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Effect of body mass index on Cardiac output after Coronary Angioplasty in patients of Acute Myocardial Infarction

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ABSTRACT

Background & Objective: Generally overweight and obese are at more risk of developing cardiovascular diseases. But few researchers found that when coronary artery disease (CAD) developed in overweight and obese patients, it does not cause poor clinical outcome accordingly. There are very few numbers of studies done to find out relation between body mass index (BMI) and outcome of coronary angioplasty (PCI). So objective of this study is to find out effect of BMI on outcome of angioplasty in acute myocardial infarction (AMI) patients.

Methods: It is a cross-sectional, self control, interventional study. In the present study Cardiac output (CO) of 52 patient of AMI were assessed by echocardiography before and after (one week) angioplasty. End diastolic volume (EDV), End systolic volume (ESV) & Left ventricular outflow tract (LVOT) diameter, measured by ECHO were used to calculate CO. Statistical software IBM SPSS version 16 was used for analysis of data.

Results: A positive and statistically significant coefficient of correlation (r=0.327 and p=0.018) was found between actual BMI and the value of CO after coronary angioplasty. Linear regression analysis was also done taking CO after coronary angioplasty as dependent variable and actual BMI as independent variable. It can be hypothesized that the person having higher BMI will show more improvement in CO after angioplasty.

Conclusion: Increased BMI is associated with improved outcome after coronary angioplasty in AMI patients.

Keywords : Acute myocardial infarction, Body Mass Index, Cardiac output, Coronary angiography, Echocardiography.

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I. INTRODUCTION

Obesity and overweight are global health concerns, with about half a billion adults and nearly 40 million children considered obese or overweight around the globe.[1],[2] Obesity is associated with various diseases and conditions, particularly cardiovascular diseases, diabetes mellitus type 2, certain types of cancer. As a result, obesity reduces life expectancy.

Health consequences due to obesity fall into two broad categories: due to increased fat mass (such as osteoarthritis) and those due to more fat cells (diabetes, cardiovascular disease). Cardiovascular diseases which are frequently associated with obesity are coronary heart disease (angina and myocardial infarction.), congestive heart failure, high blood pressure, abnormal cholesterol levels, deep vein thrombosis and pulmonary embolism.[3]-[7]

According to a 2002 report, 21% of ischemic heart disease is due to obesity while according to a 2008 European consensus it is 35%.[1,8] According to some studies 58.6% of cardiovascular diseases are due to obesity in Indian population.[9]

Obesity has been accepted as an independent risk factor for coronary artery disease (CAD) by the American Heart Association (AHA).[10] In the Munster Heart study

(PROCAM), there was a positive correlation between high BMI and other cardiovascular risk factors.[11]

However, findings of recent studies in this regard were opposite to those of previous studies. According to their findings, obesity had a protective effect on the progression of CAD, which is known as the 'obesity paradox'- a controversial finding that obese patients with coronary artery disease (CAD) have improved outcomes following myocardial infarction (MI) or percutaneous coronary intervention (PCI), in comparison to normal weight patient. [12]-[14] So it can be said that, the implications of increasing weight burdens in such patients in the setting of coronary revascularization should be adequately studied.

II. MATERIAL & METHODS

This study was a cross-sectional, self control, interventional study, performed between July 2012 and August 2013 after obtaining approval from the institutional review board of KGMU, Lucknow and written, informed consent from the patients. The study was undertaken in 52 patients of acute myocardial infarction admitted to cardiology emergency of Gandhi Memorial & Associated Hospital, KGMU, Lucknow. Patients' mean age ± SD was 57.9 ± 10.7 years (range 34–80) and all patients were male. Patients were admitted and their ejection fraction, end diastolic volume, end systolic volume and left ventricular outflow tract diameter determined stroke volume (SV) by echocardiography (ECHO) method. The CO has been obtained by multiplying SV by heart rate. Coronary angiography was done on all patients. Then patients underwent coronary angioplasty (PCI). After which CO were measured on day 7th of PCI. The CO obtained before and after PCI were analysed. Patients were divided into four groups according to their BMI; underweight (<18.5 kg/m2), normal BMI (18.5-22.9 kg/m2), overweight (23–24.9 kg/m2) and obese (≥ 25 kg/m2). Exclusion criteria were: Patients having cardiac conditions which affect stroke volume like anemia, valvular heart disease, myocarditis, cardiac tamponade, cardiac metabolic derangements, endocrinal disorders like thyroid dysfunction, arterio-venous fistula (shunt), vitamin deficiency like vitamin B_1 deficiency, pericardial effusion.

