To Study Effect of Isolated Obesity on Diastolic Dysfunction in Echocardiography

Janki Punekar[1], Neeraj Jain[2], Hemant Nargawe[3], Prashant Punekar[4]

ABSTRACT

Introduction: In the rapidly changing scenario of food habits among young working population obesity becoming a measure thrust for health. For this reason, we influence to study its possible association with CVD & DD. The aim of study was to determine direct effect of different grade of isolated obesity on DD.

Material and Methods: A case control study was designed to study obesity and DD. A total 57 cases and 57 control taken in study group using standard sampling procedure. Calculating BMI (Asian criteria) of all subjects then ECHO cardio graphic assessment done of all subjects in both groups.

Result: This study was conducted at Department of Medicine, NSCB MCH Jabalpur (M.P.) Out of 57 cases 14 have found DD which is 24.6% of total cases (x2=12.97, p<0.0001). In cases group DD is present in different obese group not in overweight individuals. In study groups correlation of BMI with grading of DD we found there is grade 2 DD present only in severe obese group (BMI>30kg/m2). We found DD in both genders equally, there is no significant difference found. A significant linear trend of DD with increased BMI was seen.

Conclusion: This study demonstrated that obesity is significantly related to the development of left ventricular DD when other known causes are excluded. A significant linear trend of DD with increased BMI was seen. In cases and controls groups there is significant different in biochemical parameters. DD appears not to be influenced by sex.

Keywords: Cardio Vascular Disease (CVD), Diastolic Dysfunction (DD), Body Mass Index (BMI)

INTRODUCTION

The prevalence of obesity has increased in both the developed and developing countries. In India 88 million individuals are overweight, 135 million individuals have obesity, [1] It is well established that obesity influence cardiovascular morbidity and mortality.[2–9] Association between severe obesity and left ventricular dysfunction is first observed in mid-20th century. Later on necropsy studies and clinical investigation on morbid obesity confirmed the entity of obese cardiomyopathy and it is characterized by volume overload that's leading to congestive heart failure.[10, 11] Obesity is an independent risk factor for development of heart failure even after adjusting for other co-morbid condition such as diabetes mellitus and hypertension.[12] The long standing obesity affect left ventricular structure and function and lead to eccentric left ventricular hypertrophy and diastolic dysfunction and occasionally systolic dysfunction and heart failure.[13, 14]

Congestive heart failure is a major health problem. A large number of patients with heart failure have nearly preserved left ventricular function and are classified as having diastolic heart failure or heart failure with preserved ejection fraction. The term "diastolic heart failure and systolic heart failure are commonly used instead of "heart failure with preserved left ventricular function or "heart failure with reduced left ventricular function" respectively.

Because of observed differences between populations “The international association for the study of obesity and the international obesity task force” have suggest lower BMI cutoff values for the definitions of overweight (23-24g kgm^2) and obesity (25.0 kg/m2) in Asian populations[15, 16]

Heart failure in India has reached in epidemic proportions.[17] The prognosis of Diastolic dysfunction is better than systolic dysfunction. Early identification of the risk factor and initiation of appropriate therapy at early stages can prevent development of diastolic dysfunction and further progression to diastolic heart failure and death.[17] Treatment of the underlying disease is currently the most important therapeutic approach.[18]

In this study we observed the echocardiography changes in obesity, relation between obesity and diastolic dysfunction of heart in the absence of other known risk factor predisposing to diastolic dysfunction

MATERIAL AND METHODS

It is case control (observational) study. In this study we had taken114 participant (n=57 cases and n=57 controls) using standard sampling procedure participants are taken who attended medicine OPD in Netaji Subhash Chandra Bose Medical college Jabalpur in period of march 2015 to July 2016. Inclusion criteria is Normotensive patients, BMI> 25kg/m^2 (obese), BMI 23-24.9 kg/m^2 (overweight), BMI 18.5 - 22.9 kg/m^2 (average/healthy individuals), Both gender, patient who give inform consents. Exclusion criteria is Hypertension >140 - 90 mmhg, Diabetes mellitus type II, Age less than 14 and more than 40 year Congestive heart failure, Valvular heart disease, Prosthetic heart valve Thyroid dysfunction, Constructive and restrictive heart diseases, Connective tissue disorder.

