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Original Research Paper

Cardiology

A STUDY ABOUT PREVALENCE OF SUBCLINICAL LV DYSFUNCTION IN ASYMPTOMATIC TYPE 2 DIABETES MELLITUS PATIENTS BY USING 2D SPECKLE TRACKING STRAIN IMAGING IN A TERTIARY CARE CENTER.

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ABSTRACT

Aim- Our aim is to assess the prevalence of subclinical left ventricular systolic dysfunction by strain imaging in asymptomatic type 2 diabetic patients in the absence of coronary disease or LV hypertrophy. **Objectives-** 1. To determine the prevalence of diabetics with subclinical left ventricular dysfunction attending to the OPD. 2. To compare the selected sociodemographic, clinical and Echocardiographic parameters between those with GLS ≥ 18 and GLS < 18. **Material and Methods-** The hospital based descriptive study was carried out in the internal medicine department of a KAP Vishwanathan Government medical college for a period of 6 months. All the patients who had attended the hospital with previously diagnosed type II diabetes mellitus during the study period were the participants for the study. To compare the mean between the groups, independent samples t test was used. To compare the distribution of qualitative variables between the groups, Chi square test was used. **Results-** Among the 140 participants, 94 (67.1%) had GLS of more than 18 and 46 (32.9%) had GLS of less than 18. The mean A among those in the GLS ≥ 18 group was 0.76 ± 0.11 and that of the GLS < 18 group was 0.71 ± 0.15. The mean E/A value among the former was 1.06 ± 0.39 and among the latter it was 1.27 ± 0.52. The mean A wave was higher in the GLS ≥ 18 group than in the GLS <18 group with P value of less than 0.05. The mean E/A value was significantly lower in the GLS ≥ 18 group than in the GLS<18 group with P value of less than 0.05. **Conclusion-** The prevalence of subclinical left ventricular dysfunction among type II diabetics was 33%. There were also derangements in the other parameters.

KEYWORDS : Type II diabetes, Echocardiography. 2D speckle echocardiography, Global Longitudinal Strain, sub clinical left ventricular dysfunction, screening.

INTRODUCTION

Type II diabetes (DM) is a metabolic disorder where the insulin resistance is increased(1). Type II DM is showing an increased trend globally. The disease was found to be associated with many other metabolic abnormalities. The cohort of type II diabetics were also recorded to have high rates of cardiovascular mortality and morbidity(2) Rani HS et al reported a higher prevalence of dyslipidaemia among the type II diabetics which might lead to high coronary heart disease risk(3). The probability of a diabetic to die from cardiovascular disease is almost two or four times more than the non-diabetics(4). Gholap N et al reported that the mean age of occurrence of type II DM and cardiovascular disease were lesser among the south Asians than the European population(5).

The increase in cardiovascular risk was theorised to be due to either chronic hyperglycaemia or the acute post prandial change in blood sugar. There would be increase in reactive oxygen species (ROS) paying way to endothelial dysfunction and activation of inflammasome. The formation of atherogenic plaque was also aided by formation of 'advanced glycation end products (AGE). Giglio RV et al in their review reported a number of biomarkers from categories like inflammation, vascular remodelling, lipids profile oxidative stress, organ damage and diagnostic to predict cardiovascular events in type II diabetics(6).

Somarathne JB et al in their review stressed in the importance of detecting asymptomatic structural heart disease among type II diabetics as a process of regular screening guideline. The parameters they suggested included left ventricular hypertrophy (LVH), left ventricular systolic and diastolic dysfunction(7). Echocardiographic abnormalities are more frequent in type 2 diabetes patients and among those with such abnormalities there was neither any cardiac symptoms nor clinical characteristics(8).

Early detection of diabetic heart disease will go a long way in delaying the development of cardiac failure. Though the traditional echocardiography was not as sensitive to detect the subclinical dysfunction. The introduction of 2D speckle tracking echocardiography helped to overcome the disadvantages and increased the sensitive of detecting the longitudinal strains occurring at the myocardium(9). The objective of the present study was to determine the proportion of diabetics with subclinical left ventricular dysfunction attending to the OPD of KAP Vishwanathan Government Medical College, Trichy, Tamilnadu and also to compare the selected sociodemographic, clinical and Echocardiographic parameters between those with strain ≥ 18 and strain < 18.