Statistical software SPSS version 16 was used for analysis of data. A "p" value of less than 0.05 was considered to be statistically significant.

III. RESULTS

A total of 52 subjects were enrolled and data from all the 52 patients were used for analysis. 34-80 years male patients were included in this study. The measurements of cardiac outputs of patients were done by ECHO within 6-8 hours of diagnosis of acute MI and on 7th day after coronary angioplasty.

Table-1: BMI category of Patients:

S. No.	BMI Category	Name	BMI Range (kg/m2)	Frequency
1.	1	Underweight	<18.5	4
2.	2	Normal BMI	18.5-22.9	15
3.	3	Overweight	23-24.9	14
4.	4	Obese	≥ 25	19
Total				**52**

Chart-1: Bar diagram showing BMI category of Patients:

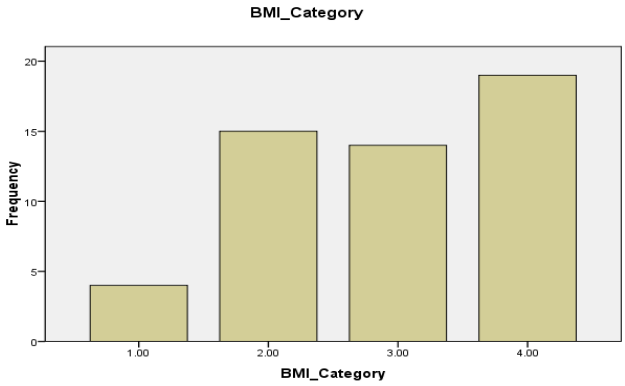
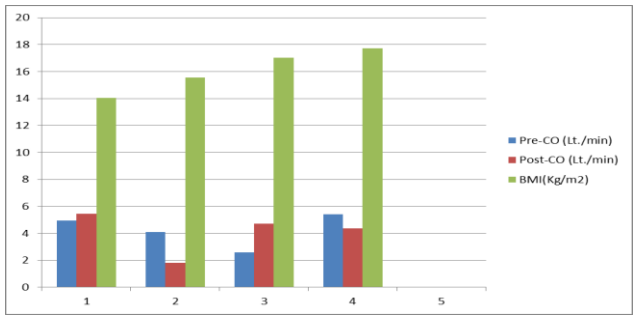


Table 2: Comparison of Cardiac Output before and after Angioplasty.

		Post CO		Pre CO		Change	
	N	Mean	SD	Mean	SD	Mean	SD
CO (Lt/min)	52	5.09	1.17	3.74	1.43	1.35	1.74

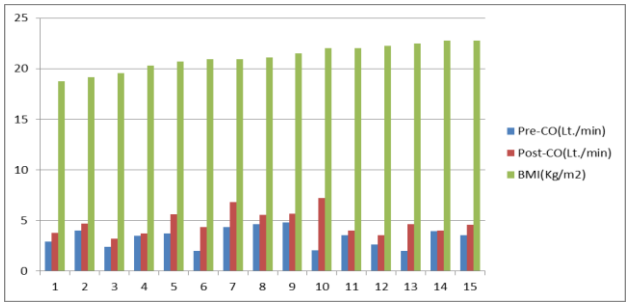
Table shows that cardiac output after coronary angioplasty improved (5.09±1.17) in comparison to cardiac output before angioplasty (3.74±1.43).

Chart-2: Bar diagram for 04 underweight patients showing Pre-CO, Post-CO and BMI:



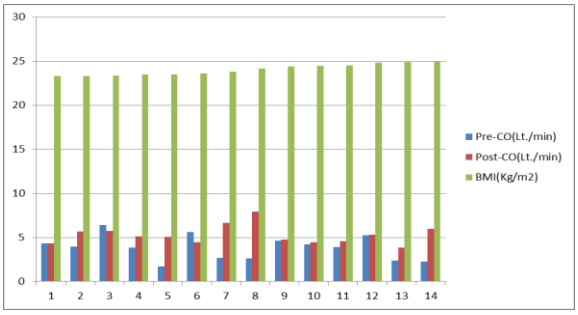
This diagram indicates that underweight show inconsistent improvement after PCI. Out of four patients, two of them showed decrease in CO after the procedure.

