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CORELATIONSHIP BETWEEN ANTHROPOMETRIC MEASURMENTS, E.C.G. AND 2-D ECHO-DOPPLER IN OBESE PATIENTS WITH TYPE-2 DIABETES MELLITUS

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ABSTRACT

Aim: To select 100 cases of diabetes mellitus type 2 with obesity and record various anthropometric measurements, relevant investigations and to find out whether there is any significant co-relationship between anthropometric measurements, ECG and 2D ECHO-DOPLLER abnormalities.

Methods. In all selected cases detailed clinical workup was done. Various anthropometric measurements were taken and relevant investigations done. Cases were instructed to empty their bladder prior to anthropomorphic measurements.

Results 12 male cases out of 30 showed ECG changes suggestive of myocardial infarction. In female cases, 22 out of 70 cases studied had ECG suggestive of MI; the differences of number of obese DM type 2 cases was possibly due to random selection 5 female cases with WHR <0.81 had ECG criteria suggestive of myocardial infarction.(6%) female case with WHR 0.81-0.85 had ECG suggestive of myocardial infarction. (34%) female cases with WHR>0.85(N=46) had ECG criteria (QS complex, ST elevation, ST depression T inversion in II.III,AVF ,T inversion in lead I,AVL, V5-V6)suggestive of myocardial infarction.(30%) female cases showed low voltage QRS complex. There was slight decrease in percentage of normal ECG with increases in WHR

Conclusion: In obese DM type 2 female cases: there was significant correlationship between the different grade of WHR and LV dysfunction (systolic/diastolic or combined).In obese DM type 2 male cases: although there were abnormalities in ECG and 2D-ECHO DOPPLER study but statistically these were insignificant when correlated with BMI and WHR.

KEYWORDS : Cardiovascular abnormalities, Electrocardiography, Korea, Metabolic syndrome

INTRODUCTION

India is experiencing an epidemic of Type-2 Diabetes Mellitus and related disorders . With an estimated 50.8 million diabetic people, India has the world's largest diabetes population. Individuals with Type 2 DM are at particular risk of the adverse consequences of obesity. The American Heart Association has designated DM as a "CAD risk equivalent." Type 2 diabetes mellitus patients without a prior MI have a similar risk for coronary artery–related events as non-diabetic individuals who had a prior MI.[1,2]

Obesity is increasingly important health problem worldwide including the developing countries. In India, obesity is emerging as an important health problem particularly in urban areas. 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, Dyslipidemia, type 2 diabetes mellitus (T2DM), and cardiovascular disease (CVD).[3,4]

Obesity has major adverse effects on health. Obesity is associated with an increase in mortality, with a 50–100% increased risk of death from all causes compared to normal-weight individuals, mostly due to cardiovascular causes. Mortality rates rise as grade of obesity increases, particularly when obesity is associated with increased intra-abdominal fat. Life expectancy of a moderately obese individual could be shortened by 2–5 years.[5]

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 are 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. ELECTROCARDIOGRAPHY and 2D ECHO DOPPLER are the non-invasive and easy methods to assess heart function and the complications.[6]

Hence we designed this study whether there is any correlationship between anthropometric measurements, E.C.G and 2D echo-Doppler in obese patients with type-2 diabetes mellitus.

METHODOLOGY

Present work was conducted in department of medicine Indore from October 2012 to September2013.100 cases with type 2 diabetic mellitus having associated obesity were taken for present work.Patents were taken randomly from various medical wards and OPDs.

INCLUSION CRITERIA

1. Age 25 year to 60 years.
2. Both male and female cases.
3. Cases who met the diagnostic 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 normal/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.

Informed consent was taken prior to taking cases for present work.In all selected cases detailed clinical workup was done. Various anthropometric measurements were taken and relevant investigations done.

METHOD

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 ,Weight ,Body mass index (BMI) was calculated from weight (Kg) divided by the square of height in meter square. A plastics coated inch/centimeter tape was used for the waist circumference and hip circumference measures.

Waist circumference Hip circumference Waist-hip ratio-A 12-lead electrocardiogram (ECG) Haematological and biochemical variables , 2D ECHO DOPLLER.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.

