Original Article

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Comparison between left Ventricular Dysfunction and Type 2 Diabetes Mellitus

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Abstract

Aim: In the present study shown that to investigate the comparison between left ventricular dysfunction and type 2 diabetes mellitus. Diabetes mellitus is a metabolic disease characterized by hyperglycemia, resulting from defects in insulin secretion and /or insulin action and/or insulin resistance. The incidence of asymptomatic cardiovascular disease in diabetes mellitus is of considerable importance and it has been suggested that 20% have occult disease like silent myocardial infarction. Echocardiography evaluation of patients have shown systolic and diastolic dysfunction in more than 50% of young insulin-dependent-diabetic patients. *Material and Methods:* This is a Prospective and Observational Study. 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. *Results:* Patients with diabetes show an significant increase in the left ventricular mass, E/A ratio diastolic dysfunction as compared to non diabetes. *Conclusions:* 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.

Keywords: Type 2 Diabetes Mellitus; left ventricular mass; Diastole and systole.

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Introduction

Type 2 diabetes mellitus eventually affects more than 150 million adults in the world. India has more than 30 million diabetics and it is known to affect Indians at a much younger age. The prevalence of diabetes is increasing worldwide and it is expected to affect around 300 million adults all over the world and 57 million in India by the year 2015.[1,2]

Life expectancy is shortened among diabetic males living an average of 9.1 years lesser and diabetic females living 6.7 years lesser than their non-diabetic counterparts. A meta-analysis of several studies estimated the risk of death from CAD in patients with diabetes at a ratio of 2.58 in men and 1.85 in women.[3]

Non-valvular heart diseases like ischemic heart diseases was thought to be associated with diabetes

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as early as 1883, when Vergeley recommended testing the urine for glucose in patients with angina.

Diabetes also increases the likehood of severe carotid atherosclerosis and mortality from stroke is increased almost threefolds in patients with diabetes. Both Type I and Type 2 diabetes are therefore powerful and independent risk factors for coronary artery disease (CAD), stroke and peripheral arterial disease. Furthermore, when patients with diabetes develop clinical events, they sustain a worse prognosis than patients without diabetes.[4]

The excess risk of congestive heart failure has led to the concept of a specific heart disease in diabetics due to microangiopathy of coronary — circulation similar to that found in retina and kidney.

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.[5,6]

Materials and Methods

Experimental Design

This study was conducted at the Meenakshi Medical College Hospital and 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 with necessary consent.

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.

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.

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 less than 0.05 was assumed to be statistically significant.

Ethical Concern

Ethical clearance was obtained from the Ethical committee meeting conducted at Meenakshi Medical College Hospital and Research Institute, Enathur, Kanchipuram, Tamil Nadu, India.

The distribution of Age in study population

Table 1 shows the distribution of cases and controls in the various age groups. 20% of cases and 20% of controls were aged 35–40/ 32% of controls and 26% of cases were aged 41–45. Similarly 48% of controls and 54% of cases were aged above 45.

Table 1: Distribution of Age

Age	Control		Case	
	Number	Percentage	Number	Percentage
35–40 Years	10	20.0	10	20.0
41–45 years	16	32.0	13	26.0
Above 45 years	24	48.0	27	54.0
Total	50	100.0	50	100.0

The distribution of sex in study population

Table 2 shows the sex distribution of cases and controls in this study. 66% of controls were males as compared to 62% in the cases. 34% of cases were females as compared to 38% in the controls.

Table 2: Distribution of Sex

Sex	Control		Case	
	Number	Percentage	Number	Percentage
Male	33	66.0	31	62.0
Female	17	34.0	19	38.0
Total	50	100.0	50	100.0

Distribution of cases according to duration of diabetes

Table 3 shows the duration of diabetes in the cases. In this study 48% had duration of diabetes <5 years, 28% had duration of diabetes of 6 to 10 years. 24% had diabetes for more than 10 years.

Table 3: Distribution of cases according to duration of diabetes

Duration of Diabetes	Number	Percentage
Below 5 Years	24	48.0
6 to 10 years	14	28.0
Above 10 Years	12	24.0
Total	50	100.0

Distribution of electrocardiography and chest X-ray abnormalities in study population

Table 4 shows that, in this study, 5 patients had electrocardiographic changes. All of them had evidence of left ventricular hypertrophy. One of the controls also had electrocardiographic evidence of left ventricular hypertrophy. Similarly, one of the patients had radiographic evidence of cardiomegaly.

