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A Study on Left Ventricular Remodelling In Diabetic Patients with and Without Hypertension

[1.]Samuel Dinesh Alfred, [2.]VijayanandRadhakrishnan, [3.]LakshmiKulandaivel, [4.]Liju Antony Raj, [5.]GomathyKrithigaKrishnaswamy
[1]*Associate Professor, Department of Medicine, Government Stanley Hospital, Chennai*
[2]*Senior Assistant Professor, Department of Medicine, Government Stanley Hospital*
[3]*Senior Assistant Professor, Department of Medicine, Government Stanley Hospital*
[4]*Junior Resident, Department of Medicine, Government Stanley Hospital*
[5]*Junior Resident, Department of Medicine, Government Stanley Hospital*
Corresponding Author: Vijayanand Radhakrishnan

Abstract:
Objectives: *Determination of left ventricular hypertrophy in diabetic patients with and without hypertension. The effect of diabetes mellitus on left ventricular dimensions.*
Methods:*This study was conducted in a tertiary care institution in Chennai fora duration of 6 months from April 2017 to Sep 2017. A proper ethical approval was obtained from the Institutional Ethical Committee .The study was conducted after getting informed consent from all the Subjects involved in this study.*
Results:*Group1 includes 10 females, 13 males. Group II includes 10 females and 13 males. Group III contains 11 females, 12 males. Group IV contains 7 females and 16 males. Age of the patients in group I ranged from 45 to 69 years with a mean of 56.17. In group II age ranged from 44 to 69 years with a mean of 57.65. In group III age ranged from 41 to 69 years with a mean of 55.04. In control group, group IV age ranged from 49 to 54 years with a mean of 51.3.between all groups, LVDD, LVSD, LV wall thickness, PW, LV mass and mass was comparable and was statistically significant (p<0.01).*

COMPARISON OF DM WITH NORMAL CONTROL PATIENTS:
Group I LVSD ranged from 4.1 to 5.1 with a mean of 4.64, while in group IV it ranged from 2.5 to 2.8 with a mean of 2.63.In group I LVDD ranged from 5.8 to 6.1 with mean of 6.01,while in control group it ranged from 4.3 to 4.5, mean being 4.36.IVS in group I ranged from 1.4 to 1.5, mean being 1.47, in control group IVS varied from 0.9 to 1.0, mean being 0.9.PW in group I ranged from 1.3 to 1.4 mean being 1.34, in control group 0.8 to1.0 ,mean being 0.85. Group I patients showed significant increase of LVDD and LVSD, LV wall thickness (IVS and PW) and mass compared to normal. The difference between the two groups was statistically significant (p<0.01).

COMPARISON OF GROUP III WITH CONTROL GROUP:
LVSD in group III ranged from 4.4 to 5.0 with mean of 4.74, LVDD ranged from 5.8 to 6.1 with mean of 5.96, IVS ranged from 1.5 to 1.7 with mean of 1.58, PW varied from 1.3 to 1.4 , mean being 1.37.Values of LVSD ,LVDD, mass , wall thickness (IVS and PW) was significantly elevated in Group III than Group IV (p<0.01). Also, the prevalence of increased LV wall mass and thickness was significantly higher in Group III.
Compared to control group, all patients in Group I, II and III showed significant decrease in LVFS. LVFS in group I ranged from 25 to 33 with mean of 29.74, in group II ranged from 26 to 34 with mean of 30.3, in group III, it varies from 22 to 33, with mean of 29.09, in control group ranged from 29 to 43 with mean of 37.96. When compared to control group, patients in all three groups, GrI, GrII, GrIII showed significant decrease in LVFS. LA was significantly larger in all three patient groups than in control group. However, in all the three patient groups (I, II and III) there is no significant differences in LA and LVFS dimension.

