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Original Article

The impact of increased body mass index on the outcomes after valve replacement

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Abstract

Background: The association between obesity and the outcomes of surgery is controversial. This study aimed to assess the effect of body mass index (BMI) on early and late morbidity and mortality after valve replacement surgery.

Methods: The study was conducted on 100 valve replacement patients from 2020 to 2022. The patients were divided according to BMI into two groups: patients with morbid obesity (BMI ≥ 35) (Group A: n = 50) and patients who had BMI< 35 (Group B.; n = 50).

Results: Hospital (9.43 ± 5.93 vs. 7.25 ± 4.05 days, P= 0.034), ICU length of stay (7.32 ± 5.67 vs. 4.52 ± 3.24 days, P= 0.003), and duration of mechanical ventilation (3.58 ± 2.54 vs. 2.342 ± 2.05 days, P= 0.008) were significantly higher in Group A. There was no significant difference in postoperative mortality between both groups (P= 0.678). There was no significant difference in morbidity and mortality after a 3-month follow-up. Hemoglobin was significantly lower in Group A (P =0.034), with no difference in postoperative laboratory investigations.

Conclusions: Morbid obesity was not associated with increased mortality after valve replacement surgery; however, it could increase the duration of ventilation, ICU, and hospital stay.

KEYWORDS

Body mass index; Quality of life; Valve replacement; Obesity

Article History

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Introduction

Rheumatic heart disease results from either single or repeated rheumatic fever attacks that result in rigidity and deformity of valve cusps, the fusion of the commissures, or the shortening and fusion of the chordae tendineae. In chronic rheumatic heart disease, the mitral valve alone is the most commonly affected in an estimated 50% to 60% of cases. Combined lesions of both the aortic and mitral valves occur in 20% of cases [1]. The number of morbidly obese patients undergoing valve surgery is increasing; however, the effect of obesity on the outcomes remains controversial [2]. Some authors reported that obesity adversely affected operative death in valvular surgery patients [3]. Others described the presence of an 'obesity paradox,' with such patients having an improved survival rate than normal-weight people [4].

This study aims to determine whether morbidly obese patients are at risk for adverse outcomes when undergoing heart valve surgery and the effect of body mass index (BMI) on early and late morbidity and mortality after valve surgery.

Patients and Methods

This study was prospective cohort research conducted between June 2020 and June 2022 on

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100 valve surgery patients. The patients were divided according to BMI into two groups: patients with morbid obesity (BMI ≥ 35) (Group A: n = 50) and patients who have (BMI< 35) (Group B.; n = 50).

The institutional review board approved the study, and the patient's consent was obtained before enrollment. We included patients aged 18 to70 years who had heart valve disease requiring valve surgery. We excluded patients with concomitant surgery and those with end-organ failure (hepatic or renal failure).

All patients were subjected to full history taking, complete clinical examination, and investigations such as chest X-ray, electrocardiography [ECG], complete blood count (CBC), kidney function tests, liver function tests, prothrombin time, partial thromboplastin time, international normalized ratio [INR], lipid profile, respiratory functions, echocardiography, HB A1C and cardiac catheterization for patients if indicated.

Operative and postoperative data:

Operative data included the operative priority, type of valve surgery, operative, cardiopulmonary bypass, and ischemic times, and the need for an intra-aortic balloon pump or inotropic support. Postoperative data included ventilation time, ICU and hospital stay length, and postoperative morbidity and mortality.

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Table 1: Comparison of the baseline characteristics of the studied groups. Continuous data were expressed as mean and standard deviation and categorical data as numbers and percentages.