Table 4: Distribution of electrocardiography and chest X- ray abnormalities

X- Ray and ECG	Cases	Control	P Value
Electrocardiography	5	1	0.017
Chest X- Ray	1	0	0.301

Relationship between mean E/A ratio and AGE

Table 5 shows that the relationship between mean E/A ratio with age. Out of 13 pateinst aged 41–45 years, only one had diastolic dysfunction. The mean E/A ratio for this age group were 1.27. Out of 27 patients aged between 46 and 50, eleven patients had diastolic dysfunction. The mean E/A ratio in this group were 0.81. None of the patients less than 40 years had diastolic dysfunction.

Table 5: Relationship between mean E/A ratio and Age

Age	Number of Cases	Number of cases having diastolic dysfunction (E/A<1)	Mean E/A ratio
35–40 years	10	—	1.43
41–45 years	13	1	1.27
46–50 years	27	11	0.81

Comparison between left ventricular mass and gender

Table 6 shows the correlation between left ventricular mass and gender. In this control group, the males had lower left ventricular mass of 166.02 gm as compared to the cases, who had left ventricular mass of 181.14 gm.

Similarly in this control group, the females had lower left ventricular mass of 144.81 gm as compared to the cases. Who had left ventricular mass of 158.81 gm.

The *p* value of 0.001 is statistically and indicates that the increase in left ventricular mass is a direct consequence of diabetes mellitus.

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[7].

Among patients with grade 2 diastolic dysfunction, 2 cases had a reversal of E/A ratio (<1) with the valsalva maneuver. They had a normal iso-volumetric relaxation time and deceleration time. 2 patients had reduced ejection fraction and fractional shortening (systolic 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 transmitral Dopper flow velocity as well as measurements of pulmonary venous flow and transmitral flow after valsalva maneuver. 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.[8,9]

Another pertinent fact that was evident in this study was the association of diastolic dysfunction

Table 6: Comparison between Left Ventricular Mass and Gender

Sex	Control			Cases			*p* Value
	Mean	SD	Mean Left Ventricular mass	Mean	SD	Mean Left Ventricular mass	
Male	166.02	18.94	158.81	181.14	19.51	172.65	0.001
Female	144.81	20.43		158.81	10.61		

(P value = 0.01 is significant)

with the duration of diabetes. A gradual worsening of diastolic dysfunction with an increase in the duration of diabetes was noted, the statically correlation too was significant.

It was interesting to note that 9 out of the 12 patients in our study with diastolic dysfunction were females.

In Framingham study, in year 1979 [1] published in Journal of American Medical Association on diabetes and cardiovascular disease by William *et al.* involving 5200 patients, showed that the cardiovascular mortality was actually greater in diabetic females as compared to diabetic males.

Though left ventricular hypertrophy is a characteristic feature of hypertension and outflow tract obstruction, in this study we found 5 patients had evidence of left ventricular hypertrophy in the ECG without any sign of systemic hypertension. Similarly one patient also showed radiographic evidence of cardiomegaly without any clinical evidence of valvular (or) dilated cardiomyopathy.

Fatima Bellow Sani *et al.* (2009)[6] demonstrated that the various resting 12 lead ECG findings among persons with type 2 diabetic mellitus reflected non-specific features of cardiovascular disease in general. The most frequent ECG abnormalities in Type 2 diabetic mellitus are ST-T segment depression and left ventricular hypertrophy. Ischemic heart disease is emerging fast in developing countries and should be routinely evaluated.

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.

The same author in another paper on left ventricular failure in diabetes in British Medical journal 1981[11,12] concluded that in diabetes abnormalities of left ventricular function are related to the duration of the disease and its complication and that a diabetes specific heart muscle disorder occurs frequently in patients with severe microvascular complication.

He also proposed that myocardial involvement in diabetes is functionally important and may occur relatively early in the course of the disease, initially impairing early diastolic relaxation and then more extensive probably in combination with decreased myocardial perfusion, further impairing relaxation and then contraction. Such abnormalities have been called diabetes cardiomyopathy but as they are secondary to a systemic disorder, the term diabetes specific heart muscle disorder should be used.[12]

Conclusion

We conclude that the earliest detection of preclinical left ventricular abnormalities like dysfunction in both systole and diastole in type 2 diabetes mellitus and then to take preventive steps in order to arrest of halt the progress of the disease.

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