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ORIGINAL RESEARCH

Valve-in-Valve Transcatheter Mitral Valve Replacement Versus Redo Surgical Mitral Valve Replacement: Meta-Analysis of Early and Late Outcomes

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BACKGROUND: Bioprosthetic mitral valve degeneration is traditionally treated with redo surgical mitral valve replacement (redo-SMVR), but valve-in-valve transcatheter mitral valve replacement (ViV-TMVR) offers a less invasive alternative.

METHODS: Systematic review and meta-analysis of studies comparing ViV-TMVR and redo-SMVR. PubMed/MEDLINE, EMBASE, Web of Science, and Cochrane databases (inception to September 2025) were searched. Meta-analyses were conducted with random-effects models to assess patient-relevant outcomes; Kaplan–Meier-derived time-to-event data were pooled to assess late outcomes.

RESULTS: Thirteen observational studies met our eligibility criteria, including 15 941 patients (ViV-TMVR: 5465; redo-SMVR: 10476). In comparison with redo-SMVR, ViV-TMVR was associated with lower risk of in-hospital mortality (risk ratio [RR], 0.72 [95% CI, 0.57–0.90]; P=0.004), stroke (RR, 0.49 [95% CI, 0.29–0.83]; P=0.008), bleeding (RR, 0.43 [95% CI, 0.20–0.94]; P=0.035), acute kidney injury (RR, 0.57 [95% CI, 0.42–0.77]; P<0.001), permanent pacemaker implantation (RR, 0.30 [95% CI, 0.19–0.49]; P<0.001), and shorter hospital length of stay (mean difference,−5.09 days [95% CI, −6.56 to −3.63]; P<0.001). There was no statistically significant difference between the groups in terms of 5-year survival (hazard ratio [HR], 0.92 [95% CI, 0.81–1.05]; P=0.256); however, the landmark analysis revealed that ViV-TMVR was associated with lower risk of death in the initial 6 months (HR, 0.69 [95% CI, 0.58–0.83]; P<0.001) but a higher risk beyond 6 months (HR, 1.47 [95% CI, 1.20–1.79]; P<0.001).

CONCLUSIONS: In patients amenable to ViV-TMVR, this procedure shows a lower initial risk of death and complications, but higher mortality after 6 months in comparison with redo-SMVR. These findings highlight the importance of striking a balance between upfront surgical risk and estimated life expectancy when selecting interventions.

Key Words: cardiac surgical procedures ■ cardiovascular surgical procedures ■ heart valve diseases ■ heart valve prosthesis implantation ■ meta-analysis ■ transcatheter mitral valve replacement

Valve-in-valve transcatheter mitral valve replacement (ViV-TMVR) has emerged as a viable alternative to redo surgical mitral valve replacement (redo-SMVR) for patients with failed bioprosthetic valves due to structural valve deterioration.[1,2] As a less invasive approach, ViV-TMVR is associated with lower periprocedural morbidity and mortality in this population.[1,2] However, to date, no randomized controlled trials directly comparing ViV-TMVR and redo-SMVR have been published.

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CLINICAL PERSPECTIVE

What Is New?

- This represents the largest pooled meta-analysis evaluating early and late outcomes of valve-in-valve transcatheter mitral valve replacement versus redo surgical mitral valve replacement (redo-SMVR) in patients with failed bioprosthetic mitral valves. It demonstrates a time-dependent pattern: Valve-in-valve transcatheter mitral valve replacement is associated with a lower risk of mortality and complications in the immediate postprocedural period compared with redo-SMVR; however, this early benefit does not persist over time, and redo-SMVR is linked to a lower risk of all-cause mortality at later follow-up in landmark analyses.

What Are the Clinical Implications?

- For patients deemed prohibitive or at high risk for redo-SMVR and for those with an anticipated short life expectancy, valve-in-valve transcatheter mitral valve replacement might remain the preferable option due to its lower up-front risk, whereas those patients with an anticipated long life expectancy, fewer comorbidities, and lower surgical risk might benefit more from redo-SMVR.
- These findings highlight the importance of striking a balance between upfront surgical risk and estimated life expectancy when selecting interventions.

Nonstandard Abbreviations and Acronyms

SMVR	surgical mitral valve replacement
ViV-TAVR	valve-in-valve transcatheter mitral valve replacement

Existing comparative studies between these 2 approaches primarily address early outcomes,[3–6] whereas those assessing long-term outcomes are limited by small sample sizes.[7,8] Within this context, the present study aimed to assess both early and late outcomes of ViV-TMVR and redo-SMVR in patients with degenerated bioprosthetic mitral valves.

METHODS

Eligibility Criteria, Databases, and Search Strategy

The data that support the findings of this study are available within the article. This study followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses reporting guideline.[9] Using the *P*opulation, *I*nterventions, *C*omparison, *O*utcome, and *S*tudy design strategy, studies were included if the following criteria were fulfilled:

1. The population comprised patients who underwent intervention for failing surgical mitral bioprostheses;
2. there was an intervention group undergoing ViV-TMVR;
3. there was a second intervention group undergoing redo-SMVR;
4. outcomes studied included any of the following outcomes: in-hospital mortality, 30-day mortality, survival, or mortality in the follow-up (with Kaplan–Meier curves), bleeding, acute kidney injury, stroke, permanent pacemaker implantation, postprocedural mean gradients, new onset atrial fibrillation, left ventricle outflow tract (LVOT) obstruction, vascular complications;
5. The study design was retrospective/prospective, randomized/nonrandomized, mono/multicentric, with matched/unmatched populations.