Abbreviations:
ATP : Adenosine tri phosphate
Ca 2+ : Calcium Ions
DM : Diabetes mellitus
EF : Ejection fraction
FFA : Free fatty acids
FS : Fractional shortening
IVS :Interventricular septum
LA : Left atrium
LV : Left ventricle

LVSD : Left ventricular systolic dimensions
LVDD : Left ventricular diastolic dimensions
MODY : Maturity onset diabetes in young
MMP : Matrix mettalloproteinases
NE : Nor epinephrine
OGTT : Oral glucose tolerance test
PW : Posterior wall
RAS : Renin angiotensin system
SR : Sarcoplasmic reticulum

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I. Introduction

Diabetes Mellitus is a fast growing epidemic in India. Its incidence rate is increasing year by year. India has an alarming epidemic of diabetes which is progressing fast, according to Indian Council of Medical Research sponsored INDIAB study, published in 20111. There is now an estimated 75 million patients with diabetes in India and the number is projected to extend beyond 100 million by the year 2030. This diabetes epidemic is right now progressing across rural and hilly areas which were previously taught as untouched. Although the prevalence of both the types of diabetes mellitus is increasing worldwide, the prevalence of type 2 diabetes mellitus is much more rapidly rising than other types attributed to more of obesity and sedentary lifestyle, high calorie density fast food as countries become more and more industrialized. Left ventricular (LV) hypertrophy either explained by echocardiographic or electrocardiographic criteria has been shown to be a strongly independent risk factor for cardiovascular morbidity and mortality. It is generally accepted that increase in mass of left ventricle is suggested to increase cardiovascular risk through a series of unfavourable metabolic, functional and structural cardiac changes. This explained the facts that an increased left ventricular mass is an important risk factor for cardiac events such as myocardial infarction and heart failure.

Patients with diabetes are characterized by an increasing likelihood of heart failure, largely showing the contribution of diabetes to coronary artery disease and its association with hypertension1. Over the last four decades, a number of epidemiological, animal, and clinical studies have proposed the presence of diabetic heart disease as a distinct clinical entity.

This study is undertaken to evaluate the effect of diabetes mellitus on left ventricular internal dimensions, systolic function and left ventricular mass using echocardiography.This study included 4 equal patients groups (DM without hypertension, Hypertension without diabetes and DM with hypertension, normal subjects) and described the changes in echo parameters in each group in comparison with the other groups and with normal individuals.

Echocardiography is the primary non-invasive diagnostic modality for the calculation of left ventricular mass because it is cost-effective and offers real-time, high resolution imaging for initial evaluation and further follow up.

Aim of The Study

- Assess left ventricular dimensions and wall thickness, mass in patients with diabetes mellitus.

Objective:

- Determination of left ventricular hypertrophy in diabetic patientswith and without hypertension.
- Theeffect of diabetes mellitus on left ventricular dimensions.

II. Materials And Methods

This study was conducted in a Tertiary care institution in Chennai fora duration of 6 months from April 2017 to Sep 2017. A proper ethical approval was obtained from the Institutional Ethical Committee .The study was conducted after getting informed consent from all the Subjects involved in this study.

Study Design : Cross Sectional Comparative Study
Study Period : 6 months (April 2017 to Sep 2017)
Conflict of Interest : Nil
Study population:
Study population will consist of patients and general population in the hospitals diagnosed with Diabetes Mellitus and systemic hypertension and matched normal subjects.

Inclusion Criteria
Cases
Diabetics in this study will be defined by the American Diabetes Association as either
-Fasting plasma glucose (FBS) of >125 mg/dl, or Postprandial blood sugars at 2Hr (PPBS) > 200 mg/dl.Hypertension SBP>140 DBP >90 mm Hg
Controls
Fasting plasma glucose (FBS) of <110 mg/dl, or Postprandial blood sugars at 2Hr (PPBS) < 140 mg/dl.SBP<140 DBP <90 mmHg.

Exclusion Criteria
Documented ischemic heart disease History suggestive of previous angina, congestive cardiac failure. Documented evidence of other cardiac disease like cardiomyopathy, valvular heart disease, Congenital Heart Disease, Myocarditis Chronic obstructive pulmonary disease Features of hypothyroidism Uremia Diabetic patients on sulphonylureas
Diagnosis of Type 2 diabetes mellitus was made by clinical records and blood investigations including fasting and postprandial blood glucose values. For the diagnosis of diabetes mellitus, WHO criteria were employed.
SAMPLE SIZE:
According to this formula:
$n=z2p(1-p)/d2$
p (Prevalence of LV remodelling in Type 2 Diabetes) =40%
Group I: included 23 patients with DM only
Group II: included 23patients with hypertension only
Group III: included 23 patients with DM and hypertension .
Group IV: included 23 normal individuals with no hypertension and DM as control group.

