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CORELATION OF BODY MASS INDEX WITH INDICES OF DIASTOLIC FUNCTION IN NORMOTENSIVE, NONDIABETIC PATIENTS

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Contribution
MI did literature review, research design and also finalized the manuscript, IK helped in data collection and FA did data analysis. UA helped in final draft. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

Objective: To determine the association between body mass index and indices of diastolic function in normotensive and nondiabetics patients.

Methodology: This cross sectional study was carried out at department of cardiology , Post Graduate Medical Institute Lady Reading Hospital Peshawar, from 1st March 2012 to 30th September 2012. Patients of either gender, age more than 40 years, who presented to cardiology OPD with cardiac problems other than heart failure symptoms were included. Patients BMI was calculated. Detailed echocardiographic study was done and EF, E' and E/E' ratio were calculated. Correlation between BMI and diastolic function parameters was assessed by multivariate logistic regression analysis and Pearson's correlation coefficient.

Results: A total of 100 patients with mean age of 50.6 ± 4.62 years were enrolled. Of them 42% were males. The study sample was grouped into three according to their BMI: Group 1: patients of normal weight (BMI less than 25.0 kg/m^2). Group 2: overweight patients (BMI between 25- 29.9 kg/m^2) and Group 3 were obese (BMI more than 30 kg/m^2). Using Tissue Doppler Imaging (TDI) for diastolic function, E' was measured and E/É ratio was calculated. Mean E/E' in group 1 was 8.10±1.74, while E' was 7.67±0.97 cm/s. Mean E/E' in group 2 was 8.84±1.69 and E' was 6.54±1.01 cm/s. E/E' in group 3 was 10.46± 2.53 and E' was 6.23±1.16 cm/s. Patient with higher BMI had lower E' wave (R^2=0.22; p=0.001) and higher E/E' ratio (R^2=0.14; p= 0.002). In separate sub analyses BMI had significant Correlation with lower E' (γ= 0.47, p <0.01) and higher E/E' (γ= 0.38, p <0.001).

Conclusion: Higher BMI is a associated with worsening of diastolic function regardless of traditional risk factors for diastolic dysfunction.

Key Words: BMI (Body Mass Index), Diastolic Dysfunction, E/E' Ratio, Obesity, Tissue Doppler Imaging, Early Diastolic Mitral Annular Velocity

INTRODUCTION

The prevalence of obesity has reached epidemic proportions around the world and the rate continues to increase. Obesity increases an individual risk for cardiovascular morbidity and mortality.[1,3] Obesity is an independent risk factor for heart failure in the general population and evidence exists that overweight also carries an increased risk of heart failure.[4,5] Obesity will become an important cause of heart failure in the coming years.[6] Impairment of cardiac function correlates with the degree of obesity, i.e. body mass index (BMI) and duration of obesity.[7,8] The abnormal diastolic function is the most important component of the impaired cardiac function while systolic dysfunction is not so common.[7] Left ventricular diastolic dysfunction (DD) reflects abnormality of diastolic distensibility, filling or relaxation of the left ventricle .It is a relatively common cardiac condition and it contributes significantly to the development of heart failure with preserved systolic function in obese patients.[6]

The diagnosis of DD is made more difficult by obesity, and conventional flow Doppler has many limitations for the assessment of DD, given that most parameters are load-dependent.[9] Conversely, tissue Doppler imaging (TDI) is a useful non-invasive tool providing accurate diagnostic and prognostic values in DD.[10] Furthermore TDI is relatively load-independent.[11,12]

METHODOLOGY

A Cross Sectional (Co-relation) study carried out at Post Graduate Medical Institute Govt. Lady Reading Hospital Peshawar, Department of Cardiology from 1st March 2012 to 30th September 2012. Patients of either gender with age more than 40 years who had some cardiac problems other than heart failure symptoms were included, using consecutive non probability sampling. Patients with valvular heart diseases, congenital heart disease, arrhythmias (AF, SVT), constrictive pericarditis, atrial myxoma, systolic dysfunction (EF <50%) were excluded. Also patient with a risk factor for diastolic dysfunction such as hypertension, DM, IHD were excluded from the study. An informed written consent was obtained. Detailed history and general physical examination was performed. Electrocardiogram was taken to exclude any arrhythmia. Patient's height and weight were taken and BMI was calculated. These patient were then subjected to echocardiography with Accoson CV 70. Ejection fraction (EF) for systolic function E, E' and E to É ratio were calculated. All data was stored and analyzed in SPSS version 16. Mean ± SD was calculated for continuous variables. Frequencies and percentages were calculated for categorical variables like gender. To look for the effect of BMI on diastolic function parameters, assessment was made by using by multivariate logistic regression analysis. Pearson's correlation coefficient was used to see the correlation between BMI, E/É ratio and E'. For Statistical significance p value was set to be < 0.05.