METHODOLOGY

The present study was hospital based descriptive study was carried out in the internal medicine department of a KAP Vishwanathan Government medical college, Trichy, Tamilnadu for a period of 6 months between April 2023 to September 2023. All the patients who had attended the hospital with previously diagnosed type II diabetes mellitus during the study period were the participants for the study. Informed consent was obtained from all the participants before enrolling them into the study. Excluding criteria were Grade 1 arterial hypertension , known coronary artery disease, known systolic or diastolic heart failure , valvular heart disease, pericardial disease, Comorbities like chronic smoking, alcoholism, cerebrovascular events , thyroid disorder , chronic anemia ,severe diabetic neuropathy or retinopathy, renal failure (proteinuria < 1g/24 hours) , atrial

fibrillation , left or right bundle branch block and pregnancy.

The basic sociodemographic characteristics like age and sex was collected from all the participants. Age was collected in completed years. Mode of treatment for type II diabetes whether oral hypoglycaemic agents or insulin was documented. Following which the heart rate of the participants was recorded. Using a sphygmomanometer, the systolic blood pressure and diastolic blood pressure of the participants were recorded in mmHg. The SpO2 of the participants was then recorded in percentages. All the participants were then made to undergo echo cardiography and all the parameters were documented. The parameters documented included Regional Wall Motion Abnormality (RWMA), Ejection Fraction, Valvular anatomy, e wave, A wave, E/A ratio, e' and E/e' ratio. The other parameters recorded included Right Ventricular Systolic Pressure (RVSP) and Tricuspid Annular Plane Systolic Excursion (TAPSE). The primary outcome parameter, the global longitudinal strain was recorded for all the participants. According to European Association of Cardiovascular Imaging , subclinical LV systolic dysfunction was defined as GLS <18%.

Statistical Analysis

The data collected were entered into Microsoft excel 2019 so as to create the master chart. The master chart was then loaded onto SPSS version 26 for statistical analysis. The data consisted of both quantitative and qualitative variables. The quantitative variables were expressed using mean and standard deviation. The qualitative variables using frequency and percentages. To compare the mean between the groups, independent samples t test was used. To compare the distribution of qualitative variables between the groups, Chi square test was used. A P value of less than 0.05 was considered to be statistically significant.

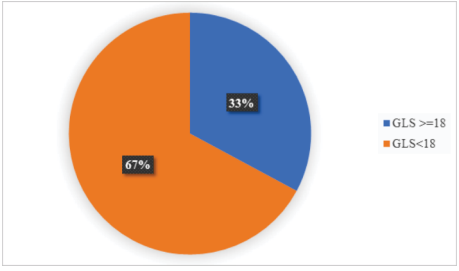

Fig 1: Pie Chart Showing Distribution Of Strain Among The Study Participants.

RESULTS

Total participants in the study were 140. Among those 94 (67.1%) had GLS of more than 18 and 46 (32.9%) had GLS of less than 18(Fig 1). The mean age among those in the GLS ≥ 18 group was 52.59 ± 8.97 and that of the GLS < 18 group was 51.73 ± 7.74. In the former group, 63% were males and in the latter, it was 53.2%. In the GLS group, everyone was taking anti hypoglycaemic agents and 1(2.2%) were under insulin and in the other group, 91 (96.8%) were using oral hypoglycaemic agents and 7(7.4%) were under insulin. Both the groups were similar with regard to age, sex and mode of treatment with P value of more than 0.05 (Table 1).

The mean heart rate among those with GLS ≥ 18 and GLS < 18 was 77.07 ± 10.58 bpm and 77.89 ± 10.37 bpm, respectively. The mean systolic bloop pressure for those in the former group was 109.13 ± 14.11 mmHg and that of the latter group was 107.98 ± 13.01 mmHg. The diastolic blood pressure was 68.48 ± 12.28 mmHg and 69.04 ± 10.27 for GLS ≥ 18 and GLS < 18 groups, respectively. The mean heartrate, systolic blood pressure and diastolic blood pressure were similar between the groups with P value of more than 0.05. The mean SpO2 among those in the GLS ≥ 18 group was 98.59 ± 1.24 % and that of GLS < 18 group was, 99.02 ± 0.99%. The mean SpO2 for the latter group was significantly greater than the mean SpO2 of the former group with P value of less than 0.05.

