Impact of BMI in Early Outcomes in Patients Undergoing on CABG

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Abstract: ***Increasing levels of obesity worldwide have led to a rise in the prevalence of obesity-related complications including cardiovascular risk factors such as diabetes, hypertension and dyslipidaemia. Healthcare providers believe that overweight and obese cardiac surgery patients are more likely to experience adverse postoperative outcomes. The body mass index (BMI) is the primary measure of obesity in clinical practice, without accounting for a patient's level of cardiopulmonary fitness or muscle mass. The main objective of this study was to evaluate the effect of BMI on the early outcomes and in-hospital mortality of patients undergoing CABG.***

Keywords: Coronary artery bypass grafting (CABG); body mass index (BMI), adverse outcome

1. Introduction

Extremely thin and overly obese patients may not tolerate cardiac surgery as well as other patients do. The extremes of body mass index (BMI) and cachexia increase the morbidity and mortality associated with cardiac operations (1). In many studies it has been demonstrated that extreme obesity is associated with increased postoperative morbidity and worse longterm survival (2). Obesity is still assumed to be an important risk factor for morbidity and mortality in coronary artery bypass graft (CABG) operation (3). According to the reviews of literature, obesity increases the risk of adverse outcomes and prolonged hospitalization in patients undergoing this operation.1 Patients with BMI>40 kg/m^2 are at increased risk of operative mortality, which reached statistical significance.4 As mentioned above, overweight and obesity are among the most important problems which predispose the patients to coronary artery occlusion and subsequent myocardial infarction (MI). These patients will likely suffer different complications following CABG. Hence weight control may prove to be of great benefit. Obese populations typically experience comorbid cardiovascular disease (CVD) often necessitating invasive cardiac surgical interventions (4). These patients are at higher risk for intraoperative and postoperative adverse events, including mortality. However, recent studies show paradoxical results, wherein obese patients can experience fewer adverse events and lower mortality than patients with normal body mass index (BMI), suggesting a benefit to obesity for postsurgical outcomes (5). Referred to as the 'obesity paradox', the underlying mechanisms and clinical paradigms of this phenomenon remain to be defined (6)

In part, this paradox may be attributable to over-reliance on singular anthropometric measures of obesity, namely BMI. BMI can be a poor predictor of clinical outcomes since it fails to account for variable whole-body adipose tissue distribution1 or inflammatory state (7). Additionally, BMI does not address the physical ability or fitness of obese patients with respect to size. Thus, the question to be addressed with this study is as follows: Why do some obese patients have 'good health-related quality of life' (QoL), maintain high physical ability and have positive outcomes, whereas other obese patients and normal BMI patients have poor QoL, low physical ability and negative outcomes? Thus, we propose segregating obese patients into two populations: high-fit obese patients ('fit' obese or normally-able) and low-fit obese patients ('non-fit' obese or less-able). This distinction could be of critical importance in determining which obese patients are more likely to do well postoperatively. Alternative measures to BMI have been proposed, including waist-to-hip ratios and waist-to-height ratios and body adiposity index (BAI) (8). These measures of central obesity reflect visceral adiposity and strongly predict cardiovascular risk, postsurgical outcomes and resource utilisation but are not often measured or easily calculated from routine patient histories. Beyond clinical measures of obesity and functional capacity, levels of circulating hormones, inflammatory cytokines (9) and the presence of insulin resistance and type-II diabetes are likely to influence obese patient outcomes (10). Developing a more complete understanding of biomarkers for obese individuals that could improve operative risk assessment is a priority. Ultimately, the need exists to better differentiate obese patients who experience fewer complications from those with increased rates of adverse events, and to determine whether they correspond with the physically distinct populations of 'high-fit' versus 'low-fit' obese. This distinction could be of critical importance in determining which obese patients are more likely to do well postoperatively. The main objective of this study was to evaluate the effect of BMI on the early outcomes and in-hospital mortality of patients undergoing CABG.

2. Material and Methods

This is a prospective study conducted at American Hospital No 3 in Tirana, Albania. A total of 543 patients who underwent selected and isolated OPCAB from March 1, 2017 to December 30, 2020 were selected for this study. The excluded criteria, included history of AF, non-sinus rhythm, congenital heart disease, concomitant surgery, valvular heart disease, cardiac pacemaker implantation. Patients were divided into AF group and non-AF group according to whether they had new-onset AF after OPCAB. AF was denied as any episode of AF noted by continuous ECG/telemetry monitoring, or documented by a physician in the chart, lasting for 30 s or more. The present study includes multiple pre, intra, and post OPCAB variables. The laboratory and ultrasound data are the values of the check before surgery. Perioperative medicine history and in-hospital complications were recorded carefully. In our study, two researchers collected clinical data, and the data between them had a high consistency. All patients were admitted into ICU after surgery and underwent continuous hardwire monitoring of blood pressure, pulse, electrocardiogram. After the patient leaved the ICU, continuous telemetry monitoring of blood pressure, pulse, electrocardiogram would be performed until discharge. Patients were checked for blood tests, liver and kidney function immediately and daily after surgery. If the patient did not have any contraindications, nitroglycerin, β-blocker, and antiplatelet drugs were routinely given after the operation. No other prophylactic therapies were taken to prevent postoperative arrhythmia. Other drugs were given according to the patient's condition. If ECG monitoring showed that AF occurred, a 12-lead ECG and bloodgas examination would be performed at the same time. And the patient would be given oral orintravenous amiodarone. All patients were converted into sinus rhythm before discharging. No patients required electrical cardio version.