The following sources were searched for articles meeting our inclusion criteria and published by September, 2025: PubMed/MEDLINE, EMBASE, Scientific Electronic Library Online, Latin American and Caribbean Health Sciences Literature, CENTRAL/CCTR (Cochrane Controlled Trials Register), Google Scholar, and the reference lists of relevant articles. We searched for the following terms: "transcatheter mitral valve replacement," "TMVR," "transcatheter mitral valve implantation," "TMVI," "redo surgical mitral valve replacement," "redo-SMVR," "reoperation," "reoperative," "valve-in-valve," "ViV," "ViV-TMVR," "ViV-TMVI," "structural valve deterioration," "structural valve degeneration," "failed bioprosthesis," and "failed bioprosthetic valves." The following steps were taken for study selection: (1) identification of titles of records through database search, (2) removal of duplicates, (3) screening and selection of abstracts, (4) assessment for eligibility through full-text articles, and (5) final inclusion in study. Studies were selected by 2 independent reviewers. When there was disagreement, a third reviewer made the decision to include or exclude the study. Ethical approval was not applicable for this study, as it consisted of a systematic review and meta-analysis. There were no language restrictions.

Assessment of Risk of Bias

The Risk of Bias in Non-Randomized Studies of Interventions tool was systematically used to assess included studies for risk of bias.[10] The studies and their characteristics were classified into low, moderate, and serious risk of bias. Two independent reviewers assessed risk for bias. When there was a disagreement,

a third reviewer checked the data and made the final decision.

Statistical Analysis

The early outcomes were meta-analyzed on the log risk ratio (log RR) scale. Study-specific log RR estimates and their corresponding SEs were combined under a random-effects model. CIs and *P* values were then calculated from the pooled log RR and its variance.[11] For outcomes in which ≥1 studies reported zero events in either arm, a constant of 0.5 was added to all 4 cells of the 2×2 table before computing study-specific log risk ratios. Forest plots were created to represent the individual study and combined odds ratio (ORs) with 95% CI. Chi-square and I^2 tests were performed for assessment of statistical heterogeneity.[12] τ^2 (tau-squared) was assessed as the between-study variance estimated under a random-effects model. To assess publication bias, funnel plots were generated visual inspection assessed approximate bilateral symmetry of studies around the pooled estimate, the presence or absence of a systematic gap in the lower-precision region of the funnel, and whether any apparent asymmetry was concentrated among high-variance studies or distributed throughout the precision range. Begg and Mazumdar's rank correlation test[13] and Egger's linear regression test were also performed.[14]

For the late outcomes (mortality in the follow-up), the analysis was performed using the "curve approach,"[15] which reconstructs individual patient data (IPD) based on the published Kaplan–Meier graphs from the included studies. In a first stage, Kaplan–Meier plots were digitized to raw data coordinates (time and survival probability). In a subsequent step, IPD was reconstructed from the raw data coordinates obtained from the digitized Kaplan–Meier graphs and the respective numbers at risk at given timepoints using the R package "IPDfromKM" (version 0.1.10).[16] The reconstructed IPD from each study was merged to create the final study data set. Kaplan–Meier analyses and Cox proportional hazard models were fitted using the reconstructed IPD using the R packages "survival" (version 3.2-13), "survminer" (version 0.4.9), and "coxph" (version 4.0.2). HRs with 95% CIs were calculated from reconstructed IPD using a Cox frailty model. Study groups (ViV-TMVR versus Redo-SMVR) were included in the model as a fixed effect. Between-study heterogeneity was assessed by the inclusion of a γ frailty term, where individual studies modeled as a random effect using random intercepts. A likelihood ratio test was used to test the significance of this γ frailty term. The proportionality of the hazards of each Cox model was assessed with the Grambsch-Therneau test and diagnostic plots based on Schoenfeld residuals.[17] Our protocol stated that flexible parametric survival models with B-splines and landmark analysis would be performed in case the proportional hazards assumption was violated as apparent either from these tests or from visual inspection of the Kaplan–Meier curves.[18–20] This approach allowed us to apply conventional Cox regression models to each of these regions separately, and to estimate the overall HR with 95% CI with each of these regions while respecting the proportionality assumption.

To ensure that our Kaplan–Meier-derived data set was accurate enough to reproduce the original Kaplan–Meier curves, the reconstructed Kaplan–Meier curves were individually reviewed for similarity with the original versions. We observed that all reconstructed curves remained within a 99% CI when compared with the original curves published. These were also evaluated by using the root mean square error and the mean and maximum absolute error. A root mean square error ≤0.05, mean absolute error ≤0.02, and maximum absolute error ≤0.05 indicate that the extracted data points are sufficiently well-captured for subsequent analyses, which was achieved in our analyses.

