

STUDY OF LEFT VENTRICULAR DYSFUNCTION IN NORMOTENSIVE TYPE 2 DIABETIC PATIENTSPradeep Nigam¹, Suraj Kathuria², Manoj Indurkar³¹Associate Professor, Department of Medicine, Shyam Shah Medical College and Associated SGM and GM Hospital, Rewa, Madhya Pradesh.²Final Year Postgraduate Student, Department of Medicine, Shyam Shah Medical College and Associated SGM and GM Hospital, Rewa, Madhya Pradesh.³Professor and HOD, Department of Medicine, Shyam Shah Medical College and Associated SGM and GM Hospital, Rewa, Madhya Pradesh.**ABSTRACT****BACKGROUND**

Diabetes mellitus (DM) is known to affect cardiovascular system adversely. Various studies reported left ventricular dysfunction (LVD) as an early sign of cardiac involvement in asymptomatic patients with type 2 DM, diagnosed using Colour Doppler echocardiography. With this background, the study was conducted with an aim to study the prevalence of left ventricular dysfunction in normotensive asymptomatic type-2 DM patients.

MATERIALS AND METHODS

The descriptive comparative study was carried out among the type 2 DM patients. 100 patients of diabetes mellitus with age > 35 years were included in the study. The patients were taken from OPD and indoor wards of medicine department and patients without the history of hypertension, heart diseases and renal dysfunction were recruited on a convenient basis. Demographic data such as age, sex, history, duration, treatment of DM, investigations like fasting and postprandial blood sugar levels, serum creatinine, fasting lipid profile, HbA1c and also ECG, 2D echocardiography were carried out. Data were entered in MS Excel spread sheet and analysed with the help of SPSS software packages and Statistical analysis was done by using percentages, mean values, standard deviation, standard error, χ^2 test (Chi-square test) (with Yates correction) and t-test (unpaired).

RESULTS

16 (16%) patients had significantly decreased ejection fraction of < 50% out of 100, 82 (82%) patients had A/E ratio of > 1 among 100 patients. A strong association of LVD with severity of Diabetes HbA1c ($p < 0.001$) was observed, but there was no correlation with duration of Diabetes.

CONCLUSION

Uncontrolled diabetes with high level of HbA1c were found to have a strong association with LVD. It is recommended that all patients with long-term and uncontrolled type 2 DM should be screened for LVD.

KEYWORDS

LVD, Duration of Diabetes, HbA1c, Diabetic Cardiomyopathy.

HOW TO CITE THIS ARTICLE: Nigam P, Kathuria S, Indurkar M. Study of left ventricular dysfunction in normotensive type 2 diabetic patients. J. Evolution Med. Dent. Sci. 2018;7(03):324-327, DOI: 10.14260/jemds/2018/72

BACKGROUND

Diabetes mellitus is a chronic multisystem disorder. According to World Health Organisation (WHO), the term diabetes mellitus describes a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Globally, an estimated 422 million adults are living with diabetes mellitus, according to the latest 2016 data from the World Health Organisation (WHO). Diabetes prevalence is increasing rapidly; previous 2013 estimates from the International Diabetes Federation put the number at 381 million people having diabetes.

'Financial or Other Competing Interest': None.
Submission 24-11-2017, Peer Review 26-12-2017,
Acceptance 04-01-2018, Published 13-01-2018.

Corresponding Author:

Dr. Pradeep Nigam,

E-13, Old Doctors Colony,

Shyam Shah Medical College,

Rewa, Madhya Pradesh.

E-mail: dnigamdrp@yahoo.co.in

DOI: 10.14260/jemds/2018/72



The number is projected to almost double by 2030. Type 2 diabetes makes up about 85% - 90% of all cases. Increases in the overall diabetes prevalence rates largely reflect an increase in risk factors for type 2, notably greater longevity and being overweight or obese. The increase in incidence in developing countries follows the trend of urbanisation and lifestyle changes including increasingly sedentary lifestyles, less physically demanding work and the global nutrition transition, marked by increased intake of foods that are high energy-dense, but nutrient-poor (often high in sugar and saturated fats, sometimes referred to as the Western pattern diet).