Methodology:
After obtaining informed written consent, basic demographic details, detailed clinical history and physical examination will be done. Echocardiography was performed to all subjects. Examination was performed while the patient in the left lateral decubitus position using both apical and parasternal views. The following M-mode parameters were measured:
1) LV systolic (LVSD) and diastolic (LVDD) internal dimensions,
2) Thickness of interventricular septum (IVS) and LV posterior wall (PW) at diastole
3) LV fractional shortening (FS).
4) LV mass using the corrected formula [LV mass (g) = 0.8 {1.04 x (LVDD + IVS + PW)3 - (LVDD)3} + 0.6,
5) LV mass index calculated by: LV mass/ body surface area
6) Left atrial (LA) dimension.

III. Data Collection & Analysis

The data of each patient will be collected on a proforma specially designed for this study and which includes demographic details, past medical history, diabetic profile. The information collected regarding all the selected subjects were recorded in a Master Chart. The collected data was analysed to identify the percentage of Left ventricular remodelling in Type 2 Diabetes patients and compared with normal and hypertensive population. The collected data were analysed with IBM.SPSS statistics software 23.0 Version.

To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the multivariate samples the one way ANOVA with Tukey's Post-Hoc test was used. To find the significance in categorical data Chi-Square test was used. In both the above statistical tools the probability value .05 is considered as significant level**.**

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
AGE	G I	23	56.17	7.63	1.59	52.87	59.47	45	69
	G II	23	57.65	7.11	1.48	54.58	60.73	44	69
	G III	23	55.04	7.31	1.52	51.88	58.20	41	69
	G IV	23	51.30	1.49	0.31	50.66	51.95	49	54
	Total	92	55.04	6.73	0.70	53.65	56.44	41	69
LVSD(cm)	G I	23	4.64	0.34	0.07	4.49	4.79	4.1	5.1
	G II	23	4.18	0.30	0.06	4.05	4.31	3.5	4.5
	G III	23	4.74	0.16	0.03	4.67	4.81	4.4	5.0
	G IV	23	2.63	0.11	0.02	2.58	2.68	2.5	2.8
	Total	92	4.05	0.88	0.09	3.87	4.23	2.5	5.1
LVDD(cm)	G I	23	6.01	0.11	0.02	5.96	6.06	5.8	6.1
	G II	23	5.94	0.12	0.02	5.89	5.99	5.8	6.1
	G III	23	5.96	0.10	0.02	5.91	6.00	5.8	6.1
	G IV	23	4.36	0.08	0.02	4.33	4.39	4.3	4.5
	Total	92	5.57	0.71	0.07	5.42	5.71	4.3	6.1
IVS(cm)	G I	23	1.47	0.05	0.01	1.44	1.49	1.4	1.5
	G II	23	1.46	0.05	0.01	1.43	1.48	1.4	1.5
	G III	23	1.58	0.09	0.02	1.54	1.62	1.5	1.7
	G IV	23	0.96	0.05	0.01	0.94	0.98	.9	1.0
	Total	92	1.37	0.25	0.03	1.31	1.42	.9	1.7
PW(cm)	G I	23	1.34	0.05	0.01	1.32	1.36	1.3	1.4
	G II	23	1.36	0.05	0.01	1.34	1.38	1.3	1.4
	G III	23	1.37	0.05	0.01	1.35	1.39	1.3	1.4
	G IV	23	0.85	0.06	0.01	0.83	0.88	.8	1.0
	Total	92	1.23	0.23	0.02	1.18	1.28	.8	1.4
FS(%)	G I	23	29.74	1.81	0.38	28.95	30.52	25	33
	G II	23	30.30	2.24	0.47	29.33	31.28	26	34
	G III	23	29.09	2.63	0.55	27.95	30.22	22	33
	G IV	23	37.96	3.84	0.80	36.29	39.62	29	43
	Total	92	31.77	4.51	0.47	30.84	32.71	22	43
LVMASS	G I	23	389.71	14.06	2.93	383.63	395.79	367.47	407.42
	G II	23	386.69	15.35	3.20	380.05	393.33	367.47	407.42
	G III	23	414.19	18.66	3.89	406.12	422.26	387.87	436.25
	G IV	23	153.56	13.45	2.81	147.74	159.38	114.17	165.57
	Total	92	336.04	107.56	11.21	313.76	358.31	114.17	436.25
MASS	G I	23	229.24	8.27	1.72	225.67	232.82	216.16	239.66
INX	G II	23	227.47	9.03	1.88	223.56	231.37	216.16	239.66
	G III	23	243.64	10.98	2.29	238.89	248.39	228.16	256.62
	G IV	23	90.33	7.91	1.65	86.91	93.75	67.16	97.39
	Total	92	197.67	63.27	6.60	184.57	210.77	67.16	256.62
LA	G I	23	4.26	0.15	0.03	4.19	4.32	3.9	4.5
	G II	23	4.36	0.21	0.04	4.27	4.45	3.9	4.6
	G III	23	4.28	0.24	0.05	4.18	4.39	3.8	4.8
	G IV	23	3.29	0.09	0.02	3.25	3.33	3.1	3.4
	Total	92	4.05	0.48	0.05	3.95	4.14	3.1	4.8