All analyses were completed with R Statistical Software (version 4.1.1, Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Study Selection and Characteristics

After excluding duplicates and noneligible studies, 13 studies[3–5,7,8,21–28] met our eligibility criteria (Figure 1). All the studies were nonrandomized, observational, and retrospective. (Table S1). A total of 15 941 patients were included (5465 patients underwent ViV-TMVR and 10 476 patients underwent redo-SMVR). Patients' characteristics are shown in Tables S2 through S4. Patients in the ViV-TMVR group were generally older, with higher proportion of diabetes, hypertension, chronic obstructive pulmonary disease, coronary disease, and atrial fibrillation. Figure 2 shows the qualitative assessment of the studies with the Risk of Bias in Non-Randomized Studies of Interventions tool. In our qualitative analysis, we observed a moderate-to-high risk of bias. There are several concerns regarding confounding factors and selection bias in the studies due to important differences between the groups; furthermore, missing data and selection of reported outcomes were also reasons for concern.

Early Outcomes

In comparison with redo-SMVR, ViV-TMVR showed lower risk of in-hospital mortality (RR, 0.72 [95% CI, 0.57–0.90]; *P*=0.004) (Figure 3A), stroke (RR, 0.49 [95% CI, 0.29–0.83]; *P*=0.008) (Figure 3B), acute kidney injury (RR, 0.57 [95% CI, 0.42–0.77]; *P*<0.001)

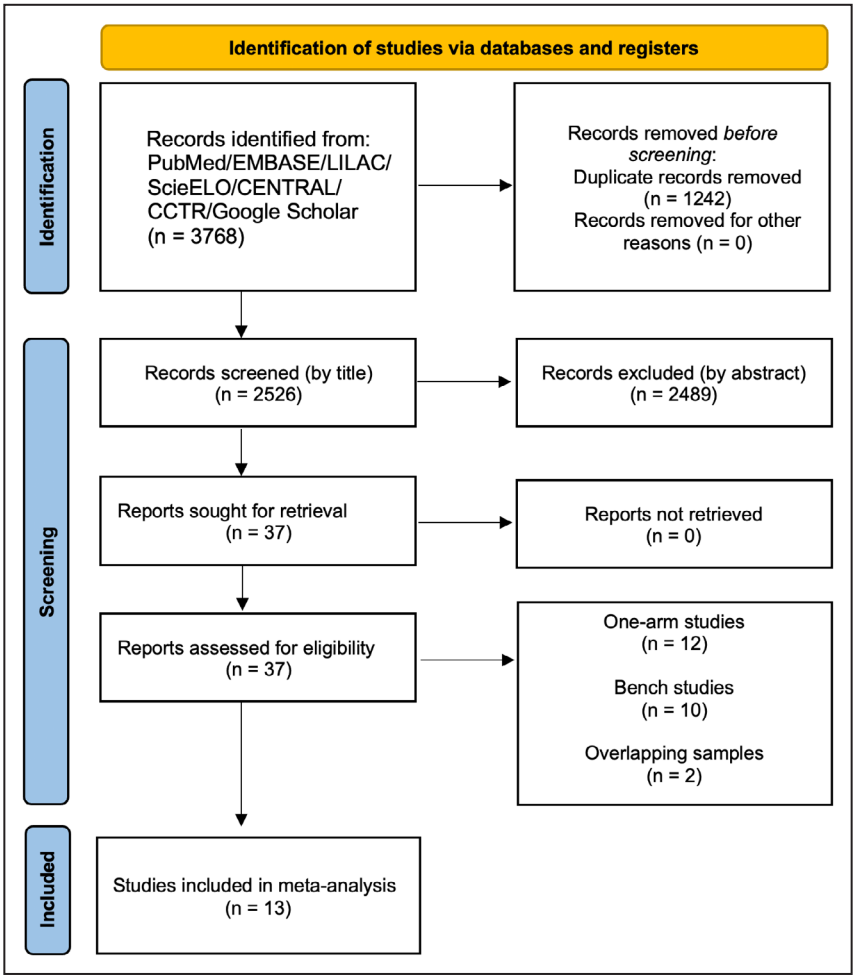

Figure 1. Flow diagram of studies included in data search.
CENTRAL/CCTR indicates Cochrane Controlled Trials Register; LILACS, Latin American and Caribbean Health Sciences Literature; and ScieELO, Scientific Electronic Library Online.

(Figure 3C), bleeding (RR, 0.43 [95% CI, 0.20–0.94]; *P*=0.035) (Figure 3D), permanent pacemaker implantation (RR, 0.30 [95% CI, 0.19–0.49]; *P*<0.001) (Figure 3E), and shorter hospital length of stay (mean difference,–5.09 days [95% CI, –6.56 to –3.63]; *P*<0.001) (Figure 3F). We did not find statistically significant differences for the following outcomes: 30-day mortality, vascular complications, atrial fibrillation, LVOT obstruction, and mean transvalvular gradients (Figures S1 through S5). The degree of between-study variability (τ^2) differed markedly across outcomes, with important implications for interpretation. Between-study heterogeneity was low for in-hospital mortality (τ^2=0.029) but increased for stroke (τ^2=0.256) and acute kidney injury (τ^2=0.114). Substantially greater variability was observed for bleeding (τ^2=0.952). The highest degree of variability was observed for hospital length of stay (τ^2=4.226 days^2), suggesting considerable between-study differences. Other outcomes reported comparable estimates of between-study variability (Figures S1 through S5).