OBSERVATIONS

Out of 100 cases 38 were in age group >55-60 years 24 in age group 50-55 years ,15 in age group 40-45 yearsOut of 70 cases,61% female cases had BMI between 25-29.9.Only 5% female cases had BMI >or=40 .0% 0f male cases had BMI between 25-29.9. In our study none of male case had BMI >0R =40

TABLE No.1 DISTRIBUTION OF CASES WITH ABNORMAL ECG FINDINGS

ECG CHENGES	NO. OF CASES	ECG CHENGES	NO. OF CASES
Low voltage QRS complex	24	Left ventricular hypertrophy	4
Qs complex	14	T inversion in I, avl, V5-V6	4
ST elevation	3	BBB	10
ST depression in precordial leads	6	VPC'S	3
		Sinus tachycardia	1
T inversion in lead II,III avf	7	Early Repolarisation	3
Poor progression of R wave	7	QT prolongation	1
Left atrial overload	7	Nonspecific changes	4
Right atrial over load	2	10 heart block	2

TALBE 2 CORRELATIONSHIP BETWEEN BMI & VARIOUS ECG CHANGES

BMI	POOR PROGRESION OF R WAVE	LAD	T INVERSION IN II, III ,AVF	T INVERSION IN I, AVL V3-V6
25-29.9	2	2	3	3
30-34.9	3	3	2	1
35-39.9	1	0	2	0
>40	1	0	0	0
TOTAL	7	5	7	4

As grade of BMI increases, percentage of cases with poor progression of R wave increase

TABLE 3 VARIOUS 2D ECHO DOPPLER FINDINGS IN OUR STUDY (OBESE DM TYPE 2) CASES

2D ECHO DOPPLER FINDING	NO OF CASES
LV systolic+diastolic dysfunction	24
Sever	5
Moderate	9
Mild	10
LVDD (LV Diastolic Dysfunction)	37
Grade I	26
Grade II	9
Grade III	2
Grade IV	0
LVH with grade LVDD	11
LVH	4
PAH	5
Dilated RA and RV	2
Dilated LA and LV	1
MR	4
TR	3

24% cases had both systolic+diastolic dysfunction.,72% cases had diastolic dysfunction.11% cases had diastolic dysfunction with concentric LVH.4% cases showed concentric LVH.

TABLE 4 CORRELATIONSHIP BETWEEN BMI AND 2D-ECHO DOPPLER ABNORMALITY

BMI	PAH	MR	TR	DILATED RA+RV	DILATED LA+LV
25-29.9	1	2	0	0	0
30-34.9	3	2	2	1	1
35-39.9	0	0	0	0	0
>40	1	0	1	1	0

TABLE 5 CORRELATIONSHIP BETWEEN WHR AND VARIOUS 2D-ECHO DOPPLER ABNORMALITIES (FEMALE CASES) (n=70)

WHR	Lv Sytolic+diastolic Dysfunction			Lv Diastolic Dysfunction				LVH+ LVDD	LVH
	Mild	Moderete	Severe	I	II	III	IV		
<O.81	2	1	0	3	0	0	0	1	0
O.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

TABLE 6 CORRELATIONSHIP BETWEEN WHR & LV DYSFUNCTION (n=30 MALE CASES)

WHR	Lv Sytolic+diastolic Dysfunction			Lv Diastolic Dysfunction				LVH+ LVDD	LVH
	Mild	Moderete	Severe	I	II	III	IV		
<or=0.90	0	00	0	0	0	0	0	3	0
0.91-0.95	0	02	1	0	0	0	0	0	1
0.96-1.0	3	2	1	0	0	0	0	0	0
>1.0	0	0	0	4	2	0	0	2	0
Total	3	4	2	4	2	0	0	5	1

RESULTS

A] WAIST HIP RATIO:

In our study 12(40%) male cases showed ECG changes (qs complex, ST elevation, ST depression T inversion in lead II,III, avf, T inversion in V5-V6) suggestive of myocardial infarction. As WHR increase, percentage of male cases with ECG (qs complex) suggestive of fully evolved myocardial infarction increases.

5(62%) female cases with WHR <0.81(N=8) have ECG criteria

(QS complex, ST elevation, ST depression, T inversion in II,III,AVF) suggestive of myocardial infarction.1(6%) female cases with WHR 0.81-0.85(N=16) have ECG criteria (QS complex, ST elevation, ST depression) suggestive of myocardial infarction. 16(34%) female cases with WHR>0.85(N=46) have ECG criteria (QS complex, ST elevation, ST depression T inversion in II.III,AVF ,T inversion in lead I,AVL, V5-V6.)Suggestive of myocardial infarction.21(30%) female cases in our study show low voltage complex.22(32%) female cases in our study show ECG criteria (QS complex, ST elevation, ST depression, T inversion in lead II, III avf, T inversion in V5-V6) suggestive of myocardial infarction.In our study there are slight decreases in percentage of essentially normal ECG with increases in WHR.

