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Original Article

Early outcomes of minimally invasive mitral and tricuspid valve surgery in obese patients

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Abstract

Background: Minimal invasive valve surgery is the new trend in cardiac surgery. Many obstacles are present to increase the number of cases operated on with minimally invasive surgery. Minimal invasive surgery is technically demanding in obese patients with uncertain outcomes. In this study, we compared minimal invasive mitral and tricuspid valve surgery (MIVS) in obese patients with high BMI (body mass index) to normal BMI.

Method: We included 240 cases who underwent MIVS. These cases were divided into two groups. Group I (n=120) included patients with BMI >30 Kg/m2, and Group II (n=120) had BMI ≤30 Kg/m2.

Result: There was no in-hospital mortality in both groups. Postoperative wound infection was non-significant between Group I (9 (7.5%) vs. 2 (1.67%); P= 0.059). Drainage (450± 112 vs. 240± 230 ml; P<0.001), mechanical ventilation time (13.4± 1.3 vs. 6.4± 6.8 h; P<0.001), and ICU stay (2± 0.4 vs. 3.5± 1.3 days, P<0.001) were significantly higher in Group I. New onset atrial fibrillation was significantly higher in obese patients (P= 0.029). There were no differences between both groups in other outcomes.

Conclusion: Minimally invasive surgery in obese patients had satisfactory outcomes compared to those with normal BMI. Obesity should not be considered a contraindication for minimally invasive surgery.

KEYWORDS
Minimally invasive; Tricuspid valve; Mitral valve; Obesity

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Introduction

Nowadays, minimally invasive mitral and tricuspid valve surgery (MIVS) has become more popular than conventional sternotomy; however, minimal invasive surgery for high body mass index (BMI) patients is more technically challenging. MIMVS could be associated with an increased risk of barotrauma. One lung ventilation elevates inspiratory pressure more than those with normal or low body mass index; venous drainage and arterial line pressure will also be affected [1-3].

On the other hand, obese patients may benefit from MIVS to avoid the risk of sternal wound complications. However, it is controversial which technique has better outcomes regarding the incidence of postoperative bleeding and reexploration [4-6]. Few series exhibited no detrimental outcomes for patients with BMI >30

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Kg/m2 who underwent mini-thoracotomy and robotic procedures [1, 7]

Minimally invasive thoracotomy for mitral and tricuspid valve surgery had excellent outcomes for obese patients, as it became as routine as the sternotomy approach [4, 8]. The surgical team's experience could affect the outcomes of the procedure; therefore, there are variations in the reported outcomes among different series [9]. More comparative studies are needed to evaluate the outcomes of MIMVS for obese patients compared to non-obese patients. In this study, we aimed to assess the outcome (hospital outcomes, ICU, and hospital stay) of the minimally invasive surgery (MIVS) (either mitral or tricuspid valves) in patients with high BMI >30 Kg/m^2 compared to those with BMI ≤ 30 Kg/m^2.

Patients and Methods

This study included 240 cases who underwent MIVS retrospectively over three years, from April 2019 until March 2022. These cases were divided into two groups. Group I (n=120) included patients with BMI >30 Kg/m^2, and Group II (n=120) had BMI ≤30 Kg/m^2. All patients had minimal invasive techniques. Patients who needed aortic valve surgery, cases with congenital heart diseases, and cases with ischemic mitral incompetence were excluded. The approval from the ethical committee was obtained, and the patients' consent was waived.

We stratified BMI as per world health Organization criteria. Preoperative, operative and postoperative data were collected and submitted for statistical analysis. The operative technique for MIMVS was practically the same for all cases. The pleural cavity was entered through 3rd or 4th intercostal space. Preoperative CT (computed tomography) angiography was done to assess the suitability of femoral or axillary cannulation. Femoral cannulation was done percutaneously, using per close prostyle suture Knot, sometimes percutaneous cannulation in a morbidly obese patient was challenging, so venous cut-down and direct canulation were performed. Axillary cannulation was performed directly via a purse string, or sometimes a Dacron graft was used.

