



Outcomes of robotic repair for the degenerative mitral valve: a systematic review and meta-analysis

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Background: Robotic mitral valve repair (RMVr) provides a minimally invasive option for degenerative mitral regurgitation (MR), yet durability signals and patient outcomes remain heterogeneously reported. This current systematic review and meta-analysis aims to summarize survival and freedom from reoperation following RMVr in degenerative disease.

Methods: Five databases were searched from inception through July 2025 for studies reporting RMVr outcomes in degenerative disease. Cohorts with mixed etiologies without separable data were excluded. Short-term mortality (<30 days) was the primary outcome, while mid- to long-term survival and freedom from reoperation were presented using Kaplan-Meier curves. Secondary endpoints included relevant morbidity outcomes and reoperation rates. Meta-regression analysis examined associations between cohort size and adverse outcomes and assessed temporal trends in RMVr technique.

Results: Following independent screening, 15 studies were selected, including 11,432 patients. Pooled mean follow-up was 60.9 months (clinical) and 20.0 months (echocardiographic). Kaplan-Meier overall survival at 1, 3, 5 and 10 years was 98.9%, 98.7%, 97.4% and 92.3%, respectively. At 1, 3 and 5 years, freedom from reoperation was 97.7%, 96.0% and 96.0%, while freedom from recurrent $\geq 2+$ MR was 98.3%, 95.8% and 95.8%. Pooled short-term (<30 days) mortality was 1.3% [95% confidence interval (CI): 1.1–1.4%]. Postoperative morbidity was low, with cerebrovascular accident (CVA) in 1.4% and acute kidney injury (AKI) in 1.3%. Reoperation for bleeding and valve dysfunction occurred in 2.3% and 2.2% of patients, respectively. Pooled mean intensive care unit (ICU) stay was 1.2 days and hospital length of stay (LOS) was 6.0 days. Meta-regression suggested increasing adoption of neochordae techniques over time ($P=0.015$). Heterogeneity was high for several parameters, reflecting differences in study design, surgeon experience, and follow-up duration.

Conclusions: In degenerative mitral disease, RMVr demonstrates low short-term mortality and complications, with favorable mid- to long-term durability, including high freedom from recurrent moderate-to-severe MR and reoperation. These findings support RMVr as an effective and durable surgical approach to degenerative mitral pathology, underscoring the need for prospective, standardized studies with robust echocardiographic follow-up and case-mix adjustment.

Keywords: Degenerative mitral valve disease; mitral valve repair; robotic cardiac surgery; robotic mitral valve repair (RMVr)



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Introduction

Degenerative mitral valve disease is the leading cause of primary mitral regurgitation (MR) in developed countries and remains the second most common valvular disorder requiring surgical intervention worldwide (1). Furthermore, from 1990 to 2021, absolute case numbers of non-rheumatic degenerative mitral valve disease increased by 85%, highlighting the significance of optimal treatment in an aging society (2). Conventional mitral valve repair, typically performed via median sternotomy, has long been established as the gold standard due to its proven long-term survival and durability. However, over the past two decades, the emergence of minimally invasive and robotic techniques has transformed the surgical landscape, offering the potential for favorable surgical outcomes, including hospital stay, post-operational complications, and in-hospital mortality (3).

Since its first FDA-approved clinical application by Chitwood and colleagues in the early 2000s, robotic mitral valve repair (RMVr) has evolved significantly in both technology and technique (4). The da Vinci system (Intuitive Surgical, Sunnyvale, CA, USA) has become the dominant platform, facilitating enhanced visualization, wristed instrumentation, and precise suturing through small thoroscopic ports. These advances have made it possible to replicate the complex leaflet resections, chordal replacements, and annuloplasty procedures traditionally performed via open approaches, particularly in degenerative etiologies where repair durability is paramount.

Despite widespread adoption across high-volume centers, the long-term outcomes of robotic mitral repair in degenerative MR remain variably reported despite this being one of the most common causes of severe MR and indications for mitral valve repair (5). Systematic reviews have demonstrated low perioperative mortality, short hospital stays, and excellent repair rates; however, questions persist regarding the durability of repair, recurrence of regurgitation, and need for reoperation in the long term (6). Furthermore, while recent registry analyses suggest expanding utilization of robotic techniques, heterogeneity in patient selection, surgeon experience, and follow-up duration complicates interpretation (7).