	Group A (n =50)	Group B (n =50)	p-value
Age (years)	51 ± 6.33	52.32 ± 5.31	0.261
Male	21 (42%)	32 (64%)	0.045
Weight (kg)	108.88 ± 13.56	82.72 ± 12.75	<0.001
Height (cm)	166.76 ± 8.86	173.6 ± 8.13	<0.001
BMI (kg/m²)	39.02 ± 1.83	27.38 ± 3.31	<0.001
Hb (g/dL)	13.14 ± 1.76	13.76 ± 1.64	0.071
PLTs (×10³/µL)	197.62 ± 50.98	213.64 ± 67.65	0.184
Creatinine (mg/dL)	1.21 ± 0.23	1.15 ± 0.29	0.067
AST (U/L)	25.16 ± 16.54	22.78 ± 8.91	0.373
ALT (U/L)	31.34 ± 11.13	30.8 ± 11.27	0.81
LDL (mg/dL)	165.54 ± 47.92	138.34 ± 43.73	0.004
HDL (mg/dL)	64.9 ± 12.93	70.4 ± 6.48	0.008
TG (mg/dL)	165.76 ± 40.84	163.58 ± 32.69	0.769
HbA1c (%)	5.694 ± 1.91	5.048 ± 1.58	0.068
HTN	37 (74%)	22 (44%)	0.004
Hyperlipidemia	37 (74%)	24 (48%)	0.013
DM	19 (38%)	13 (26%)	0.284
Current smoking	8 (16%)	12 (24%)	0.454
CVD	6 (12%)	4 (8%)	0.741
NYHA			
I	7 (14%)	8 (16%)	0.513
II	18 (36%)	19 (38%)	
III	20 (40%)	14 (28%)	
IV	5 (10%)	9 (18%)	

BMI: Body mass index, Hb: Hemoglobin, PLTs: Platelets, AST: Aspartate transaminase, ALT: Alanine transaminase. LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TG: Triglycerides. HTN: Hypertension, DM: Diabetes mellites, CVD: Cerebrovascular disease. NYHA: New York heart association

Table 2: Comparison of the operative data between the studied groups. Continuous data were expressed as mean and standard deviation and categorical data as numbers and percentages.

	Group A (n =50)	Group B (n =50)	p-value
Type of surgery			
MVR	23 (46%)	21 (42%)	0.606
AVR	8 (16%)	12 (24%)	
Double valve	19 (38%)	17 (34%)	
Total surgery time (min)	302.8 ± 60.59	303.5 ± 47.06	0.948
Total bypass time (min)	120.96 ± 41.25	132.78 ± 45.33	0.176
Cross clamp time (min)	92.68 ± 33.78	95.04 ± 31.27	0.718
Inotropes			
One	14 (28%)	22 (44%)	0.226
Two	16 (32%)	14 (28%)	
Three	20 (40%)	14 (28%)	
Mitral valve size			
25	8 (16%)	15 (30%)	0.244
27	16 (32%)	10 (20%)	
29	13 (26%)	9 (18%)	
31	5 (10%)	4 (8%)	

MVR: Mitral valve repair, AVR: Aortic valve repair

The patients were followed up after three months, and the routine laboratory investigations, BMI, and functional New York Heart Association (NYHA) class were reported

Statistical analysis:

The data were analyzed using the statistical package SPSS (version 24 for Windows; SPSS Inc, Chicago, IL, USA). The student T-test was used to assess the statistical significance of the difference between continuous data. The Chi-squared test was used to examine the relationship between two qualitative variables. A P-value was considered significant if <0.05.

Results

Preoperative data

There was no significant difference in age between the two groups. Females, weight, and BMI were significantly higher in Group A than in Group B (P =0.045, <0.001, and <0.001, respectively]. Both studied groups had no significant difference in hemoglobin, platelets, serum creatinine, and liver enzymes. Low-density lipoprotein (LDL) was significantly higher in Group A than in Group B (P =0.004). Still, high-density lipoprotein (HDL) was significantly higher in Group B than in Group A (P =0.008). There was no significant difference in triglycerides between Group A and Group B.