Funnel plots for all outcomes are shown in Figures S1 through S16. For hospital length of stay, Egger's test was statistically significant (*P*=0.008) and visual inspection revealed concentration of smaller, imprecise studies in the ViV-TMVR-favoring lower-left region, consistent with possible small-study effects or selective reporting (Figure S6). For in-hospital mortality and permanent pacemaker implantation, the funnel plots showed some visual asymmetry (Figures S12 and S14), and formal test results for these outcomes should be interpreted in the context of the limited number of contributing studies. For the remaining outcomes, 30-day mortality, stroke, acute kidney injury, bleeding, atrial fibrillation, LVOT obstruction, mean transvalvular gradient, and vascular complications, funnel plots appeared broadly symmetric and neither Egger's nor Begg and Mazumdar's tests reached statistical significance.

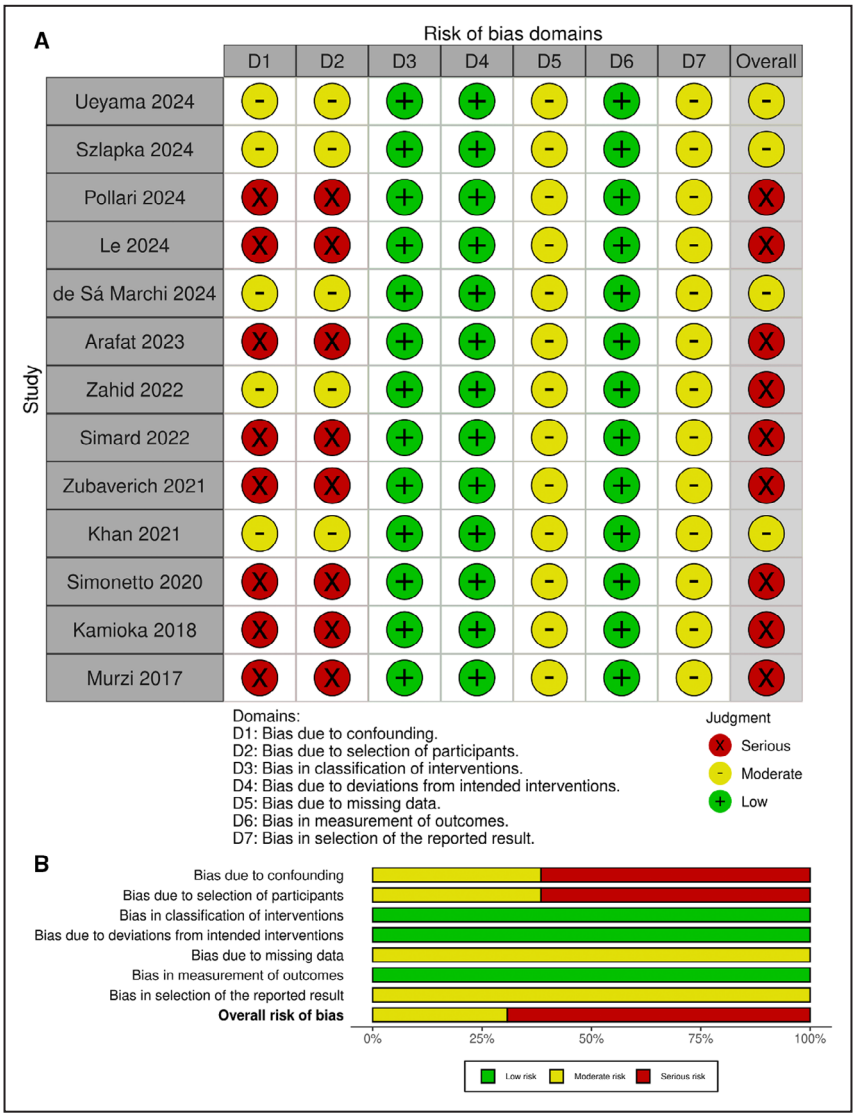

Figure 2. Risk of bias summary—ROBINS-I tool with traffic lights (A) and summary plot (B).
Studies referenced: [3–5,7-8,21-28]. ROBINS-I indicates Risk of Bias in Non-Randomized Studies of Interventions.

However, with <10 contributing studies per outcome for most outcomes, these tests have insufficient statistical power to reliably detect moderate degrees of asymmetry, indicating that there is little evidence of publication bias for most outcomes.

