Mitral valve repair in a regional quality collaborative: Respect or resect?

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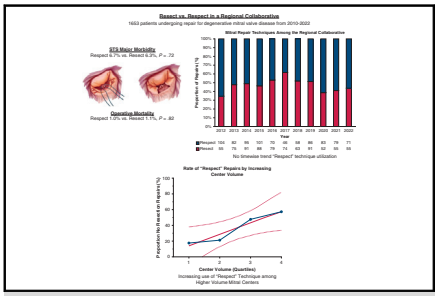
ABSTRACT

Objective: Mitral valve repair is the gold standard for treatment of mitral regurgitation, but the optimal technique remains debated. By using a regional collaborative, we sought to determine the change in repair technique over time.

Methods: We identified all patients undergoing isolated mitral valve repair from 2012 to 2022 for degenerative mitral disease. Those with endocarditis, transcatheter repair, or tricuspid intervention were excluded. Continuous variables were analyzed via Wilcoxon rank sum, and categorical variables were analyzed via chi-square testing.

Results: We identified 1653 patients who underwent mitral valve repair, with 875 (59.2%) undergoing a no resection repair. Over the last decade, there was no significant trend in the proportion of repair techniques across the region ($P = .96$). Those undergoing no resection repairs were more likely to have undergone prior cardiac surgery (5.0% vs 2.2%, $P = .002$) or minimally invasive approaches (61.4% vs 24.7%, $P < .001$) with similar predicted risk of mortality (median 0.6% vs 0.6%, $P = .75$). Intraoperatively, no resection repairs were associated with longer bypass times (140 [117-167] minutes vs 122 [91-159] minutes, $P < .001$). Operative mortality was similar between both groups (1.1% vs 1.0%, $P = .82$), as were other postoperative outcomes. Anterior leaflet prolapse (odds ratio, 11.16 [6.34-19.65], $P < .001$) and minimally invasive approach (odds ratio, 6.40 [5.06-8.10], $P < .001$) were most predictive of no resection repair.

Conclusions: Despite minor differences in operative times, statewide over the past decade there remains a diverse mix of both classic "resect" and newer "respect" strategies with comparable short-term outcomes and no major timewise trends. These data may suggest that both approaches are equivocal. (JTCVS Techniques 2024;24:66-75)



There remains a diverse mix of the "resect" and "respect" approach to MVr.

CENTRAL MESSAGE

Despite some suggesting a "respect" approach to MVr, both techniques resulted in similar 30-day outcomes with no trends in technique use.

PERSPECTIVE

The optimal repair technique for the mitral valve remains debated, with some experts advocating for no resection repairs. From a regional collaborative, we did not find a timewise trend over the last decade in preference toward no resection repairs in isolated mitral repair. Morbidity and mortality were similar between groups, suggesting no clear advantage to either technique.

Mitral valve repair (MVr) is the gold standard for the treatment of degenerative mitral valve disease.[1-3] MVr has been shown to fully restore age- and sex-matched life expectancy and improve quality of life for these patients who would otherwise experience high mortality and frequent cardiac events.[2,4-6] The MVr techniques currently used aim to

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Abbreviations and Acronyms
MVr = mitral valve repair
OR = odds ratio

optimize leaflet coaptation and strengthen the valve annulus, and can be broadly categorized into no resection (respect) or leaflet resection (resect) techniques.[7]

The respect approach involves resuspending portions of prolapsed leaflets with artificial "neochordae" alone, whereas the resect approach involves resecting areas of prolapsed leaflet and suturing the remaining portions together, with or without concomitant implantation of neochordae.[3] There is no current consensus in the literature to support the routine use of one of these techniques over the other; however, several studies favor the respect approach due to higher rates of successful repair.[7-11] Additionally, a recent meta-analysis by Sá and colleagues[7] suggested that leaflet-sparing techniques were not only associated with lower perioperative mortality but also may result in less valve stress and better durability. Despite this evidence, some authors have continued to advocate for a tailored case-specific approach,[12,13] echoing the sentiment originally described by Dreyfus and colleagues to "respect when you can, resect when you should."[14] Because there appears to be a discrepancy between what the data suggest in this recent meta-analysis and prevailing opinions in the field, we sought to understand the trends in surgical technique use in MVr.

By using a regional collaborative of 17 participating hospitals, we sought to determine the trends in use of either technique over time, the associated short-term outcomes for each technique, and preoperative predictors of technique use. We hypothesized that given evidence of no resection techniques providing a possible long-term advantage, this technique would be increasing in use throughout the collaborative over time.

