ORIGINAL RESEARCH

To evaluate cardiac co-morbidities in patients with newly diagnosed type 2 diabetes mellitus using 2d echocardiography

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ABSTRACT

Aim: To evaluate cardiac co-morbidities in patients with newly diagnosed type 2 diabetes mellitus using 2d echocardiography.

Method and material: This research comprised 100 newly diagnosed type 2 diabetes mellites individuals who were clinically asymptomatic, had blood pressure of 130/80mmHg, and had a normal ECG. All patients underwent FBS, PPBS, Renal function tests, including electrolytes, Glycosylated haemoglobin (HbA1c), urine routine and microscopy, ECG, Fundoscopy, Chest x-ray, and Echocardiography.

Results: In the current research, 100 asymptomatic type 2 diabetes mellitus patients received 2-D echocardiography, with men (75%) outnumbering women (25%). The most prevalent age groups were 45-55 years and 55-65 years (30% apiece), with under 45 years (22%). Diastolic dysfunction was detected on 2-D echocardiography in 22 individuals (22%). Diastolic dysfunction of grades I, II, and III was seen in 12%, 7%, and 3% of patients, respectively. In present study, reduced early mitral inflow velocity was noted in 10 cases (10%) and mitral annular early diastolic velocity was noted in 19 cases (19%). We discovered that when HbA1c levels rise, so does the degree of left ventricular diastolic dysfunction; this difference was statistically significant (Chi-square test, p value 0.001). Three cases with grade 3 diastolic dysfunction had HbA1c >9.5, two cases with HbA1c >9.5 had grade 2 diastolic dysfunction, and six cases with HbA1c >9.5 had grade 1 diastolic dysfunction, all of which had LVDD.

Conclusion: Screening for cardiovascular abnormalities by 2D Echo is indicated in all newly diagnosed type 2 diabetes melites patients, with or without cardiovascular symptoms, so that early measures may be done to avoid further development of symptomatic cardiovascular abnormalities.

Keywords: Cardiac, Co-morbidities, Type 2 diabetes mellitus , 2d echocardiography

INTRODUCTION

Since 1980, the worldwide incidence and prevalence of type 2 diabetes mellitus (T2DM) has tripled and is continually rising. [1] Cardiovascular illnesses (CVDs), namely coronary artery disease (CAD), heart failure (HF), and stroke, are the leading causes of mortality and disability among T2DM patients. [2,3] Patients with co-existing T2DM and HF are one group that need special care. A recent study found an alarming increase in the risk of cardiovascular (CV) mortality and hospitalisation for heart failure (HHF) among individuals with HF and

T2DM compared to those with HF but no T2DM. [4] Despite better evidence-based therapy, the 5-year mortality rate in individuals with advanced HF is around 50%, and in certain places, the number of fatalities from HF has overtaken the number of deaths from myocardial infarction (MI) in T2DM patients.[5-8]

Because of the clinical burden of CVD problems found in T2DM patients, there has been an increase in awareness of the simultaneous care of T2DM and CVD. Though the importance of tight glycemic control for protection against microvascular complications and CVD in persons with type 1 diabetes mellitus is well known, its involvement in decreasing CV risk in people with T2DM has not been proven as clearly.[9-12] As a consequence, regulatory authorities are increasing pressure on anti-hyperglycemic drugs (AHAs) to show CV safety and benefits in T2DM patients, particularly for severe CV events such as CV mortality, HF, and non-fatal MI. [13,14] Following these regulatory criteria, various CV outcomes studies (CVOTs) were conducted to evaluate the CV safety of AHAs. These CVOTs demonstrated a decreased risk of CVDs linked with certain medicines when compared to others. This has prompted a significant paradigm shift away from glucose management and toward a wider approach of comprehensive CV risk reduction. [15] The presence of certain comorbidities (e.g., atherosclerotic CVD, HF, chronic renal disease, obesity) mandates a special approach to the choice of glucose-lowering medications in the majority of patients with simultaneous T2DM and CVD. The study's goal was to use echocardiography to assess cardiac co-morbidities in newly diagnosed type 2 diabetes mellitus patients in a tertiary hospital.

METHOD AND MATERIAL

The ethics committee granted authorization for this research to be conducted. This research comprised 100 newly diagnosed type 2 diabetes mellites individuals who were clinically asymptomatic, had blood pressure of 130/80mmHg, and had a normal ECG. This research excluded individuals with signs of coronary artery disease, hypertensive patients, patients using antihypertensive drugs, E/O left ventricular hypertrophy on echocardiography, and patients with systolic dysfunction (LVEF40%).