To date, no dedicated quantitative synthesis has focused exclusively on RMVr for degenerative etiologies. Prior meta-analyses have often combined mixed pathologies or compared robotic and conventional approaches, obscuring insights into long-term survival and repair durability

specific to this subgroup (3). Therefore, this systematic review and meta-analysis aims to comprehensively evaluate contemporary outcomes of RMVr in degenerative mitral disease, focusing on (I) overall and freedom-from-reoperation survival, and (II) freedom from recurrent moderate ($\geq 2+$) MR. By pooling available Kaplan-Meier data and examining procedural and postoperative characteristics, this study seeks to define the long-term efficacy and durability of robotic mitral repair in appropriately selected degenerative cohorts.

Methods

Literature search strategy

Five electronic databases were used to perform the literature search, including MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews (CDSR) and SCOPUS. These databases were searched from inception to the July 23, 2025. The search strategy included a combination of keywords and Medical Subject Headings (MeSH) including “robotics” AND “mitral valve” AND “degenerative”. Full details of the MeSH search strategy are available in the [Table S1](#). Predefined criteria for selection were used to assess all articles. The article was written in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations (7). The PRISMA flowchart is outlined in [Figure S1](#). Two reviewers (D.D. and K.R.) independently screened the abstracts of all identified records. Included titles were then reviewed with a full-text copy by authors D.D. and K.R. Any conflicts were then resolved by a third independent reviewer (A.E.). The reference list of selected studies was manually searched to identify any additional titles, not identified by the electronic search.

Study eligibility

Studies were eligible if they included a patient population that underwent robotic mitral valve surgery for a degenerative etiology and reported at least a primary or secondary outcome. Studies that underwent surgery for mixed pathologies (e.g., ischemic MR, functional MR, rheumatic heart disease) or did not delineate between the outcomes for degenerative pathologies to others were excluded. Studies with cohorts that were either mixed without reporting separate outcomes for mitral valve

repair/replacement, or different surgical approaches other than robotically assisted repair, were excluded. If centers/registries reported outcomes of overlapping patient series with either larger cohort size or extended follow-up, only the most complete, contemporary series was included for analysis. Included studies were limited to those in English and only involving human subjects. Abstracts, case reports, conference presentations, editorials, and reviews were excluded.

Outcomes

The primary outcome of the study was mortality, specifically within 30 days of operation. Secondary outcomes included postoperative stroke [cerebrovascular accident (CVA)], acute kidney injury (AKI), reoperation for bleeding, reoperation for valve dysfunction and length of stay (LOS). Longer term data was presented as aggregated Kaplan Meier curves utilizing the algorithm presented by Guyot *et al.* (8). These include freedom from significant (2+) MR, overall survival and freedom from reoperation. In order to perform meta regression, a composite endpoint of mortality, CVA and reoperation were chosen in order to attain sufficient power for analysis.

Data extraction and statistics

Two independent reviewers (L.M. & C.D.) extracted data directly from publication texts, tables, and figures. Two further reviewers (A.E. & D.D.) independently reviewed and confirmed the integrity of all extracted data. For baseline variables, nominal data was recorded as the number of events (n) and expressed as a percentage. Continuous variables were either expressed as a mean and standard deviation (SD) or median and interquartile range (IQR). For statistical analysis, medians and IQR were first converted to mean and standard deviation utilising the method outlined by Wan *et al.* (9). Statistical analysis was carried out using R Version 4.5.1 (Vienna, Austria). Baseline continuous data was collated using the *metaprop* function and the pooled result expressed as a weighted mean (n) and 95% confidence interval (CI). Nominal data was collated and expressed as a proportion and percentage. To summarize outcome data, a meta-analysis of proportions was performed using the *forest* function, with a Freeman-Tukey arcsine transformation. A random effects model was utilized to account for varied study design, experience of the surgeons, center protocol, and population. Results were expressed as forest plots

where appropriate, with cumulative proportion expressed as a single percentage. Statistical significance was denoted by $P < 0.05$. Kaplan-Meier survival curves were digitized where numbers at risk were presented, and an algorithmic computational tool was utilized to derive individual patient data as outlined by Guyot *et al.* (8). Event and censoring data were compiled for up to five years, and overall survival curves were produced with Stata (version 17.0, StataCorp, Texas, USA).

