**The impact of increased body mass index on outcome and quality of life after valve replacement**

**Abstract**

**Background**: The association between obesity and operative results is blurred. Some authors reported that obesity adversely affects operative death in patients undergoing valvular surgery**.** **This study aimed to** assess the effect of BMI in early & late morbidity & mortality after valve surgery. **Methods:** The present study was conducted on 100 patients. patients were subdivided according body mass index (BMI) into 2 groups: patients with severe obesity (BMI ≥ 35) (group A: n = 50) and patients who have (BMI< 35) (group B.; n = 50). All patients were subjected to full history taking, complete clinical examination and investigations as chest X-ray, electrocardiography (ECG) complete blood picture, 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. All patients operative, post operative and follow up data were obtained. **Results**: Regarding post-operative data in the studied groups, hospital, ICU length of stay, and duration on mechanical ventilation were significantly higher in group A than group B (p =0.034, 0.003, and 0.008 respectively). There was no significant difference in post operative mortality between the studied groups. There was no significant difference in Morbidity and mortality after 3-month follow up in the studied groups. There was no significant difference in (CBC, kidney, and liver function tests) between both groups except for Hb was significantly lower in group A than group B (p =0.034). **Conclusion:** we found that obesity did not correlate with raised postoperative illness or mortality rate except for only surgical site infection.

**Keywords:** body mass index; quality of life; valve; replacement; obesity

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**Introduction**

Rheumatic heart disease results from either a single or repeated attacks of rheumatic fever that results in rigidity and deformity of valve cusps, the fusion of the commissures, or shortening and fusion of the chordae tendineae. Over 2 to 3 decades, valvular stenosis and/or regurgitation results. In chronic rheumatic heart disease, the mitral valve alone is the most commonly affected valve in an estimated 50% to 60% of cases. Combined lesions of both the aortic and mitral valves occur in 20% of cases [1].

The percentage of obese patients suitable for cardiac surgery is behind the equal up drift, which increases the topic of the perioperative threat of this people. Low BMI [< 20 kg/m 2] is a self-determining reason that affects illness and death for next cardiac surgery [2].

On the other hand, the association between obesity and operative results is blurred. Some authors reported that obesity adversely affects operative death in patients undergoing valvular surgery [3].

Whereas others recommended the presence of an ‘obesity paradox', with such patients having an improved survival rate than normal-weight people [4].

The objective of this study is to determine whether fitness capacity of obese cardiac surgical patients and biomarkers, will help identify patients at risk for adverse outcomes when undergoing cardiac surgery and the effect of BMI in early & late morbidity & mortality after valve surgery.

**Patients and methods**

This study was a cohort prospective comparison study between June 2020 and June 2022 in Cardiothoracic Department at XXXX University Hospitals.

The present study was conducted on 100 patients during the period from June 2020 to June 2022 in Cardiothoracic Department in XXXX University Hospitals. patients were subdivided according body mass index [BMI] into 2 groups: patients with severe obesity [BMI ≥ 35] [group A: n = 50] and patients who have [BMI< 35] [group B.; n = 50].

The study was approved by the institutional review board in The Faculty of Medicine, XXXX University. The study was approved by the local ethics committee on research involving human subjects of XXXX faculty of medicine.

**Inclusion criteria:** Patients aged 18 to70 years, of both sexes and who had heart valve disease requiring valve surgery.

**Exclusion criteria:**

1. Patients with adult congenital heart disease.
2. Patients associated with coronary artery disease.
3. Patients requiring coronary artery bypass graft [CABG].
4. Patient with liver cell failure.
5. Patient with renal failure.

All patients were subjected to full history taking, complete clininal examination and investigations as chest X-ray, electrocardiography [ECG] complete blood picture, kidney function tests, liver function tests, prothrombine time, partial thromboplastine time, international normalized ratio [INR], lipid profile, respiratory functions, echocardiography, HB A1C and cardiac catheterization for patients if indicated.

**Operative data:**

* Priority of procedure [urgent, emergent and elective]
* Time of surgery: [First do, redo, and third-do surgery]
* Type of surgery: [Mitral valve surgery, aortic valve surgery, tricuspid valve surgery and combined].
* Operative time and ischemic time, CPB time, use of blood products, use intra-aortic balloon-pump [IABP] and use of inotropes.

1. All patients monitored routinely in the operating room during cardiac surgery.
2. Cannulation techniques and cardiopulmonary
3. bypass [CPB] was conducted as usual.
4. Myocardial protection was done by antegrade warm blood cardioplegia repeated every 30 min.
5. Sternal closure was done in a similar fashion in the 2groups, mostly with seven simple wires.
6. After the surgical procedure, patients were monitored in an intensive care unit [ICU] for at least 24 h.
7. Strict control of blood glucose level was done during the first two postoperative days, by means of an intra-venous insulin infusion.

