Sex-based Differences In Early Outcomes After Minimally Invasive Mitral Valve Surgery: A Propensity-matched Analysis

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BACKGROUND

Women undergoing mitral valve surgery often present with more advanced disease and experience lower repair rates and worse clinical outcomes than men. However, whether minimally invasive mitral valve surgery (MIMVS) can mitigate sex-based differences remains uncertain. We retrospectively reviewed an academic single-center database of patients undergoing MIMVS to assess sex-based differences in operative strategy and early postoperative outcomes.

METHODS

We included 190 consecutive patients (122 men, 68 women) undergoing elective isolated MIMVS between March 2021 and July 2025. Patients were stratified by sex and compared using a propensity score–matched (PSM) analysis. To balance baseline characteristics, a 1:1 nearest-neighbor matching was performed based on age, BMI, EuroSCORE II, and clinically relevant comorbidities, resulting in resulting in 65 matched pairs (n = 130). Primary outcomes were early clinical outcomes and 30-day all-cause mortality. A secondary analysis compared repair success rates by sex in the degenerative disease population. Continuous variables were compared using the Student's t-test. The Mann–Whitney U test was used for ordinal variables and non-normally distributed continuous variables. Categorical variables were analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant. All analyses were performed using R statistical software, version 4.6.0 (R Foundation for Statistical Computing, Vienna, Austria). Ethical approval was obtained (IRB number 21-252).

RESULTS

Baselines characteristics were well balanced after PSM. Women had more complex mitral valve pathology than men, including higher rates of rheumatic disease and MAC. Women also had longer cardiopulmonary bypass and cross-clamp times and required postoperative inotropic support and blood transfusion more frequently than men. ICU and hospital length of stay were longer in women. Despite these differences, major early adverse outcomes were uncommon, with no sex-based differences in stroke, pacemaker implantation, AKI, dialysis, mitral valve reoperation, rehospitalization, functional status or early mortality.

Post-match balance

Baseline characteristics were well balanced after matching, with residual differences in:

- Rheumatic disease
- Mitral stenosis
- Mitral annular calcification
- Left ventricular dimensions/volume: LVESD, LVEDD, and LVESV

Rheumatic disease: 18.4% vs 3.1% (p = 0.005)
Mitral stenosis: 20.0% vs 7.7% (p = 0.042)
Mitral annular calcification: 18.6% vs 3.3% (p = 0.007)
LVESD: 29.6 vs 35.3 mm (p < 0.001)
LVEDD: 49.1 vs 56.1 mm (p = 0.006)
LVESV: 40.9 vs 53.3 mL (p = 0.022)

Valve phenotype

	WOMEN	vs MEN	p-value
Any mitral regurgitation	65 (100%)	63 (96.9%)	p = 0.154
Any mitral stenosis	13 (20.0%)	5 (7.7%)	p = 0.042
Degenerative disease	45 (69.2%)	53 (81.5%)	p = 0.103
Infective endocarditis	2 (3.1%)	5 (7.7%)	p = 0.829
Rheumatic disease	12 (18.4%)	2 (3.1%)	p = 0.005
Mitral annular calcification	11 (18.6%)	2 (3.3%)	p = 0.007
Other etiology	6 (9.2%)	5 (7.7%)	p = 0.753

Women had more complex mitral valve pathology.

Operative complexity

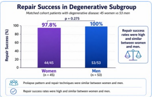
	WOMEN	vs MEN	p-value
Mitral valve repair	50 (76.9%)	58 (89.2%)	p = 0.061
Mitral valve replacement	15 (23.1%)	7 (10.8%)	p = 0.061
Cardiopulmonary bypass time	131.5 min	119.4 min	p = 0.030
Cross-clamp time	78.8 min	71.0 min	p = 0.042
Conversion to sternotomy	2 (3.1%)	0 (0%)	p = 0.154
Among patients with preoperative atrial fibrillation			
Concomitant surgical ablation	9 (75.0%)	13 (86.7%)	p = 0.438
LAA closure	11 (91.7%)	12 (80.0%)	p = 0.396

Women had longer operative times.

Perioperative complications

	WOMEN	vs MEN	p-value
Reoperation for bleeding	3 (4.6%)	2 (3.1%)	p = 0.648
Postoperative atrial fibrillation	18 (27.7%)	19 (29.2%)	p = 0.846
Acute kidney injury	0 (0%)	2 (3.1%)	p = 0.154
In-hospital mortality	0 (0%)	1 (1.5%)	p = 0.315
Stroke	No events in either group		
Pacemaker implantation	No events in either group		
Dialysis	No events in either group		
Mitral valve reoperation	No events in either group		

No significant sex-based differences in major perioperative complications.



Resource utilization

	WOMEN	vs MEN	p-value
IABP	0 (0%)	1 (1.5%)	p = 0.315
Prolonged ventilation > 24h	No events in either group		
Inotropic support	14 (21.5%)	3 (4.6%)	p = 0.004
Blood transfusion	9 (13.8%)	2 (3.1%)	p = 0.027
ICU length of stay	1 [1–3] days	1 [1–1] days	p = 0.046
Hospital length of stay	7 [5–9] days	4 [4–6] days	p < 0.001

Women required greater perioperative support and longer hospitalization.

Early clinical outcomes

	WOMEN	vs MEN	p-value
Median follow-up [months]	1.5 [0.9–2.3]	1.4 [1.3–1.9]	p = 0.407
Rehospitalization	6 (11.3%)	7 (12.2%)	p = 0.876
Residual mitral regurgitation at follow-up	1 [0–1]	0 [0–1]	p = 0.251
NYHA functional class	1 [1–1]	1 [1–1]	p = 1.000
Mitral valve reoperation	No events in either group		
All-cause mortality at follow-up	No events in either group		

Early follow-up outcomes were similar between groups.

CONCLUSION

In this single-center retrospective PSM analysis, women and men had similar early clinical outcomes after MIMVS, including 30-day all-cause mortality. However, women had a higher prevalence of calcified mitral valves due to rheumatic disease and MAC, potentially increasing procedural complexity. Women also showed increased perioperative resource utilization and longer stays than men. In the degenerative cohort, repair success rates was similar between groups. In conclusion, our findings suggest that MIMVS may help mitigate sex-based differences in surgical strategy and early outcomes after valve surgery, but we emphasize the importance of early diagnosis and optimized perioperative strategies targeting the female population.

REFERENCES

Gianluigi Bisleri reports serving on speaker bureaus and advisory boards for Edwards Lifesciences, Medtronic, AtriCure, and Corcym. All other authors declare no relevant conflicts of interest related to this work.