Late Outcomes

Figure 4A shows the Kaplan–Meier incidence function of all-cause mortality. The Cox regression model showed no statistically significant difference for ViV-TMVR compared with redo-SMVR (HR, 0.92 [95% CI, 0.81–1.05]; *P*=0.256). Figure 4B shows the forest plot for all-cause mortality in the follow-up (HR, 0.84 [95% CI, 0.64–1.11]; *P*=0.115). However, there was evidence of violation of the proportional hazards assumption, underscored by the Schoenfeld residuals and the Grambsch-Therneau test for time-varying effect (*P*=0.002). The effect estimation based on Cox regression might therefore be misleading. To account for the time-varying effect of treatment, we proceeded with flexible parametric survival models with B-splines and landmark analysis.

The analysis of time-varying HRs based on flexible parametric survival models with B-splines is presented in Figure 5 and revealed 2 distinct phases: (1) an early phase from 0 to 0.5 years of follow-up where we can see a decreasing HR; (2) a later phase from 0.5 to 5.0 years of follow-up where we can see an increasing HR.

Subsequently, landmark analysis (Figure 6) was performed, designating 0.5 years as the landmark time

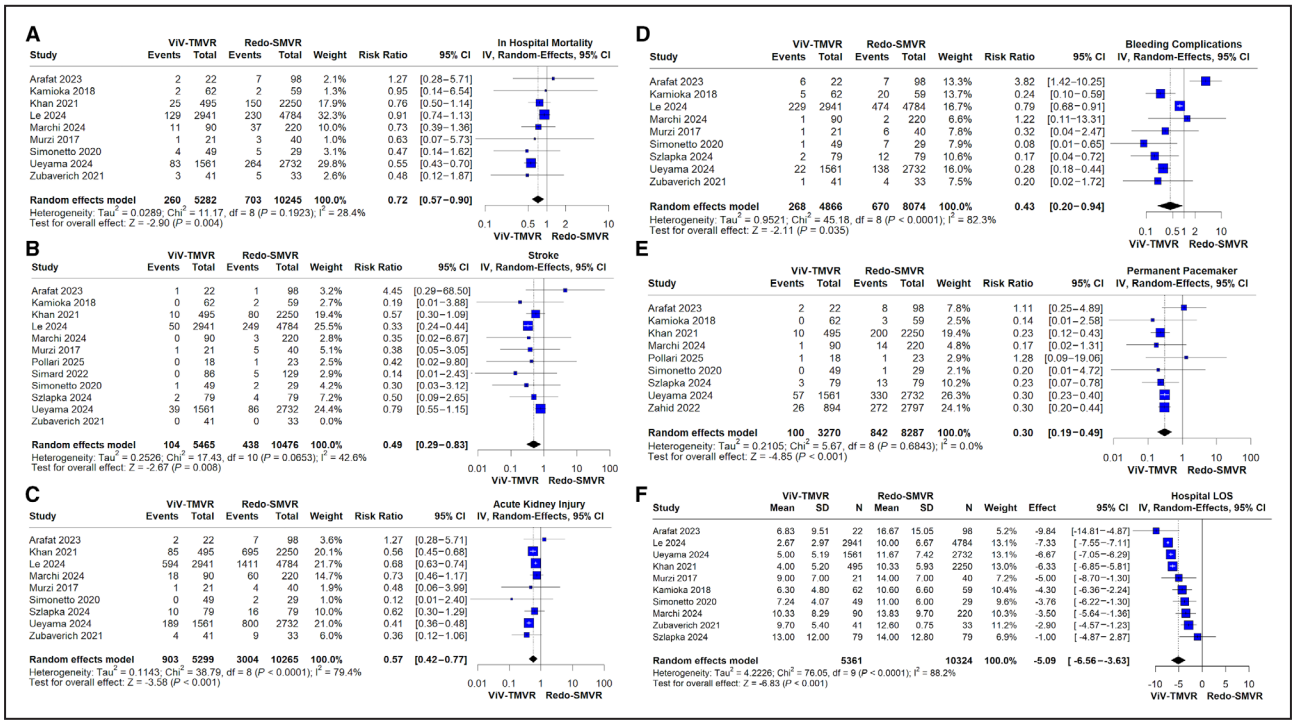

Figure 3. Forest plots of immediate postprocedural outcomes.
Studies referenced: [3–5,7,21-28]. IV indicates inverse variance; redo-SMVR, redo surgical mitral valve replacement; ViV-TMVR, valve-in-valve transcatheter mitral valve replacement.

point based on the HR inflection around 6 months as shown by the flexible parametric survival models with B-splines in Figure 5. In the first 6 months after the procedure, ViV-TMVR was associated with a significantly lower incidence of all-cause mortality (HR, 0.69 [95% CI, 0.58–0.83]; *P*<0.001). The landmark analysis of all-cause mortality beyond 6 months yielded a significant reversal of the HR and ViV-TMVR was associated with higher incidence of all-cause death (HR, 1.47 [95% CI, 1.20–1.79]; *P*<0.001).

DISCUSSION

Summary of Evidence

To the best of our knowledge, this is the largest pooled meta-analysis of early and late outcomes comparing ViV-TMVR with redo-SMVR. We found a time-varying trend with ViV-TMVR associated with lower risk of death immediately after the procedure in comparison with redo SMVR; however, this primary advantage is not consistent over time and redo-SMVR is associated with lower risk of all-cause mortality at a later stage (Graphical abstract). ViV-TMVR is also associated with lower risk of stroke, acute kidney injury, bleeding, permanent pacemaker implantation, and shorter hospital length of stay. In our qualitative analysis, we observed a moderate-to-high risk of bias.