Chart-3: Bar diagram for 15 normal weight patients showing Pre-CO, Post-CO and BMI:



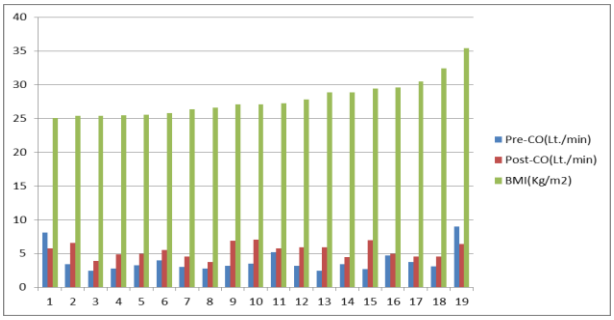
The diagram shows that patients with normal BMI improved after PCI. All of these patients showed increased CO after intervention.

Chart-4: Bar diagram for 14 overweight patients showing Pre-CO, Post-CO and BMI:



In case of overweight patients most of them showed improved CO after PCI. Only two cases showed decreased CO after PCI.

Chart-5: Bar diagram for 19 obese patients showing Pre-CO, Post-CO and BMI:



In case of Obese, most of them showed improvement after intervention. Only two showed decreased CO after intervention.

Table 3: Correlation and statistical significance between BMI and Pre- Post CO

		BMI	Pre-CO	Post-CO
BMI	Pearson Correlation	1	0.133	0.327*
	Sig. (2-tailed)		0.346	0.018
Pre-CO	Pearson Correlation	0.133	1	0.109
	Sig. (2-tailed)	0.346		0.440
Post-CO	Pearson Correlation	0.327*	0.109	1
	Sig. (2-tailed)	0.018	0.440	

**. Correlation is significant at the 0.05 level (2-tailed).*

Karl-Pearson coefficient of correlation was determined between BMI and Pre-CO and Post-CO to measure the strength of linear relationship. And further it was tested for its statistical significance.

The correlation was found significant only between BMI and Post CO. (r=0.327, p=0.018). The positive correlation shows that the patient with high BMI score will have higher post CO value. This shows that the patients having higher BMI will show more improvement in CO after angioplasty.

Simple Linear regression was also done taking CO after coronary angioplasty as dependent variable and actual BMI as independent variable. The regression coefficient β of post CO on BMI was 0.095 (p=0.018). The regression equation is given as below:

Post CO = 2.810 + 0.095×BMI.

IV. DISCUSSION

The results of present study revealed a linear relationship between BMI categories and CO after PCI in AMI patients. The overweight and obese showed more improvement after revascularization in comparison to those who were normal weight and underweight. Although it was an established fact that increasing BMI has adverse effect on cardiovascular physiology, obese and overweight showed more improvement after PCI. The so-called obesity paradox has been reported by many researchers.[15]-[19] In a meta-analysis it was reported that underweight is associated with more risk of mortality in comparison to overweight and obese among patients who underwent PCI. [19]

Few researchers tried to find out explanation for this paradox and explored that most of the time obese and overweight patients present earlier as well as they receive more intense treatment. [20]-[22] Some authors reported a limitation of BMI that BMI is not able to differentiate body fat from lean body mass. [23], [24]

Consistent with previous study, the results of this study also find the so-called obesity paradox between BMI and CO after PCI. The exact mechanism for this obesity paradox is not clear. There are some hypotheses which tried to explain some issues in this field. Malnutrition/inflammation complex syndrome (MICS) hypothesis believed that in heart failure (HF) patients, cardiac cachexia is an independent risk factor of mortality.[25] In cardiac cachexia patient tumor necrosis factor level increases and also hypoalbuminemia is seen.[26] In presence of hypoalbuminemia, cytokine either contributes to protein energy malnutrition (PEM) or independently lead to cachexia and PEM. This leads to increased mortality in HF patients.[27]

According to the endotoxin-lipid hypothesis adverse effect of endotoxins are neutralized by circulating lipids. High level of cholesterol and lipids effectively remove endotoxins from circulation by binding to them and prevent inflammatory response.[27] Some authors explained that HF is a catabolic state so the obese patients have favourable prognosis because of having more metabolic reserve.[28],[29] According to studies on neurohormonal effect on outcome of HF patients, circulating natriuretic peptides level is reduced in obese and overweight so the obese patients become symptomatic at an earlier stage.[30]-[32]

In conclusion, the present study demonstrated that overweight and obese AMI patients show more improvement after coronary angioplasty. Our findings showed the association between BMI and prognosis in AMI

patients and indicate the need for a better understanding of the role of body weight in such patients.

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VI. CONFLICTS OF INTEREST

There are no potential conflicts of interest.

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