Table 1: Comparison of preoperative characteristics between groups. Data were presented as mean and SD or number and percentages

Variables	BMI>30 (n=120)	BMI≤30 (n=120)	*P* -value
Age (Mean ± SD)	42.6 ± 12.8	48.5 ± 13.4	0.25
Female gender	92 (80%)	75 (62.5%)	0.017
Diabetes Mellitus	4 (3.3%)	3 (2.5%)	>0.99
Preoperative NYHA III	32 (26.7%)	28 (23.3%)	0.551
Preoperative NYHA IV	88 (73.3%)	92 (76.7%)	0.551
Atrial fibrillation	30 (25%)	36 (30%)	0.39
LVEF 30-50%	96 (20%)	89 (25.8%)	0.231
PASP (mmHg) (Mean ± SD)	48.9±18.7	43±15.3	0.54
Mitral Valve Pathology			
Mitral severe stenosis	80 (66.7%)	65 (54.2%)	
Mitral severe insufficiency	10 (8.3%)	20 (16.7%)	0.072
Mixed stenosis +incompetence	30 (25%)	35 (29.2%)	
Tricuspid Regurgitation			
Moderate	3 (25%)	20 (16.7%)	0.07
Severe	10 (8.3%)	20 (16.7%)	
Logistic Euro SCORE	2.6 ±1.3	2.7 ±1	0.32

AF: atrial fibrillation, MIMVS: minimal invasive mitral valve surgery, NYHA: New York Heart Association, LVEF: left ventricular ejection fraction, PASP: pulmonary artery systolic pressure

Table 2: Comparison of Intraoperative data between both groups. Data were presented as mean and SD or number and percentages

Variable	BMI>30 (n=120)	BMI≤30 (n=120)	*P* value
ACC time (min)	118±15.5	94.4±32.3	0.064
CPB time (min)	155±28.5	115±48.8	0.54
Mitral valve replacement	112 (93.3%)	110 (91.7%)	0.624
Mitral valve repair	8 (6.7%)	10 (8.3%)	0.624
Cox-Maze procedure	30 (25%)	36 (30%)	0.386
Tricuspid repair	29 (21.1%)	35 (29.2%)	0.381
Conversion to sternotomy	3 (2.5%)	0	0.247

ACC: aortic cross-clamp, CPB: cardiopulmonary bypass

Mini-thoracotomy (4-5 cm) with a small rib spreader and soft tissue retraction were used. Antegrade cardioplegia was delivered through a catheter inserted in the ascending aorta, and the cross-clamp was applied via a separate stab incision. Pericardial fat was excised, the right side of the pericardium was opened, and then the mitral valve was exposed for either repair or replacement. In the case of tricuspid valve repair, the right atrium was incised after finishing mitral valve surgery, or the trans-septal approach was used. The Cox-Maze procedure was performed for AF (Atrial fibrillation) patients with bipolar ablation. Transesophageal echocardiography (TEE) was done at the end of the surgical procedure to start weaning off CPB and decannulation and closure of the chest.

Statistical analysis:

Categorical data were described as absolute numbers and percentages and compared with the Chi-squared or Fisher exact test. Continuous variables were described as mean and standard deviation and compared with the t-test or Mann-Whitney test. The analysis was achieved using SAS v9.3; significant results were defined as $P< 0.05$.

Results

The baseline characteristics of the patients in both groups are delineated in (Table 1). There were no significant differences in baseline variables. Echocardiography showed no significant differences between the two groups in the concomitant tricuspid valve or mitral valve pathology, EF (Ejection fraction), and pulmonary artery systolic pressure.

Risk stratification with EuroSCORE showed no significant differences in both groups. Atrial fibrillation was reported in 25% and 30% in Groups I and II, respectively, with no significant difference. There was no difference between groups in the preoperative New York Heart Association (NYHA) dyspnea class.

Intraoperatively, the two groups had no significant differences regarding the aortic cross-clamp and cardiopulmonary bypass (CPB) times. However, three cases needed conversion to median sternotomy in patients with high BMI because of right pleural adhesions. (Table 2)

We did not report cases of hospital mortality or neurological complications in both groups. Group I had nine cases of wound infection; five had superficial femoral wound infection, two had superficial thoracotomy wound infection, and one had deep femoral wound infection. However, Group II had only two cases of superficial femoral wound infection.