Hypertension and hyperlipidemia were significantly higher in Group A than in Group B (P =0.004 and 0.013, respectively). Neither group had a significant difference in diabetes (DM), current smoking status, cerebrovascular disease (CVD), history of surgery, and NYHA class. (Table 1)

Operative and postoperative data

There was no significant difference in operative data (type of surgery, total surgery time, total bypass time, cross-clamp time, type of inotropes, and mitral valve size) between the studied groups. (Table 2)

Regarding postoperative data in the studied groups, hospital, ICU length of stay, and duration of mechanical ventilation were significantly higher in Group A than in Group B (P =0.034, 0.003, and 0.008, respectively). There was no significant difference in postoperative mortality between the studied groups. (Table 3)

Table 3: Comparison of postoperative data in the studied groups. Continuous data were expressed as mean and standard deviation and categorical data as numbers and percentages.

	Group A (n =50)	Group B (n =50)	p-value
Hospital length of stay (days)	9.43 ± 5.93	7.25 ± 4.05	0.034
ICU length of stay (days)	7.32 ± 5.67	4.52 ± 3.24	0.003
Duration of mechanical ventilation (days)	3.58 ± 2.54	2.342 ± 2.05	0.008
Postoperative mortality	4 (8%)	2 (4%)	0.678
Hb (g/dL)	13.24 ± 1.38	13.78 ± 1.11	0.034
PLTs (×10³/µL)	203.22 ± 46	219.24 ± 63.46	0.152
Creatinine (mg/dL)	1.17 ± 0.18	1.1 ± 0.2	0.069
AST (U/L)	27.3 ± 18.03	23.44 ± 10.22	0.191
ALT (U/L)	32.84 ± 12.01	31.4 ± 11.64	0.544

Hb: Hemoglobin, PLTs: Platelets, AST: Aspartate transaminase, ALT: Alanine transaminase

Both groups had no significant difference in CBC, kidney, and liver function tests. Hemoglobin was significantly lower in Group A than in Group B (P =0.034).

There was no significant difference in morbidity and mortality after a 3-month follow-up in the studied groups. (Table 4)

Discussion

We found that postoperative data, including hospital, ICU length of stay, and duration of mechanical ventilation, were significantly higher in Group A than in Group B. Acharya and colleagues [5] stated that increasing BMI correlated with reduced mechanical ventilation time. Our results were incompatible with Yazdanian and coworkers [6], who stated that comparable hospitalization and ICU stay were found between obese and normal-weight patients. Acharya and associates [5] stated that high BMI did not extend ICU or overall hospital stay. On the other hand, Rockx and coworkers [7] also documented that raised BMI was accompanied by prolonged ICU days.

Cheung W. [8] documented that possibly hostile results like extended intubation periods, extended postoperative ICU and hospital stay, more demand for pacing, and amplified infections in morbidly obese patients did not reach statistical significance. Potapov and associates [9] stated that in obese patients, mechanical ventilation time was elongated compared to normal-weight people. Sakr and colleagues [10] documented that obesity was commonly linked with extended mechanical ventilation, particularly when BMI is ≥ 40 kg/m2.

Wigfield and fellows [11] stated that severely and morbidly obese people have substantially augmented problems regarding the duration of stay and prolonged mechanical ventilation compared with normal-weight patients. There was also no association between body mass index and mechanical ventilation and intensive care unit or hospital stay in Costa and colleagues [12] study.

Table 4: Morbidity and mortality after 3-month follow-up in the studied groups. Continuous data were expressed as mean and standard deviation and categorical data as numbers and percentages.