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
AGE	Between Groups	507.478	3	169.159	4.114	.009
	Within Groups	3618.348	88	41.118		
	Total	4125.826	91			
LVSD(cm)	Between Groups	65.797	3	21.932	360.550	.0005
	Within Groups	5.353	88	.061		
	Total	71.150	91			
LVDD(cm)	Between Groups	44.621	3	14.874	1357.278	.0005
	Within Groups	.96	88.00	.01		
	Total	45.59	91.00			
IVS(cm)	Between Groups	5.23	3.00	1.74	447.445	.0005
	Within Groups	.34	88.00	.00		
	Total	5.57	91.00			
PW(cm)	Between Groups	4.40	3.00	1.47	547.592	.0005
	Within Groups	.24	88.00	.00		
	Total	4.63	91.00			
FS(%)	Between Groups	1190.12	3.00	396.71	52.887	.0005
	Within Groups	660.09	88.00	7.50		
	Total	1850.21	91.00			
LVMASS	Between Groups	1031609.30	3.00	343869.77	1428.914	.0005
	Within Groups	21177.30	88.00	240.65		
	Total	1052786.60	91.00			
MASS INX	Between Groups	356965.09	3.00	118988.36	1428.943	.0005
	Within Groups	7327.78	88.00	83.27		
	Total	364292.87	91.00			
LA	Between Groups	17.78	3.00	5.93	176.626	.0005
	Within Groups	2.952	88	.034		
	Total	20.728	91			

Post Hoc Tests

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
AGE	G I	G II	-1.478	1.891	.863	-6.43	3.47
		G III	1.130	1.891	.932	-3.82	6.08
		G IV	4.870	1.891	.056	-.08	9.82
	G II	G I	1.478	1.891	.863	-3.47	6.43
		G III	2.609	1.891	.515	-2.34	7.56
		G IV	6.348*	1.891	.006	1.40	11.30
	G III	G I	-1.130	1.891	.932	-6.08	3.82
		G II	-2.609	1.891	.515	-7.56	2.34
		G IV	3.739	1.891	.204	-1.21	8.69
LVSD(cm)	G I	G II	.4565*	.0727	.000	.266	.647
		G III	-.1043	.0727	.481	-.295	.086
		G IV	2.0087*	.0727	.000	1.818	2.199
	G II	G I	-.4565*	.0727	.000	-.647	-.266
		G III	-.5609*	.0727	.000	-.751	-.370
		G IV	1.5522*	.0727	.000	1.362	1.743
	G III	G I	.1043	.0727	.481	-.086	.295
		G II	.5609*	.0727	.000	.370	.751
		G IV	2.1130*	.0727	.000	1.923	2.304
LVDD(cm)	G I	G II	.0696	.0309	.117	-.011	.150
		G III	.0522	.0309	.335	-.029	.133
		G IV	1.6478*	.0309	.000	1.567	1.729
	G II	G I	-.0696	.0309	.117	-.150	.011
		G III	-.0174	.0309	.943	-.098	.063
		G IV	1.5783*	.0309	.000	1.497	1.659
	G III	G I	-.0522	.0309	.335	-.133	.029
		G II	.0174	.0309	.943	-.063	.098
		G IV	1.5957*	.0309	.000	1.515	1.676
IVS(cm)	G I	G II	.0087	.0184	.965	-.039	.057
		G III	-.1130*	.0184	.000	-.161	-.065
		G IV	.5043*	.0184	.000	.456	.553
	G II	G I	-.0087	.0184	.965	-.057	.039
		G III	-.1217*	.0184	.000	-.170	-.074
		G IV	.4957*	.0184	.000	.447	.544
	G III	G I	.1130*	.0184	.000	.065	.161
		G II	.1217*	.0184	.000	.074	.170
		G IV	.6174*	.0184	.000	.569	.666
PW(cm)	G I	G II	-.0217	.0153	.488	-.062	.018
		G III	-.0304	.0153	.198	-.070	.010
		G IV	.4870*	.0153	.000	.447	.527