B] ECG CHANGES:

7(23%) male cases had normal ECG, while 23(32%) female cases had normal ECG.12(40%) male cases out of 30 male cases showed ECG changes (qs complex, ST elevation, ST depression T inversion in lead II,III, avf, T inversion in V5-V6) suggestive of myocardial infarction.

In female cases, 22 (31%) cases out of 70 cases studied had ECG suggestive of MI; the differences of number of obese DM type 2 cases was possibly due to random selection5 female cases with WHR <0.81(n=8) had ECG criteria suggestive of myocardial infarction.1(6%) female case with WHR 0.81-0.85(N=16) had ECG criteria (QS complex, ST elevation, ST depression) suggestive of myocardial infarction. 16(34%) female cases with WHR>0.85(N=46) had ECG criteria (QS complex, ST elevation, ST depression T inversion in II.III,AVF ,T inversion in lead I,AVL, V5-V6)suggestive of myocardial infarction.21(30%) female cases showed low voltage QRS complex.There was slight decrease in percentage of normal ECG with increases in WHR.

C] ECHOCARDIOGRAPHY CHANGES

In our study, male cases showing only diastolic dysfunction are seen with WHR >1.0.9 (30%) male cases in our study(N=30) show both left ventricular systolic and diastolic dysfunction.20(66%) male cases (N=30) show diastolic dysfunction.% of male cases with normal 2D ECHO DOPPLER finding decrease as increase in WHR

As WHR increases, % of female cases with only diastolic dysfunction increases.15(21%) female cases show both left ventricular systolic and diastolic dysfunction.52(74%) female cases (N=70) show LVDD with systolic dysfunction, concentric LVH or as alone.In our study female cases, severe LVD (systolic +diastolic) are seen only with WHR>0.85As increases in waist hip ratio, % of female cases with diastolic dysfunction grade II &III increase but not of grade I.% of female cases with normal 2D ECHO DOPPLER study decrease as WHR increases.

STATISTICAL ANALYSIS:

- Statistical analysis of the data observed by us was done with help of statistician department of community medicine, M.G.M.Medical College, Indore.Various types of statically analysis tests including chi square test, Mann Whitney test, Fisher Exact test were utilized.

DISCUSSION

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

Association between components of the metabolic syndrome and electrocardiographic abnormalities in Korean adults was studied by Kim HK, Kim CH et al .Resting electrocardiogram (ECG) abnormalities have been strongly associated with cardiovascular disease mortality. Ischemic ECG findings were separately identified and analyzed.The overall prevalence rates of ECG abnormalities were significantly higher in subjects with than in those without metabolic syndrome ($p < 0.01$). Ischemic ECG was strongly associated with metabolic syndrome in all age groups of both sexes, except for younger women. In multiple logistic regression analysis, metabolic syndrome was independently associated with ischemic ECG (odds ratio, 2.30 [2.04 to 2.62]; $p < 0.01$), after adjusting for sex, age, smoking, and family history of cardiovascular disease. Of the metabolic syndrome components, hyperglycemia in younger subjects and hypertension in elderly subjects were major factors for ischemic ECG changes, whereas hypertriglyceridemia was not an independent risk factor in any age group. The association between ischemic ECG findings and central obesity was weaker in women than in men. Hong-Kyu Kim et al found that overall rates of ECG abnormalities were significantly higher in subjects with metabolic syndrome than in those without metabolic syndrome ($p < 0.01$). .Metabolic syndrome was strongly associated with ECG abnormalities, especially ischemic ECG findings. The association between ischemic ECG findings and central obesity was weaker in women than in men .Looking at the results of both studies the authors concluded that metabolic syndrome was strongly associated with ECG abnormalities, especially ischemic ECG findings, in Koreans. The association between each component of metabolic syndrome and ECG abnormalities varied according to age and sex.[7]