Comments

ViV-TMVR seems to be less risky in terms of the immediate postprocedural lower rates of negative outcomes probably due to its less invasive nature: minimally invasive transcatheter with less physical trauma and blood loss, no need for cardioplegic cardiac arrest, aortic clamping, and cardiopulmonary bypass. These reasons are equally valid to explain the lower rates of stroke, acute kidney injury, bleeding, permanent pacemaker implantation, and shorter hospital length of stay in ViV-TMVR. Noteworthy, the paradigm shift from the early era of ViV-TMVR with transapical access (which involved a mini-thoracotomy) to the current transeptal approach (which involves no thoracic incisions, but rather femoral venous access) surely contributed to a safer performance of ViV-TMVR.

Despite the lower rates of death and complications with ViV-TMVR in the in-hospital period, the 30-day mortality was not statistically different from that of redo-SMVR. This nondifference in 30-day mortality between the 2 procedures warrants further explanation. One possibility might be the difference in characteristics of the populations. Patients undergoing ViV-TMVR are often older, frail, and with more comorbidities. These covariates may influence the outcomes, potentially counterbalancing the advantages of the less invasive procedure. Furthermore, when we look at the entire follow-up (as in Figure 4), there seems to be no

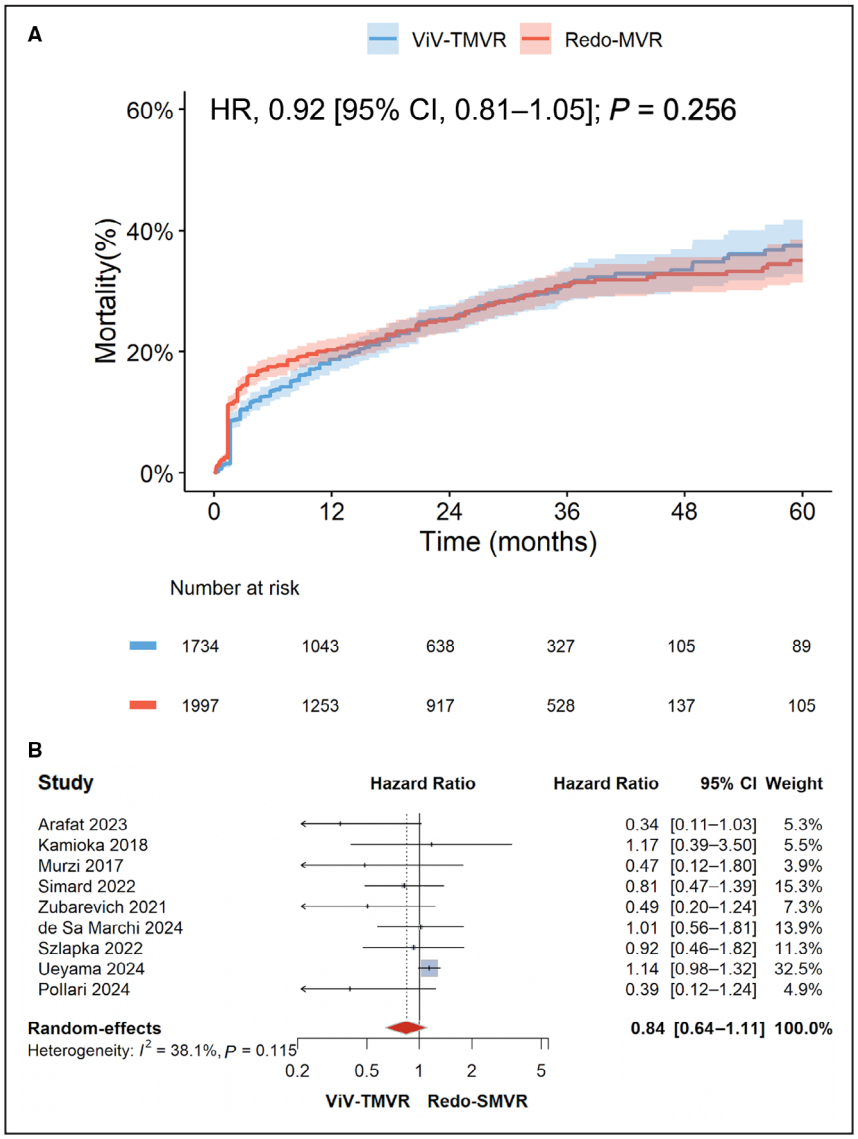

Figure 4. Pooled Kaplan–Meier curve (A) and forest plot (B) for all-cause mortality in the follow-up.
Studies referenced: [3,7–8,21,22,24–26,28]. HR indicates hazard ratio; redo-SMVR, redo surgical mitral valve replacement; and ViV-TMVR, valve-in-valve transcatheter mitral valve replacement.

difference in terms of survival between the procedures. If ViV-TMVR seems to be advantageous immediately after the procedure, but not when we look at the bigger picture, this casts a shadow on the late effectiveness of ViV-TMVR. Negative events following ViV-TMVR not captured during the in-hospital period may explain the nondifferent survival over time. Indeed, we identified a time-varying hazard ratio (HR) (Figure 5) and the landmark analysis (Figure 6) revealed that ViV-TMVR is associated with lower mortality in the first 6 months after the procedure but with higher mortality after 6 months and up to 5 years. Again, we should keep in mind that this finding might not be necessarily related to superiority of redo-SMVR over ViV-TMVR, but it might also be due to shorter life expectancy in the ViV-TMVR group because the covariates that might exert some impact on the outcomes immediately after the procedure continue to exert its influence during the entire follow-up.