Assessment of bias and heterogeneity

Heterogeneity was assessed using the I^2 test statistic. Low heterogeneity was denoted by $I^2 < 50\%$, moderate heterogeneity by $I^2 50\text{--}74\%$, and high heterogeneity by $I^2 \geq 75\%$. Small-study effects were assessed visually using funnel plots generated in R with the *funnel* function. Publication bias was assessed through visual inspection of funnel plots and Egger's regression test in R. Meta regression was performed assessing the effect of study cohort size to the composite outcome and year of recruitment to the use of neochordae. An influential study analysis with adjusted effect sizes and heterogeneity was computed after the omission of each study. The risk of bias was performed utilising the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I).

Results

Study characteristics

The literature search identified a total of 391 studies (Figure S1). After review, 15 observational studies with 11,432 total patients met the inclusion criteria and were selected (4,7,10-22). Included studies were primarily retrospective single-centre cohorts, with four prospective studies and one multicenter registry. The years of participant recruitment spanned from 2000 to 2023. All eight studies which reported the chosen robotic platform utilised da Vinci Si, X or Xi. Clinical follow-up time was reported in three studies, with a pooled mean of 60.9 months (95% CI: 58.3-63.5). Echocardiographic follow-up time was documented in four studies, with a pooled mean of 20.0 months (95% CI: 17.6-22.4). Study data are summarised in Table S2.

Baseline demographic data

All studies reported baseline patient characteristics (Table 1). The weighted mean age was 58.0 years (95% CI: 56.1-

Table 1 Baseline patient characteristics

Characteristic	Total recorded patients	N	Pooled weighted estimate (95% CI)	Heterogeneity I ² (%)
Age (years)	11,538	15	58.0 (56.1–60.0)	99
Males	8,081	15	72.7% (68.9–76.2%)	90
Body mass index (kg/m ²)	10,766	10	25.7 (25.1–26.3)	98
Hypertension	5,817	12	39.5% (33.5–45.9%)	96
Diabetes	632	13	4.29% (3.18–5.75%)	80
Cerebrovascular disease	223	10	2.06% (1.81–2.34%)	0
Left ventricle ejection fraction	160	9	61.9% (60.4–63.4%)	98
Atrial fibrillation	2,016	13	13.2% (9.4–18.1%)	95
Severe mitral regurgitation	9,130	11	90.7% (82.4–95.4%)	98
Pathology				
Posterior leaflet	1,879	11	73.4% (67.6–80.2%)	91
Anterior leaflet	110	10	6.4% (4.27–9.48%)	76
Bileaflet	452	11	16.3% (10.9–23.7%)	92

CI, confidence interval.

60.0%), and 72.7% (95% CI: 68.9–76.2%) were male. Mean body mass index, reported by ten studies (n=10,766), was 25.7 kg/m² (95% CI: 25.1–26.3). Regarding comorbidities, hypertension was present in 39.5% (95% CI: 33.5–45.9%) of measured patients (n=5,817). Diabetes was present in 4.3% (3.2–5.8%) of measured patients (n=632). Prior cerebrovascular disease was reported in 2.06% (95% CI: 1.8–2.3%) of patients, and pre-operative atrial fibrillation in 13.2% (95% CI: 9.4–18.1%). Nine studies recorded left ventricular ejection fraction (n=160), with a pooled mean of 61.9% (95% CI: 60.4–63.4%). Degenerative pathology predominantly occurred in the posterior leaflet only (73.4%, 95% CI: 67.6–80.2%), with bileaflet and isolated anterior leaflet involvement in 16.3% (95% CI: 10.9–23.7%) and 6.4% (95% CI: 4.3–9.5%), respectively. Between-study heterogeneity was substantial for most parameters (I² typically >90%) (Table 1).