The EF% among those in the GLS ≥ 18 group was 65.32 ± 3.23 and that of GLS < 18 was 65.76 ± 3.67. The mean was similar between the groups with P value of more than 0.05. Among those in the GLS ≥ 18 group, 7 (15.2%) were AVS + and Grade I LVDD followed by 3 (6.5%) were AVS+ and 1(2.2%) had grade I LVDD with mild TR and trivial TR, respectively. Among those with GLS < 18, 17(18.1%) had AVS+ and grade I LVDD followed by 4(4.3%) were AVS+,3 (3.2%) were Grade I LVDD, 2(2.1%) had grade I LVDD with mild TR and mild AR, respectively. The distribution was similar between the groups with P value of more than 0.05(Fig 2).

The mean E among the participants with GLS ≥ 18 was 0.71 ± 0.19 and that of the other group was 0.70 ± 0.17. The mean A among those in the former group was 0.76 ± 0.11 and that of the latter group was 0.71 ± 0.15. The mean E' values for those with GLS ≥ 18 was 0.10 ± 0.02 and for those with no GLS was 0.10±0.02. The mean E/A value among the former was 1.06 ± 0.39 and among the latter it was 1.27 ± 0.52. The mean E/E' values among those with GLS ≥ 18 and GLS <18 was 6.85 ± 2.12 and 6.69 ± 1.72, respectively. The mean A wave was higher in the GLS ≥ 18 group than in the GLS <18 group with P value of less than 0.05. The mean E/A value was significantly lower in the GLS ≥ 18 group than in the GLS<18 group with P value of less than 0.05. All the other parameters (E, E', and E/E' values) were similar between the groups with P value of more than 0.05.

The mean RVSP value for the GLS ≥ 18 and no GLS were 20.65 ± 5.14 and 20.62 ± 5.17, respectively. 6.5% had mild PAH in the former group and 3.2% had mild PAH in the latter. The mean TAPSE was 21.17 ± 2.18 and 21.16 ± 2.32 for those with GLS ≥ 18 and <18, respectively. All the three (RVSP, PAH and TAPSE) were similar between the groups with P value of more than 0.05(Table 2).

Table 1: Comparison Of Baseline Characteristics Between The Groups.

Variable		GLS ≥ 18 (n=46)	GLS < 18 (n=94)	P value
Age (in years)		52.59 ± 8.97	51.73±7.74	0.563
Sex	Male	29(63)	50(53.2)	0.270
	Female	17(37)	44(46.8)	
Oral hypo-glycaemic agents	Yes	46(100)	91(96.8)	0.221
	No	0	3(3.2)	
Insulin	Yes	1(2.2)	7(7.4)	0.207
	No	45(97.8)	87(92.6)	

Table 2: Comparison Of Outcome Parameters Between The Groups.

Variable		GLS ≥ 18 (n=46)	GLS < 18 (n=94)	P value
Heart rate (bpm)		77.07 ± 10.58	77.89 ± 10.37	0.660
Systolic blood pressure (mmHg)		109.13 ± 14.11	107.98±13.01	0.633
Diastolic blood pressure (mmHg)		68.48 ± 12.28	69.04±10.27	0.775
SpO2 (%)		98.59 ± 1.24	99.02 ± 0.99	0.042
RWMA	Nil	46 (100)	94 (100)	-
EF%		65.32±3.23	65.76±3.67	0.491
E		0.71±0.19	0.70±0.17	0.755
A		0.76±0.11	0.71±0.15	0.042
E'		0.10±0.02	0.10±0.02	0.843
E/A		1.06±0.39	1.27±0.52	0.016
E/E'		6.85±2.12	6.69±1.72	0.629
RVSP		20.65±5.14	20.62±5.17	0.970
PAH	Mild	6 (13.1)	3(3.2)	0.025
	No	40 (86.9)	91(96.8)	
TAPSE		21.17 ± 2.18	21.16±2.32	0.972

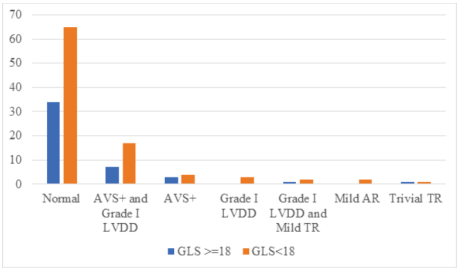

Fig 2: Comparison Of Valves Between The Groups.

