Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2016, 5, 8:102-106

A study of left ventricular dysfunction and hypertrophy by various diagnostic modalities in normotensive type 2 diabetes mellitus patients

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ABSTRACT

The aim of this study was to assess the role of left ventricular dysfunction and hypertrophy by various diagnostic modalities in normotensive type 2 diabetes mellitus patients. The burden of cardiovascular disease related to diabetes mellitus has been increasing multifold day by day. Diabetes mellitus formerly thought of as a problem of glucose metabolism, actually produces most of its harm by effect on the cardiovascular system. This is a Prospective and Observational Study. The selection of the 50 type 2 diabetes mellitus patients was done from either inpatients admitted for control of diabetes or out patients. 50 controls for the study were chosen from volunteering staff members and patients attenders. Patients with diabetes shows an significant increase in the left ventricular internal dimension, left ventricular mass, left ventricular wall thickness and diastolic dysfunction as compared to non diabetes. We conclude that earliest detection of preclinical left ventricular abnormalities like dysfunction in both systole and diastole and then to take preventive steps in order to arrest of halt the progress of the disease.

Key words: Type 2 Diabetes Mellitus, cardiovascular disease, left ventricular mass, diastole and systole

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INTRODUCTION

Diabetes mellitus is a metabolic disease characterized by hyperglycemia, resulting from defects in insulin secretion and/or insulin action and/ or insulin resistance.[1] The chronic hyperglycemia of diabetes mellitus is associated with long – term damage, dysfunction and failure of various vital organs; especially the eyes, kidneys, nervous system and cardiovascular system.[2]

Individuals with undiagnosed type 2 diabetes are also at significantly higher risk of stroke and peripheral vascular disease than non-diabetic population. Type 2 diabetes is more common in individuals with family history of diabetes, and in member of certain racial or ethnic groups, especially Indians.[3]

The risk of developing cardiovascular complications in diabetes mellitus has been established in the past. Accelerated coronary artery disease and left ventricular dysfunction are well known features of diabetes mellitus and account for higher morbidity. Histopathological reports and studies of left ventricular function in diabetes mellitus by non-invasive methods have enabled us to recognize specific entity of heart disease called as Diabetic cardiomyopathy. [4]

Left ventricular abnormalities encountered in diabetic subjects may pass through a preclinical phase when left ventricular function is impaired to a certain extent and this phase could be elicited by using sensitive and accurate non-invasive methods like echocardiography for evaluating the left ventricular function. [5]

MATERIALS AND METHODS

IIa. Experimental Design

This study was conducted at the Meenakshi medical college hospital &Research Institute, Kanchipuram. The selection of the 50 type 2 diabetes mellitus patients was done from either in patients admitted for control of diabetes or out patients. 50 controls for the study were chosen from volunteering staff members and patients attenders.

Inclusion criteria

1. Type 2 diabetes patients
2. Age less than 50 years

Exclusion Criteria

1. Hypertension (Blood pressure >140/90mmHg)
2. Previous history of coronary artery disease
3. Congestive heart failure
4. Thyroid disease
5. Overt nephropathy
6. Valvular heart disease

Patients demographic data, including sex, age, and risk factors for cardiac events including high-risk age,smoking history, medical history of hypertension, hyperlipidemia, diabetes, and a positive family history, drug history, presence of arrhythmia, laboratory data, Chest X-Ray, ECG, and echocardiography findings, were recorded

IIb. Echocardiography

Echo was done at Department of Cardiology, Meenakshi medical college & research institute. Philips HD7 equipment was used to do Echo. It has the capacity of performing 2 dimensional, M-mode, pulse wave and continuous wave Doppler. Assessment of left ventricular systolic function and diastolic function were performed, the various parameters were recorded from the Echo evaluation as per protocol.

III. Statistical Analysis

Data were analyzed using the SPSS software package, version 17.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed using range, mean, SD, and median, whereas qualitative data were expressed as frequency and percentage. P value was assumed to be statistically significant at 0.05.

IV. ETHICAL CONCERN

Ethical clearance was obtained from the Ethical committee meeting conducted at Meenakshi medical college hospital & research institute, Enathur, Kanchipuram, Tamil Nadu, India

RESULTS

1. The distribution of Left Ventricular Internal Dimension

Table 1.Shows the distribution of left ventricular internal dimension among the study population. 50% of the cases and 35% of the controls had LVID<3cms. Only 1 patient had LVID (S) >4cms. Similarly 44% of the controls had LVID (D) between 3.1 to 4, 96% of the cases had LVID (D) between 4.1 to 5cm. 2 patients had LVID of greater than 4cms.

