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A Study of Echocardiographical Findings in Obese Type 2 Diabetes Mellitus Patients from Central India

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ABSTRACT

Introduction

Obesity is increasing health problem worldwide including the developing countries. In India, obesity is emerging as an important health problem particularly in urban area. Almost 30-65% of adult urban Indians are either overweight or obese or have abdominal obesity. The rising prevalence overweight and obesity in India has a direct correlation with the increasing prevalence of obesity related co-morbidities; systemic hypertension, metabolic syndrome, dyslipidaemia, type 2 DM and cardio vascular disease.

Materials and Methods

This prospective observational study was conducted in 100 consecutive type 2 diabetic patients who were obese and attended Dept of Medicine, MGM Medical College and MYH, Indore in one year of study duration.

Results

In this studied population, 24% cases had both systolic+ diastolic dysfunctions and 72% cases had diastolic dysfunction only. While 11% cases had diastolic dysfunction with concentric LVH and only 4% cases showed concentric LVH. According to BMI grades, pulmonary hypertension was present in 1, 3, 0, and 1 patient, mitral regurgitation was present in 2 and 2 patients in BMI range 25-29.9 and 30-34.9 respectively. 23 cases in our study showed over all normal 2D echo Doppler study of which 29% patients had BMI 25-29.9, 12% patients had BMI 30-34.9, and 12% patients had BMI 35-39.9. Female cases with WHR >0.80 had higher grade of LV dysfunction as compared to female cases with WHR<or =0.80 (p value <0.046 statistically significant). As WHR increases, % of female Cases with isolated diastolic dysfunction increases. In Female cases, severe LVD (both systolic and diastolic) was seen only in subgroup with WHR >0.85.

Conclusions

All obese patients with type 2 DM should offer base line echocardiography to assess the cardiac function status. Female cases with high WHR had higher grade of LV dysfunction as compared to female cases with lower WHR which was statistically significant. Severe LVD (both systolic and diastolic) are seen in female cases only with WHR >0.85.

Keywords: Body mass index, left ventricular dysfunction, waist hip ratio

INTRODUCTION

Obesity is increasing health problem worldwide including the developing countries. In India, obesity is emerging as an important health problem particularly in urban area. Almost 30-65% of adult urban Indians are either overweight or obese or have abdominal obesity. The rising prevalence overweight and obesity in India has a direct correlation with the increasing prevalence of obesity related co-morbidities; systemic hypertension, metabolic syndrome, dyslipidaemia, type 2 DM and cardio vascular disease.

The American heart association has designed DM as CAD risk equivalent. Type 2 diabetes mellitus patient without a prior MI have a similar risk for coronary artery related events as non-diabetic individuals who had a prior MI.

A 20 to 30 year old male with a BMI >45 may lose 13 years of life. It is also apparent that the degree to which obesity affects particular organ systems is influenced by susceptibility genes that vary in the population. When the additional glucose intolerance associated with obesity is included, the adverse impact of obesity is even more evident.

BMI and WHR are commonly used clinical parameters to measure obesity. Increase in BMI and WHR is associated with increase in risk of several cardiovascular diseases. 2D Echo is the non-invasive and easy method to assess heart function and the complications. We studied echocardiographical findings in type 2 diabetes mellitus obese patients in central India.

MATERIALS AND METHODS

This prospective observational study was conducted in 100 consecutive type 2 diabetic patients who were obese and attended Dept of Medicine, MGM Medical College and MYH, Indore in one year of study duration from October 2012 to September 2013.

Inclusion Criteria

1. Age 25 years to 60 years
2. Both male and female cases.
3. Cases who met the criteria for Diabetes mellitus type 2.
4. Cases with BMI>25.
5. Old as well as newly detected diabetic cases with various risk factors.

Exclusion Criteria

1. Age <25 year and case with age>60 years not included because cases with <25 year of age may have often diabetes mellitus type 1 and severe other age related diseases may see in senior citizens.
2. Cases with the normal and subnormal BMI.
3. Seriously ill cases with multisystem disease.
4. Cases were excluded who had clinical hypo or hyperthyroidism.
5. COPD cases.
6. Cases with deranged renal function.
7. Cases not giving consent.

The anthropometric measurements of cases were recorded by observer and his colleagues, using standard protocol. Cases were instructed to empty their bladder prior to anthropomorphic measurements.

Cases stood in light clothing without shoes/Chapels.

Height was measured to the nearest 0.1 cm using by inchs centimetre tape pasted to wall. Cases were asked to stand erect while their occiput shoulder hips and heel touched the wall. A firm cardboard was put over the vertex to get the height in centimetres.