	G II	G I	.0217	.0153	.488	-.018	.062
		G III	-.0087	.0153	.941	-.049	.031
		G IV	.5087*	.0153	.000	.469	.549
	G III	G I	.0304	.0153	.198	-.010	.070
		G II	.0087	.0153	.941	-.031	.049
		G IV	.5174*	.0153	.000	.477	.557
FS(%)	G I	G II	-.565	.808	.897	-2.68	1.55
		G III	.652	.808	.851	-1.46	2.77
		G IV	-8.217*	.808	.000	-10.33	-6.10
	G II	G I	.565	.808	.897	-1.55	2.68
		G III	1.217	.808	.437	-.90	3.33
		G IV	-7.652*	.808	.000	-9.77	-5.54
	G III	G I	-.652	.808	.851	-2.77	1.46
		G II	-1.217	.808	.437	-3.33	.90
		G IV	-8.870*	.808	.000	-10.98	-6.75
LVMASS	G I	G II	3.01870	4.57451	.912	-8.9611	14.9985
		G III	-24.47609*	4.57451	.000	-36.4559	-12.4963
		G IV	236.15217*	4.57451	.000	224.1724	248.1320
	G II	G I	-3.01870	4.57451	.912	-14.9985	8.9611
		G III	-27.49478*	4.57451	.000	-39.4746	-15.5150
		G IV	233.13348*	4.57451	.000	221.1537	245.1133
	G III	G I	24.47609*	4.57451	.000	12.4963	36.4559
		G II	27.49478*	4.57451	.000	15.5150	39.4746
		G IV	260.62826*	4.57451	.000	248.6485	272.6080
MASS INX	G I	G II	1.77739	2.69089	.912	-5.2695	8.8243
		G III	-14.39696*	2.69089	.000	-21.4439	-7.3500
		G IV	138.91522*	2.69089	.000	131.8683	145.9621
	G II	G I	-1.77739	2.69089	.912	-8.8243	5.2695
		G III	-16.17435*	2.69089	.000	-23.2213	-9.1274
		G IV	137.13783*	2.69089	.000	130.0909	144.1848
	G III	G I	14.39696*	2.69089	.000	7.3500	21.4439
		G II	16.17435*	2.69089	.000	9.1274	23.2213
		G IV	153.31217*	2.69089	.000	146.2652	160.3591
LA	G I	G II	-.1000	.0540	.257	-.241	.041
		G III	-.0261	.0540	.963	-.168	.115
		G IV	.9696*	.0540	.000	.828	1.111
	G II	G I	.1000	.0540	.257	-.041	.241
		G III	.0739	.0540	.522	-.068	.215
		G IV	1.0696*	.0540	.000	.928	1.211
	G III	G I	.0261	.0540	.963	-.115	.168
		G II	-.0739	.0540	.522	-.215	.068
		G IV	.9957*	.0540	.000	.854	1.137

***. The mean difference is significant at the 0.05 level.**

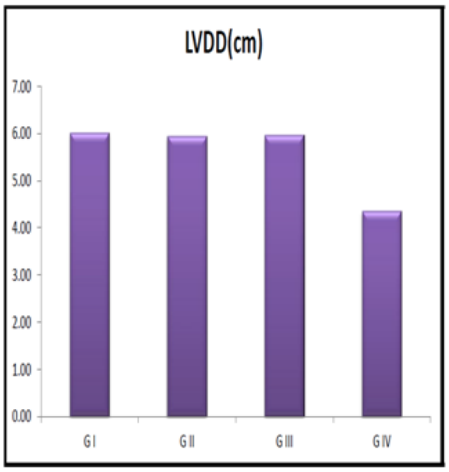
GENDER DISTRIBUTION

Groups * Gender Cross Tabulation

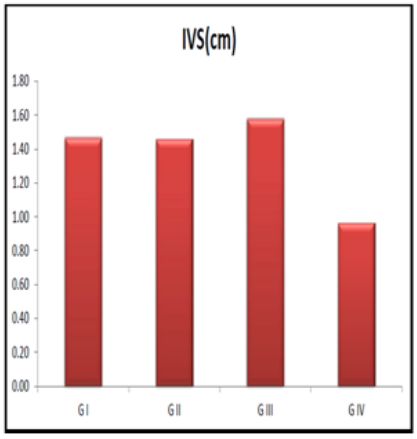
			Gender		Total
			Female	Male	
Groups	G I	Count	10	13	23
		% within Groups	43.5%	56.5%	100.0%
	G II	Count	10	13	23
		% within Groups	43.5%	56.5%	100.0%
	G III	Count	11	12	23
		% within Groups	47.8%	52.2%	100.0%
	G IV	Count	7	16	23
		% within Groups	30.4%	69.6%	100.0%
Total	Count		38	54	92
	% within Groups		41.3%	58.7%	100.0%