	Group A (n =46)	Group B (n =48)	p-value
Superficial wound infection	8 (17.39%)	4 (8.33%)	0.227
Deep wound infection	5 (10.87%)	2 (4.17%)	0.263
Chest infection	6 (13.04%)	4 (8.33%)	0.519
Rehospitalization	4 (8.69%)	3 (6.25%)	0.711
Mortality after three months	5 (10.87%)	3 (6.25%)	0.481

In our study, there was no significant difference in the need for IABP and postoperative mortality between the studied groups. Our results were compatible with William and associates [13], who documented that AVR patients showed equal survival in patients with low and high BMI. Similarly, Tawfek and coworkers [14] and Cheung [8] tried to ascertain if there was an elevated rate of death or illness in morbidly obese people needing heart operations. Nevertheless, they could not demonstrate any statistically substantial differences in postoperative results.

Our results were similar to Hysi and coworkers [15] statement that severely obese people can have no operative death. Acharya and colleagues [5] found no significant correlation between BMI and other postoperative mortality. Lopez-Delgado and coworkers [16] documented that obesity augmented perioperative myocardial infarction and septicemia post-heart surgery but did not affect in-hospital death. Our results were not similar to Rahmanian and associates [3], who documented that obesity was a self-determining interpreter of hospital death in patients who performed valve surgery. This may be due to the large sample [6,940 consecutive patients] who was collected and underwent cardiac surgery between January 1998 and September 2006. Costa and colleagues [12] showed no association between BMI and other complications or mortality.

Interestingly, Mariscalco's study [17] found that obesity was associated with low mortality risk after cardiac surgery. Although this is a large study, which included 13 countries, it has several differences that make it not comparable with our population: first of all, 27% were women, while in our group, women comprised 58% of the patients; second place, Mariscalco's study included all cardiac surgeries, the vast majority of which were coronary artery bypass surgery, but even lower risk procedures were included, such as right mini-thoracotomy for the mitral valve and trans-AVR, in their logistic regression analysis only Grade 3 obesity was associated as an independent risk factor for mortality following isolated valvular surgery. Valve surgery generally formed a low percentage of their patients.

In our study, there was no significant difference in CBC, kidney, and liver function tests between both groups. Hb was significantly lower in Group A than in Group B. Wigfield and coworkers [11] stated that severely and morbidly obese people have substantially augmented problems regarding postoperative kidney shutdown rates. Similar rates of renal dysfunction were observed in both normal- and overweight/obese-BMI groups in Acharya and colleagues study [5].

Regarding the outcomes in the studied groups at the end of follow-up, there was no significant difference in morbidity, mortality after three months, and infection between Group A and B.

This may be due to people with elevated BMI and a high portion of body fat having more dietary stores, which may give them some protection against complications. Similar to our results, Acharya et al. [5] observed no significant difference in sternal wound complications in both normal- and overweight/obese-BMI groups. Differently from these data, Tawfek et al. [14] found a significant difference between groups. This hazard may be enriched by diabetes mellitus, and physicians' necessity to give specific care to wound healing in patients with numerous risk aspects.

Our results are not similar to Rahmanian and colleagues [3], who reported that former reports had demonstrated a link between obesity and postoperative illness, such as wound infection. Costa and colleagues [12] showed that obesity was associated with an increased frequency of wound dehiscence.

Our study did not assist the remarkably held idea that obese people were at raised hazard of operative death; Therefore, the term obesity paradox should be changed. The result of supporting the paradox of obesity should be taken with reserve. This may apply to certain groups and ages. Overall, heart valve surgery can be done with satisfactory early results in obese patients like non-obese.

Study limitations and possible future prospects

Our study is limited by its observational design, which does not allow us to explore causal relationships, and only comment on noteworthy associations. Furthermore, we did not have complete data with regard to the functional class of all patients; therefore, this information has not been included in the analysis.

More studies are necessary to be done to study the effect of obesity on the intermediate and long-term results of patients after heart valve surgery. The focus should be placed on these populations in risk assessment, preparation, and resource allocation prior to cardiac surgery.

Conclusion

Morbid obesity was not associated with increased mortality after valve replacement surgery; however, it could increase the duration of ventilation, ICU, and hospital stay.

Conflict of interest: Authors declare no conflict of interest.

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