Diabetes mellitus is independent risk factor for cardiovascular diseases (CVD). Cardiovascular diseases is the leading cause of diabetes-related death, responsible for up to three-fourths of all diabetic mortality. The factors which contribute to the increased incidence of cardiovascular diseases in diabetes mellitus is accelerated atherosclerosis, macrovascular complications, microvascular disease and cardiomyopathy. This pathophysiological phenomenon, directly or indirectly causes myocardial dysfunction, which is common and important determinant of cardiovascular morbidity.

MATERIALS AND METHODS

The present study entitled “Study of Left Ventricular Dysfunction in Normotensive type-2 diabetic patients by 2D echocardiography” was carried out in Department of Medicine SGMH and associate Shyam Shah Medical College, Rewa (MP) from July 2016 to June 2017. This descriptive comparative study comprises of 100 patients who are normotensive, diabetic and 80 normal healthy patients with age > 35 years were included in the study with convenient consecutive sampling after proper written informed consent. The patients were taken from OPD and indoor wards of medicine department with type 2 diabetes mellitus with fasting glucose more than 126 mg/ dL and/or 2-hr PP glucose more than 200 mg/dL were included in the study. Investigations like Fasting and Postprandial blood sugar levels, Serum creatinine, fasting lipid profile, HbA1c and ECG were carried out and Echocardiographic assessment was done by using Model HD7 XE Phillips 2D ECHO machine.

Inclusion Criteria

1. Patients with Diabetes mellitus who are Normotensive type 2 diabetic patients aged 35 - 65 yrs.
2. Patients with type 2 diabetes mellitus without any complications of diabetes.

Exclusion Criteria

- a. Patients with Pre-existing ischaemic heart disease.
- b. Thyroid Disease.
- c. Renal Disease.

Patients taken in the study were treated as per standard treatment schedule except beta blockers, which was withheld one week before Echocardiography. Data were entered in MS Excel spread sheet and analysed with the help of SPSS version 16 software packages and Statistical analysis was done by using percentages, mean values, standard deviation, standard error, χ^2 test (Chi-square test) (with Yates correction), t-test (unpaired). The level of significance used was 0.05 level for the corresponding degree of freedom to draw the inference. A p-value < 0.05 was considered statistically significant and a p > 0.05 was considered as not statistically significant with value < 0.001 as highly significant.

RESULTS

All the patients were evaluated for cardiac functions by non-invasive cardiac diagnostic techniques. Nomograms of 80 age and sex matched normal subjects were taken for comparison- **Group 1** - Type 2 diabetes mellitus patients (Study group). **Group 2** - Normal population (Control group).

Maximum number of patients were in the age group of 35-40 and least number of patients were in the age group of >60 present in our study. 50.0% of the male and 45.0% of the female were present and male: female ratio was 1.22:1. Majority of patients (76.0%) had duration of diabetes > 5 years and only 24.0% had duration of diabetes < 5 years and mean duration of diabetes in study group was 7.62 years (25 ± 19.30). In study group, mean FBS was 183.7±15.0 and PPBS was 252 ± 25.67 which were higher than control group. Hence, mean FBS and PPBS in study group was highly statistically significant (p < 0.001) as compared to control

