

Impact of Body Mass Index in outcome of Surgery of Valvular Heart Diseases

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ABSTRACT

Objective: To determine the role of body mass index (BMI) in clinical outcomes after valve surgery.

Study Design: Retrospective study.

Place and Duration of Study: Department of cardiac Surgery, Shalimar Hospital, Shalimar Medical and Dental College, Lahore from 1st July 2018 to 30th June 2020.

Methodology: A total of one hundred and fifty-nine (n =159) patients who had valve surgery were categorized into two groups based on their body mass index (BMI). Group A comprised forty-six patients with a body mass index below 18.5, while in Group B, one hundred and twelve patients were included with a BMI greater than 18.5. As it was a retrospective study the data for analysis were retrieved from the medical and perfusion records, post operative charts and operation theatre registers. All patients over 16 years of age and undergone the first surgical procedure were included. Informed consent was obtained from all the patients. The primary outcome of the study was to evaluate the mortality benefits between the two groups and the other outcomes were the difference in postoperative complications.

Results: Patients in Group A; 60% were NYHA Class III & IV, mean pulmonary artery pressure was 59, atrial fibrillation was present in 48% and preoperative inotropes were needed in 15 % as compared to 10% in Group B. Majority of patient had rheumatic valvular heart disease in both groups (66% Vs 67%). The most common valve surgery done was isolated mitral valve replacement (MVR) in both groups (40% Vs 48%). Aortic cross-clamp was higher in Group A (73.4 min) and time for cardiopulmonary bypass were significantly longer in group B (91.2 min). Overall, in-hospital mortality was significant in Group A 10.6%, as compared to group B 5.4% (P=0.001). Moreover, total hospital stays (14.6 days Vs 9.8 days, P=0.003), blood transfusions (60% Vs 45%, P=0.002), complications (45% Vs 21%, P=0.0001) and readmissions (15% Vs 4.5%, P=0.01) were significantly higher in Group A in comparison to Group B.

Conclusion: Patients with low body mass index have higher mortality and complication when compared with higher body mass index. These patients require risk stratification, intensive preoperative testing, and optimization of Nutritional status preoperatively.

Key words: Body mass index (BMI), Valvular heart disease, Valve surgery

INTRODUCTION

Most patients who present for surgical treatment of valvular heart disease are in chronic heart failure (CHF).¹ CHF has prevalence of 1-2% in population which is increasing.² CHF leads to the syndrome of loss of lean tissue, fat tissue, bone and muscle mass leading to cardiac Cachexia. This will eventually causes reduce in functional activity, decrease exercise capacity and left ventricular function. Multi-factorial neurohormonal and metabolic changes cause poor outcome. About 10-15% of CHF patients are in stat of Cardiac Cachexia.¹ Its impact in our surgical patients is unknown.

37.5 million (24%) Pakistani population is undernourished. Although literature on malnourished surgical patients has been published in western world, but low BMI as a risk factor in surgical cases has been given weightage in third world country like Pakistan. This retrospective study was conducted to determine the impact

of low body mass index on morbidity and mortality in patients after valvular heart surgery in context of Pakistan.

MATERIALS AND METHODS

This retrospective study was conducted at Department of Cardiac Surgery, Shalimar Hospital, Lahore from 1st July 2018 to 30th June 2020 and comprised 159 confirmed cases of valvular heart disease through echocardiographic study. The degree of thinness or obesity was assessed by the BMI. The BMI is defined as the weight in kilograms divided by the height in meters squared. This study was approved by the ethical committee of Shalimar medical and dental college, Lahore. Patients were grouped into two according to their BMI: Group A with BMI less than 18.5 and Group B with BMI greater than 18.5. Data were recorded from patient's charts, perfusion records and surgical notes. All patients over 16 years of age who underwent valvular heart surgery for the first time and had complete records available were included in the study. A

total of 159 patients fulfilled criteria; 46 were in BMI Group A and 112 were in Group B. The surgeon and the operative team were the same in all cases and similar operative technique was used.

Primary outcome parameter was post-operative mortality and secondary end points were complications like re-exploration, prolonged intubation, renal failure, stroke, duration of hospital stay, blood transfusions and rates of re-admission.

Data for the two groups was compared using SPSS version 16. A p-value less than 0.05 was considered significant.

RESULTS

Preoperative characteristics are shown in Table 1. Notably, patients in Group A; 60% were NYHA class III & IV, mean pulmonary artery pressure was 59, atrial fibrillation was present in 48% and preoperative Inotropes were needed in 15 % as compared to 10% in Group B (Table 2).

The majority of patient had rheumatic disease in both groups (Table 3). The procedure adopted for surgery according to BMI group are shown in Table 4. The commonest procedure was isolated mitral valve replacement (MVR) in both groups. Aortic cross clamp was higher in Group A and longer time for cardiopulmonary bypass was noted in group B.

Overall, in-hospital mortality was significant in Group A 10.6% as compared to group B 5.4% (P=0.001). Moreover, total hospital stay, blood transfusions, complications and readmission were significantly higher in Group A in comparison to Group B (Table 5). Nevertheless, there were no significant differences in prolonged ventilation and stroke rate among the groups (Table 6). However, incidence of renal failure and re-exploration was higher in Group A.