Group I required longer mechanical ventilation, ICU, and hospital stay, bled larger blood, and four cases needed reexploration. (Table 3)

Persistent atrial fibrillation after the Cox-Maze procedure was nonsignificantly higher in Group I. There was a significant appearance of new atrial fibrillation postoperatively in six patients in Group I; no patient had new-onset AF in Group II. (Table 3)

Table 3: Comparison of postoperative data between both groups. Data were presented as mean and SD or number and percentages

Variable	BMI >30(n=120)	BMI≤30 (n=120)	P-value
Wound Infection	9 (7.5%)	2 (1.67%)	
Superficial	8	2	0.059
Deep	1	0	
Pacemaker Implantation	1 (0.8%)	1 (0.8%)	>0.99
Blood loss (ml) in drains	450 ± 112	240 ± 230	<0.001
Blood Transfusion	0.3 ± 0.53	0.2 ± 0.7	0.213
Reexploration for bleeding	4 (3.3%)	0	0.122
Mechanical ventilation time (hours)	13.4± 1.3	6.4 ± 6.8	<0.001
ICU duration (days)	2± 0.4	3.5± 1.3	<0.001
Length of hospital stay (days)	9± 1.3	7± 1.5	<0.001
Pain (VAS) at discharge	1.4 ± 0.6	2.5 ± 1.5	<0.001
Respiratory infection	2 (1.6%)	1 (0.8%)	>0.99
Persistent atrial fibrillation	5 (16.67%)	4 (11.11%)	0.255
New atrial fibrillation	6 (5%)	0	0.029

VAS: visual analog scale

Discussion

Although our results showed significant differences in wound infection in obese patients, most of these infections were superficial infections. We faced only one deep infection, which dramatically responded to vacuum dressing. Similarly, bleeding was significantly higher in the obese group. This study demonstrated insufficient data against minimally invasive mitral and tricuspid valvular surgery for obese patients. Consequently, elevated BMI should not be considered a contraindication for minimally invasive mitral and tricuspid valvular surgery.

Several studies [10-16] considered obesity a significant comorbidity for patients undergoing cardiac surgery, as it increases postoperative complications, especially sternal wound infection, prolonged ventilation, and atrial arrhythmias. Consequently, patients needed a longer hospital stay. Santana and group [17] found that patients with BMI >30 Kg/m^2 had lower mortality and in-hospital stay for the group that underwent minimally invasive mitral or aortic procedures than conventional sternotomy. Kitahara and colleagues [18] compared 138 obese and non-obese patients who underwent robotic minimally invasive mitral valve surgery. They found that the obese group needed longer cross-clamp and CPB times; however, obese patients with BMI >30 showed no significant difference in postoperative mortality, ventilation time, and length of stay. In our study, we did not report a significant difference in the cross-clamp or CPB time between the two groups, and we did not have any cerebrovascular complications

Although we had three cases that needed conversion to sternotomy, this was not related to obesity but because of pleural adhesions. Few cases needed exploration postoperatively; the source of bleeding was from the intercostal artery or chest wall bleeder, so bleeding was controlled easily.

Banerjee and group [19] had outstanding short results for patients who underwent a Cox-Maze procedure (CMP) with mini-thoracotomy. They concluded that full CMP has better early and late results than pulmonary vein isolation only. We performed full CMP; however, we did not review the long-term follow-up. We found that 16% of obese patients who had CMP failed to resume their sinus rhythm postoperatively, while in the non-obese group, 11% of CMP did not succeed. Moreover, we reported six patients with new onset of atrial fibrillation postoperatively. Some series concluded that those with BMI >30 Kg/m2 who underwent CABG have a higher rate of atrial

arrhythmias. Rapetto and colleagues [20], in their study on obese patients who underwent mitral valve surgery via sternotomy, reported no significant difference in postoperative complications, ventilation, or intensive care unit stay.

Concerning the minimally invasive approach for mitral and tricuspid valve surgery, we had significant differences in ventilation period, ICU, and hospital stay, but no differences in other complications. Even though obesity is challenging for minimal invasive procedures, it is not considered a contraindication for minimally invasive approaches.

Study limitations

The study is limited by the small number of cases, which need multicenter analysis to confirm these results. This study concerns valve surgery and did not include other cardiac surgical procedures such as congenital heart disease. The study is also limited by retrospective design.

Conclusion

Minimally invasive valve surgery had satisfactory postoperative outcomes in patients with high BMI compared to those with normal BMI. Obesity should not be considered a contraindication for minimally invasive surgery.