Table 1

LVID		Control		Case	
		Number	Percentage	Number	Percentage
LVID (Systolic in cms)	≤3	35	70	25	50
	3.1 to 4	15	30	24	28
	>4.0	0	0	1	2
LVID (Diastolic)(in cms)	3.1 to 4	22	44	0	0
	4.1 to 5	28	56	48	96
	>5	0	0	2	4

2. The Distribution of Left Ventricular Mass

Table.2. shows the distribution of left ventricular mass in the study population.86% of controls and 66% of the case had left ventricular mass less than 180g.
12% of the controls and 24% of cases had left ventricular mass between 181-200g.
2% of the controls and 10% of the cases had left ventricular mass greater than 200g.

Table 2

Left Ventricular Mass (g)	Control		Case	
	Number	Percentage	Number	Percentage
<180	43	86	33	66
181-200	6	12	12	24
>200	1	2	5	10

3. The Distribution of Left Ventricular Wall Thickness

Table.3. Shows the distribution of left ventricular wall thickness in the study population. 78% of the controls and 48% of the cases had left ventricular wall thickness less than 2cms.

Similarly, 22% of the controls and 52% of cases had left ventricular wall thickness of greater than 2cms.

The p value of 0.01 signifies that the increase in left ventricular wall thickness in diabetics as compared to non-diabetics was significant.

Table 3

Left Ventricular wall Thickness	Control			Case			P Value
	Number	Percentage	Mean & SD	Number	Percentage	Mean & SD	
<2cm	39	78	1.94±0.09	24	48	2.11 + 0.17	0.001 (P<0.01)
≥2cm	11	22		26	52		

(P Value = 0.01 is significant)

4. Prevalence of Diastolic dysfunction in study population
Table.4. shows that the diastolic dysfunction in the study population. Out of 12 patients, 10 patients had grade I diastolic dysfunction and 2 patients had grade 2 diastolic dysfunction. None of them had diastolic dysfunction in control group.

Table 4

Diastolic Dysfunction (E/A Ratio)	Control	Case
Grade-I	0	10
Grade-II	0	2
Grade-III	0	0
Grade-IV	0	0

5. Prevalence of Diastolic dysfunction in study population

Table.5. This table shows the systolic dysfunction in the study population. In cases, 2 patients had mild systolic dysfunction. None of them had systolic dysfunction in the control group.

Systolic Dysfunction (Ejection Fraction)	Control	Case
Mild	0	2
Moderate	0	0
Severe	0	0

DISCUSSION

In this study, a total of 50 type 2 Diabetes Mellitus patients and 50 controls were taken. Among these, 12 patients out of 50 showed diastolic dysfunction.

Out of these 12 patients, 10 had grade 1 diastolic dysfunction and 2 had grade 2 diastolic dysfunction. None of them had grade 3 or 4 diastolic dysfunction. On the other hand, the controls had no evidence of diastolic dysfunction.

In this study we noticed that the incidence of diastolic dysfunction was common among diabetes when compared to non diabetics. Poirier et al.performed a study using conventional assessment of transmitralDopper flow velocity as well as measurements of pulmonary venous flow and transmitral flow after valsalva maneuver. The latter method decreases filling pressures and consequently unmasks the underlying impaired relaxation. The main findings of this study are a very high prevalence of diastolic dysfunction in men with well – controlled type 2 diabetes and no clinically detectable heart disease. Among the 46 patients studied,60% had diastolic filling abnormalities,32% had impaired relaxation, and 28% had a pseudo normal filling pattern.

The glycemic control of the patients as represented by the fasting blood sugar also showed that those patients with evidence of diastolic dysfunction had an increase in fasting and post prandial blood sugar.

In this study, it was found that people with diabetics had increased left ventricular wall thickness as compared to non-diabetics. The p value of 0.001 also fortified this relationship. Another incidental finding from the study was presence of non- valvular mitral regurgitation found in 4 patients.

C.S. Wilson et al. (2008) [6,7]demonstrated that during cardiac catheterization, the diabetic group had greater frequency of functional mitral regurgitation.

Functional mitral regurgitation mayoccur secondary to generalized left ventricular dysfunction with left ventricular dysfunction and failure (or) secondary to segmental myocardial disease involving the papillary muscle or its subjacent left ventricular wall.

The results from this study indicated that there is an increase in left ventricular mass in diabetics as compared to people who are non diabetics.

The MILIShas stated that person with diabetes, especially women have greater left ventricular mass and higher heart rates than their non-diabetic counterparts.

Shapiro L.M. et al in (1980) [8,9]showed that diastolic dysfunction is more common than systolic dysfunction in diabetes, especially in type 2 diabetes mellitus. He also believed that systolic time interval is a non specific indicator of left ventricular systolic function.

Bonoraet al conclude that cardiac dysfunction occurring in untreated non insulin dependent diabetes may be caused by metabolic factors and it may be reversed at least partially by correction of hyperglycemia.

CONCLUSION

We conclude that, the importance of study lies in the earliest detection of preclinical left ventricular abnormalities like dysfunction in both systole and diastole and then to take preventive steps in order to arrest of halt the progress of the disease.

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