Guzder RN, Gatling et al studied prognostic value of the Framingham cardiovascular risk equation and the UKPDS risk engine for coronary heart disease in newly diagnosed type 2 diabetes.The Framingham equations underestimated the overall number of cardiovascular events by 33% and coronary events by 32% and showed modest discrimination and poor calibration for CVD ($P < 0.001$)] and CHD risk ($P = 0.011$)]. Although the overall underestimate was lower and non–significant with the UKPDS risk engine for CHD (13%), its performance in terms of discrimination and calibration were similar]. The 15%, 10–year CHD risk threshold with both the Framingham and UKPDS risk engines had similar sensitivity for primary CVD as the lipid level threshold [85.7 and 89.8% vs. 93.9% ($P = 0.21$ and 0.34)] and both had greater specificity [33.0 and 30.3% vs. 12.1% ($P < 0.001$ and $P < 0.001$ .Conclution of the study was in people with newly diagnosed Type 2 diabetes, both the Framingham equation and UKPDS risk engine are moderately effective at identifying those at high–risk (discrimination) and are poor at quantifying risk (calibration). Nonetheless, at a population level, a 15% 10–year CHD risk threshold using either risk calculator has similar sensitivity as an approach based on a single lipid risk factor level and may have benefits in terms of cost–effectiveness given the improved specificity.[8]

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,RA,LA,LV, MR, and TR.Effort was made to correlate BMI with LV dysfunction (systolic+diastolic) or isolated diastolic dysfunction.Despite various 2D-ECHO DOPPLER abnormalities, there was insignificant correlationship between grade of BMI and 2D-ECHO DOPPLER abnormalities. Out 100 cases 23 had normal 2D- ECHO DOPPLER. Maximum cases with normal 2D- ECHO DOPPLER, 19 cases were in subgroup of BMI 25-29.9.As per WHO criteria these candidates were in pre-obesity group however as per revised Indian guidelines these cases are considered as obese.

BEPPU S, PARK YD et al studied clinical features of intracardiac thrombosis based on echocardiographic

observation .Mehta RH, Rathore S et al on the other hand studied acute myocardial infarction in the elderly and differences by age.50 DM patients were evaluated for LVDD using DOPPLER echocardiography. They found that, LVDD was there in78% of patients. 11 patients (22%) had no diastolic dysfunction. While 69% Diabetic showed isolated LVDD with normal systolic function .They evaluated the clinical characteristics and outcomes of elderly patients hospitalized with acute myocardial infarction (AMI) to describe differences by age. Elderly patients with AMI are perceived as a homogeneous population, though the extent by which clinical characteristics vary among elderly patients has not been well described.Older age was associated with a greater proportion of patients with functional limitations, heart failure, prior coronary disease and renal insufficiency and a lower proportion of male and diabetic patients. Of note, the proportion of patients presenting with chest pain within 6 h of symptom onset, and with ST-segment elevation, was lower in each successive age group. Data indicate significant age-associated differences in clinical characteristics in elderly patients with AMI, which account for some of the age-associated differences in mortality. The practice of grouping older patients together as a single age group may obscure important age-associated differences.[9,10]

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 , out of 50 patients , 33 patients (66%) had abnormal 2D-ECHO finding .Also Dr. Seema mahant et al concluded in their study, that incidence of left ventricular diastolic dysfunction was higher in NIDDM patients who were free of clinically detectable heart disease. Further they found that the incidence of diastolic dysfunction had a strong correlation ship with age, duration of diabetes, HbA1C level and diabetic complications.[11]

Punekar J, Jain et al did asimilar work to Study Effect of Isolated Obesity on Diastolic Dysfunction in Echocardiography. Likewise Dwivedi S, Aggarwal A et al did work on Pedigree Profile: a valuable tool in the risk assessment of coronary artery disease in young. According to WHR we divided the female cases in 3 sub groups.[12,13]
Subgroup 1 WHR <OR=O.80,
Subgroup2 WHR 0.81-0.85,
Subgroup 3 WHR >0.85

Similarly we divided male cases according to WHR in 4 sub groups (since guidelines for WHR are different for male and female)
Subgroup 1 WHR <OR=O.90
Subgroup2 WHR 0.91-0.95,
Subgroup 3 WHR 0.96-1.0
Subgroup 4 WHR >1.0

Pandey ak et al did assessment of myocardial mechanics in overweight and obese indian subjects.They found *in their study that Subclinical diastolic dysfunction was more prevalent among obese subjects, & BMI correlated significantly with indices of left ventricular systolic and diastolic function. Further they observed that subclinical left ventricular diastolic dysfunction was there in all grades of obesity which correlates with BMI.[14]*