Statistical analysis

The SPSS 25.0 statistical software was uses for data analysis. Kolmogorov-Smirnov test was used to test the normality of distribution of continuous variables. Means and standard deviations were reported. Analysis of variance ANOVA was used to compare the means of categories of BMI. Chi square test was used to compare the proportion of categorical variables. Multivariate logistic regression was used to determine the independent predictors of atrial fibrillation. A p value ≤ 0.05 was considered statistically significant.

3. Results and Discussion

Eighty-nine (16.4%) were females and 454 (83.6%) males. Table 1 shows the comparison of the mean values of variables according to BMI of patients. In univariate analysis patients with BMI>31 had a higher mean of LDH (p=0.001), HBA1c (p=0.001), and a lower mean level of HDL (p=0.001) and EF (p<0.0001). No significant differences were found regarding other continuous variables. Association of clinical variables with BMI is shown in table 2. The increase of BMI was associated with adverse outcome.

In many studies, obesity has been described as a risk factor for the development of coronary artery disease, stroke, cancer, renovascular disease, and other physical and psychological comorbidities1-5. Conversely, several other epidemiological and observational studies on different diseases have shown better outcomes and survival rates in overweight and obese patients than in those with normal body mass index (BMI) (11). This counter-intuitive relationship between higher BMI and decreased morbidity and mortality is known as the “obesity paradox” (12), and has been observed in patients with hypertension, diabetes, heart failure, coronary and peripheral artery diseases, non-cardiac surgery, and end-stage renal disease8-10. However, studies examining the association between obesity and adverse outcomes after cardiac surgery still remain controversial (13). For instance, the EuroSCORE II model does not include BMI as a predictive variable for stratification of perioperative death risk16. Some studies have demonstrated that overweight and moderately obese patients have better early hospital outcomes in terms of mortality (14), and a lower incidence of major adverse cardiac and cerebrovascular events (15,16). Other studies have not found any clear protective effect of overweight and obesity on mortality or adverse events after cardiac surgery (17); or they have even demonstrated a deleterious effect for sternal wound infection (18), leg infection (19), sternal dehiscence (20), renal failure (21), atrial fibrillation (22), venous thromboembolism (23), and pulmonary and gastrointestinal complications (24). Another bias might be the young age of obese patients.In general, studies with negative evidence for the “obesity paradox” have tended to include far fewer patients than reports with positive evidence, a difference possibly related to the power analysis of sample size. Nevertheless, outcomes from large samples may in turn exaggerate the clinical value of a statistical difference.

4. Conclusion

Postoperative complication rates systematically increased with higher BMI levels. Fit or not, healthy or unhealthy, chronic obesity is strongly linked to metabolic deterioration, a major risk factor for CVD. The results of the study will inform cardiac surgeons and allied healthcare professionals on the important relationships that exist between obesity and adverse outcomes after cardiac surgery. Clinicians and healthcare administrators will be better able to identify an obese patient who is more likely to experience adverse outcomes and require additional hospital resources in their recovery.

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Table 1: Comparison of the mean values of variables according to BMI of patients

Variables	BMI < 25		BMI 25-30		BMI>31		P
	Mean	SD	Mean	SD	Mean	SD	
Age	62.9	7.0	60.4	7.8	61.1	8.5	0.5
LDH	304.8	123.7	390.3	160.1	436.4	187.8	0.2
LDL	127.0	23.7	120.6	32.1	140.3	36.2	<0.001
HBA1c	6.2	1.0	6.6	1.3	7.6	1.5	<0.001
HDL	36.0	4.2	40.3	7.0	33.7	4.9	<0.001
Hgb	14.3	0.8	14.2	1.0	14.0	1.0	0.6
EF	51.3	1.5	50.1	7.3	45.7	6.7	<0.001
ICU stay	47.5	1.7	48.3	12.5	47.0	6.8	0.7

Table 2: Association of clinical variables with BMI (%)

Variables	BMI < 25	BMI 25-30	BMI>31	P
Intrahospital mortality	8.3	3.0	11.9	0.001
IRA	0	3.4	25.4	0.001
CVA	0	1.3	7.5	0.001
FAPOAF	41.7	26.5	53.7	0.001
POP Hipotension	8.3	11.6	22.4	0.04
Cardiac failure NYHA	8.3	7.3	16.4	0.02
TC	58.3	29.7	38.8	0.04
SAK_2_RCA	8.3	8.6	25.4	0.001
SAK3	91.7	67.5	55.2	0.001
DM	50.0	54.9	76.1	0.004
DMoral	41.7	28.2	0	0.0001
DMinsulin	8.3	25.0	74.6	0.0001

IR	0	23.1	43.3	0.0001
Clearence <50	0	1.1	7.5	0.0001
Clearence 50-85	0	22.0	35.8	0.006
Clearence >85	100.0	76.9	55.2	0.0001
COPD	50	20.0	16.4	0.0001
Arteriopathy	0	56.0	73.1	0.0001
Reduced motility	0	0.2	7.5	0.0001
PostIMpreoperatory	100	76.7	89.6	0.01