All the individuals were under taken for all anthropometric measurements. Subjects of both group were under taken for weight and height measurements under standard techniques, weight is measured by using standard electronic balance and height measuring scales were used for height. After this calculated BMI of all subjects and then ECHO cardio graphic assessments were done in all subjects of both groups. Other

[1]Associate Professor, [2]Assistant Professor, [3]RMO 3rd Year, [4]Associate Professor, Department of Medicine, NSCB MCH, Jabalpur, Madhya Pradesh, India

Corresponding author: Dr. Janki Punekar, 119 JDA 2A Ekta Vihar Madan Mahal, Jabalpur, Madhaya Pradesh, Pin Code - 482001, India

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standard biochemical indices in the form of blood urea, serum creatinine, fasting lipid profile, glucose tolerance test, blood glucose and hemoglobin obtained in all subjects including heart rate blood pressure etc.

STATISTICAL ANALYSIS

The data were analyzed using SPSS 20. Appropriate univariate and bivariate Statistical analysis were carried out using the Student's *t* test for the continuous variable (Age) and two-tailed Fisher exact test or chi-square (c^2) test for categorical variables. To measure the linear dependence between two random variables Pearson's correlation coefficient was used. All means and all means are expressed as mean ± standard deviation and proportion in percentages are expressed as mean ± standard deviation. The critical levels of significance of the results were considered at 0.05 levels i.e. $P < 0.05$ was considered significant.

RESULT

In this study 57 obese individuals were taken along with 57 controls of normal BMI. Mean age of cases is 31.60and control is 29.36. In cases 24 were male and 33 were female and in control group 29 were male and 28 were females. cases and controls were divided on the basis of for "Body mass index in Asian criteria" controls have body mass index 18.5 to 22.9 and cases are derived as overweight 23 to 24.9 and moderate obese 25 to 29.9 and sever obese >30. Cases have their mean body mass index is 28.80 and control have their mean body mass index is 20.37 (t-test for equality is 13.765 ($p<0.05$)which is significant). Out of 57 cases 14 had diastolic dysfunction which is 24.6% of total cases which was significant ($x2=12.97$, $p<0.0001$). on comparision in cases on the basis of grades of BMI no cases of diastolic dysfunction is found in overweight group while in moderate obese 22.58% have diastolic dysfunction and in severe obese 41.17% have diastolic dysfunction. A significant linear trend of diastolic dysfunction with increased BMI was seen ($X^2=6.53$, $p=<0.05$).Grade 2 Diastolic Dysfunction present only in severe obese group (BMI>30kg/m^2). There grade 2 diastolic dysfunction is absent in overweight and moderate obese individuals. Diastolic Dysfunction in both genders were equal, there was no significant difference found in study group, $X^2 = 0.47$ and p value =0.49 (non-significant). there was no correlation found between age and diastolic dysfunction in our study. In comparision between cases and controls on the basis of fasting lipid profile and fasting and post prandial sugar level and glucose tolerance test we found significant difference in serum cholesterol ($t>2.797$), serum cholesterol/HDL ratio ($t>1.97$), FBS ($t>4.472$), PPBS ($t>2.62$), GTT ($t>3.46$) level. In low density lipid level in overweight and moderate obese ($t>2.08$) and Triglyceride level and Serum cholesterol/HDL ratio in overweight and sever obese ($t>1.97$, $t>2.41$) and moderate and severe Obese ($t>2.14$, $t>2.10$). there is significant increased in serum cholesterol/HDL level in those who had Diastolic dysfunction compare to who did't have Diastolic dysfunction ($t>3.31$).

DISCUSSION

Obesity is an independent risk factor for development of heart failure even after adjusting for other co-morbid condition such as diabetes mellitus and hypertension.[12] The long standing obesity affect left ventricular structure and function and lead to eccentric left ventricular hypertrophy and diastolic dysfunction and occasionally systolic dysfunction and heart failure.[13, 14]

