and symptoms till the late stage. These sub-

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

clinical manifestations are quite difficult to recognize and study which makes this combo an extremely enigmatic in many of the clinical scenario.[3]

T2DM is considered to be a heterogeneous disorder which is mainly characterized by variable levels of insulin resistance, impaired insulin secretion and increased glucose production. This metabolic dysregulation that is associated with DM could easily lead to secondary pathological changes in multiple organs that could eventually lead to long-term complications resulting in permanent disability or finally death.[4-6]

Diastolic dysfunction is defined as a disturbance in ventricular relaxation, distensibility or filling regardless of normal or reduced ejection fraction (EF), which results in development of diastolic heart failure (DHF). A number of epidemiological and clinical arguments suggest that diastolic abnormalities may contribute to the high morbidity and mortality among patients with diabetes.[7]Four main causes for development of heart failure in Diabetic cardiomyopathy are microangiopathy and related endothelial dysfunction, metabolic alterations including abnormal glucose use and increased fatty acid oxidation, generation and accumulation of free radicals and alteration in ion homeostasis especially calcium transients.[8]

Thus this study has been carried out to to access left ventricular diastolic dysfunction in type 2 diabetes mellitus patients and compare doppler echocardiography parameters of left ventricular (LV) diastolic function between uncomplicated type 2 diabetes mellitus (DM2) and normo-glycemic control subjects.

Materials and methodology

This study is a prospective study on type -2 Diabetes Mellitus patients referred to the outpatient clinical department of RIMS teaching Hospital, Raichur Institute of Medical Sciences, Karnataka. The study period is from September 2022 to February 2023, after getting clearance from institutional ethics committee and informed written consent from each subject.

A total of 50 patients with type-2 Diabetes Mellitus of both the gender who matched normoglycemic control subjects, those patients aged between 40 and 75 years, no symptoms or history of overt heart disease (cardiomyopathy, coronary artery disease, or valvular heart disease), no signs and symptoms of any associated cerebrovascular disease and who will voluntarily provide consult for enrolment are included in the present study.

Patients with LVEF of less than 55%, regional LV wall motion abnormalities and valvular heart diseases assessed by ECHO, type 1 diabetes mellitus, severely uncontrolled diabetes mellitus (defined as glycated hemoglobin > 12%), uncontrolled blood pressure at rest (defined as systolic blood pressure > 180 mm Hg or diastolic blood pressure > 100 mm Hg) were excluded from the study.

Total hemoglobin and HbA1c concentrations are measured colorimetrically and immunotur bidimetrically respectively after haemolysis of the anticoagulated whole blood specimen. The ratio of both concentrations yields the final percent HbA1c results. Blood glucose are calculated by glucose oxidase peroxidase enzymatic methodThe data collected are analysed and expressed as Mean ± SD. Chi – square test and Student's unpaired test will be applied. All p values of < 0.05 were considered statistically significant. . Statistical analysis was done using the software (SPSS, version 20.0, SPSS).

Results

The age of the patients who were included in the study is 40 years and higher with a mean age of 53.75 years. Out of these 50 participants, 36 were reported to be males and 14 were females. Table – 1 revealed that 60% of the total participants have reported to be diagnosed with diabetes with the duration of 2-5 years and the remaining 40% have diabetes mellitus with the duration of 6 – 10 years.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

Table – 2 summarised that 66% of the participants of diabetes with duration of 2 – 5 yearsobserved to have been seen with diastolic dysfunction and 75% of patients with diabetes with 6 – 10 years duration have diastolic dysfunction.

Table – 3 tabulated the correlation of various chronic complications with respect to gender revealed female predilection of about 85% having diastolic dysfunction. Table – 4 showed the total incidence of diastolic dysfunction among the study participants wherein

Table 1: Age distribution

Age	No. of patients	With LVDD (%)	Without LVDD (%)
40 – 45 years	5 (10)	2 (4)	3
46 – 50 years	16 (32)	12 (21)	4
51 – 55 years	12 (24)	8 (16)	4
56 – 60 years	6 (12)	5 (10)	1
61 – 70 years	11 (22)	8 (16)	3
Total	50	35	15

Table – 2: Diastolic dysfunction of diabetes mellitus with duration of diabetes

Duration (years)	With LVDD	Without LVDD
2 – 5 (30 patients)	21	9
6 – 10 (20 patients)	15	5

Table – 3: Diastolic dysfunction of diabetes mellitus with gender

Gender	With LVDD	Without LVDD
Males (36 patients)	24	12
Females (14 patients)	12	2

Table – 4: Total number of patients with diastolic dysfunction

No. of patients	With LVDD	Without LVDD
50	36	14

Discussion

From the study, it has been found that the pre-clinical diastolic dysfunction is briefly defined as diastolic dysfunction with normal systolic function and no other symptoms of heart failure. The duration of diabetes with 6-10 years had reportedly seemed to have higher incidence of diastolic dysfunction. Diastolic dysfunction was significantly higher in patients with aged more than 45 years.