	Female	Male
G I	43.5%	56.5%
G II	43.5%	56.5%
G III	47.8%	52.2%
G IV	30.4%	69.6%

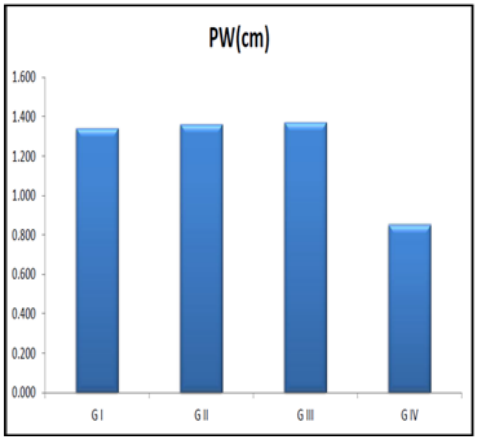
LVDD IN CASES AND CONTROLS



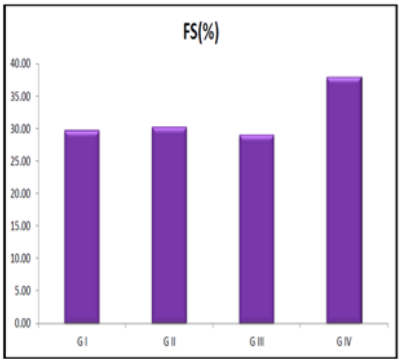
IVS IN CASES AND CONTROLS



PW IN CASES AND CONTROLS



FRACTIONAL SHORTENING IN CASES AND CONTROLS



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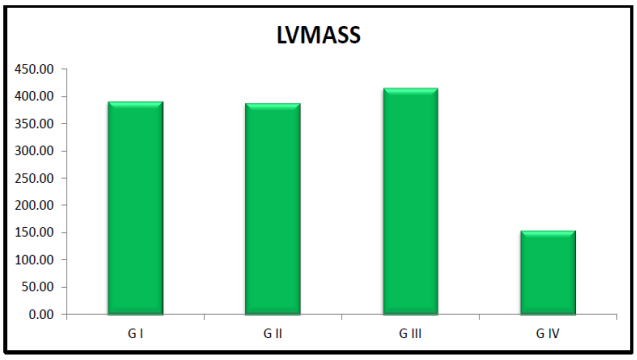
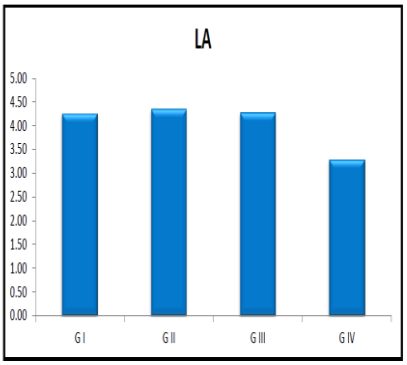


LA COMPARISON IN CASES AND CONTROLS



Group1 includes 10 females, 13 males. Group II includes 10 females and 13 males. Group III contains 11 females, 12 males. Group IV contains 7 females and 16 males. Age of the patients in group I ranged from 45 to 69 years with a mean of 56.17. In group II age ranged from 44 to 69 years with a mean of 57.65. In group III age ranged from 41 to 69 years with a mean of 55.04. In control group, group IV age ranged from 49 to 54 years with a mean of 51.3.between all groups, LVDD, LVSD, LV wall thickness, PW, LV mass and mass was comparable and was statistically significant ($p<0.01$).