Conflict of interest: Authors declare no conflict of interest.

References

1. Gammie JS, Bartlett ST, Griffith BP. Small-incision mitral valve repair: safe, durable, and approaching perfection. Ann Surg 2009; 250:409–15.
2. Oberg B, Poulsen TD. Obesity: an anaesthetic challenge. Acta Anaesthesiol Scand 1996; 40:191–200.
3. Elmahrouk AF, Hamouda TE, Kasab I, Ismail MF, Jamjoom AA. Short term outcome of conventional versus off-pump coronary artery bypass grafting for high-risk patients. Journal of the Egyptian Society of Cardio-Thoracic Surgery. 2018; 26 (1), 57-63.
4. Chiu KM. Minimally invasive cardiac surgery. Formos J Surg 2013;46: 183–8.
5. Modi P, Hassan A, Chitwood WR. Jr. Minimally invasive mitral valve surgery: a systematic review and meta-analysis. Eur J Cardiothorac Surg 2008; 34:943–52.
6. Hamouda, T.H., Ismail, M.F., El-Mahrouk, A.F. et al. Coronary artery bypass grafting versus concomitant mitral valve annuloplasty in moderate ischemic mitral regurgitation: 4-year follow-up. Indian J Thorac Cardiovasc Surg. 2017; 33, 1–8.
7. Modi P. Minimally invasive mitral valve repair: the Liverpool Heart and Chest Hospital Technique—tips for safely negotiating the learning curve. Ann. Cardiothoracic. Surg 2013;2: E2.
8. Krakor R. Endoscopic Mitral Valve Surgery Handbook of Minimal Invasive Cardiac Surgery. Berlin: Walter de Gruyter; 2012,44.
9. Baker C. Obesity Statistics. House of Commons Library. Briefing Paper Number 3336, 6 August 2019: 3.
10. Kuduvalli M, Grayson AD, Oo AY, Fabri BM, Rashid A. Risk of morbidity and in-hospital mortality in obese patients undergoing coronary artery bypass surgery. Eur J Cardiothorac Surg 2002; 22:787–93.
11. Hartrumpf M, Kuehnel RU, Albes JM. The obesity paradox is still there: a risk analysis of over 15 000 cardiosurgical patients based on body mass index. Interact Cardiovasc Thorac Surg 2017; 25:18–24.
12. Stamou SC, Nussbaum M, Stiegel RM, et al. Effect of body mass index on outcomes after cardiac surgery: is there an obesity paradox? Ann Thorac Surg 2011; 91:42–7.
13. Choi JC, Bakaeen FG, Cornwell LD, et al. Morbid obesity is associated with increased resource utilization in coronary artery bypass grafting. Ann Thorac Surg 2012; 94:23–8.
14. Al Salmi H, Elmahrouk A, Arafat AA, et al. Implementation of an evidence-based practice to decrease surgical site infection after coronary artery bypass grafting. Journal of International Medical Research. 2019;47(8):3491-3501.
15. Khaodhiar L, McCowen KC, Blackburn GL. Obesity and its comorbid conditions. Clin Cornerstone 1999; 2:17–31.
16. Stegenga H, Haines A, Jones K, Wilding J. On behalf of the Guideline Development Group.

Identification, assessment, and management of overweight and obesity: summary of updated NICE guidance. BMJ 2014; 349: g6608–g6608.
17. Santana O, Reyna J, Grana R, Buendia M, Lamas GA, Lamelas J. Outcomes of minimally invasive valve surgery versus standard sternotomy in obese patients undergoing isolated valve surgery. Ann Thorac Surg 2011; 91:406–10.
18. Kitahara H, Patel B, McCrorey M, Nisivaco S, Balkhy HH. Morbid obesity does not increase morbidity or mortality in robotic cardiac surgery. Innovations (Phila) 2017; 12:434–9
19. Banerjee A, Singh S, Tempe DK. Intraoperative endocardial ablation of chronic atrial fibrillation along with mitral valve surgery using high frequency ultrasound with a ball-tipped harmonic scalpel probe. Indian Heart J. 2004; 56:178–80.
20. Rapetto F, Bruno VD, King M, et al. Impact of body mass index on outcomes following mitral surgery: does an obesity paradox exist? Interact Cardiovasc Thorac Surg 2018; 26:590–5.