Operative data

Twelve studies reported cardiopulmonary bypass (CPB) and cross clamp times (n=10,687), with weighted means of 146 minutes (95% CI: 132–160) and 99 minutes (95% CI: 90–108), respectively. Across eight studies, conversion from repair to replacement occurred in 1.0% (95% CI: 0.5–1.8%)

of patients. Concomitant procedures included tricuspid valve repair in 5.3% (95% CI: 3.4–8.0%) and atrial fibrillation ablation in 10.1% (95% CI: 4.79–19.9%). A variety of techniques were applied to facilitate repair including: annuloplasty in 99.2% (95% CI: 95.6–99.9%), leaflet resection in 47.1% (95% CI: 32.5–62.1%), neochordae in 46.1% (95% CI: 31.7–61.2%), and commissuroplasty in 11.4% (95% CI: 4.36–26.7%). These results were associated with significant heterogeneity (I²>90% for most parameters). Aggregate data is summarised in Table 2, and a complete overview of operative outcomes is available in Table S2.

Primary endpoint

A total of 14 studies reported short term (<30 days) mortality (n=11,476). The pooled short-term mortality was 1.3% (95% CI: 1.1–1.4%). This result was associated with reasonably low heterogeneity (I²=22%; Figure 1).

Secondary endpoints

A total of 13 studies reported postoperative CVA (n=11,319), with a pooled result of 1.4% (95% CI: 1.2–1.6%). This result was associated with low heterogeneity (I²=40%,

Table 2 Operative data

Parameter	Total recorded patients	N	Weighted pooled estimate [95% CI]	Heterogeneity I ² (%)
Cardiopulmonary bypass time (min)	10,687	12	146 [132–160]	100
Cross clamp time (min)	10,687	12	99 [90–108]	100
Conversion to replacement	92	8	0.98% [0.53–1.82%]	62
Concomitant tricuspid repair	534	9	5.25% [3.40–8.01%]	83
Concomitant atrial fibrillation surgery	4,288	12	10.1% [4.79–19.9%]	99
Repair technique				
Resection	2,175	13	47.1% [32.5–62.1%]	98
Annuloplasty	3,602	14	99.2% [95.6–99.9%]	94
Neochordae	1,245	14	46.1% [31.7–61.2%]	98
Commissuroplasty	306	10	11.4% [4.4–26.7%]	98

CI, confidence interval.

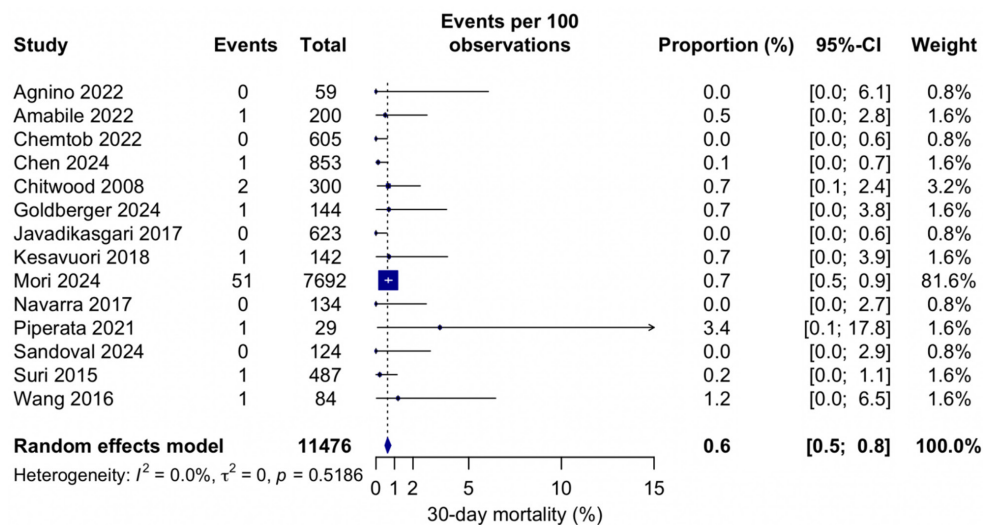


Figure 1 Forest plot: short term mortality. CI, confidence interval.