Table 1: Demographic and Preoperative variables

Variables	Group A (BMI <18.5)	Group B (BMI >18.5)	P-value
Age	32.4	33.1	0.57
Males	22	51	0.72
Females	25	61	
Weight (kg)	41.3	51.6	<0.0001
Height (cm)	143.7	149.2	<0.001
BMI (kg/m ²)	16.8	22.5	<0.0001
Diabetes	5	11	0.67
Hypertension	3	7	0.86
Creatinine	0.85	0.92	0.01
Stroke	2	2	0.28
COPD	5	11	0.77

Table 2: Preoperative hemodynamics

Variable	Group A	Group B	P-value
NYHA Class III & IV	28 (60%)	49 (43%)	0.002
Pulmonary artery pressure	65	59	0.23
Atrial fibrillation	23 (48%)	45 (42%)	0.47
Preoperative inotropes	7 (15%)	11 (10%)	0.52

Table 3: Valve disease aetiology

Variable	Group A	Group B
Rheumatic disease	31 (66%)	76 (67%)
Degenerative disease	6 (13%)	17 (15%)
Myxomatous disease	8 (17%)	15 (13%)
Bicuspid aortic valve	2 (4%)	4 (4%)

Table 4: Operative procedures

Operation	Group A	Group B	P-value
Elective	38 (80%)	89 (79%)	0.99
Urgent	4 (9%)	10 (9%)	1.00
Emergent	5 (11%)	13 (12%)	0.99
Isolated mitral valve	19 (40%)	54 (48%)	0.08
Isolated aortic valve	8 (17%)	22 (20%)	0.68
Mitral and aortic Valve	9 (19%)	29 (26%)	0.26
Mitral and tricuspid valve	11 (23%)	7 (6%)	0.02
CPB time	85.8	91.2	0.43
X- clamp time	73.4	68.6	0.37

Table 5: Postoperative courses

Variable	Group A	Group B	P-value
Total hospital stay	14.6	9.8	0.003
Blood transfusions	28 (60%)	50 (45%)	0.002
Complications	19 (45%)	24 (21%)	0.0001
Mortality	5 (10.6%)	6 (5.4%)	0.001
Readmission	7 (15%)	5 (4.5%)	0.01

Table 6: Postoperative complications

Variable	Group A	Group B	P-value
Re-exploration	3	1	0.001
Prolonged intubation	5	6	0.07
Renal failure	5	5	0.04
Stroke	1	2	0.38

DISCUSSION

Obesity is a worldwide healthcare concern, most studies that have looked at the association between obesity and CABG. This study suggests low BMI is a significant predictor of postoperative mortality and morbidity. Like Western studies, our data suggest that low BMI patients have increased rate of mortality, greater postoperative complication and long length of hospital stay.³⁻⁶ The obesity paradox in the cardiac surgery explained in different ways by the cardiac surgeons. In a previous study similar results were justified with the conclusion that the obese persons have greater functional reserves so might have better survival chances and less complication than patients with low BMI.⁵

In Pakistan our results have highlighted that patient with BMI >18.5 patients undergoing any valve procedure experienced better postoperative outcomes compared to Patients with BMI <18.5. Existing data supports that overweight patient are prone to lower mortality after cardiovascular events heart failure.^{7,8}

Other reasons which could be associated with the paradox of obesity and cardiovascular surgery can be caused by the presence of low systemic vascular resistance and renin (hormone) activity among high BMI versus lean cases.^{9,10} Additionally, adipose tissues have been shown to generate soluble receptors of tumour necrosis factor (TNF), which are assumed to counteract the harmful impacts of tumour necrosis factors on the cardiac muscles. This results in the potential protective effect of obesity.¹¹

Engelman and colleagues¹² also found that low BMI (less than 20) as an independent risk for higher mortality, and post operative complications such as Acute Kidney Injury, stroke and incidence of haemorrhage and re-exploration after cardiopulmonary bypass.

Ranucci and colleagues¹³ have reported same that risk of postoperative haemorrhage requiring re-exploration

was higher in patients with a low BMI, which can be related to abundant mediastinal fat and high abdominal pressure which, increased intrathoracic pressure and compressed minor bleeding points. A decrease in volume load after cardiopulmonary bypass surgery and a reduction in haemolysis in obese patients may also have assisted to a reduced probability of postoperative haemorrhage.¹⁴

It is known that low BMI patients do not have the enough body reserves in the form of energy to overcome burden surgery.⁷ Moreover, low BMI is associated with increased haemodilution and postoperative bleeding.¹⁵

Detailed investigation to find relationship between poor outcome and low BMI in cardiac valve surgery is needed more randomised trials to solve the specific reason behind the obesity paradox exist in cardiac surgeries.

CONCLUSION

Patients with Low BMI have higher postoperative mortality and complication. These patients require risk stratification, intensive preoperative testing, and optimization of Nutritional status preoperatively. Moreover, Nutritional status should be included one of the criteria for risk stratification.

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