M. Pascual[19] et al (2003) they took 73 healthy peoples they divided on the basis of body mass index WHO criteria 25 are normal weighted 17 are overweight 20 are moderate weight and 11 are severe obese. And they found subclinical diastolic dysfunction in 12% of overweight, 35% of obese and 45% in severe obese persons. Overall 29% of all obese person have diastolic dysfunction. Davinder S[20] et al (2009) they include 239 individuals and divided all of them on the basis of body mass index, % body fat and waist-hip ratio into obese (165) and non-obese (74) they had mean age of obese group (34.31± 0.72) and non-obese (35.32±1.31) and BMI (28.42± 0.23) and (22.79±0.17) respectively. Praveen kumar[21] et al (2013) observed in 200 individuals and found 28 obese patients have diastolic dysfunction grade 1 (impaired relaxation). Patient have diastolic dysfunction they have mean age group 34± 4 and body mass index 36± out of 200 individuals 28 (14%) have diastolic dysfunction our finding are similar to above.

In the study conducted by Hiroyuki okura[22] et al (2009) they found age related changes in diastolic dysfunction were gender specific. irrespective of this our study didn't have any age and gender related correlation to diastolic dysfunction because we exclude the age >40 years.

Rajesh G. Kathortia[23] et al (2010) they took 74 asymptomatic healthy individuals. They concluded that decrease in diastolic function in form of increased atrial filling velocity (A) in obese and even on overweight as comparison with control and decrease in E/A ratio early to atrial filling velocity. Cesare russo[24] et al (2011) they took total 950 individuals they found impaired diastolic function in both overweight and obese individuals. Anil kumar pandey[25] et al (2013) found that subclinical diastolic dysfunction is present in all grades of obesity. Study by M. Pascual[19] et al (2003) also found subclinical diastolic dysfunction is present in all grades of obesity. different result in our study is due to lack of tissue doppler imagination in our set up and exclusion of diabetes and hypertension individuals.

Smita P. Patil[26] et al (2012) found there was a positive relation between fasting blood sugar and body mass index increasing body mass increases chances of diabetes mellitus. BMC Family Practice (2002) study Impact of obesity on glucose and lipid profiles in adolescents at different age groups in relation to adulthood and found they used to Determine the impact of obesity on glucose and lipid profiles at 7 different age groups from 9 to 38years old in both sexes and conclude that hypothesis that overweight and obese adolescentshave higher fasting plasma glucose and insulin levels, and an abnormal lipid profile relative to their leanpeers.

There is need of longitudinal study are required to investigate cardiovascular events and overall mortality in healthy obese subjects with cardiac morphological and functional changes

CONCLUSION

This study demonstrated that obesity is significantly related to the development of left ventricular diastolic dysfunction when other known causes are excluded. We found significant difference in serum cholesterol, serum cholesterol/HDL ratio, FBS, PPBS, GTT level of cases and controls. observed that overweight and obese adolescents have higher fasting plasma

Variable	Controls BMI 18.5 - 22.9 kg /m2 (n=57)	Cases BMI > 23kg/m2 (n=57)	p-value
Age	29.26 ± 6.58	31.59±6.07	>0.005
Males	29 50.87%	24 42.11%	-
Females	28 49.13%	33 57.89%	-
Weight	52.61±8.53	72.38±10.21	<0.001
Height (meter)	1.6±0.1	1.6±0.1	>0.05
BMI (Kg/m2)	20.37±1.44	28.78±4.39	<0.01
p < 0.05 is significant			

Table-1: Demographic profile and clinical characteristics of the subjects categorized on the basis of body mass index

glucose and an abnormal lipid profile relative to their lean individuals diastolic dysfunction appers not to be influenced by sex in younger ages.

All obese and overweight individuals should go for evaluation of diastolic function and systolic function. Because early detection of it causes early prevention and treatment of it and help in help in reduction of cardio vascular disease burden over society. Further study is needed to determine the effect of duration of obesity on diastolic dysfunction.

ABBREVIATIONS

FBS fasting blood sugar, PPBS post prandial blood sugar, GTT glucose tolerance test, Sch serum cholesterol, HDL high density lipid, LDL low density lipid, VLDL very low density lipid, TG triglycerie.