group (Table 1). Maximum number of patients, i.e. 50.0% were in the range of HbA1c level from 7.1 to 8% and least number of the patients i.e. 12.0% were in the range of > 8.0%. 16% (16) of the patients had decreased EF < 50% out of 100 in the study group as compared to control group 2% (80), which is statistically significant i.e. p < 0.001 (Table 2). EF >50% were 84% present; in duration of diabetes mellitus from 5 to 15 years and patients with EF < 50% were 16% present in duration of diabetes mellitus from 5 to 15 years. There is no positive correlation of EF with the duration of diabetes mellitus (Table 3). A/E ratio > 1 was present in 82% of the patient in study group indicating Diastolic Dysfunction and A/E ratio <1 in study group and control group were 18% and 100% respectively. Hence, A/E ratio >1 were present only in study group, which was highly statistically significant (Table 4). Maximum number of patients with A/E > 1, i.e. 82% were in the duration of diabetes mellitus from 5 to > 15 yrs. and A/E < 1 i.e. 18% were in duration of the diabetes mellitus from 5 to > 15 yrs. Hence, there is no positive correlation of duration of diabetes mellitus with A/E ratio > 1 (Table 5). In the present study, 70 patients had IVRT of > 100. All these patients also had A/E ratio of > 1. IVRT was within normal range in 20 patients and it was < 60 msec in 10 patients who also had coexisting LV systolic dysfunction with ejection fraction of < 50%.

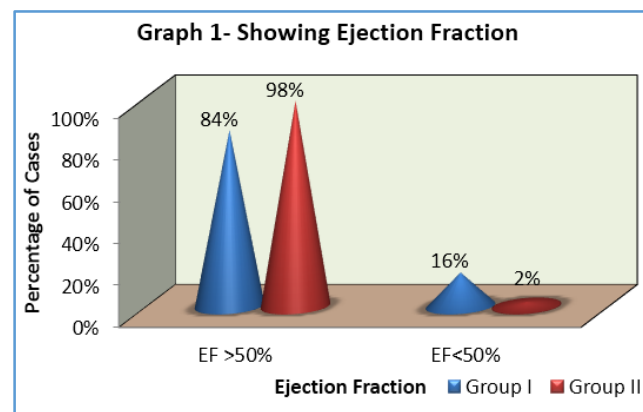
Mean Value

Sl. No.	Study Group	FBB	PPBS	P value
1	Study Group	183.7±15.0	252±25.67	P <0.001
2	Control Group	80.2±13.25	112.4±16.20	

Table 1. Table showing Blood Glucose Level

Sl. No.	Study Group	EF > 50%	EF < 50%	Total	P value
1	Study Group	84 (84%)	16 (16%)	100	P < 0.001
2	Control Group	80 (98%)	80 (2%)	80	

Table 2. Table showing Ejection Fraction

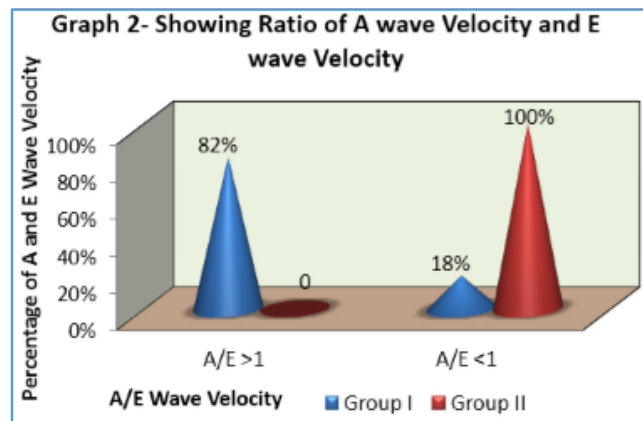


Sl. No.	Duration	EF >50%	EF <50%	Total
1	< 5 yrs.	21 (87.5%)	03 (12.5%)	24
2	5 to 10 yrs.	43 (82.69%)	09 (17.31%)	52
3	10 to 15 yrs.	14 (82.35%)	03 (17.65%)	17
4	> 15 yrs.	06 (85.71%)	01 (14.29%)	07
		84	16	100

Table 3. Table showing the Relation of Duration of DM with Ejection Fraction

Sl. No.	Group	A/E > 1	A/E < 1	Total	P value
1	Study Group	82 (82%)	18 (18%)	100	P <0.001
2	Control Group	00	80 (100%)	80	