Although LVOT obstruction did not show a statistically significant difference between the groups, it did not go unnoticed that ViV-TMVR had higher risk of LVOT obstruction (near the statistical significance). We should bear in mind that LVOT obstruction remains a challenge for ViV-TMVR, but this can be mitigated with appropriate preprocedural assessment and planning.[29] Another strategy to mitigate the risk of LVOT obstruction is the use of leaflet modification techniques in patients with the previous concerns. For example,

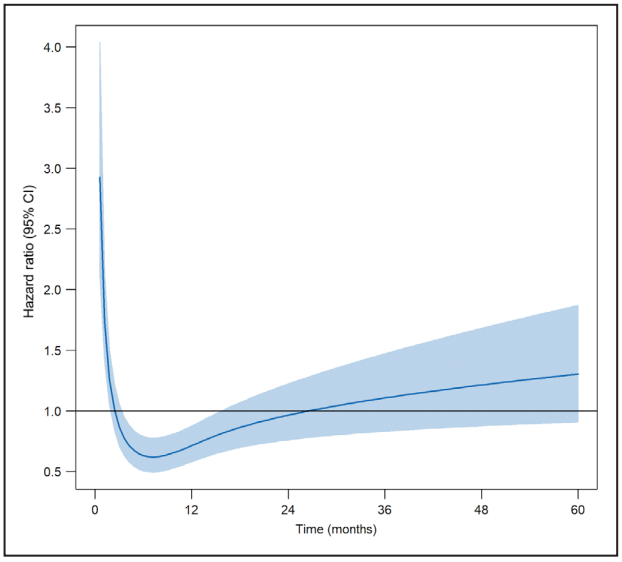

Figure 5. Time-varying hazard ratios with 95% CI for all-cause mortality for valve-in-valve transcatheter mitral valve replacement versus redo surgical mitral valve replacement at every given time during follow-up; these are derived from flexible parametric survival models with B-splines.
HR indicates hazard ratio.

Krishnaswamy et al.[30] assessed the clinical efficacy of the novel Cleveland Valve Electrosurgery leaflet modification technique in 6 patients undergoing ViV-TMVR at high risk for LVOT obstruction and had no complications at 30 days. They achieved successful leaflet clearance in 100% of cases without any evidence of LVOT obstruction. Other important procedures that proved to be useful to prevent LVOT obstruction in these cases are the Laceration of the Anterior Mitral leaflet to Prevent Outflow Obtruction[31] and Balloon-Assisted Translocation of Mitral Anterior leaflet[32] procedures.

Another aspect that might affect outcomes of ViV-TMVR is underexpansion of the transcatheter heart valve. Fukui et al.[33] showed that nonuniform underexpansion of the transcatheter heart valves was not uncommon after ViV-TMVR. Overall, the incidence of hypoattenuating leaflet thickening in their series at 30 days was 27.3%. The authors also found that deformation of the transcatheter heart valves is negatively affected by excessive oversizing. Another study by Fukui et al.[34] revealed that deep implantation and the presence of a polymer surgical stent frame were associated with underexpansion of the functional portion of transcatheter heart valves, which in turn was associated with worse postprocedural hemodynamics. Furthermore, analogous to patients undergoing valve-in-valve transcatheter aortic valve replacement when compared with those undergoing surgical aortic valve replacement,[35,36] prosthesis–patient mismatch and high residual gradients may play an important role in the outcomes of patients undergoing ViV-TMVR. Indeed, Simonato et al.[37] evaluated data of patients enrolled in the VIVID Registry (Valve-in-Valve International Data Registry) and found that 8.2% of those undergoing ViV-TMVR presented significant residual gradients (mean gradient ≥5 mm Hg) with smaller true internal diameter of the transcatheter heart valves correlated with higher residual gradients. Noteworthy, significant residual gradients were independently associated with repeat mitral valve replacement.

In this scenario, we would propose the following interpretation of our findings: for patients deemed prohibitive or at high risk for redo sternotomy and for those with an anticipated short life expectancy, ViV-TMVR might remain the preferable option due to its lower upfront risk, whereas those patients with an anticipated long life expectancy, fewer comorbidities and lower surgical risk might benefit more from the potentially more durable outcomes yielded by redo-SMVR.