Figure S2). Nine studies reported postoperative AKI (n=2,136), with a pooled result of 1.3% (95% CI: 0.4–3.3%). This result was associated with low heterogeneity (I²=33%, Figure S3). Eleven studies reported reoperation rates for bleeding (n=3,131), with a pooled result of 2.3% (95% CI: 1.4–4.2%). This was associated with a reasonably high heterogeneity (I²=71%, Figure S4). Eleven studies reported reoperation rates for valve dysfunction (n=2,311), with a pooled result of 2.2% (95% CI: 1.1–4.0%). This was associated with moderate heterogeneity (I²=46%, Figure S5).

Eight studies reported ICU LOS in days, with a pooled result of 1.2 days (95% CI: 0.9–1.6). This was associated with high heterogeneity (I²=99%, Figure S6). Eleven studies reported length of hospital stay in days, with a pooled result of 6.0 days (95% CI: 5.0–6.9). This was also associated with high heterogeneity (I²=99%, Figure S7). Outcome data is summarised in Table 3.

A meta-regression analysis was conducted using a composite endpoint comprising short-term mortality, postoperative CVA, and reoperation for valve dysfunction.

Parameter	Events/total	N	Weighted pooled estimate (95% CI)	Heterogeneity I^2 (%)
Short term mortality	60/11,476	14	0.62% (0.5–0.8%)	22
Cerebrovascular accident	122/11,319	13	1.24% (0.83–1.62%)	40
Acute kidney injury	11/2,136	9	1.00% (0.53–2.11%)	33
Reoperation for bleeding	62/3,131	11	2.34% (1.41–3.84%)	71
Reoperation for valve dysfunction	36/2,311	11	1.91% (1.22–3.01%)	46
Mean ICU length of stay (days)	N/A	8	1.24 (0.85–1.56)	99
Mean hospital length of stay (days)	N/A	11	5.94 (4.99–6.90)	99

CI, confidence interval; ICU, intensive care unit; N/A, not available.

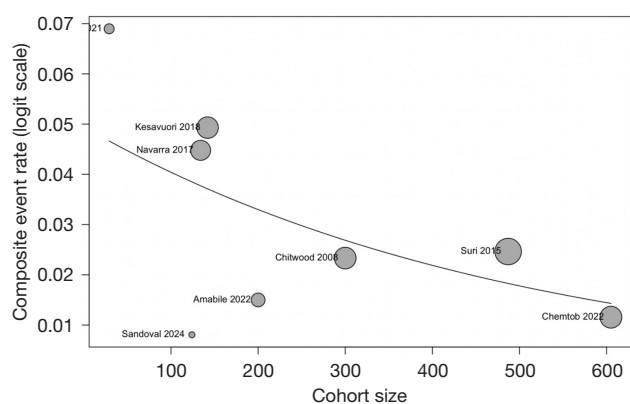


Figure 2 Meta regression of composite endpoint of death/stroke/reoperation for valve dysfunction *vs.* cohort size.

Figure 2 visually shows an association between larger study cohort size and a reduced rate of the composite endpoint ($P=0.053$). Meta-regression was also performed investigating trends in MVR technique over time. Figure 3 shows a statistically significant ($P=0.015$) positive association between mid-study recruitment year and the use of the neochordae technique, indicating increased adoption over time.

Kaplan-Meier curve analysis

Aggregation of overall survival was performed on five of the included studies. Actuarial survival at 1, 3, 5 and 10 years was 98.9%, 98.7% and 97.4% and 92.3% respectively (Figure 4). Aggregation of reoperation rates due to valve dysfunction was performed on three of the included studies. Freedom from reoperation at 1, 3 and 5 years was 97.7%,

96.0% and 96.0% (Figure 5). Aggregation of freedom from 2+ MR was performed on three of the included studies. Freedom from 2+ MR at 1, 3 and 5 years was 98.3%, 95.8% and 95.8% respectively (Figure 6).