METHODOLOGY

Patients were informed about the study in their native language, and signed permission was obtained for participation and research. A detailed history of symptoms was taken, as well as a medical history (previous illnesses, prescriptions, and physical examination results). All patients underwent FBS, PPBS, Renal function tests, including electrolytes, Glycosylated haemoglobin (HbA1c), urine routine and microscopy, ECG, Fundoscopy, Chest x-ray, and Echocardiography.

All patients were examined using a commercially available ultrasound equipment Phillips CX 50 (Bothell, WA, USA) S4-2 phased-array transducer with M-mode, two-dimensional, pulsed and continuous wave, color-flow, and tissue Doppler capabilities. Ejection percent, E-peak velocity of early mitral flow, E/A ratio, and Left atrial size were determined in all patients using echocardiography. E/A 1 and an increase in LA size were regarded indicators of left ventricular diastolic dysfunction.

DATA EXAMINATION

Data was gathered and organised in Microsoft Excel and analysed in SPSS 25.0. For continuous data, frequency, percentage, means, and standard deviations (SD) were computed, whereas ratios and proportions were determined for categorical variables. The proportional difference between qualitative variables was examined using the chi-square test or the Fisher exact test, if appropriate. A P value of less than 0.5 was deemed statistically significant.

RESULTS

In the current research, 100 asymptomatic type 2 diabetes mellitus patients received 2-D echocardiography, with men (75%) outnumbering women (25%). The most prevalent age groups were 45-55 years and 55-65 years (30% apiece), with under 45 years (22%).

Table 1: Gender and age group distribution

Gender	Number	Percentage
Male	75	75
Female	25	25
Age		
below 45	22	22
45-55	30	30
55-65	30	30
above 65	18	18

Diastolic dysfunction was detected on 2-D echocardiography in 22 individuals (22%). Diastolic dysfunction of grades I, II, and III was seen in 12%, 7%, and 3% of patients, respectively.

Table 2: Diastolic dysfunction

Grade	No. of patients	Percentage
Impaired Relaxation (Grade 1)	12	12
Pseudonormal (Grade 2)	7	7
Restrictive Filling (Grade 3)	3	3
Normal	78	78

In present study, reduced early mitral inflow velocity was noted in 10 cases (10%) and mitral annular early diastolic velocity was noted in 19 cases (19%).

Table 3: Early mitral inflow velocity and mitral annular early diastolic velocity

Parameters	No. of patients	Percentage
Early Mitral Inflow Velocity(E)		
<50 Cm/S	10	10
>50 Cm/S	90	90
Mitral Annular Early Diastolic Velocity		
< 7 cm/s	19	19
≥ 7 cm/s	81	81

We discovered that when HbA1c levels rise, so does the degree of left ventricular diastolic dysfunction; this difference was statistically significant (Chi-square test, p value 0.001). Three cases with grade 3 diastolic dysfunction had HbA1c >9.5, two cases with HbA1c >9.5 had grade 2 diastolic dysfunction, and six cases with HbA1c >9.5 had grade 1 diastolic dysfunction, all of which had LVDD.

Table 4: Comparison of LVDD and Hba1c

Hba1c	LVDD Grade				
	I	II	III	Absent	Total
6.5-7.5	0	0	0	62	62
7.5-8.5	3	0	0	13	16
8.5-9.5	3	5	0	3	11
> 9.5	6	2	3	0	11
Total	12	7	3	78	100

Between patients with and without LVDD, there was a statistically significant difference in age (years), BMI (kg/m2), FBS (mg/dl), PPBS (mg/dl), and HbA1c (%).

Table 5: Distribution of patients according to duration of Diabetes

	Patients with LVDD (Mean ±SD)	Patients without LVDD (Mean ±SD)	P value
Age (years)	53.69 ± 10.58	47.85 ± 8.96	0.055
BMI (kg/m^2)	25.96± 3.67	24.36 ± 2.97	0.041
FBS (mg/dl)	161.52 ± 12.73	129.66 ± 15.67	0.036
PPBS (mg/dl)	215.63 ± 19.99	188.67 ± 18.77	0.052
HbA1c (%)	9.02 ±1.44	7.63 ± 1.63	0.044