Weight was measured by using conventional weight machine.

Body mass index (BMI) was calculated from weight (kg) divided by square of height in meter square. A plastic coted inch/ centimetre tape was used for the waist circumference and hip circumference measures.

Waist circumferencewas measured at the smallest circumference between the costal margin and the iliac crest to the nearest 0.1 cm while the case was standing with the abdomen relaxed, at the end of normal expiration. Where there was no natural waistline, the measurement was taken at the level of umbilicus.

Hip circumference was measured at the maximum circumference between the iliac crest and the crotch while the participant in standing and recorded to the nearest 0.1 cm.

2D Echo Dopller was performed in all cases with the help of consultant cardiologist in department of medicine, ICCU using GE HEALTH CARE bio version 1.0 ECHO DOPPLER machine.

Echocardiograms

Included Cross sectional, M mode, 2D-echo and Doppler studies.

The following Indices of cardiac function were evaluated; Left ventricular systolic function, Left ventricular end diastolic diameter (EDD), End systolic diameter (ESD) and fractional shortening (FS) was obtained in parasternal long axis views using M mode.

Left ventricular diastolic function: Doppler measurements were obtained in the apical four chamber view.

The following variables were calculated: maximum velocity of passive mitral filling (E), maximum velocity of active mitral fills (A), ratio of passive to

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active velocity, deceleration time (DT) and isovolumic relaxation time (IVRT).

Statistical analysis

The discrete data were assessed in number and percent. Chi-square test was used for determining the correlation between carotid artery disease and various atherosclerotic risk factors. P value (2 sided) <0.05 represents statistical significance. Statistical significance was assessed by Statistical Package for Social Science (SPSS) version 10.

RESULTS

This study was conducted in 100 Diabetes Mellitus Type 2 patients with obesity. Out of 100 cases studied 77 had abnormal 2D echocardiography findings and 23 had normal 2D echocardiography. Our findings are as follows:

As shown in table 1, 24% cases had both systolic and diastolic dysfunctions. 72% cases had diastolic dysfunction only. 11% cases had diastolic dysfunction with concentric LVH. 4% cases showed concentric LVH.

Table 1: Various 2D ECHO DOPPLER findings in our studied cases (n=100)

2D-Echo Doppler Finding		No. Of Cases
LV Systolic and Diastolic dysfunction	severe	5
	Moderate	9
	Mild	10
	Total	**24**
LVDD (LV diastolic dysfunction)	Grade I	26
	Grade II	9
	Grade III	2
	Grade IV	0
	Total	**37**
LVH with grade LVDD		11
LVH		4
PAH		5
Dilated RA and RV		2
Dilated LA and LV		1
MR		4
TR		3

Out of total 100 cases studied, 77 cases had abnormality in 2D-ECHO DOPPLER.

As shown in table 2, out of 77 cases with abnormal 2D Echo Doppler, 25 cases had LV dysfunction (both Systolic and Diastolic). Out of 25 cases with LV dysfunction the degree of LV dysfunction was mild, moderate, and severe in 41%, 38%, and 21% cases respectively.

Table 2: Showing correlation between BMI & LVD (both systolic and diastolic)

BMI	LV (SYSTOLIC and DIASTOLIC DYSFUNCTION)

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25-29.9	MILD	MODERATE	SEVERE
30-34.9	4	5	2
35-39.9	3	4	2
>40	3	0	1
Total	10	9	5

As shown in table 3, according to grade of BMI, LVDD was present in 27, 3, 4, and 3 patients. In BMI of 25 to 29.9, 19 patients had grade I and 8 patients had grade II LVDD. In BMI of 30-34.9, 2 patients had grade I and 1 patient had grade III LVDD. In BMI of 35 to 39.9, 4 patients had grade I LVDD. And in BMI of 40 or more, grade I, grade II, and grade III LVDD was found in 1 patient in each group.

Table 3: Correlation between BMI and obese DM type 2 cases with LVDD

BMI (in Kg/m^2)	**LV DIASTOLIC DYSFUNCTION**				
	I	**II**	**III**	**IV**	**Total**
25-29.9	19	8	0	0	27
30-34.9	2	0	1	0	3
35-39.9	4	0	0	0	4
>40	1	1	1	0	3
Total	26	9	2	0	37

As shown in table 4, 5 patients had both LVH and LVDD and 1 patient had LVH only in BMI of 25 to 29.9. In BMI of 30-34.9, 4 patients had LVD and LVDD both and 3 patients had LVH only. In BMI of 35-39.9, 2 patients had both LVH and LVDD.