Study quality and bias assessment

Leave-one-out analysis confirms that no single study materially alters the pooled short-term mortality calculations. Pooled estimates ranged from 0.5% to 0.6% after the omission of individual studies and were most impacted by the omission of Mori *et al.* (7) (Figure S8). Visual analysis of the funnel plot for the primary outcome, short-term mortality, does not reveal marked asymmetry, suggesting no publication bias for the primary outcome (Figure S9). However, completion of weighted regression analysis (Egger's test) revealed statistically significant ($P<0.05$) skew for AKI (Table S3). This suggests potential publication bias, meaning results for postoperative AKI should potentially be interpreted with caution. The ROBINS-I tool was applied to all 15 studies, with nine studies scoring "moderate" in terms of risk of bias. Six studies scored a "serious" risk of bias, reflecting the largely retrospective nature of the cohort studies included (Figure S10).

Discussion

Robotic mitral valve surgery has been shown to be a safe procedure with robust postoperative outcomes (23). When compared to minimally invasive open and conventional sternotomy, it has demonstrated a similar short-term postoperative mortality, shorter hospital LOS and reduced

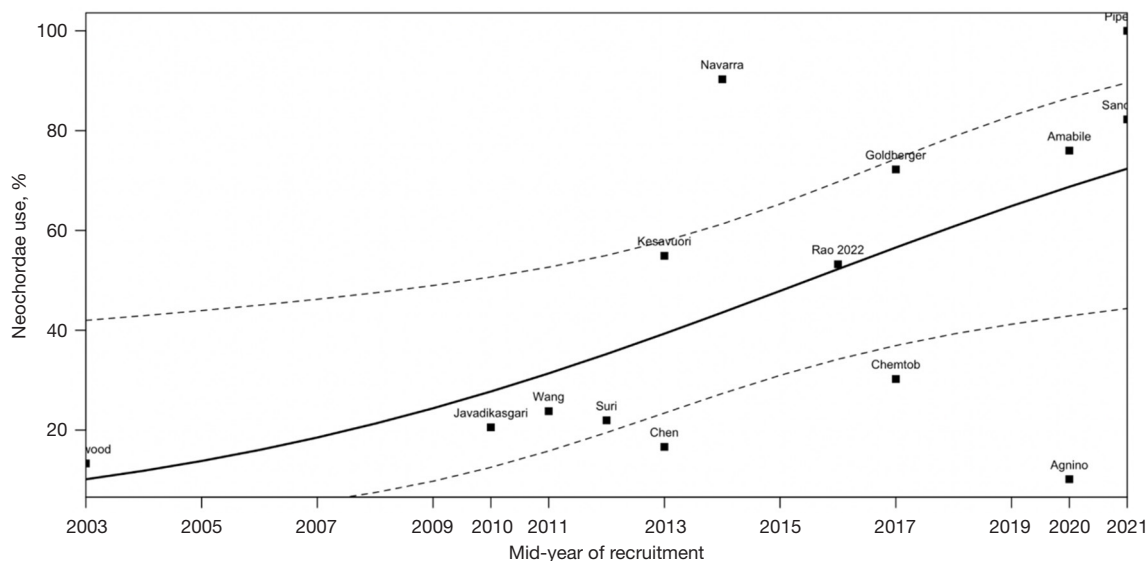


Figure 3 Meta regression of mid-recruitment year vs. use of neochordae.

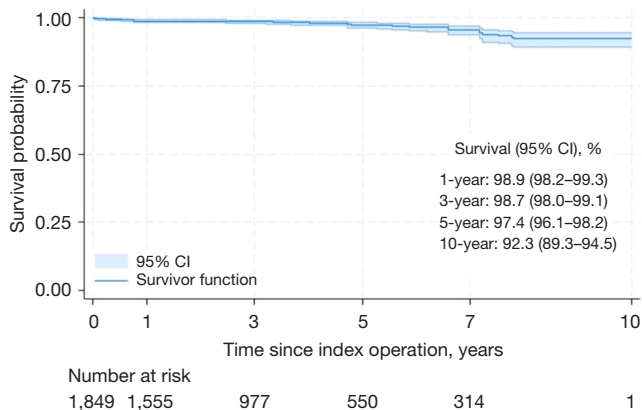


Figure 4 Kaplan-Meier curve for overall survival. CI, confidence interval.

