International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

The Correlation between Diabetes Mellitus and Left Ventricular Function in the Indian Population

Dr. Sridhar .S .P[1], Dr. Swaminathan .N[2]

[1]Post Graduate in Cardiology, Madras Medical College, Chennai, Tamil Nadu, India
[2]Professor of Cardiology, Madras Medical College, Chennai, Tamil Nadu, India

Abstract: ***Background: Diabetes mellitus is an important risk factor for cardiovascular disease. Cardiovascular disease is the most common cause of morbidity and mortality in diabetics. Echocardiography can be used to identify significant myocardial injury even before overt cardiovascular disease in diabetes mellitus. This study aimed at evaluating left ventricular structure and function in the Indian population with diabetes mellitus. The findings underscore the importance of regular cardiac screening in diabetes patients and the need for aggressive management of cardiovascular risk factors.***

Keywords: Left Ventricular Diastolic Dysfunction, Left Ventricular Mass Index, Diabetes Mellitus, Echocardiography, Cardiovascular Disease

1. Introduction

Diabetes mellitus is a chronic metabolic disorder caused by decreased insulin secretion or insulin resistance or both. It affects millions of people worldwide and is associated with various complications, including cardiovascular complications. Cardiovascular disease is the leading cause of morbidity and mortality in patients with diabetes. Ventricular dysfunction is one of the most important cardiovascular complications of diabetes mellitus which can lead to heart failure [1].

Echocardiography is an easily available investigation that can be used to assess left ventricular structure and function. Left ventricular ejection fraction left ventricular mass index, and left ventricular diastolic function are useful echocardiographic parameters for predicting cardiovascular outcomes.

Several studies have investigated the impact of diabetes mellitus on echocardiographic parameters of left ventricular structure and function. These studies have shown that patients with diabetes mellitus have a higher prevalence of left ventricular dysfunction compared to non - diabetic individuals. Moreover, diabetes mellitus has been associated with alterations in echocardiographic parameters such as left ventricular mass index, left ventricular systolic function, and left ventricular diastolic function.

The mechanisms underlying the impact of diabetes mellitus on echocardiographic parameters of left ventricular structure and function are not fully understood. However, it has been suggested that hyperglycemia, insulin resistance, inflammation, oxidative stress, and endothelial dysfunction may play a role [2]. Understanding the impact of diabetes mellitus on echocardiographic parameters of left ventricular structure and function is important for the early detection and management of cardiovascular disease in patients with diabetes mellitus.

Objective

To evaluate the impact of diabetes mellitus on echocardiographic parameters of left ventricular function and structure in the Indian population

2. Methodology

A cross - sectional case - control study with patients with diabetes mellitus as cases and patients without diabetes mellitus as controls. Patients were selected from the cardiology OPD in MMC & RGGGH who visit for routine cardiac evaluation. ECHO parameters of diastolic dysfunction, septal thickness, posterior wall thickness, ejection fraction, left atrial volume index and left ventricular mass index are obtained for all the cases.

Sample Size:

100 participants - 50 cases and 50 controls

Inclusion Criteria for Cases:

Patient with diabetes mellitus of age group 30 - 60 yrs

Inclusion Criteria for Control:

Patient of age group 30 - 60 yrs with no diabetes mellitus

Exclusion Criteria for Cases and Control:

1) Coronary artery disease
2) Congenital heart disease
3) Cardiomyopathies
4) Valvular heart disease
5) Age > 60 yrs
6) Pregnancy

Statistical analysis

The data collected were entered into Microsoft Excel 2019 and the master chart was created. The qualitative variable was expressed using frequency and percentage and the quantitative variable using mean and standard deviation. To compare the distribution of qualitative variables between the cases and controls, a chi - square test was used. To compare the mean between cases and controls, independent samples to test were used. P value of less than 0.05 was considered to be statistically significant.

3. Results

The mean age among the participants in cases was 51.66 ± 6.63 years and that of controls was 51.54 ± 6.62 years. The mean age was similar between cases and controls with a P value of more than 0.05. Among the cases, 54% were males and among the controls, 52% were males. The proportion of males was found to be similar between cases and controls with a P value of more than 0.05. The mean systolic blood pressure was 134.44 ± 20.14 mmHg for the cases and 122.44 ± 9.64 mmHg for the controls. The mean diastolic blood pressure among the cases was 81.52 ± 14.30 mmHg and among the controls, it was 76.32 ± 10.24 mmHg. The mean systolic and diastolic blood pressure was more among the cases than the controls with a P value of less than 0.05 (Table 1).

The mean left ventricular mass index among the cases was 109.42±9.63 and that of controls was 82.18 ± 11.15. The mean left ventricular mass index was more among the cases than the controls with a P value of less than 0.05. The mean left atrial volume index was 34.28 ± 2.97 among cases and 29.66 ± 2.79 among controls (Fig 1). The mean left atrial volume was more among the cases than the control with a P value of less than 0.05 (Fig 2).