Variable	Controls BMI 18.5 - 22.9 kg /m2 (n=57)	Cases BMI > 23kg/m2 (n=57)	p-value / test
Diastolic dysfunction (DD)	0 00%	14 24.6%	p-value < 0.0001 X^2 = 12.97
E/A	1.0946±0.1166	0.9768±0.2310	p-value < 0.05 t-test 3.43
Deceleration time (DT)	186.51±19.36	198.30±38.46	p-value < 0.05 t-test 2.07
Isovolumic relaxation time (IVRT)	77.65±6.22	75.82±8.466	p-value > 0.05 t-test 1.315
X^2>3.84 is significant, t> 1.96 is significant, p<0.05 is significant			

Table-2: Echocardiographic Indices Categorized on the Basis of Body Mass Index

Variable	Overweight BMI 23 - 24.9 kg/m² (n=9)	Moderate obese BMI 25 - 29.9 kg/m² (n=31)	Severe obese BMI 23 - > 30 kg/m² (n=17)	p-value
Age	31.44±6.34	29.96±5.95	34.64±5.2	<0.05
Males	6 33.33%	13 41.94	5 29.41	-
Females	3 66.66%	18 58.06	12 70.59	-
Weight (kg)	65.67±5.70	69.62±7.01	81±11.72	<0.05
Height (meter)	1.66±0.07	1.60±0.07	1.55±0.10	<0.05
BMI (kg/m²)	23.97±0.49	27.11±1.45	34.39±3.40	<0.05

Table-3: Demographic Profile and Clinical Characteristics of the Subjects Categorized on the Basis of grades of Body Mass Index

Variable	Overweight BMI 23 - 24.9 kg/m² (n=9)	Moderate obese BMI 25 - 29.9 kg/m² (n=31)	Severe obese BMI 23 - > 30 kg/m² (n=17)	X^2_{trend} p-value
Diastolic dysfunction (DD)	0 0%	7 22.58%	7 41.17%	X^2_{trend} = 6.53 p<0.05
A significant linera trend of BMI and DD was seen.				

Variable	Overweight BMI 23 - 24.9 kg/m2 (n=9)	Moderate obese BMI 25 - 29.9 kg/m2 (n=31)	Servere obese BMI 23 - > 30 kg/m2 (n=17)	t-1/2	t-1/3	t-2/3
E/A	1.07±0.15	0.99±0.25	0.89±0.20	1.19 p>0.05	2.58 <0.05	1.51 p>0.05
Deceleration time (DT)	179.88 ±14.99	202.77 ±36.48	199.88 ±48.34	2.78 p<0.01	1.57 p>0.05	0.22 p>0.05
Isovolumic relaxaton time (IVRT)	71.66 ±4.15	77.12 ±10.12	75.64 ±5.88	2.39 p<0.05	2.0 p<0.05	0.64 p>0.05
Using Bonferroni posthoc test						

Table-4: Echocardiographic Indices Categorized on the Basis of grades of Body Mass Index

Variable	Overweight BMI 23 - 24.9 kg/m2 (n=9)	Moderate obese BMI 25 - 29.9 kg/m2 (n=31)	Servere obese BMI 23 - > 30 kg/m2 (n=17)	t-1/2	t-1/3	t-2/3
Sch	160.50 (±25.04)	172.71 (±26.73)	188.93 (±54.29)	1.32	1.81	1.13
HDL	39.36 (±6.93)	50.29 (±52.20)	37.47 (±9.66)	1.14	0.58	1.32
LDL	91.20 (±15.27)	104.50 (±23.30)	99.50 (±25.47)	2.08	1.04	0.66
TG	99.20 (±41.62)	99.75 (±41.16)	151.75 (±92.72)	0.04	1.97	2.14
VLDL	24.24 (±6.18)	26.48 (±20.16)	31.44 (±18.25)	0.55	1.45	0.85
Sch/HDL	4.12 (±0.57)	4.31 (±0.90)	5.42 (±2.01)	0.75	2.41	2.10
FBS	88.70 (±12.39)	84.94 (±14.12)	89.19 (±13.71)	0.81	0.09	1.00
PPBS	118.80 (±6.647)	114.48 (±12.74)	117.63 (±15.39)	1.39	0.27	0.70
GTT	117.90 (±11.68)	118.97 (±8.130)	119.19 (±9.79)	0.27	0.29	0.08
t> 1.96 is significant						

Table-5: Lipid Profile, fasting blood glucose, post prandial blood sugar and glucose tolerance test Indices Categorized on the Basis of grades of Body Mass Index.

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