Table 4: Correlation between BMI and 2D Echo Doppler abnormality

BMI	**LVH + LVDD**	**ONLY LVH**	**Total**
25-29.9	5	1	6
30-34.9	4	3	7
35-39.9	2	0	2
>40	0	0	0
Total	11	4	15

As shown in table 5, in WHR less than 0.81, LVD (both systolic and diastolic) was present in 3 patients, LVDD in 3 patients, and LVH with LVDD in 1 patient. In WHR between 0.81-0.85, LVD (both systolic and diastolic) was present in 2 patients, LVDD in 7 patients, and LVH was present in 1 patient. In patients with WHR more than 0.85, LVD (both systolic and diastolic) was present in 10 patients, LVDD in 21 patients, LVH with LVDD in 5 patients, and LVH in 1 patient. This table shows that as WHR increases LVD also increases in numbers and severity both.

Table 5: Correlation between WHR and various 2D Echo Doppler abnormalities in female cases (n=70)

WHR	**LVD (Systolic and Diastolic)**	**LV DIASTOLIC DYSFUNCTION**	**LVH+LVDD**	**LVH**

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	MILD	MODERATE	SEVERE	I	II	III	IV		
<0.81	2	1	0	3	0	0	0	1	0
0.81-0.85	1	1	0	6	1	0	0	0	1
>0.85	4	3	3	13	6	2	0	5	1
Total	7	5	3	22	7	2	0	6	2

As shown in table 6, various echocardiography findings are summarized according to WHR.

Table 6: Correlation between WHR and various 2D Echo Doppler changes (n=70)

WHR	PAH	MR	TR	DILATED LA+LV	DILATED RA+RV	NORMAL ECHO
<0.81	0	1	0	0	0	2
0.81-0.85	0	0	0	0	0	7
>0.85	4	3	3	0	1	7
Total	4	4	3	0	1	16

DISCUSSION

The results observed in 100 obese DM type 2 cases studied during October 2012- September 2013 in Medicine Department, MGM Medical College and M.Y.H. Indore, MP, are presented for discussion.

Table 1 shows various 2D Echo Doppler findings in our study. Out of 100 cases studied by us, 77 cases had abnormal 2D Echo Doppler. Various abnormalities found in 2D Echo Doppler were LV dysfunction (systolic/diastolic or combined). Other abnormalities were LVH, PAH, dilated RV and RA, LA, LV, MR and TR. Effort was made to correlate BMI with LV dysfunction (systolic and diastolic) in table 2 or isolated diastolic dysfunction (table 3).

Despite various 2D Echo Doppler abnormalities, there was insignificant correlation between grade of BMI and 2D Echo Doppler abnormalities.

Our study is comparable with a study conducted by Patil MB et al[1], which showed that diastolic dysfunction was present in 64% of the studied patients. LVDD was more common among female sex (68.18%) compared to male (60.17%).

In a study of cardiac profile in Type 2 DM patients with normal resting ECG with special reference to ECHOCARDIOGRAPHY and TMT done by Dr. Seema Mahant et al[2], out of 50 patients, 33 patients (66%) had abnormal 2D Echo finding.

In a study conducted by M pascual et al[3], showed that subclinical diastolic dysfunction was more prevalent among obese subjects (p =0.002), with mild obesity (12%), with moderate obesity (35%) and severe obesity (45%). BMI correlated significantly with indices of left ventricular function.

Table 5 and 6 shows correlation between WHR and various 2D Echo Doppler findings in female cases (n=70). According to WHR we divided the female case in 3 sub groups. In our study, female cases with WHR >0.80 had higher grade of LV dysfunction as compared to female cases with WHR<or =0.80 (p value <0.046 statistically significant). As WHR increases, % of female Cases with isolated diastolic dysfunction increases. In Female cases, severe LVD (both systolic and diastolic) was seen only in subgroup with WHR >0.85. Percentage of female cases having normal 2D Echo Doppler decreases as WHR increases.

CONCLUSIONS

All obese patients with type 2 DM should offer base line echocardiography to assess the cardiac function status. Female cases with high WHR had higher

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grade of LV dysfunction as compared to female cases with lower WHR which was statistically significant. Severe LVD (both systolic and diastolic) are seen in female cases only with WHR >0.85.

DISCLOSURES

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Conflict of interest: Nil

Ethical Approval: Study was approved by institutional review board.

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