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Comparative Outcomes of Mitral Valve in Valve Implantation Versus Redo Mitral Valve Replacement for Degenerated Bioprotheses

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Structural valve deterioration is the Achilles' heel of surgical bioprotheses.¹ It is estimated that >1/3 of patients receiving mitral valve replacement (MVR) with a bioprosthetic valve require MV re-intervention within 10 years.² Although redo-MVR has been the gold-standard strategy for degenerated bioprotheses, transcatheter mitral valve-in-valve (MViV) recently emerged as a feasible alternative to redo-MVR.³ However, comparative data of the 2 strategies are limited.⁴ We sought to compare outcomes of MViV versus redo-MVR using the National Readmission Database.

We used the International Classification of Disease 10th-Clinical Modification codes to identify patients age ≥50 years with structural valve deterioration (T82.01XA, T82.02XA, T82.03XA, T82.09XA, T82.221A, T82.222A, T82.223A, T82.228A, Z45.09, Z95.2, and T82.857) who underwent redo-MVR (02RG07Z, 02RG08Z, 02RG0KZ, and 02RG0JZ) or MViV (02RG37H, 02RG37Z, 02RG38H, 02RG38Z, 02RG3JH, 02RG3JZ, 02RG3KH, and 02RG3KZ) between January 1, 2016 and December 31, 2017. This method has been used in previous studies to identify re-interventions for degenerated bioprotheses.⁵ We excluded patients with infective endocarditis, patients with missing mortality data, and those who were transferred to another hospital to avoid duplication. The primary end point was in-hospital mortality. Secondary end points were in-hospital major adverse events (MAEs); a composite of death, vascular complications, acute kidney injury, or stroke; length of stay, cost, and 30-day readmissions.

Descriptive statistics were presented as frequencies with percentages for categorical variables. Medians and interquartile ranges (IQR) were reported for continuous variables. To account for differences in baseline characteristic, a nearest neighbor 1:3 variable ratio, parallel, balanced propensity-score matching model with a caliper of 0.01 was applied. Furthermore, we performed a sensitivity analysis by excluding patients who underwent

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Disclosures

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concomitant valve surgery. Statistical analyses were performed using statistical package for social science (SPSS) version 26 (IBM Corp).

A total of 1,788 patients (MViV = 384; MVR = 1,404) were included in the current analysis. Patients who underwent MViV were older (76 years [IQR 68 to 82] vs 68 years [IQR 61 to 75], $p < 0.01$) and had higher comorbidity burden (Table 1). After propensity-score matching, in-hospital mortality and MAEs were lower in the MViV group (5.3% vs 11.9%, $p < 0.01$), and (25.8% vs 44.1%, $p < 0.01$), respectively. Length of stay was shorter, and cost was less in the MViV group. However, 30-day readmissions were similar in the 2 groups (Table 1). In the sensitivity analysis, MViV remained associated with lower incidence of adjusted in-hospital mortality, but this did not achieve statistical significance (4.8% vs 8.0%, $p = 0.06$). However, adjusted MAEs continued to be significantly less with MViV (25.6% vs 40.0%, $p < 0.01$).

This study suggests that MViV for degenerated mitral surgical valves is associated with favorable short-term outcomes and resource utilization compared with redo-MVR. The results of this study need to be interpreted in the context of the known limitations of administrative databases which include: the potential for under- or over-coding; the lack of echocardiographic, hemodynamic, or angiographic information or details on surgical techniques; the limited ability to account for selection bias, and the lack of long-term follow-up data. Nonetheless, considering the low likelihood of randomized comparative data of MViV versus redo-MVR, this real-world observational study provides reassuring evidence supporting the short-term safety and cost-effectiveness of MViV as a primary strategy in selected patients with degenerated mitral bioprostheses.