**Postoperative data:**

* Inotropic support [type and dose].
* Ventilation time.
* Length of ICU stay.
* Length of hospital stay.
* Post operative complications.
* Post operative mortality.

**Follow up within 3 months and six months:**

* **Lab:** CBC, Kidney function tests, Liver function tests, PT, PTT, and INR.
* **BMI**
* **Clinical examination NYHA class**.

**Statistical analysis**

The data were analyzed using the statistical package SPSS [version 24 for Windows; SPSS Inc, Chicago, IL, USA]. Student T Test was used to assess the statistical significance of the difference between two study groups. Chi-Square test was used to examine the relationship between two qualitative variablesA p value is considered significant if <0.05 at confidence interval 95%.

**Results**

Patients were randomly assigned into 2 groups, Group A: 50 patients with BMI ≥35 and Group B: 50 patients with BMI <35. There was no significant difference in age between the two groups. Females, weight, and BMI were significantly higher in group A than group B [p =0.045, <0.001, and <0.001 respectively]. Height was significantly higher in group B than group A [p <0.001]. **Table 1**

There was no significant difference in Hb, PLTs, serum creatinine, AST, and ALT between both studied groups. **Table 2**

LDL was significantly higher in group A than group B [p =0.004] but HDL was significantly higher in group B than group A [p =0.008]. There was no significant difference in TG between group A and group B. **table 3**

HTN and hyperlipidemia were significantly higher in group A than group B [p =0.004, and 0.013 respectively]. There was no significant difference in DM, current smoking status, CVD, history of surgery, and NYHA class between both groups. **Table 4**

There was no significant difference in operative data [type of surgery, total surgery time, total bypass time, cross clamp time, type of inotropes, mitral valve size] between the studied groups. There was also no significant difference in total number of patients with mitral valve replacement between the studied groups. But total number of patients with aortic valve replacement was significantly higher in group B than group A [p =0.035]. **Table 5**

Regarding post-operative data in the studied groups, hospital, ICU length of stay, and duration on mechanical ventilation were significantly higher in group A than group B [p =0.034, 0.003, and 0.008 respectively]. There was no significant difference in post operative mortality between the studied groups. **Table 6**

There was no significant difference in [CBC, kidney, and liver function tests] between both groups except for Hb was significantly lower in group A than group B [p =0.034]. **Table 7**

There was no significant difference in Morbidity and mortality after 3-month follow up in the studied groups **table 8.**

**Discussion**

It was interesting to find out that post-operative data in the studied groups, hospital, ICU length of stay, and duration on mechanical ventilation were significantly higher in group A than group B [p =0.034, 0.003, and 0.008] respectively.

**Acharya et al.** [5]stated that increasing BMI correlated with reduced mechanical ventilation time [p = 0.039]. Our results were incompatible **Yazdanian et al ,** [6]stated that comparable hospitalization and ICU stay were found between obese and normal-weight. **Acharya et al.** [5]stated that raised BMI did not extend ICU [p = 0.3310] or overall hospital stay [p = 0.2614]. On the other hand, **Rockxet al,** [7] also documented that raised BMI was accompanied with 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 the morbidly obese patients, did not reach statistical significance. **Potapov et al** [9] stated that in obese patients MVT was elongated than in the normal weight people. **Sakr et al,** [10] documented that obesity was commonly linked with extended period on mechanical ventilation in ICU, particularly when BMI is ≥ 40 kg m2.

**Wigfield et al.,** [11] stated that severely and morbidly obese people have substantially augmented problems as regard to 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 et al.,** [12] **study.**

In our study, there was no significant difference in the need for iABP and post operative mortality between the studied groups. Our results were compatiblewith **William et al** [13]who documented that patient having AVR showed equal survival in patients with low and high BMI **[William et al., 2011].** Similarly, **Tawfek et al** [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, it was incapable to demonstrate any statistically substantial differences in postoperative results.

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

Interestingly the **Mariscalco’s** study [17] found that obesity is associated with a low risk of mortality 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 population; in 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, in fact, valve surgery in general formed a low percentage of the total of their patients .

