Study of Left ventricular Diastolic Dysfunction in Normotensive Type 2 Diabetes Mellitus in Western Rajasthan

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Abstract— *Diabetes Mellitus (DM) is one of the major risk factors for diastolic heart failure (DHF). So this study was undertaken on 75 cases of type 2 Diabetes Mallitus and 75 matched healthy controls to study the diastolic dysfunctions in normotensive type 2 Diabetes Mellitus. Normotensive type 2 Diabetes Mellitus 61.33%) showed LVDD in 61.33% which was significantly higher than in matched normal control where it was 6.67%. LVDD was found significantly more in elder age, with longer duration of disease and higher HbA_1C. Mean of E/A ratio in case group was significantly lower as compared to control group. The case group also showed prolonged IVRT and DT in comparison to control as the p value was statistically significant ($p<0.01$).*

Keywords: Type 2 Diabetes Mellitus, Left Ventricular Diastolic Dysfunction (LVDD).

I. INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorder that shares phenotype of hyper-glycaemia. The incidence of diabetes mellitus (DM) is increasing worldwide. The Indian Council of Medical Research-Indian Diabetes Study 2011 (ICMR- INDIAB) estimates that currently India has 62.4 million people with DM. The majority (>90%) of them have Type 2 DM.[1] It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India. According to the International Diabetes Federation (IDF) (2015) 415 million people in the world live with diabetes.[2]

DM is one of the major risk factors for diastolic heart failure (DHF). Over the last three decades, a number of epidemiological, clinical and autopsy studies have proposed the presence of diabetic heart disease as a distinct clinical entity. Diastolic heart failure (DHF) is also referred to as HF, with preserved left ventricular systolic function. Many studies have reported that the incidence of heart failure in diabetic subjects is high even in the absence of hypertension and coronary artery disease. Studies have also reported a high prevalence of pre-clinical diastolic dysfunction among subjects with DM.[3]

Left ventricular diastolic dysfunction (LVDD) represents the first stage of diabetic cardiomyopathy preceding changes in systolic function, reinforcing the importance of early evaluation of ventricular function in individuals with diabetes.[4,5] The diastolic abnormalities are present in diabetic patients in absence of diabetic complications of cardiovascular system.[6-8]

Presently very few studies have been carried out in India to study the relation between diastolic dysfunction in DM (type2). So the present study was undertaken to evaluate left ventricular dysfunction in Normotensive type 2 Diabetes mellitus patients. So this case control study was conducted to study the diastolic dysfunctions in normotensive type 2 Diabetes Mellitus.

II. METHODOLOGY

This case control study was conducted on 75 Type 2 normotensive diabetes mellitus patients attending the Department of Internal Medicine at DR SN Medical College & MDM Hospital, Jodhpur and compared to the control group (75 patients). Participants after understanding the study protocol and procedures were asked to given their written consents for the study. The study is a hospital based cross-sectional study where the study populations were selected from the Diabetics Clinic, General medical wards and OPD's.

For study group, 18-65 years aged cases of Type 2 DM diagnosed by ADA criteria with BP less than 130/90 mm of Hg ((at least 3 recordings with the highest recording taken into consideration) were taken. Out of which, cases with other diseases were excluded from study. Thus finaly 75 cases were taken in study group. likewise age sex matched healthy controls were chosen from their attendent.

The diagnosis of diabetes will make on the basis of clinical evaluation, biochemical and ancillary investigation fasting plasma glucose (FPG)/postprandial plasma glucose (PPPG) and HbA1C according to recent American Diabetic Association (ADA) recommendations.

A detailed clinical history with specific reference to cardiovascular symptoms, drug intake and smoking was taken. A complete general and systemic examination was carried out. A normal resting electrocardiogram and chest radiograph were prerequisites for participation. Plasma glucose (fasting and post prandial) was measured by the glucose oxidase method and the urine sugar by Benedict's reagent. Biochemical investigations in the form of blood urea, serum creatinine and serum cholesterol were also carried out enzymatically. A standard 12 lead electrocardiogram and a transthoracic echocardiogram in all its modes (M, colour Doppler) were carried out.

All the subjects (all diabetic patients and healthy volunteers) were evaluated by transthoracic 2-D and Doppler Echocardiography to assess left ventricular diastolic function. Echocardiographer was not aware of this study to avoid bias in the interpretation. Measurements of the different cardiac chambers were made according to recommendation of the American Society of Cardiology. All examinations were performed using an ALOKA SSD 2000 machine 2.5MHz transducer.

Statistical analysis: Categorical data was expressed as proportion and difference in proportion was analyzed using Chi square test. Quantitative data was expressed as mean and standard deviation and the difference in mean between two groups was inferred using unpaired 't' test. Statistical significance was kept at $p<0.05$. All statistical analysis was done using Epi info version 7.2.1.0 software.

III. RESULTS

This study was conducted on 75 cases of normotensive Type 2 Diabetes mellitus as study group and age sex matched healthy control at the Mathura Das Mathur Hospital, attached to Dr. S.N. Medical College, Jodhpur.

Out of total 75 cases of normotensive Type 2 Diabetes mellitus, 46 (61.33%) showed LVDD whereas in control group only 05 (6.66%) showed LVDD. This difference was statistically significant ($p< 0.01$). (Table 1)

Table 1
Comparison of LVDD distribution in Study and Control group

LVDD Status	Study group (N=75)	Control group (N=75)
Present	46 (61.33%)	05 (6.67%)
Absent	29 (38.67%)	70 (93.33%)

LVDD- left ventricular diastolic dysfunction

The various Echo variables studied were E (mitral early filling velocity), A (mitral late Atrial filling velocity), DT (deceleration time), IVRT (Isovolumetric relaxation time), EF (ejection fraction), IVST (inter-ventricular septal thickness), LV PWT (left ventricular posterior wall thickness).