MATERIAL AND METHODS

Patients

By using the Virginia Cardiac Services Quality Initiative, Society of Thoracic Surgeons Adult Cardiac Surgery Database, the data of all patients from January 2012 to August 2022 who underwent MVr for degenerative mitral valve disease were identified. Standard Society of Thoracic Surgeons definitions were used for all variables. Patients with endocarditis, patients undergoing tricuspid interventions, and patients undergoing transcatheter or percutaneous mitral valve interventions were excluded. Patients with pure annular dilation without leaflet prolapse and patients with no mention of any leaflet prolapse were excluded.

Leaflet resection techniques were defined as any MVr that required resection of anterior or posterior mitral valve leaflet tissue including triangular or quadrangular resections or sliding plasty techniques. If patients did not undergo leaflet resection, they were categorized into the no resection repair group. An additional sensitivity analysis stratified by type of leaflet prolapse was also performed. This study was approved by the University of Virginia's Institutional Review Board (#23305, July 14, 2021).

Statistical Analysis

Continuous variables were presented as medians with interquartile range and analyzed via Wilcoxon rank-sum test. Categorical variables were analyzed via chi-square testing or Fisher exact testing depending on expected counts. Analysis of variance testing was used to compare multiple means with Bonferroni adjustment. Logistic regression was used to determine independent predictors of technique use with graphical demonstration via Forest plot. Variables for logistic regression were chosen on the basis of significance on univariate analysis and clinical relevance. Linear regression was used to determine any significant increasing trend over time with one technique over another. Center volume was used as a continuous variable to determine any specific technique use trends among higher-volume mitral repair centers, and surgeon volume was categorized. Categories with missing data of less than 10% were imputed using median value for continuous variables and the most common value for categorical variables. All statistical analyses were carried out using SAS Version 9.4 (SAS Institute, Inc).

RESULTS

Population Characteristics

From 2012 to 2022, there were a total of 2641 patients who underwent MVr. After exclusions, we identified 1653 patients who underwent MVr for degenerative mitral regurgitation (Figure E1), with 52.9% (875) undergoing a no resection repair and 47.1% (778) undergoing a leaflet resection approach. Linear regression did not demonstrate a timewise trend in the use of the no resection repair compared with leaflet resection (Figure 1; $P = .96$). There was significant variation from center to center regarding proportion of different technique use (Figure 2). When categorizing centers into quartiles for volume of mitral repairs, there was a significant trend toward a higher proportion of no resection repairs with increasing center volume ($R^2 = 0.92$, $P = .04$) (Figure 3), although there was no significant trend when categorizing surgeon volume into quartiles for one technique use over another ($R^2 = 0.41$, $P = .36$) (Figure 4). Table 1 contains a list of preoperative characteristics between the groups. Patients undergoing a no resection repair were of similar ages (63 [54-70] years vs 62 [55-70] years, $P = .95$) and body mass index (26.6 kg/m^2 [23.6-30.1] vs 26.3 kg/m^2 [23.2-30.3], $P = .36$) compared with patients undergoing leaflet resection. Patients undergoing no resection repair were more often female (38.3% vs 32.9%, $P = .02$) and African American (11.4% vs 7.8%, $P = .01$), and had lower rates of hypertension (53.9% vs 59.0%, $P = .02$) and similar median predicted risk of mortality (0.6% [0.3%-1.1%] vs 0.6% [0.3%-1.0%], $P = .75$). More patients undergoing no resection repairs were done through a minimally invasive approach (61.4% vs 24.7%, $P < .001$) and had anterior leaflet prolapse (12.2% vs 2.1%, $P < .001$) and bileaflet prolapse (24.0% vs 11.3%, $P < .001$), whereas resection repairs more often had posterior prolapse (63.8% vs 86.6%, $P < .001$). The rate of atrial ablation was similar between groups (35.2% vs 35.0%, $P = .92$), although the no resection group had a lower rate of left atrial appendage ligation (25.7% vs

31.4%, $P = .011$). A history of cardiac surgery was also higher in the no resection repair group (5.0% vs 2.2%, $P = .002$). Intraoperative patient characteristics are listed in Table 2. No resection repairs were associated with longer cardiopulmonary bypass times (140 minutes [117-167] vs 122 minutes [91-159], $P < .001$), longer crossclamp times (101 minutes [83-119] vs 86 minutes [64-113], $P < .001$), higher number of artificial chordae placed (4 [2-4] vs 1 [1-3], $P < .001$), larger implant size (34 mm [31-36] vs 32 mm [30-34]), more frequent use of edge-to-edge repair technique (14.7% vs 6.7%, $P < .001$), and less band annuloplasty use (24.5% vs 29.3%, $P = .03$).