Table 4. Table showing Ratio of A-Wave Velocity and E-Wave Velocity



Sl. No.	Duration	A/E > 1	A/E < 1	Total
1	< 5 yrs.	21(87.5%)	3(12.5%)	24
2	5 to 10 yrs.	42(80.76%)	10(19.24%)	52
3	10 to 15 yrs.	13(76.47%)	4(23.53%)	17
4	> 15 yrs.	06(85.71%)	01(14.29%)	7
		82	18	100

Table 5. Table showing the Duration of Diabetes Mellitus with A/E Ratio

DISCUSSION

In our study, mean age of the present study (47) was comparable to that of Poirie et al¹ (2003) (48 years), Khaliq et al² (2001) (51 years) and Boyer et al³ (2004) (49.8 years). In the present study, 50.0% of the male and 45.0% of the female were present which is comparable to Patil et al⁴ (2007) studies 50 diabetic patients of which 28 (56%) were male and 22 (44%) were female. Poantă et al⁵ (2010) studies 62 diabetic patients, of which 32 (51.62%) were male and 30 (48.38%) were female. The present study has mean duration of the disease as 7.6 years, which is comparable to that of Poirie et al¹ (2003) (4.8 years), Khaliq et al² (2001) (4 years) and Boyer³ (2004) (5.8 years).

The FBS (183 mg%) and PPBS (252 mg%) levels in the present study are significantly lower, which is comparable to study by Khaliq et al² (2001) showed the mean FBS of 203 ± 51 and mean PPBS of 261 ± 56. This may be because of factors like genetics and environmental factors, modes of management of diabetes and BMI.

In the present study, 16 (16%) patients had significantly decreased ejection fraction of < 50%. Whereas, Naik et al⁶ (2009) showed EF < 50% in 6% of diabetic patients and Khaliq et al² (2001) had 18 (28%) patients with ejection fraction < 50%.

Velocities of mitral A-wave A/E ratio were significantly higher in the present study indicating left ventricular diastolic dysfunction. In the present study, 82 patients had A/E ratio of > 1 constituting 82% of study group, which is comparable to that of Boyer et al and Valle et al which is 75% and 51% respectively. 18 patients had A/E ratio < 1. A/E > 1 is very sensitive and specific indicator of LV diastolic dysfunction. In the present study, the late atrial filling wave (A) was significantly increased, probably due to elevated LV

filling pressure secondary to impaired relaxation among diabetic individuals. The diastolic abnormalities in diabetic patients most likely to indicate reduced LV compliance secondary to small vessel disease, infiltrative myocardial process, metabolic derangement or a combination of the three.

Zarich et al⁷ (1988) and Papillolec et al⁸ (1989) reported that diabetics who had normal ejection fraction had evidence of diastolic dysfunction in the form of increased A/E ratio. They also found that LV fractional shortening was normal in majority of subjects who had increased A/E ratio among diabetics.

In the present study, there was no correlation of diastolic dysfunction with the duration of diabetes which is comparable to the study by Grandi et al⁹ (2006) who concluded that the severity of diabetes mellitus is more important than duration of diabetes mellitus for the development of diastolic dysfunction.

In the present study, the isovolumetric relaxation time (IVRT) showed mean and SD of 102 ± 20.14 as compared to IVRT mean of Poirie et al¹ (2003) and Boyer et al³ (2004) showing 109.11 msec and 79.14 msec respectively, which is statistically significant. The prolongation of IVRT more than 100 msec is a significant indicator of early LV diastolic dysfunction. In the present study, 70 patients had IVRT of > 100. All these patients also had A/E ratio of > 1. Hiramatsu¹⁰ (1992) and Papillolec et al⁸ (1989) showed in their studies that diabetic patients had greater isovolumetric relaxation time.