In our study, there was no significant difference in [CBC, kidney, and liver function tests] between both groups except for Hb was significantly lower in group A than group B [p =0.034]. **Wigfield et al.,** [11] stated that severely and morbidly obese people have substantially augmented problems as regard to rate of postoperative kidney shutdown. Similar rates of renal dysfunction were observed in both normal- and overweight/obese-BMI groups in **Acharya et al.,** [5]**.**

Regarding Outcomes in the studied groups in the end of follow-up, there was no significant difference in morbidity, mortality after 3 months and infection between group A and group B.

This may be due to people with elevated BMI, and a high portion of body fat have more dietary store, which may give them some protection against complications. Similar to our results, **Acharya et al.** [5]observed no significant difference of sternal wound complications were observed 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 give specific care to wound healing in patients with numerous risk aspects.

Our results not similar **Rahmanian et al ,** [3] who reported that Former reports have demonstrated a link between obesity and postoperative illness, such as wound infection [**Rahmanian et al 2007]. Costa et al.** [12] showed that obesity was associated with increased frequency of wound dehiscence [P=0.021].

Our study did not assist the remarkably held idea that obese people were at raised hazard of operative death; so, 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.

**Conclusion**

We found that obesity did not correlate with raised postoperative illness or mortality rate except for only surgical site infection.

**Study limitations and possible future prospects**

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

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

**Conflicts of interest:**

No conflicts of interest

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**Table (1): Baseline characteristics of the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =50)** | **Group B**  **(n =50)** | **p value** |
| **Age**  **(years)** | **Mean ± SD** | 51 ± 6.33 | 52.32 ± 5.31 | 0.261 |
| **Range** | 30 - 60 | 37 - 60 |
| **Gender** | **Male** | 21 (42%) | 32 (64%) | **0.045\*** |
| **Female** | 29 (58%) | 18 (36%) |
| **Weight**  **(kg)** | **Mean ± SD** | 108.88 ± 13.56 | 82.72 ± 12.75 | **<0.001\*** |
| **Range** | 84 - 142 | 58 - 115 |
| **Height**  **(cm)** | **Mean ± SD** | 166.76 ± 8.86 | 173.6 ± 8.13 | **<0.001\*** |
| **Range** | 150 - 186 | 158 - 188 |
| **BMI**  **(kg/m2)** | **Mean ± SD** | 39.02 ± 1.83 | 27.38 ± 3.31 | **<0.001\*** |
| **Range** | 36 - 42 | 21 - 33 |

**BMI: Body mass index**

**Table2: CBC, kidney, and liver function tests of the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =50)** | **Group B**  **(n =50)** | **p value** |
| **Hb**  **(g/dL)** | **Mean ± SD** | 13.14 ± 1.76 | 13.76 ± 1.64 | 0.071 |
| **Range** | 10 - 16 | 9 – 16 |
| **PLTs**  **(×103/µL)** | **Mean ± SD** | 197.62 ± 50.98 | 213.64 ± 67.65 | 0.184 |
| **Range** | 121 - 302 | 114 – 396 |
| **Creatinine**  **(mg/dL)** | **Mean ± SD** | 1.21 ± 0.23 | 1.15 ± 0.29 | 0.067 |
| **Range** | 0.67 - 1.73 | 0.54 - 1.78 |
| **AST**  **(U/L)** | **Mean ± SD** | 25.16 ± 16.54 | 22.78 ± 8.91 | 0.373 |
| **Range** | 9 - 95 | 9 – 50 |
| **ALT**  **(U/L)** | **Mean ± SD** | 31.34 ± 11.13 | 30.8 ± 11.27 | 0.81 |
| **Range** | 12 - 56 | 13 – 49 |

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

**Table3: preoperative Lipid profile and HbA1c of the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =50)** | **Group B**  **(n =50)** | **p value** |
| **LDL**  **(mg/dL)** | **Mean ± SD** | 165.54 ± 47.92 | 138.34 ± 43.73 | **0.004\*** |
| **Range** | 70 - 271 | 60 - 213 |
| **HDL**  **(mg/dL)** | **Mean ± SD** | 64.9 ± 12.93 | 70.4 ± 6.48 | **0.008\*** |
| **Range** | 32 - 80 | 58 - 83 |
| **TG**  **(mg/dL)** | **Mean ± SD** | 165.76 ± 40.84 | 163.58 ± 32.69 | 0.769 |
| **Range** | 110 - 280 | 116 - 220 |
| **HbA1c**  **(%)** | **Mean ± SD** | 5.694 ± 1.91 | 5.048 ± 1.58 | 0.068 |
| **Range** | 3.3 - 10.5 | 3.2 - 9.2 |