A study conducted by *Boyers*et al[9] revealed that the prevalence of left ventricular diastolic dysfunction in asymptomatic normotensive patients with type – 2 diabetes is relatively high. Another study by *Masugata*et al[10] in their study among normotensive patients revealed that the diastolic dysfunction without LVDD in patients with well-controlled type – 2 diabetes is not related with hypertension or left ventricular hypertrophy but it is indirectly related to aging and duration of type – 2 diabetes mellitus.

*Exiara*et al[11] in their study stated that the prevalence of LVDD among normotensive, asymptomatic and in well controlled diabetes patients is relatively high and relatively increases with age. Similarly *Sacre*et al[12] insisted that there was a independent association between global cardiac autonomic neuropathy and LVDD among patients with type – 2 diabetes mellitus. Likewise *Poanta L*et al[13] in their study among 58 patients revealed that cardiac autonomic neuropathy with LVDD in patient with type – 2 diabetes but without any clinical manifestations of the heart diseases. *Poirier*et al[14] in their study observed that the

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

diastolic dysfunction and cardiac autonomic neuropathy are seen in patients in uncomplicated well controlled type – 2 diabetes mellitus.

Females have been reported to have higher prevalence of diastolic dysfunction when compared with males in spite of being males are outnumbered in numbers. From the above study, it has been studied that, there was higher prevalence of diastolic dysfunction in patients with asymptomatic type – 2diabetes and it was well correlated with age, duration and HbA1C. Additionally, the incidence of left ventricular diastolic dysfunction among patients with type – 2diabetes are relatively high. Also there was a direct relation between the duration of diabetes and the diastolic dysfunction and significantly higher rate of diastolic dysfunction was seen in patients with diabetes duration of more than 5 years.

Conclusion

Diastolic dysfunction is relatively higher in prevalence among patients with type – 2diabetes and showed some positive correlation with HbA1c level, obesity and most importantly duration of diabetes.

References

1. Ogurtsova K, da Rocha FJ, Huang Y, Linnenkamp U, Guariguata L, Cho N et al (2017) IDF Diabetes Atlas: global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res ClinPract 128:40–50.
2. Kenny, H.; Abel, E. Heart Failure in Type 2 Diabetes Mellitus. Circ. Res. 2019, 124, 121–141.
3. Sharkey SW, Windenburg DC, Lesser JR, Maron MS, Hauser RG, Lesser JN, et al. Natural history and expansive clinical profi le of stress (tako-tsubo) cardiomyopathy. J Am CollCardiol 2010;55:333-41.
4. Marwick TH. Diabetic heart disease. Heart 2006;92:296-300.
5. Shehadeh A, Regan TJ. Cardiac concequences of diabetes mellitus. ClinCardiol 1995;18:301-5.
6. Raev DC. Which left ventricular function is impaired earlier in the evolution of diabetic cardiomyopathy? An echocardiographic study of young Type I diabetic patients. Diabetes Care 1994;17:633-9.
7. Elburki AR, Patil R, Amgrab EA. Assessment of Diastolic Dysfunction in Normotensive Asymptomatic Type II Diabetes Mellitus and Correlation with Pulmonary Artery Pressure.
8. Jain S, Nawal C, Singh A, Chejara RS, Barasara S, Marker S. Echocardiographic evaluation of left ventricular diastolic dysfunction.
9. Boyer JK, Thanigaraj S, Schechtman KB, Pérez JE. Prevalence of ventricular diastolic dysfunction in asymptomatic, normotensive patients with diabetes mellitus. Am J Cardiol 2004;93:870-5.
10. Masugata H, Senda S, Goda F, Yoshihara Y, Yoshikawa K, Fujita N, et al. Left ventricular diastolic dysfunction in normotensive diabetic patients in various age strata. Diabetes Res ClinPract 2008;79:91-6.
11. Exiara T, Konstantis A, Papazoglou L, Kouroupi M, Kalpaka A, Mporgi L, et al. Left ventricular diastolic dysfunction in diabetes mellitus Type 2. J Hypertens 2010;28:e294.
12. Sacre JW, Franjic B, Jellis CL, Jenkins C, Coombes JS, Marwick TH. Assocation of cardiac autonomic neuropathy with subclinical myocardial dysfunction in Type 2 diabetes. JACC Cardiovasc Imaging 2010;3:1207-15.
13. Poanta L, Fodor D, Albu A. Left ventricular function in patients with uncomplicated well-controlled diabetes mellitus. Med Ultrason 2010;12:184-7.