http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v9i2.03

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Relationship of Obesity with Early Post-operative Outcomes Following Coronary Artery Bypass Grafting - A Prospective Study

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Abstract
The global burden of obesity is on a rising trend and is a major aetiopathogenic factor for non-communicable diseases, prevalence of obesity-related complications including cardiovascular risk factors such as diabetes, hypertension and dyslipidemia. But numerous studies have documented an obesity paradox in which overweight and obese people with cardiovascular disease have a better prognosis compared with patients with normal body mass index (BMI). This prospective observational study aims to evaluate the effects of obesity on early post-operative outcomes after coronary artery bypass grafting (CABG). This is a prospective study, which includes total 100 patients of multi-vessel CAD who has undergone elective CABG. These patients have been divided in two groups: Group I with 54 patients having BMI> 30 and Group II with 46 patients having BMI< 30. Aim- This study aims to evaluate the effects of obesity on the early post-operative outcomes following CABG like post-operative ventilation time, duration of ICU and hospital stay, improvement in ejection fraction, wound infection, CVA, renal impairment, hepatic insufficiency and mortality. Result: Our study demonstrated a significantly prolonged duration of hospital stay and increased wound infection rates in obese patients, but no statistically significant difference in other parameters between the two groups.

Keywords: *BMI- Body Mass Index, CABG- Coronary Artery Bypass Grafting, CAD- Coronary Artery Disease, LIMA- Left Internal Mammary Artery, DM- Diabetes Mellitus, EDD- End Diastolic Dimension, EF- Ejection Fraction, ESD- End Systolic Dimension, HTN- Hypertension, IABP- Intra-Aortic Balloon Pump.*

Introduction

Obesity has a great impact on overall mortality and morbidity in cardiac surgery. The magnitude of obesity is defined by means of body mass index (BMI). Patients with BMI $\geq$ 30 Kg/m^2 were classified as obese and those with BMI < 30 Kg/m^2 considered as non-obese. Controversies still exist between authors regarding whether a high BMI is associated with more complications or not in cardiac surgery. Engelman and colleagues proposed a significant increase of mortality and morbidity in obese patients

following cardiac surgery. While Reeves and his team showed some increase in rates of complications but neither reaching a statistical significance. This is a single-center prospective observational study conducted in G B Pant Institute of Post-graduate Medical Education and Research, New Delhi, India. It included hundred patients with multi-vessel coronary artery disease and candidate for CABG, divided into two groups Group I: 54 patients with BMI over 30. Group II: 46 patients with a BMI under 30.

Inclusion Criteria

Patients of coronary artery disease scheduled for elective CABG.

Exclusion Criteria

- HBA1c of more than 7.5
- Emergency CABG
- Patients with ischemic mitral valve regurgitation
- Redo CABG
- Significant stenosis of the carotid artery with CABG
- Patients with comorbidities (hepatic impairment, renal insufficiency and impaired pulmonary function)
- Patients requiring perioperative intra-aortic balloon pump (IABP).

Patients underwent similar perioperative anaesthetic protocol and surgical procedures. All procedures were done off-pump. Revascularization was done using conventional pedicled LIMA harvesting andsaphenous vein grafts as needed. Perioperative glycemic status was maintained below 200 mg/dL.

Results

There is no statistically significant difference between group I and group II as regard age and sex; however, the prevalence of CABG in male patients (63) is more than in female patients (37). The mean age in both groups was about the same (53.45 ± 6.6, 54.89 ± 6.13) as shown in Table 1. Group I had a lower prevalence of hypertension than group II (62.96% versus 65.22%) in contrast to DM (50.00% versus 47.83%) respectively with no significant difference, as shown in Table 2.

Table 1: Patients' demographics

Variables	Group I (BMI>30)		Group II (BMI<30)			
	Mean	SD	Mean	SD	Independent sample t-test	P-value
Age	53.45	6.60	54.89	6.13	-1.109	0.270
Sex	No	%	No	%	Chi-square test	P-value
Male	32	59.26	31	67.39	0.414	0.519
Female	22	40.74	15	32.61		

Table 2: Patients' co-morbidities

Variables		Group-I (BMI>30)		Group-II (BMI<30)		Chi-square test	P-value
		Number	%	Number	%		
HTN	Yes	34	62.96	30	65.22		
	No	20	37.04	16	34.78	0.055	0.815
DM	Yes	27	50.00	22	47.83		
	No	27	50.00	24	52.17	0.047	0.828

Table 3: Pre-operative echocardiographic results

Variables	Group-I (BMI>30)		Group-II (BMI<30)		Independent t-test	P-value
	Mean	SD	Mean	SD		
EDD	5.64	0.65	5.62	0.69	0.149	0.882
ESD	4.39	3.10	3.93	0.62	0.989	0.325
EF	50.43	9.39	51.73	5.54	0.824	0.412

As shown in table 3, there is a statistically insignificant difference in preoperative echocardiography characteristics (EDD, ESD and EF) between group I (BMI > 30) and group II (BMI < 30). Group I (BMI > 30) had higher mean Pre-operative End-diastolic and End-systolic dimension rather than group II (BMI < 30), (5.64 ± 0.65 versus 5.62 ± 0.69) for Pre-operative End-diastolic dimension and (4.39 ± 3.10 versus 3.93 ± 0.62) for Pre-operative End Diastolic dimension. But, group I (BMI > 30) had lower mean Ejection Fraction (%) than group II (BMI < 30) (50.43 ± 9.39 versus 51.73 ± 5.54).