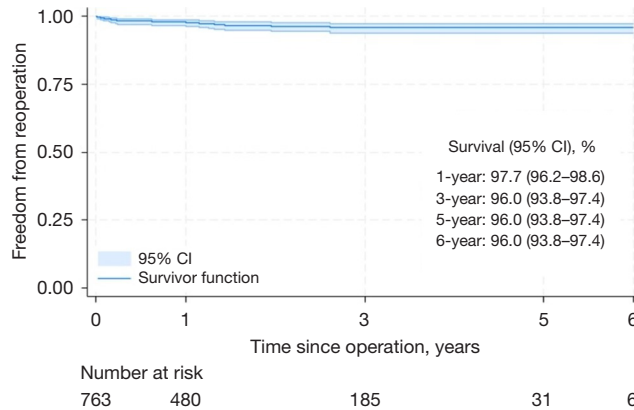


Figure 5 Kaplan-Meier curve for freedom from reoperation. CI, confidence interval.

red blood cell (RBC) use (6). The robotic platform also offers other benefits such as high-definition 3-dimensional visualization, magnification and increased precision enabled by the robotic instruments. As such, it is gaining in popularity with an increasing adoption of this minimally invasive technique. One of the disadvantages of robotic mitral valve surgery, especially within the context of cardiac surgery more broadly, is the steep learning curve. Sandoval and colleagues assessed that the turning point demarcating the end of the learning case is around 50 to 60 cases (20). This learning curve may contribute to the disparity in outcomes between “lower volume” and “higher volume

centers” however this is yet to be formally established (24). In the context of degenerative mitral valve disease, mitral valve repair remains the gold standard treatment (25). A robust repair bypasses the risks associated with prosthetic and mechanical valves and the need for anticoagulation. One of the issues assessing the robustness of the repair is the paucity of long-term echocardiographic follow-up data (26).

Our study assessing a robotic repair in degenerative mitral valve disease demonstrates a short-term mortality of 1%. This result was associated with low heterogeneity, suggesting that this finding was uniform across all included studies. This result echoes pre-existing systematic reviews

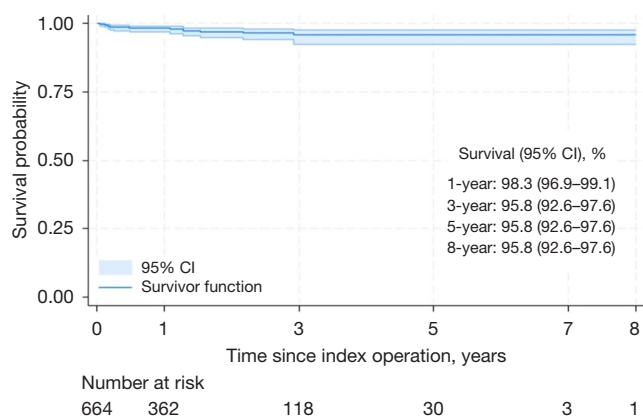


Figure 6 Kaplan-Meier curve for freedom from moderate or greater (2+) mitral regurgitation. CI, confidence interval.

demonstrating that RMVr is a safe procedure, whereby pooled mortality rates remain less than 1% (6,27). Additionally, our findings show that postoperative outcomes for major complications such as CVA, AKI, and reoperation for bleeding were all less than 2%. These findings again align with existing meta-analysis that highlight the robust safety profile of RMVr (28). We demonstrate a hospital LOS and an ICU LOS of 5.9 and 1.2 days respectively. These results are consistent with recent studies, reporting median hospital stays ranging from 5 to 7 days for robotic procedures, with ICU stays typically lasting between 1 and 2 days (29,30). When compared to open approaches, one of the key advantages of robotic mitral valve surgery remains lower postoperative pain and LOS. These are attributable to several factors inherent in the approach, including smaller incisions, reduced postoperative pain, and potentially fewer complications leading to a faster recovery (31).