In the present study, echocardiographic evidence of LV diastolic dysfunction among asymptomatic type 2 diabetes mellitus patient was recognised in more than 50% of patients and systolic dysfunction was seen in only 16% of patients.

CONCLUSION

Cardiac dysfunction, predominantly involving LV diastolic function is commonly seen in asymptomatic normotensive Type 2 DM patients. Alteration of A/E ratio > 1 is a sensitive and specific indicator of early diastolic dysfunction. There is a positive correlation of diastolic dysfunction with severity of diabetes mellitus, but not with the duration of diabetes mellitus. Hence, severity of diabetes mellitus is more important than duration of diabetes mellitus because patient with short duration of diabetes mellitus but with uncontrolled blood glucose level can lead to early diastolic dysfunction in diabetic patients. LV diastolic dysfunction in asymptomatic normotensive patients with type 2 DM without evidence of coronary heart disease is significantly higher.

LV systolic dysfunction was seen in a small number of asymptomatic normotensive Type 2 DM, which may point towards prevalence of silent cardiac muscle disease in asymptomatic Type 2 DM.

Conventional echocardiography is a simple economical test for detecting LV dysfunction in normotensive, asymptomatic and type 2 diabetic patients, and should be applied to detect early Left ventricular dysfunction so that actively preventive and therapeutic treatment could be planned early to prevent long-term morbidity and mortality and LV functions may be preserved for long.

REFERENCES

- [1] Poirier P, Bogaty P, Philippon F, et al. Preclinical diabetic cardiomyopathy: relation of left ventricular dysfunction to cardiac autonomic neuropathy in men with uncomplicated well-controlled type 2 diabetes. *Metabolism* 2003;52(8):1056-61.
- [2] Annonu AK, Fattah AA, Mokhtar MS, et al. Left ventricular systolic and diastolic functional abnormalities in asymptomatic patients with non-insulin-dependent diabetes mellitus. *Journal of The American Society of Echocardiography* 2001;14(9):885-91.
- [3] Boyer JK, Thanigaraj S, Schechtman KB, et al. Prevalence of ventricular diastolic dysfunction in asymptomatic, normotensive patients with diabetes mellitus. *The American Journal of Cardiology* 2004;93(7):870-5.
- [4] Patil VC, Patil HV, Shah KB, et al. Diastolic dysfunction in asymptomatic type 2 diabetes mellitus with normal systolic function. *J Cardiovasc Dis Res* 2011;2(4):213-22.
- [5] Poantă L, Fodor D, Albu A. Left ventricular function in patients with uncomplicated well-controlled diabetes mellitus. *Med Ultrason* 2010;12(3):184-7.
- [6] Nakai H, Takeuchi M, Nishikage T, et al. Subclinical left ventricular dysfunction in asymptomatic diabetic patients assessed by two-dimensional speckle tracking echocardiography correlation with diabetic duration. *Eur J Echocardiogr* 2009;10(8):926-32.
- [7] Zarich SW, Arbuckle BE, Cohen LR, et al. Diastolic abnormalities in young asymptomatic diabetic patients assessed by pulsed Doppler echocardiography. *J Am Coll Cardiol* 1988;12(1):114-20.
- [8] Papillae C, Dahan M, Paycha F, et al. Prevalence and significance of left ventricular filling abnormalities determined by Doppler echocardiography in type 1 (insulin dependent) diabetic patients. *Am J Cardiol* 1989;64(16):1010-6.
- [9] Grandi AM, Piantanida E, Franzetti I, et al. Effect of glycemic control on left ventricular diastolic function in type 1 diabetes mellitus. *Am J Cardiol* 2006;97(1):71-6.
- [10] Hiramatsu K, Ohara N, Shigematsu S, et al. Left ventricular filling abnormalities in non-insulin-dependent diabetes mellitus and improvement by a short-term glycemic control. *Am J Cardiol* 1992;70(13):1185-9.