The mean septal thickness among the cases and controls were 9.46 ± 1.64 and 8.12 ± 0.79, respectively. The mean septal thickness was more among the cases than the controls (P value < 0.05). The mean posterior wall thickness among the cases and controls were 8.86 ± 1.48 and 8.16 ± 0.73, respectively. The mean posterior wall thickness was more among the cases than the controls with a P value of less than 0.05. The mean ejection fraction among the cases was 55.40 ± 5.825 and that of controls was 63.18 ± 3.98. The ejection fraction was also found to be more among the cases than controls with a P value of less than 0.05. The mean E/E' among the cases was 9.84 ± 2.17 and the mean E/E' among the controls was 7.84 ± 0.71. The mean E/E' was more among cases than controls with a P value of less than 0.05. Among the cases, 36% had grade 1 diastolic dysfunction, 32% had grade 2 diastolic dysfunction, 10% had grade 3 diastolic dysfunction and 22% had no diastolic dysfunction while among the controls, 10% had grade 1 diastolic dysfunction and 90% had no diastolic dysfunction. The proportion of participants with diastolic dysfunction was more among the cases than the controls with a P value of less than 0.05.

Table 1: Comparison of baseline characteristics between cases and controls

Variable		Cases (n=50)	Controls (n=50)	P value
Age (in years)		51.66±6.63	51.54±6.62	0.928
Sex	Male	27 (54)	26 (52)	0.841
	Female	23 (46)	24 (48)	
Systolic blood pressure (mmHg)		134.44±20.14	122.44±9.64	0.001
Diastolic blood pressure (mmHg)		81.52±14.30	76.32±10.24	0.039

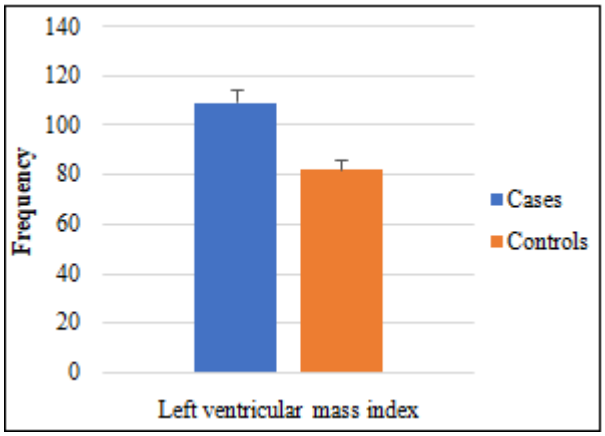

Figure 1: Bar chart showing the comparison of mean left ventricular mass index between cases and controls

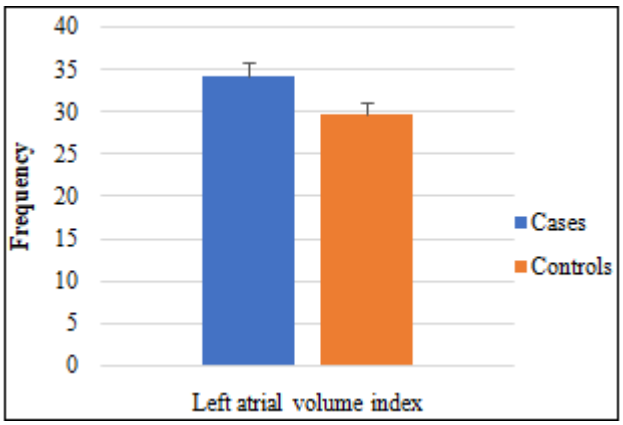

Figure 2: Bar chart showing the comparison of mean left atrial volume index between cases and controls.

Table 2: Comparison of other echocardiographic parameters of left ventricular structure and function between cases and controls

Variable		Cases (n=50)	Controls (n=50)	P value
Septal thickness		9.46±1.64	8.12±0.79	0.001
Posterior wall thickness		8.86±1.48	8.16±0.73	0.004
Ejection fraction		55.40±5.82	63.18±3.98	0.001
E/E'		9.84±2.17	7.84±0.71	0.001
Diastolic dysfunction	Nil	11 (22)	45 (90)	0.001
	Grade 1	18 (36)	5 (10)	
	Grade 2	16 (32)	0	
	Grade 3	5 (10)	0	

4. Discussion

This study demonstrated that 78% of the patients with diabetes evaluated had any one form of left ventricular diastolic dysfunction. Studies in the USA demonstrated a similar prevalence of LVDD. [3, 4]. However, a study conducted by Danbauchi *et al.*, and Masugata *et al.*, *showed no* significant difference in the prevalence of diastolic dysfunction between diabetic and control subjects in Zaria, Nigeria, and Japan respectively. [1, 5] The differences in prevalence in different studies may be due to the use of different instruments and parameters in assessing diastolic function. Although this study showed normal LV systolic function in both patients and the control groups, there was no enhancement of LV systolic function in the individuals with diabetes as reported by some of the studies. [11]. This

is because diastolic dysfunction may occur earlier than systolic abnormalities in diabetics [10, 6, 7] But, Marwick [8] argued that systolic dysfunction has been more difficult to find in human studies because of the low sensitivity of standard parameters used to assess LV systolic function (for example, ejection fraction). The individuals with diabetes had a higher left ventricular mass index (LVMI) than controls in this study. A similar observation made by Danbauchi *et al.*, *[*1] and Liu *et al.* patients with diabetic heart disease is characterized by increased apoptosis and necrosis which results in increased deposition of collagen in a diffuse manner. [9] This ultimately results in increased LV mass and consequently decreased ventricular compliance. This study also showed a higher left a trial volume index in individuals with diabetes.

5. Conclusion

This study highlights the impact of diabetes mellitus on echocardiographic parameters of left ventricular structure and function in the Indian population. The findings underscore the importance of regular cardiac screening in diabetes patients and the need for aggressive management of cardiovascular risk factors.

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