DISCUSSION

Cardiac diastolic dysfunction is one of the first signs of diabetes-induced cardiomyopathy. This disorder has the potential to lead to heart failure. As a result, it is critical to recognise diastolic dysfunction early in order to prevent it from progressing to overt heart failure. Diastolic dysfunction is characterised by extended relaxation and increasing filling pressure, resulting in decreased contraction velocity and cardiac output. Reduced ventricular function stimulates rennin angiotensin and the sympathetic nervous system, causing additional myocardial injury and, if left untreated, myocardial remodelling. Arrhythmias, pump failure, and death are all possible outcomes.[16,17] Thus, diastolic dysfunction should be identified and treated as soon as possible to avoid morbidity and death. Khade SK et al.,[18] discovered 44.4% prevalence of diastolic dysfunction in type 2 diabetes mellitus patients without cardiac symptoms. Diastolic dysfunction was seen in 47.4% of men and 42.9% of females. Diastolic dysfunction was seen in 11.1%, 77.3%, and 80% of patients with illness durations of 0-5 years, 6-10 years, and more than 10 years, respectively. Diastolic dysfunction was more common in patients with poor glycemic control (HbA1c value >8%) than in patients with adequate glycemic control. Madhumathi R et al.,[19] discovered diastolic dysfunction in 24 (48%) of their patients, 8 of whom were men and 16 of whom were females. The age group 50-59 years had the highest number of individuals with LV diastolic dysfunction. With increasing age, duration of diabetes mellitus, and HbA1c levels, the prevalence of diastolic dysfunction rose linearly. There was also a link between LV diastolic dysfunction (LVDD) and microangiopathy. Eight of the 13 patients with diabetic retinopathy had LVDD, while nine of the 11 patients with microalbuminuria had LVDD. In the research by Pratik D M et al., [20] out of 175 patients, the majority of whom were male (62%), had HbA1c levels in the 7-10% range (79%). The majority of patients had normal cardiac diastolic function, with just 15 (8%) having restricted filling (grade 3 diastolic dysfunction). Grade 2 and 3 diastolic dysfunction was more prevalent in older age groups, namely 51-60 and >60 years, but it was nonexistent in those younger than 40 years. Diastolic dysfunction was more prevalent in individuals with proteinuria more than 200 mg/dl, higher blood cholesterol levels, hba1c levels greater than 10%, and an E/e' ratio greater than 14. Only three individuals had EF 50% with hba1c >10%, while 47 had systolic dysfunction 50% with hba1c less than 10%. Jain S et al.,[21] discovered LVDD in 63 of 100 individuals. HbA1c and LVDD had a strong positive connection (p value 0.001). As HbA1c levels rose, so did the severity of LVDD. In this research, when BMI rose, so did HbA1c and LVDD, both of which were statistically significant (p value =0.001). They found that diabetes-related cardiac damage affects diastolic function before systolic function, and that a higher HbA1C level is substantially correlated with the existence of LVDD. Patients should be counselled to keep their diabetes under rigorous control in order to limit their chance of developing LVDD, which is a precursor to more severe illness. Diastolic dysfunction was found in 81 (81%) of the patients in a research by Chandey M et al.[22]. Systolic dysfunction was found in 14 (14%) of the individuals. With increasing age, FPG, and BMI, the prevalence of diastolic dysfunction rose linearly. There was also a link between LV diastolic dysfunction (LVDD) and LA size. While

no significant link was established between gender, diabetes duration, HbA1c, and diastolic and systolic dysfunction. Diabetic cardiomyopathy manifests as early in the form of LV diastolic failure. In diabetic individuals, LVDD considerably adds to the morbidity of congestive heart failure. In type 2 diabetes patients, echocardiography is a highly valuable noninvasive method for diagnosing LVDD and systolic dysfunction. K M Hassan et al.[23] discovered that 61% of the participants exhibited diastolic dysfunction with maintained ejection fraction. Left ventricular diastolic dysfunction (LVDD) was seen in 75% of diabetic individuals with HbA1c 8.1. Patients with LVDD exhibited significantly higher levels of dyslipidaemia than those without. WHR and HbA1c levels were shown to be the sole predictors of decreased diastolic function in individuals with new-onset DM using multivariate logistic regression analysis. The Kaplan-Meier survival curves revealed a substantial link between the occurrence of diastolic dysfunction and the length of DM, with HbA1c 8.1 being associated with a greater incidence. Shankar Roy et al.[24] evaluated 226 individuals (151 males, 75 females), and discovered cardiac abnormalities in 29.2% of them. In addition to dyslipidaemia, a history of hypertension, a higher body mass index, and poor glycemic parameters, diabetic microvascular sequelae (e.g. neuropathy, retinopathy, and nephropathy) were highly related with it (each with p 0.0001). Because of its accuracy, availability/portability, safety, and low cost, echocardiography is the imaging method of choice in patients with suspected HF. It can properly detect and distinguish between heart failure, diastolic dysfunctions, valvular heart disease, and coronary heart disease. [25,26] Diastolic dysfunction is a major risk factor for diabetes individuals developing heart failure and morbidity. Early detection and treatment may halt the progression of heart failure. Routine screening for such issues in all diabetics, followed by high-risk patients receiving strain echocardiography, may be a highly cost-effective diagnostic, therapeutic, and predictive technique.

CONCLUSION

Screening for cardiovascular abnormalities by 2D Echo is indicated in all newly diagnosed type 2 diabetes melites patients, with or without cardiovascular symptoms, so that early measures may be done to avoid further development of symptomatic cardiovascular abnormalities.

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