**LDL: Low density lipoprotein, HDL: High density lipoprotein, TG: Triglycerides**

**Table 4: Medical history in the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =50)** | **Group B**  **(n =50)** | **p value** |
| **HTN** | **Yes** | 37 (74%) | 22 (44%) | **0.004\*** |
| **No** | 13 (26%) | 28 (56%) |
| **Hyperlipidemia** | **Yes** | 37 (74%) | 24 (48%) | **0.013\*** |
| **No** | 13 (26%) | 26 (52%) |
| **DM** | **Yes** | 19 (38%) | 13 (26%) | 0.284 |
| **No** | 31 (62%) | 37 (74%) |
| **Current smoking** | **Yes** | 8 (16%) | 12 (24%) | 0.454 |
| **No** | 42 (84%) | 38 (76%) |
| **CVD** | **Yes** | 6 (12%) | 4 (8%) | 0.741 |
| **No** | 44 (88%) | 46 (92%) |
| **NYHA** | **I** | 7 (14%) | 8 (16%) | 0.513 |
| **II** | 18 (36%) | 19 (38%) |
| **III** | 20 (40%) | 14 (28%) |
| **IV** | 5 (10%) | 9 (18%) |

**HTN: Hypertension, DM: Diabetes mellites, CVD: Cerebrovascular disease. NYHA: New York heart association.**

**Table 5: Operative data in the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **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)** | **Mean ± SD** | 302.8 ± 60.59 | 303.5 ± 47.06 | 0.948 |
| **Range** | 202 - 395 | 210 - 375 |
| **Total bypass time**  **(min)** | **Mean ± SD** | 120.96 ± 41.25 | 132.78 ± 45.33 | 0.176 |
| **Range** | 45 - 190 | 43 - 205 |
| **Cross clamp time**  **(min)** | **Mean ± SD** | 92.68 ± 33.78 | 95.04 ± 31.27 | 0.718 |
| **Range** | 35 - 150 | 31 - 148 |
| **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%) |
| **Total number of patients with mitral valve replacement** | | 42 (84%) | 38 (76%) | 0.454 |
| **Total number of patients with aortic valve replacement** | | 27 (54%) | 38 (76%) | **0.035\*** |

**MVR: Mitral valve repair, AVR: Aortic valve repair.**

**Table 6: Post-operative data in the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =50)** | **Group B**  **(n =50)** | **p value** |
| **Hospital length of stay**  **(days)** | **Mean ± SD** | 9.43 ± 5.93 | 7.25 ± 4.05 | **0.034\*** |
| **Range** | 0.4 - 23.6 | 1 - 16.1 |
| **ICU length of stay**  **(days)** | **Mean ± SD** | 7.32 ± 5.67 | 4.52 ± 3.24 | **0.003\*** |
| **Range** | 0 - 20 | 0.2 - 14 |
| **Duration on mechanical ventilation**  **(days)** | **Mean ± SD** | 3.58 ± 2.54 | 2.342 ± 2.05 | **0.008\*** |
| **Range** | 0 – 9 | 0 - 7 |
| **Post-operative mortality** | **Yes** | 4 (8%) | 2 (4%) | 0.678 |
| **No** | 46 (92%) | 48 (96%) |

**Table 7: Post-operative investigations in the studied groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Group A**  **(n =48)** | **Group B**  **(n =49)** | **p value** |
| **Hb**  **(g/dL)** | **Mean ± SD** | 13.24 ± 1.38 | 13.78 ± 1.11 | **0.034\*** |
| **Range** | 11 - 16 | 10 - 16 |
| **PLTs**  **(×103/µL)** | **Mean ± SD** | 203.22 ± 46 | 219.24 ± 63.46 | 0.152 |
| **Range** | 124 - 295 | 120 - 365 |
| **Creatinine**  **(mg/dL)** | **Mean ± SD** | 1.17 ± 0.18 | 1.1 ± 0.2 | 0.069 |
| **Range** | 0.77 - 1.5 | 0.69 - 1.44 |
| **AST**  **(U/L)** | **Mean ± SD** | 27.3 ± 18.03 | 23.44 ± 10.22 | 0.191 |
| **Range** | 5 - 103 | 5 - 46 |
| **ALT**  **(U/L)** | **Mean ± SD** | 32.84 ± 12.01 | 31.4 ± 11.64 | 0.544 |
| **Range** | 10 - 58 | 8 - 51 |

**Hb: Hemoglobin, PLTs: Platelets, Cr. Cl.:, AST: Aspartate transaminase, ALT: Alanine transaminase.**

**Table8:** **Morbidity and mortality after 3-month follow up in the studied groups**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **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 3 months** | 5 (10.87%) | 3 (6.25%) | 0.481 |