The mean of E/A ratio in case group was significantly lower as compared to control group (p value<0.01).The case group also showed prolonged IVRT and DT in comparison to control as the p value was statistically significant (p<0.01). All subjects' cases and control showed normal systolic function. (Table 2)

Table 2
Comparison of Echo parameters in Study and Control group

Echo parameters	Study group (N=75)	Control group (N=75)	*P Value
E(cm/sec)	0.61±0.076	0.61±0.06	0.999
A(cm/sec)	0.7±0.089	0.51±0.09	**<0.01****
E/A	0.89±0.21	1.24±0.17	**<0.01****
DT(msec)	209.28±19.5	168.2±18.14	**<0.01****
IVRT(msec)	76.97±10.51	89.29±8.33	**<0.01****
IVS (mm)	11.6±1.71	11.6±1.71	0.999
LVPW T (mm)	12.09±1.05	12.09±1.05	0.999
EF	59.13±3.14	61.4±3.36	0.999

Unpaired 't'Test** * Significant***

Out of 75 DM cases, 22 cases were < 50yrs and 53 cases were 50 yrs and above. LVDD was present in only 06 cases out of 22 (27.27%) who were < 50 yrs. However, 40 (75.47%) cases out of 53 showed LVDD who were 50 yrs and above. So elderly showed significantly more (p<0.001) LVDD. (Table 3)

Table 3
Association of LVDD status with Age of patients (N=75)

Age	LVDD status	
	Present No (%)	Absent No (%)
<50 Years	6	16
50 and above years	40	13

Chi-square = 13.265 with 1 degree of freedom; P<0.001 LS=Significant

Out of 75 DM cases, 35(46.67%) had mean HbA1c < 8 and 40(53.33%) cases had mean HbA1c > 8. LVDD was present in 34 (85%) cases with mean HbA1c > 8 compared to only 12 (34.29%) cases with mean HbA1c < 8. the results were statistically significant (P<0.001). (Table 4)

Table 4
Association of LVDD status with HbA_1C Status of Patient (N=75)

HbA_1C Status	LVDD status	
	Present No (%)	Absent No (%)
<8	12	23
8 and above	34	6

Chi-square = 18.172 with 1 degree of freedom; P<0.001 LS=Significant

The distribution of total cases (n=75) according to the duration of diabetes were as follows; 31 cases with <5 years duration, 31 cases with duration between 5-10 yrs and 13 cases with duration >10 years. LVDD was present in 12 (92.3%) out of 13 cases with duration of diabetes >10 yrs and the relation was statistically significant (P<0.001). (Table 5)

Table 5
Association of LVDD status with Duration of DM disease (N=75)

Duration of DM disease	LVDD status	
	Present No (%)	Absent No (%)
<5 Years	12	19
5-10 Years	22	9
>10 Yeras	12	1

Chi-square = 13.163 with 2 degree of freedom; P<0.001 LS=Significant

IV. DISCUSSION

In the present study conducted in Western Rajasthan population, we assessed that left ventricular diastolic dysfunction (LVDD) is common in patients with DM, (a precursor of DCM) and its correlation with duration of diabetes and mean HbA1c. Isolated LVDD has been shown to be effected in early stage of DM when systolic function remains normal.

In the present study, 75 cases with type-2 DM and 75 healthy subjects as controls were included. Mean of FBS, HbA1c in case group was significantly higher as compared to the control group.

Total 46 (61.33%) subjects from the case group had left ventricle diastolic dysfunction compared to only 05 (6.67%) amongst control group showed the left ventricle diastolic dysfunction. Left Ventricle diastolic dysfunction in type 2 diabetes subjects was significantly higher as compared to the control group (‘*P*’< 0.001).

Duration of diabetes mellitus of >10 years had more prevalence of left ventricle diastolic dysfunction (‘*P*’ <0.001). Subjects with HbA1c > 8.0% had more prevalence of left ventricle diastolic dysfunction than subjects with HbA1c < 8.0% (‘*P*’ <0.01). Left Ventricle diastolic dysfunction was significantly high in patient with age > 50 years compared to age < 50 years (‘*P*’ <0.01).

Patil et al[11] in their study of 127 asymptomatic Type II diabetics found a significant incidence (54.33%) of diastolic dysfunction in diabetics. Dikshit NM et al[12] in their study of 50 asymptomatic Type II diabetics found a significant incidence (66%) of diastolic dysfunction in diabetics. Similarly, in our study, 61.33% diabetics were found to have LVDD.

Exiara et al.[13] in their study of 114 subjects stated that the prevalence of LV diastolic dysfunction in normotensive, asymptomatic and well-controlled DM type2 patients is high, and increases with age. A total of 63.2% patients had diastolic dysfunction in their study compared to present study's prevalence of 61.33%. Another author[14] also found LVDD in 41% in their series of 100 DM cases.

Table 6
Comparison of present study with other studies

Study variables	Present study	Patil VC et al[11]	Dikshit et al[12]	Chaudhary et al[14]
Cases	75	127	50	100
LVDD	46	69	33	41
P Value	**<0.01**	**<0.001**	**<0.01**	**-**

V. CONCLUSION

Left ventricular dysfunction is prevalent among type II diabetic patients in Western Rajasthan without symptomatic heart disease. Echocardiography is of immense benefit in the management of type II DM patients as this will enhance early detection of left ventricular dysfunction with a view to early treatment in order to reduce morbidity and mortality.

Limitations of the study:- Stress electrocardiography, myocardial perfusion imaging, and coronary angiography were not used to exclude sub clinical coronary disease.

CONFLICT OF INTEREST

None declared till now.

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