Pascual M, Pascual DA et al studied effects of isolated obesity on systolic and diastolic left ventricular function. In their study they concluded that Subclinical left ventricular diastolic dysfunction is present in all grades of isolated obesity, correlated with BMI, and was associated with increased systolic function in the early stages of obesity.Ejection fraction ($p < 0.05$), fractional shortening ($p < 0.05$), and mean velocity of circumferential shortening ($p < 0.05$) were increased in slight and moderate obesity. Subclinical left ventricular diastolic dysfunction is present in all grades of isolated obesity, correlates with BMI, and is associated with increased systolic function in the early stages of obesity . BMI correlated significantly with indices of left ventricular function.[15]

One Indian study by R. Gupta et al on correlation of regional cardiovascular disease mortality in India with lifestyle and nutritional factors. In this Indian study (R. Gupta et all 2002) on risk factors for coronary heart disease observed that percentage of subjects who have abdominal obesity (as defined by WHR >0.9 in men, and >0.8 in women) as being 57.4% and 68.4%, respectively.[]In another study (2001) it was noted that WHR was significantly higher in cases with acute myocardial infarction than controls (0.93 v. 0.89[]. In a study Misra et al working on cases with visceral obesity reported a mean BMI of 24.5, WHR of 0.88 and waist circumference of 86.2 in 20 Asian Indian men. There is a wide disparity in prevalence and cardiovascular disease mortality in different Indian states. To determine significance of various nutritional factors and other lifestyle variables in explaining this difference in cardiovascular disease mortality we performed an analysis .They studied prevalence of diabetes, metabolic syndrome, and cardiovascular risk factors in US Asian Indians: results from a national study. [16,17]

In a similar study Misra A, Chowbey P e al gave a consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management.There was a significant positive correlation of cardiovascular disease mortality with prevalence of obesity ($R = 0.37$) and dietary consumption of fats ($R = 0.67$), milk and its products ($R = 0.27$) and sugars ($R = 0.51$) and negative correlation with green leafy vegetable intake ($R = -0.42$) ($p < 0.05$).There are large disparities in cardiovascular disease mortality in different Indian states. This can be epidemiologically explained by difference in dietary consumption of fats, and prevalence of obesity.[18]

Ruisanchez Villar C. et al studied The impact of new echocardiographic techniques to detect myocardial dysfunction in asymptomatic type 1 diabetes mellitus: insight myocardial deformation and three dimensional echocardiography.Patil S. did a A Comparative Study Of Coronary Artery Disease In Diabetics And Non-Diabetics (Doctoral dissertation).Abd Almonem N, Selem A et al did Assessment of Cardiac Changes in Obese Children and Its Relations to Metabolic Syndrome. The results and conclutions were similar to what we saw in our study.[19 -21]

Vijay Achari, AK Thakur, Arun K Sinha observed in their study that out of 936 cases subjected to study,596 (64.2%) were positive for the metabolic syndrome while 516 (55.6%) tested positive for coronary artery disease; There was a strong correlationship between these entities (p = < 0.001). When the individual components were tested for their relationship with coronary artery disease, it was found that obesity and microalbuminuria had the strongest association with the presence of ischemic heart disease.[22]

CONCLUTION

a) Basic anthropometrics measurements (BMI+WHR) are simple clinical parameters to evaluate obese DM type 2 cases for cardiovascular complications.
b) Obese DM type 2Cases with abnormal WHR and BMI may have abnormalities in ECG and/ or 2D-ECHO DOPPLER. Hence ECG and 2D-ECHO DOPPLER study may help for proper evaluation of obese DM type 2 cases.
c) In obese DM type 2 female cases: there was significant correlationship between the different grade of WHR and LV dysfunction (systolic/diastolic or combined).
d) In obese DM type 2 male cases: although there were abnormalities in ECG and 2D-ECHO DOPPLER study but

statistically these were insignificant when correlated with BMI and WHR.

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WHAT THIS STUDY ADD TO EXISTING KNOWLEDGE : 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. ELECTRO CARDIOGRAPHY and 2D ECHO DOPPLER are the non-invasive and easy methods to assess heart function and the complications.

CONTRIBUTION BY DIFFERENT AUTHORS

First author : Dr.Bharat Kumar Parmaq2rp] ,Assistant Professor Department of medicine Govt. Medical College ; Ratlam .Worked on 6Concept ,materials and methods and data collection

Corresponding Author : Dr Sanjay Kumar Dubey Assistant Professor Department of medicine Govt. Medical College ; Ratlam Worked on statistical analysis and discussion

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