Body mass index impact on minimally invasive mitral valve surgery: report from a multicenter registry

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Introduction

Underweight and obese patients represent an unquestionable challenge for cardiac surgeons. To date controversial data have been reported about the impact of BMI on morbidity and mortality after cardiac surgery. Most of the available analyses are focused on coronary artery bypass grafting (CABG) and only few reports analyze the relationship between patient BMI and minimally invasive mitral valve (MV) surgery outcomes.
Aim of this study is to evaluate the effect of BMI on patients undergoing minimally invasive MV surgery (MIMVS).

Methods and Materials

From January 2015 to December 2023, data of consecutive patients who underwent MIMVS at seven high-volume cardiac surgery centers experienced in minimally invasive surgery were prospectively collected and retrospectively reviewed.
Inclusion criteria were indication for MV surgery through a right mini-thoracotomy as well as concomitant procedures such as tricuspid valve surgery, atrial septal defect closure and atrial fibrillation ablation.
Exclusion criteria were urgent and emergent procedures and age lower than 18 years.
For the purpose of the study patients were separated in 3 BMI-based groups according to the international classification of weight by the World Health Organization [14]: underweight (BMI<18.5), normal weight (BMI 18.5-29.9) and obese (BMI ≥30).
The 3 groups were compared in terms of pre-operative characteristics, operative data and post-procedural outcomes. To reduce possible differences between the 3 study groups a matched analysis using propensity score was performed.

Results

Data from 1692 patients undergoing MIMVS were overall collected. After propensity score matching, 170 normal weight patients (mean BMI 24.78 ± 5.71) were compared to 69 underweight patients (mean BMI 17.21 ± 1.01) and 141 obese patients (mean BMI 33.63 ± 4.57). Baseline characteristics of the matched population are reported in **Table 1**. Operative data are given in **Table 2.**
Both CBP (154.38 ± 50.60 vs 136.02 ± 44.56 vs 135.81 ± 39.48 min, p=0.008) and cross-clamp time (106.42 ± 34.91 vs 95.74 ± 31.6 vs 95.07 ± 28.93 min, p= 0.001) were significantly longer in obese patients compared to normal weight and underweight patients. No more significant differences were reported in terms of perfusion and clamping strategies. Repair and replacement resulted to be equally performed in the 3 groups, as well as combined procedures.
No significant differences were reported between the 3 study groups were reported in terms of post-operative outcomes, ICU and in-hospital length of stay and early mortality.
All detailed post operative outcomes are reported in **Table 3**.

	BMI <18,5 n=69	BMI 18,5-29,9 n=170	BMI≥30 n=141	p value
Isolated MV surgery, n (%)	47 (68.12%)	138 (81.18%)	103 (73.05%)	0.065
MV Repair, n (%)	37 (53.62%)	102 (60%)	78 (55.32%)	0.500
MV replacement, n (%)	32 (46.38)	68 (40%)	63 (44.68%)	0.500
CBP time, mean, (SD), min	135.81 (39.48)	136.02 (44.56)	154.38 (50.60)	0.008
Aortic clamping, mean, (SD), min	95.07 (28.93)	95.74 (31.6)	106.42 (34.91)	0.001
Trans-thoracic clamp, n (%)	47 (68.12%)	128 (75.29%)	103 (73.05%)	0.525
Endo-aortic clamp, n (%)	21 (30.43%)	40 (23.53%)	36 (25.53%)	0.540
Beating/fibrillating heart, n (%)	1 (1.45%)	2 (1.18%)	2 (1.42%)	0.977
Retrograde arterial perfusion, n (%)	63 (91.30%)	155 (91.18%)	128 (90.78%)	0.989
AF abaltion, n (%)	7 (10.14%)	10 (5.89%)	14 (9.93%)	0.110
Concomitant TV surgery, n (%)	11 (15.94%)	10 (5.89%)	17 (12.01%)	0.625
Early failure, n (%)	4 (5.8%)	3 (1.76%)	4 (2.84%)	0.242
Conversion to sternotomy, n (%)	3 (4.34%)	4 (2.35%)	6 (4.25%)	0.588