RESULTS

Total number of the study population was 100. Their mean age was 50.6 ± 4.62 years (range 40-58 years). Of them male patient were 42% (n=42) while female were 58% (n=58).

The study sample were grouped according to their BMI into three: Group 1 included subjects consisted with BMI of less than 25.0 kg/m^2 (n=36), Group 2 included subjects consisted with a BMI ranging between 25.0 and 29.9 kg/m^2 (n=50), and Group 3 included subjects consisted with a BMI of greater than 30 kg/m^2 (n=14). Mean BMI was 26.50 kg/m^2 (range 21-34 kg/m^2) (Table 1).

Using Tissue Doppler Imaging (TDI) for diastolic function E' was measured and E/É ratio was calculated. Overall mean E/É ratio was 8.78 ± 1.96 (range 6-14), while mean E' was 6.91 ± 1.19 cm/s. Mean E/E' in Group 1 was 8.10±1.74, while E' was 7.67±0.97cm/s. Mean E/E' in Group 2 was 8.84±1.69 and E' was 6.54±1.01cm/s. E/E' in Group 3 was 10.46± 2.53 while E' was 6.23±1.16 cm/s (Table 2).

Effect of BMI on diastolic function parameters was determined by simple linear regression models .Linear correlation was found between BMI and E/E' while there was inverse linear relation between BMI and E'. Patient with higher BMI had higher E/E' ratio (R^2=0.14; p= 0.002) (Figure1) while E' wave declined with increasing BMI (R^2=0.22; p=0.001) (Figure 2). The correlation was significant in Group 2 and Group 3 compared with Group 1 for both E/E'ratio and E' (both p <0.01). In separate sub analyses using Pearson correlation coefficient, BMI had significant Correlation with lower E' (γ=-0.47, p <0.01) and higher E/E'= 0.38 (p <0.001) (Table 3). The correlation between BMI, E/E' and E' was more pronounced in female subject than male (0.40 vs. 0.32 and -0.53 vs. -0.36).

DISCUSSION

This study was designed to determine the effect of BMI on LV diastolic function in normotensive and non-diabetics

Table 1: Demographic Characteristics of Study Population

	Group 1 BMI <25 kg/m^2 M±SD	Group 2 BMI 25-29.9 kg/m^2 M±SD	Group 3 BMI >30 kg/m^2 M±SD
Age (years)	50.13±5.4	50.74±4.1	51.53±3.9
Male	17	20	5
Female	19	30	9
Weight (kg)	58.1±2.5	68.8±4.5	81.8±2.9
Height (m)	1.57±0.15	1.58±0.25	1.59±0.29
BMI(kg/m^2)	23.3±1.01	27.3±1.29	32.3±0.9

Table 2: Tissue Doppler Parameters of Diastolic Function Among BMI Groups

Parameters	Group 1 M±SD	Group 2 M±SD	Group 3 M±SD
E/E' ratio	8.10±1.74	8.84±1.69	10.4±2.5
Peak E' (cm/s)	7.67±0.97	6.54±1.01	6.23±1.1

population. Our finding suggests that BMI has continuous correlation with diastolic function parameters even in the absence of traditional risk factors for diastolic dysfunction such as hypertension, DM and LVH.

Although transmitral filling patterns are fundamental to the assessment of LV diastolic function, they have several limitations. They may change rapidly with variations in preload. To overcome this, less load-dependent indices of LV filling can be used. Therefore Tissue Doppler imaging is the more sensitive echocardiographic technique compared with tradition Doppler for the assessment of LV diastolic function currently. Loading factors as well as physiological changes like respiration has no effect on it. Early diastolic mitral annulus velocity (E') is a useful indicator of LV relaxation and it continuously decline with the progression of LV diastolic dysfunction. As a consequence, É decreases and the E/É ratio continuously increases with advanced and worsening of LV diastolic dysfunction. [13] Furthermore, the E/E' ratio has better correlation with left ventricular filling pressure and is a strong independent predictor of fatal and nonfatal cardiovascular events.