DISCUSSION

Diabetes mellitus even in the absence of any CAD and obesity was found to be a important contributor to heart failure(10). Early detection of diabetic heart disease is very important to plan the life style modifications and medical interventions in order to prevent or delay the impending heart failure. Introduction of 2D speckle tracking echocardiography made the identification of any structural abnormality as it was more sensitive and specific in that aspect(9). The present study was a descriptive hospital-based study carried out with the objective of determining the proportion of diabetics with subclinical left ventricular dysfunction attending to the OPD of KAP Vishwanathan Government Medical College, Trichy, Tamilnadu and also to compare the selected sociodemographic, clinical and Echocardiographic parameters between those with strain and no strain.

Among the 140 type II diabetics included into the study 32.9% were found to have GLS <18%. Both those with GLS<18% and GLS >18% was found to be similar with regard to age, sex and mode of treatment. Holland D et al conducted a prospective study where type II DM patients with GLS <18% were followed up. The study concluded that strain wa more common in a type II DM which the present study also reiterates. The holland D et al study also documented that those with subclinical LV dysfunction had higher all-cause mortality and hospitalisation(11). El-Hini SH et al reported higher mean strain in the diabetic group than in the prediabetic and normal group respectively(12).

The clinical parameters like heartrate, systolic blood pressure and diastolic blood pressure were found to be similar between the groups. The mean SpO2 was found to be significantly lower among those with GLS ≥ 18 than those with GLS < 18. With regard to echocardiography parameters, none had RWMA. The ejection fraction was found to be similar between those with GLS ≥ 18 and GLS < 18. Kosmala M et al reported similar left ventricular ejection fraction among those with diabetes, diabetes along with hypertension and normal individuals. The above findings is similar to the present study(13). Karagoz A et al also reported a similar finding with regard to ejection fraction(14).

The mean E wave was found to be similar between the groups. The mean A wave was significantly more among those with GLS ≥ 18 than those with GLS < 18. The mean E/A ratio was significantly lower among those with GLS ≥ 18 than those with GLS < 18. Zoroufian A et al compared the echocardiographic parameters between diabetics and non-diabetics and reported significantly increased isovolumetric contraction time and isovolumetric relaxation time among the diabetics. The myocardial performace index was significantly higher. Mean Peak A and E/A ratios were significantly reduced among the diabetics and so was the septal E'(10). Similar results were also obtained by Nakahi H et al where the mean A wave was significantly more in the diabetics than the control group. The E/A ratio also exhibited a similar pattern(9).

The present study found no difference in mean E' between the groups. The mean E/E' was also found to be similar between those with GLS ≥ 18 and GLS < 18. There was no difference in mean RVSP values also. With regard to PAH, mild PAH was significantly more in the GLS ≥ 18 than the GLS < 18 group with P value of less than 0.05. The mean TAPSE values was found to be similar between those with strain and no strain with P value of more than 0.05.

One of the pathophysiological backgrounds of diabetes was found to be structural and functional alterations in heart muscle. There would be intracellular accumulation of triglycerides and toxic fatty acid intermediates due to disturbance in the myocardial carbohydrate and lipid metabolism. The changes like reduced adenosine triphosphate activity, abnormalities in the sarcoplasmic reticulum and sarcolemmal calcium transport were found to be responsible for functional myocardial disarrangement. The structural changes again could also lead to altered myocardial function. Hyperglycaemia, ROS and increased angiotensin II levels could produce cardiomyocyte apoptosis and necrosis. The above will culminate to fibrosis and myocardial stiffness. The other contributing factors were microangiopathy and autonomic neuropathy(13)(15)(16)(17). Roy S et al associated the presence of subclinical left ventricular dysfunction with the presence of microangiopathies like neuropathy and retinopathy(18). The generalisability of the results may be limited as it was a single centre study and the population involved could be more homogenous. There was a significant subclinical left ventricular dysfunction among the type II diabetics and some functional parameters were also disarranged in them.

CONCLUSION

The prevalence of subclinical left ventricular dysfunction among type II diabetics was 33% in the present study. There were also derangements in the other parameters. The study stresses the importance of screening diabetics patients using 2D speckle Tracking echocardiography for early detection of subclinical LV dysfunction.

Conflict of interest: None
No funding

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