As shown in table 4, there is a statistically insignificant difference between group I and group II in the number of diseased coronary vessels in Coronary Angiography (P>0.05).

Table 4: Number of diseased vessels

Variables		Group-I (BMI>30)		Group-II (BMI<30)		P-value
		No	%	No	%	
Number of Diseased vessels	Two	10	18.52	8	17.39	0.867
	Three	40	74.08	35	76.09	
	Four	4	7.4	3	6.52	

Table 5 shows no statistical differences in the number of grafts between the two groups (P > 0.05); however, group I had a lower prevalence of two grafts rather than group II (18.52% versus 23.91%) in contrast to three and four grafts.

Table 5: Number of grafts

		Group-I (BMI>30)		Group-II(BMI<30)		P-value
		No.	%	No.	%	
Grafts	Two grafts	10	18.52	11	23.91	0.770
	Three grafts	32	59.26	25	54.35	
	Four grafts	12	22.22	10	21.74	

Table 6: Post-operative parameters

Variables	Group-I (BMI>30)		Group-II(BMI<30)		P-value
	Mean	SD	Mean	SD	
Ventilation time(hours)	14.74	7.31	12.29	5.14	0.059
ICU-stay (days)	3.99	3.12	3.12	2.39	0.126
Ward-stay (days)	8.01	2.12	6.21	3.92	0.004
EF (Post-operative)	52.23	6.92	53.19	7.13	0.497

Table-6 shows a statistically insignificant difference between group I and group II as regard ventilation time, ICU stay and Ejection Fraction (Postoperative) (P > 0.05); where; group I had higher mean Ventilation time and ICU stay rather than group II (14.74 ± 7.31 versus 12.29 ± 5.14) and (3.99 ± 3.12 versus 3.12 ± 2.39) respectively; but group I had lower mean Ejection Fraction (Postoperative) as compared to group II (52.23 ± 6.92 versus 53.19 ± 7.13).

There is a statistically significant difference between group I and group II as regard ward stay in days (P < 0.05), group I had higher mean ward stay rather than group II (8.01 ± 2.12 versus 6.21 ± 3.92).

There is a statistically significant difference between group I and group II regarding incidence of chest wound infection including both superficial and deep sternal wound exploration (P < 0.05); where the group I had a higher incidence of wound infection than group II(18.59% versus 2.17%)(Table 7).

Table 7: Wound infection

		Group-I(BMI>30)		Group-II(BMI<30)		P-value
		No.	%	No.	%	
Wound infection	Yes	10	18.59	1	2.17	0.009
	No	44	81.41	45	97.83	

These patients underwent dressing under strict aseptic conditions with no-touch technique and wound culture and sensitive antibiotics administration. None of the patients were re-explored due to wound infection. There is no statistically significant difference in the requirement of inotropic support, blood product administration, renal impairment, hepatic insufficiency, incidence of cerebrovascular accident and mortality.

Discussion

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2). For adults, WHO defines overweight and obesity as follows: overweight is a BMI greater than or equal to 25 and obesity is a BMI greater than or equal to 30.

BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals.

Many authors advocate a negative impact of obesity over postoperative outcome following CABG: obesity being associated with metabolic syndrome. Our study has shown no difference between group (I) and group (II) in age, sex and other co-morbidities like diabetes and hypertension. Our study has included 63% males and 37% females with obesity being more prevalent in both males and females. HTN is more common in group II in contrast to DM. As shown in most other studiesthere is significant difference in the duration of hospital stay; more common in obese group than the non-obese group. But in contrast there is no statistical difference in ventilation time, duration of ICU stay. Our study has demonstrated a higher occurrence of sternal wound infection in the obese group in concurrence with DM indicating hyperglycemia, a risk factor for wound infection. The sternal wound infections were managed conservatively sterile dressing and sensitive antibiotic administration. None of the patients underwent re-exploration. In the two groups, there is no statistically significant difference in the requirement of inotropic support, blood product administration, renal impairment, hepatic insufficiency, incidence of cerebrovascular accident and mortality. This study has revealed that obesity has negative impact on the postoperative recovery following CABG.

Limitations of the study

This is a single-center study which has included limited number of patient and lacks post-discharge follow-up data.

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