Limitations

Firsty, no randomized trials were found, and all included studies were observational and retrospective, which carries the potential of introducing selection bias influenced by surgical risk, operator experience, age, and comorbidities. For example, patients in the ViV-TMVR group were generally older, with higher proportion of diabetes, hypertension, chronic obstructive pulmonary disease, coronary disease, and atrial fibrillation (Tables S2 and S3). Furthermore, although only seven studies described the surgical risk based on Society of Thoracic Surgeons-Predicted Risk of Mortalityand European System for Cardiac Operative Risk Evaluation, in 5 of them, the mean/median risk score was higher in the ViV-TMVR group (Table S3). Given the fact that individual surgical risk was not considered in this analysis and VIV-TMVR groups had average scores pointing to high surgical risk, our findings support the current indication of ViV-TMVR approved for patients at high or prohibitive surgical risk.

Second, although most ViV-TMVR cases are truly cases with failed bioprosthetic mitral valves, some of these studies were carried out with data from national databases that do not allow for precise differentiation between patients with ViV-TMVR and valve-in-ring TMVR. Furthermore, the codes in these databases do not allow for the distinction between a full redo sternotomy and a minimally invasive surgical approach.

Third, although we excluded overlapping studies with data originated from the same database (eg, when ≥2 studies were carried out with the National Readmission Database[5,6,23]), we recognize that the same patient in one database might be present in another database (for example, a patient might be included in the National Readmission Database and in the National Inpatient Sample[4]), which might

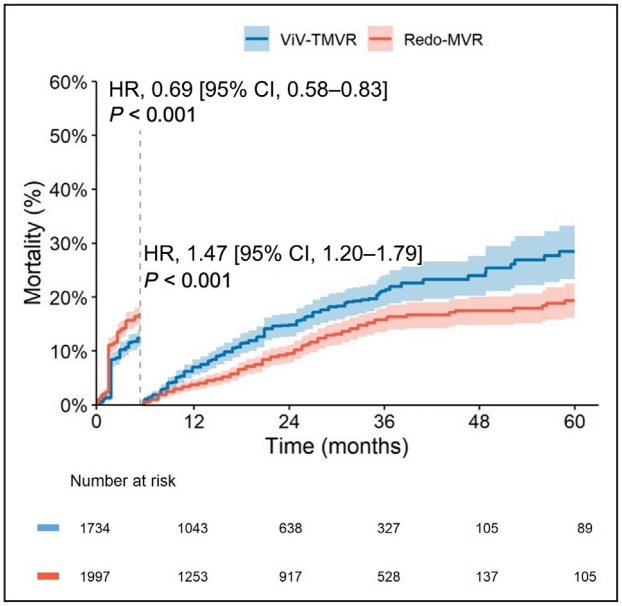

Figure 6. Landmark analysis of all-cause mortality for valve-in-valve transcatheter mitral valve replacement and redo surgical mitral valve replacement.
HR indicates hazard ratio; redo-SMVR, redo surgical mitral valve replacement; and ViV-TMVR, valve-in-valve transcatheter mitral valve replacement.

cause some unintentional overlap of cases in different studies. Although Zogg et al.[6] was excluded, Zahid et al.[5] and Le et al.[23] were included in the meta-analysis because they contributed to different outcomes despite using data from the same database—by doing so, we avoided the overlap of cases in the same outcome. To mitigate the effect of possible overlapping occurrences in the National Readmission Database-based studies[5,23] and National Inpatient Sample-based studies,[4] we carried out "leave-one-out" sensitivity analyses and did not identify any study with a particular effect on the summary measures (Figures S17 through S22). This means that, even if there is any overlap, this did not affect our summary measures substantially.

Fourth, no patient-level risk adjustment or propensity matching could be applied in the pooled analysis because the reconstructed time-to-event data lack individual covariates. Covariate-adjusted RR or HR estimates were not consistently reported across the included studies, and where available, the covariates and modeling strategies differed substantially. Key unmeasured confounders expected to bias the late-mortality HR away from the null include frailty and functional status, severity of bioprosthetic degeneration, and center and operator experience. All these factors were systematically worse in the ViV-TMVR group (Tables S2 and S3). Regarding proportional hazards: the overall Cox HR with robust sandwich variance (HR, 0.92 [95% CI, 0.81–1.05]) does provide valid inference on the time-averaged contrast, and is reported for completeness, but we consider the landmark analysis the more clinically informative primary summary as it separates two directionally opposite phases of risk. Then, analyses of rare events, particularly in this article LVOT obstruction, are limited by zero-event data in the comparator arm, such that the use of a constant continuity correction (+0.5) may bias RR estimates and inflate precision, warranting cautious interpretation of these results. Finally, our use of a random-effects model assumes exchangeability and targets the mean effect across studies, although appropriate for generalization beyond the included studies, this estimand may differ from a fixed-effects summary, which may be disproportionately influenced by a small number of large administrative data sets, and thus results should be interpreted in the context of existing between-study heterogeneity.

CONCLUSIONS

In patients amenable to ViV-TMVR, this procedure shows a lower initial risk of death and complications but higher mortality after 6 months in comparison with redo-SMVR. These findings highlight the importance of striking a balance between upfront surgical risk and estimated life expectancy when selecting procedures.

ARTICLE INFORMATION

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Disclosures

None.

Supplemental Material

Tables S1–S4
Figures S1–S22

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