Our findings correlate with the previous epidemiological based recent studies that have shown an association between increased adiposity and diastolic dysfunction. The effect of BMI on diastolic function parameters was

Table 3: Correlations Between BMI and E/E' Ration and E'

		Body mass index	E/E' ratio	septal E' (cm/s)
Body mass index (Kg/m²)	Pearson Correlation	1	.382**	-.474**
	p		.000	.000
	n	100	100	100
E/E' ratio	Pearson Correlation	.382**	1	-.424**
	p	.000		.000
	n	100	100	100
septal E'(cm/s)	Pearson Correlation	-.474**	-.424**	1
	p	.000	.000	
	n	100	100	100
**** Correlation is significant at the 0.01 level (2-tailed).**				

Pearson correlation coefficient (γ) 0.382 for E/E' and -0.474 for E'

determined by simple linear regression models. The correlation was significant in Group 2 and 3 compared with Group 1 for both E/E' ratio and E '(both $p < 0.01$). Peak E´ was significantly lower while E/E´ ratio was significantly higher in Group 2 and 3 compared with Group 1 (both $p < 0.01$).

Grandi et al has previously studied the effect of obesity on LV diastolic function. [15] They found an association between obesity and asymptomatic LV diastolic dysfunction in both normotensive and hypertensives; similar results were found in our study.

Chadha et al. assessed the effect of different grades of obesity on the left ventricular diastolic function. [16] All patients with isolated obesity have subclinical left ventricular diastolic dysfunction, which correlates with BMI.

Figure 1: Correlation Between BMI and E/E' Ratio

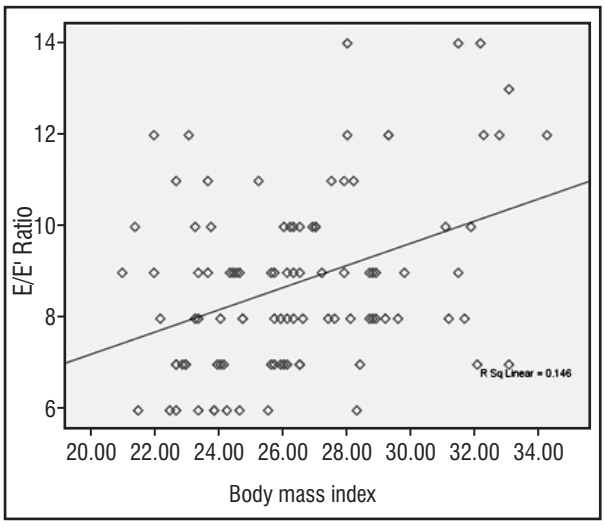
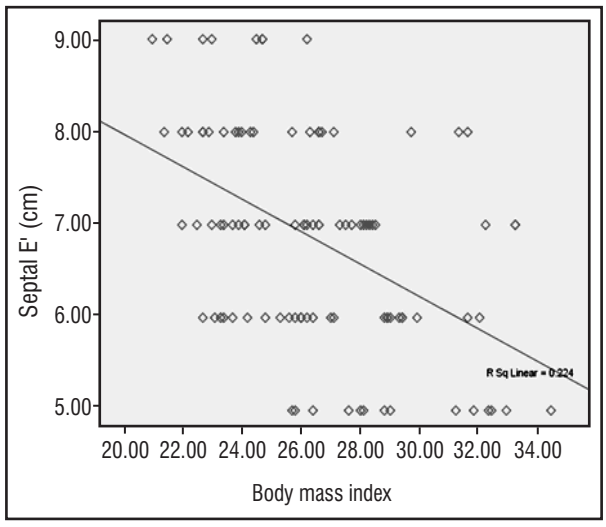


Figure 2: Correlation Between BMI and Septal E'



In a general population sample, Russo et al. found an association between increased BMI and reduced early diastolic mitral annulus velocity (E'), increased filling pressures (E/E') and the presence of diastolic dysfunction.[14] They concluded from their study that patient with higher BMI has lower E/A (R2=0.08; p=0.01) and higher E/E´ ratio (R2=0.20; p=0.001), independent of other tradition risk factors for LV diastolic dysfunction .

Early detection of asymptomatic and subclinical DD using TDI in patient with increased BMI may help to reverse this condition from early weight loss. A small observation study has evaluated the effect of weight loss on DD in morbidly obese patients. There is some facts supporting of getting better of diastolic parameters with weight loss, while many other studies demonstrated no satisfactory improvement. It is of interest to evaluate in a large cohort of patients whether reduction of BMI is associated with improvement in DD after adjusting for improvement in blood pressure, diabetes and LV mass.[17]

CONCLUSION

Higher BMI is associated with worsening of diastolic function regardless of traditional risk factors for diastolic dysfunction. Early detection of asymptomatic and subclinical DD using TDI in patient with increased BMI may help to reverse this condition from early weight loss.

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