Table 2. Operative data

	BMI <18,5 n=69	BMI 18,5-29,9 n=170	BMI≥30 n=141	p value
Age, mean (SD), years	62.05 (14.85)	66.55 (15.43)	67.41 (11.92)	0,337
Female, n (%)	37 (53.62%)	82 (48.23%)	72 (51.06%)	0.136
COPD, n (%)	4 (5.8%)	22 (12.94%)	26 (18.44%)	0,052
Cerebrovascular disease, n (%)	1 (1.45%)	4 (2.35%)	2 (1.42%)	0,801
CKD (eGFR<90 ml/min), n (%)	56 (81.16%)	60 (35.29%)	62 (43.97%)	0,631
Poor mobility, n (%)	0	2 (1.18%)	1 (0.71%)	0,642
Atrial fibrillation, n (%)	22 (31.88%)	65 (38.23%)	54 (38.3%)	0.611
Active EI, n (%)	6 (8.69%)	10 (5.88%)	8 (5.67%)	0,666
REDO surgery, n (%)	10 (14.5%)	19 (11.18%)	19 (13.47%)	0,728
Pre EF, mean (SD), (%)	60.20 (9.24)	56.78 (10.34)	56.77 (10.67)	0,989
sPap, mean (SD), mmHg	41.65 (13.89)	42.56 (15.97)	39.17 (12.04)	0,025
Critical pre-operative state, n (%)	5 (7.25%)	12 (7.06%)	8 (5.67%)	0.860
Euroscore II, mean (SD)	3.78 (5.68)	3.13 (3.64)	3.61 (5.42)	0,333
Associate moderate/severe TR, n (%)	15 (21.74%)	29 (17.06%)	28 (19.86%)	0.836
Degenerative MV, n (%)	49 (66.67%)	112 (5.88%)	83(58.86%)	0.256
Fibrocalcific/ Rheumatic MV, n (%)	20 (33.33%)	58 (34.12%)	58 (41.14%)	0.256

Table 1. Baseline characteristics

BMI: body max index, SD: standard deviation, COPD: chronic obstructive pulmonary disease, CKD: chronic kidney disease, eGFR: estimated glomerular filtration rate, IE: infective endocarditis, EF: ejection fraction ,sPAP: systolic pulmonary artery pressure, TR: tricuspid regurgitation, MV: mitral valve, CBP: cardiopulmonary bypass, AF: atrial fibrillation, TV: tricuspid valve, ICU: intensive care unit, MI: myocardial infarction, MOF: multiorgan failure, LOS: length of stay

	BMI <18,5 n=69	BMI 18,5-29,9 n=170	BMI≥30 n=141	p value
ICU, mean (SD), days	1.69 (1.35)	1.99 (2.3)	2.58 (4.49)	0.052
Time on ventilation, mean (SD), Hours	13.03 (11.83)	15.81 (16.68)	15.41 (19.1)	0.853
Reintubation, n (%)	5 (7.25%)	10 (5.88%)	2 (1.42%)	0.74
MI, n (%)	0	0	0	-
Stroke, n (%)	0	2 (1.18%)	3 (2.13%)	0.441
Heamodialysis, n (%)	1 (1.45%)	5 (2.94%)	9 (6.38%)	0.155
Blood transfusion, n (%)	30 (48.48%)	60 (35.29%)	54 (38.3%)	0.472
Permanent PM implantation, n (%)	3 (4.38%)	4 (2.35%)	10 (7.09%)	0.134
New AF, n (%)	19 (27.54%)	48 (28.23%)	34 (24.11%)	0.680
Thoracic wound complications, n (%)	0	2 (1.18%)	4 (2.84%)	0.261
Inguinal wound complications, n (%)	1 (1.45%)	0	1 (0.7%)	0.348
Re-exploration for bleeding, n (%)	4 (5.8%)	3 (1.76%)	3 (2.13%)	0.256
MOF, n (%)	0	0	2 (1.42%)	0.184
In hospital LOS, mean (SD), days	8.43 (3.37)	9.22 (8.1)	9.17 (6.7)	0.475
30-day mortality, n (%)	1 (1.45%)	1 (0.59%)	5 (3.5%)	0.140

Table 3 Post-operative outcomes

Conclusions

MIMVS seems to be a safe and feasible approach in underweight and obese patients too. A high expertise in minimally invasive surgery and an optimal pre-operative planning are mandatory to achieve these results.

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