References

1. Alkhouli M. The unrelenting search for bioprosthetic aortic valve durability. *JACC Cardiovasc Imaging* 2020;13:354–356. [PubMed: 30878416]
2. Vohra HA, Whistance RN, Roubelakis A, Burton A, Barlow CW, Tsang GM, Livesey SA, Ohri SK. Outcome after redo-mitral valve replacement in adult patients: a 10-year single-centre experience. *Interact Cardiovasc Thorac Surg* 2012;14:575–579. [PubMed: 22294560]
3. Guerrero M, Vemulapalli S, Xiang Q, Wang DD, Eleid M, Cabalka AK, Sandhu G, Salinger M, Russell H, Greenbaum A, Kodali S, George I, Dvir D, Whisenant B, Russo MJ, Pershad A, Fang K, Coylewright M, Shah P, Babaliaros V, Khan JM, Tommaso C, Saucedo J, Kar S, Makkar R, Mack M, Holmes D, Leon M, Bapat V, Thourani VH, Rihal C, O'Neill W, Feldman T. Thirty-day outcomes of transcatheter mitral valve replacement for degenerated mitral bioprostheses (valve-in-valve), failed surgical rings (valve-in-ring), and native valve with severe mitral annular calcification (valve-in-mitral annular calcification) in the United States: data from the society of thoracic surgeons/American College of Cardiology/Transcatheter Valve Therapy Registry. *Circ Cardiovasc Interv* 2020;13:e008425. [PubMed: 32138529]
4. Kamioka N, Babaliaros V, Morse MA, Frisoli T, Lerakis S, Iturbe JM, Binongo J, Corrigan F, Yousef A, Gleason P. Comparison of clinical and echocardiographic outcomes after surgical redo mitral valve replacement and transcatheter mitral valve-in-valve therapy. *JACC Cardiovasc Interv* 2018;11:1131–1138. [PubMed: 29929633]
5. Hirji SA, Percy ED, Zogg CK, Malarczyk A, Harloff MT, Yazdchi F, Kaneko T. Comparison of in-hospital outcomes and readmissions for valve-in-valve transcatheter aortic valve replacement vs. reoperative surgical aortic valve replacement: a contemporary assessment of real-world outcomes. *Eur Heart J* 2020; ehaa252. doi: 10.1093/eurheartj/ehaa252.

Characteristic and outcomes of MVIV versus MVR

Table 1

Characteristics/outcomes	Unmatched cohort		Propensity-matched cohort	
	MVIV (n = 384)	MVR (n = 1,404)	MVIV (n = 361)	MVR (n = 807)
Age, Median (25th to 75th IQR)	76 (68-82)	68 (61-75)	75 (67-82)	73 (66-78)
Female	56%	54.8%	56%	55%
Diabetes mellitus	34.6%	38.7%	34.9%	37.1%
Hypertension	57.3%	41.4%	57.1%	50.9%
Peripheral vascular disease	9.2%	9.1%	9.4%	9.2%
Chronic anemia	31%	22.2%	29.9%	25.8%
Chronic heart failure	85.9%	64.1%	85%	80.4%
Coronary artery disease	53.9%	46.8%	52.4%	51.4%
Chronic kidney disease	40.9%	35.6%	38.8%	34%
Atrial fibrillation	65.9%	72.1%	67%	68.8%
Conduction abnormality	5.2%	6.3%	5.5%	5.2%
Prior defibrillator	8.1%	4.4%	6.1%	5.8%
Chronic liver disease	6.8%	6.8%	6.9%	7.1%
Clinical outcomes				
Major adverse events	25.8%	38.7%	25.8%	44.1%
Death	5.5%	9.5%	5.3%	11.9%
Vascular complications	3.9%	5.9%	3.9%	6.4%
Acute kidney Injury	21.1%	32.3%	21.3%	35.6%
Stroke	1.0%	1.1%	1.1%	1.4%
Blood transfusion	15.9%	34.8%	15.2%	37.4%
Length of hospitalization median days (25th to 75th IQR)	5 (2-11)	11 (7-18)	5 (2-11)	11 (7-17)
Cost of hospitalization median \$ (25th to 75th IQR)	60,670 (45,188-83,070)	67,232 (46,911-97,277)	59,790 (44,255-82,430)	68,421 (47,742-99,861)
30-day readmission rate	14.7%	14.9%	14.7%	14.4%

MVIV = mitral valve in valve; MVR = redo-mitral valve replacement, IQR = the interquartile range; \$ = US dollar.