Mid- to long- term outcomes of RMVr in degenerative disease remain satisfactory and also consistent with other surgical approaches. The aggregate survival at 5 years is 97.4%. This result is consistent with existing literature, with 5-year survival rates ranging from 94–97% in other systematic reviews (6,32). Our study also reported a 5-year freedom from reoperation and freedom from 2+ MR of 96% and 95.8% respectively. This is higher than previously reported, with a retrospective study by Kim *et al.* demonstrating a freedom from significant MR of 86.5% at 5 years (33). This paper, however, assessed a robotic approach to all mitral pathologies (including degenerative) in a Korean population. Our result is also in line with mid-term outcomes in mitral repair reported using a conventional sternotomy, whereby a prospective single

surgeon study of 840 cases demonstrated a re-operation rate of 2.7% and freedom from moderate/severe MR of 90% at 5 years (26). This highlights the robustness of robotic repair especially in the degenerative etiology. Further long-term follow-up with echocardiographic data is required to further elucidate these results.

The two main approaches for mitral valve repair are chordal replacement (“respect approach”) and leaflet resection (“resect approach”), sometimes utilizing both these methods. In addition to both these methods, an annuloplasty ring is required to stabilize the repair and improve leaflet coaptation and is utilized in almost all repairs (34). Our study noted that 47.1% of patients underwent leaflet resection and 46.1% of patients underwent neochordae implantation. Consistent with common practice, almost all (99.2%) patients underwent an annuloplasty. Leaflet preservation has demonstrated some superiority to leaflet resection in the short term, with a potentially lower pacemaker implantation rate and lower mean valvular gradients (35). Long-term propensity matched data provided by Holubec and colleagues suggest lower freedom from mitral valve re-operation and cardiac death at 10 years (36). This study only included 85 matched pairs of patients. The growing evidence for the non-resection technique suggests superiority due to preserved leaflet mobility, zone of coaptation and the ability to implant a larger prosthetic ring (36). Our study demonstrated a significant trend on meta-regression towards leaflet preservation with time ($P=0.015$), with more recent studies utilising a leaflet preservation repair technique. Long term randomized data is required to validate these results.

As alluded to, one of the major pitfalls of robotic mitral valve surgery is the learning curve associated with the procedure. Evidence suggests that mitral valve repair performed at larger, higher volume institutions is done so more safely (7). Mori *et al.* demonstrated mitral valve repair performed at institutions with more than 40 cases per annum had a mortality and morbidity rates that declined from 19.3% to 7.7% (7). As a surrogate for institution size, we analyzed the study cohort size and its effect on a composite endpoint of death, CVA, and re-operation for valve dysfunction. As such, there was a reduction in this composite endpoint in studies with larger population sizes and this result reached significance ($P=0.05$).

Limitations

This study is subject to several important limitations. Firstly,

the included studies were predominantly retrospective in nature, introducing inherent risks of selection and reporting bias. Patients selected for RMVr are often younger, have fewer comorbidities, and are deemed lower risk compared to those undergoing conventional or minimally invasive open approaches, thereby potentially inflating the apparent safety and efficacy of robotic surgery. The selection bias in this study is also evident in the number of patients with a history of AF or undergoing concurrent tricuspid valve repair which is lower than traditionally reported. This again alludes to strict patient selection; potentially misrepresenting the overall population with degenerative mitral valve disease. Secondly, the widespread heterogeneity in study design, institutional experience, and surgeon learning curves introduces additional variability that may confound pooled estimates. Reporting bias is also likely, as outcomes from high-volume centers with established robotic programs are more frequently published, whereas smaller institutions or those with less favourable results may remain underrepresented in the literature. In addition, inconsistent reporting of key operative and echocardiographic follow-up data limited the ability to perform granular subgroup analyses, particularly regarding long-term durability of repair. These factors collectively underscore the need for prospective, multicenter studies with standardised reporting frameworks to better delineate the true outcomes and generalizability of robotic repair for the degenerative mitral valve.

Conclusions

Our long-term data expand on prior literature, showing favorable survival and durability after RMVr for degenerative mitral disease, with high freedom from reoperation and recurrent $\geq 2+$ MR. Short-term mortality and operative complications were low and corresponded with contemporary series, reinforcing perioperative safety. The demonstrated shift toward the leaflet-preserving neochordae technique and improving center experience suggest that this safety and durability may be attributed to advancements in surgical proficiency. To confirm generalizability, prospective studies with standardized echocardiographic follow-up are needed.

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Footnote

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Conflicts of Interest: The authors have no conflicts of interest to declare.

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