COMPARISON OF DM WITH NORMAL CONTROL PATIENTS:

Group I LVSD ranged from 4.1 to 5.1 with a mean of 4.64, while in group IV it ranged from 2.5 to 2.8 with a mean of 2.63.In group I LVDD ranged from 5.8 to 6.1 with mean of 6.01,while in control group it ranged from 4.3 to 4.5, mean being 4.36.IVS in group I ranged from 1.4 to 1.5, mean being 1.47, in control group IVS varied from 0.9 to 1.0, mean being 0.9.PW in group I ranged from 1.3 to 1.4 mean being 1.34, in control group 0.8 to1.0 ,mean being 0.85. Group I patients showed significant increase of LVDD and LVSD, LV wall thickness (IVS and PW) and mass compared to normal. The difference between the two groups was statistically significant ($p<0.01$).

COMPARISON OF GROUP III WITH CONTROL GROUP:

LVSD in group III ranged from 4.4 to 5.0 with mean of 4.74, LVDD ranged from 5.8 to 6.1 with mean of 5.96, IVS ranged from 1.5 to 1.7 with mean of 1.58, PW varied from 1.3 to 1.4 , mean being 1.37.Values of LVSD ,LVDD, mass , wall thickness (IVS and PW) was significantly elevated in Group III than Group IV ($p<0.01$). Also, the prevalence of increased LV wall mass and thickness was significantly higher in Group III.
Compared to control group, all patients in Group I, II and III showed significant decrease in LVFS. LVFS in group I ranged from 25 to 33 with mean of 29.74, in group II ranged from 26 to 34 with mean of 30.3, in group III, it varies from 22 to 33, with mean of 29.09, in control group ranged from 29 to 43 with mean of 37.96. When compared to control group, patients in all three groups, GrI, GrII, GrIII showed significant decrease in LVFS. LA was significantly larger in all three patient groups than in control group. However, in all the three patient groups (I, II and III) there is no significant differences in LA and LVFS dimension.

IV. Discussion

It has been agreed that an left ventricular mass increase is thought to significantly increase the cardiovascular risk through a series of deleterious functional, metabolic, and structural cardiac changes. Hence, a left ventricular mass increase is a significant risk factor for various cardiac events .Collected data from pathological, epidemiological, clinical, experimental studies have shown that diabetes mellitus affects the systolic and diastolic cardiac function and structure not taken the account of other risk factors such as hypertension, coronary artery disease .

Our study is aimed to examine the effect of diabetes mellitus on left ventricular internal dimensions, mass of left ventricle, systolic function by use of echocardiography. Our study included 3 equal patients groups (Hypertension without diabetes, DM without hypertension and DM with hypertension) and details the changes in echo parameters in each patient group in comparison with the other groups and with control group.

Our study shows that the prevalence of increased left ventricle wall thickness and mass in patients with DM was comparable to those with hypertension and normal .In cases with diabetes associated with hypertension, the prevalence became significantly higher .In comparison to control group, left ventricle mass was significantly higher in all 3 patient groups. In this study, diabetes mellitus was associated with lower fractional shortening values than in controls whether there is associated hypertension or not. Our study shows an

increased left atrial size in both diabetic and hypertensive groups. This can be substantiated as a consequence to decreased left ventricular dysfunction in systolic and diastolic phase and/or as an effect of increase in left ventricular mass. These cardiac disturbances can be explained as a consequence of direct effect of diabetes mellitus on cardiac musculature causing left ventricular remodelling leading to systolic and diastolic dysfunction. These changes which are brought by diabetes mellitus include replacement fibrosis caused by focal necrosis of myocytes and increased interstitial fibrosis, defective energy metabolism, impaired collagen degradation due to glycosylation of the lysine residues on collagen. Increased blood sugar levels also results in the production of reactive oxygen and nitrogen species, that significantly increases the oxidative stress and causing abnormal gene expression, change in signal transduction, and activation of pathways leading to myocardial cell death.

V. Conclusion

Diabetes mellitus is associated with a cardiomyopathy, independent of other comorbid conditions, and that metabolic disturbances, insulin resistance myocardial fibrosis, cardiac autonomic neuropathy, small vessel disease, endothelial dysfunction may all contribute to the development of diabetic heart disease. Salient functional effects include dysfunction of systole and diastole, which may manifest as dyspnea and exercise intolerance. Hypertension coupled with diabetes was more important for an increase in the risk of left ventricular remodeling and concentric hypertrophy. It will be of significant value for the treating clinician to assess the parameters for left ventricular hypertrophy and systolic function with the start of treatment and during follow up of diabetic patients with or without associated hypertension.

References

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