Postoperative Outcomes

In the postoperative period, patients undergoing a no resection repair had comparable outcomes, including rate of stroke (0.8% vs 0.4%, $P = .35$), renal failure (1.3% vs 0.9%, $P = .48$), reoperation for bleeding (1.6% vs 1.8%, $P = .75$), and pneumonia (0.9% vs 1.0%, $P = .81$) (Table 2). Patients undergoing a no resection repair had a lower rate of reoperation for valve dysfunction (0.0% vs 0.6%, $P = .02$) and lower rate of postoperative atrial fibrillation (20.7% vs 25.2%, $P = .03$). There was no difference in ventilator hours (4.3 hours [3.2-6.8] vs 4.5 hours [3.4-6.4 hours], $P = .19$), although a shorter length of intensive care unit stay (29 hours [22-69] vs 45 [24-71], $P < .001$) and shorter length of hospital stay (5 [4-6] vs 5 [4-7] days, $P < .001$) in patients undergoing a no resection repair. Operative mortality was similar between no resection repair and leaflet resection approaches (1.1% vs 1.0%, $P = .82$), with similar rates of discharge to home after surgery (92.1% vs 91.1%, $P = .82$). There were no differences in the rate of readmission between the groups (6.5% vs 6.4%, $P = .94$). All postoperative outcomes are shown in Table 2.

Sensitivity Analysis With Stratification by Leaflet Prolapse

Of the cohort, 1232 patients (74.5%) presented with posterior leaflet prolapse, 297 patients (18.0%) presented with bileaflet prolapse, and 124 patients (7.5%) presented with anterior leaflet prolapse (Table E1). Leaflet resection most often occurred in posterior prolapse compared with bileaflet and anterior prolapse, respectively (54.7% vs 29.3% vs 13.7%, $P < .001$). The most common resection technique was triangular resection (36.9% vs 11.8% vs 8.9%, $P < .001$). Ring annuloplasty was the most often used annulus stabilization technique in all forms of prolapse (69.2% vs 80.5% vs 74.2%, $P < .001$), with band annuloplasty occurring less often although significantly more in the case of posterior prolapse or anterior leaflet prolapse compared with bileaflet prolapse (29.3% vs 17.5% vs 23.4%, $P < .001$). Mitral implant size was significantly larger in bileaflet prolapse compared with anterior leaflet prolapse (34 mm [30-34] vs 32 mm [30-34], $P = .003$) and posterior leaflet prolapse compared with anterior leaflet prolapse (33 mm [30-36] vs 32 mm [30-34], $P = .003$). Artificial chordae use was highest among patients with anterior leaflet prolapse (40.3% vs 39.7% vs 61.3%, $P < .001$), with a higher number of median chords used in patients with posterior prolapse or

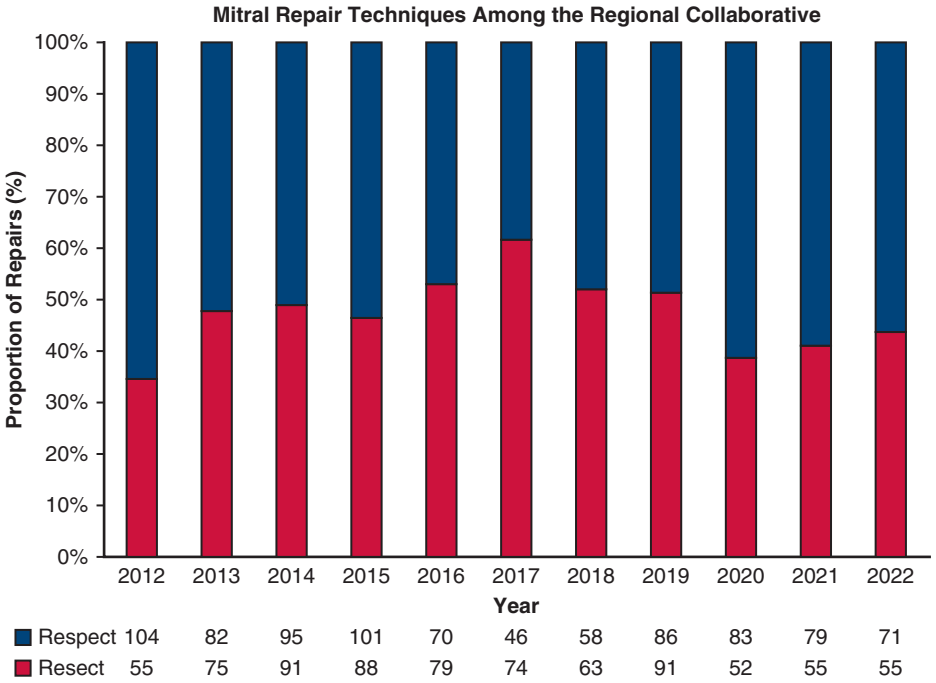

FIGURE 1. Time trend of technique use over last decade. Linear regression with P value = .96.

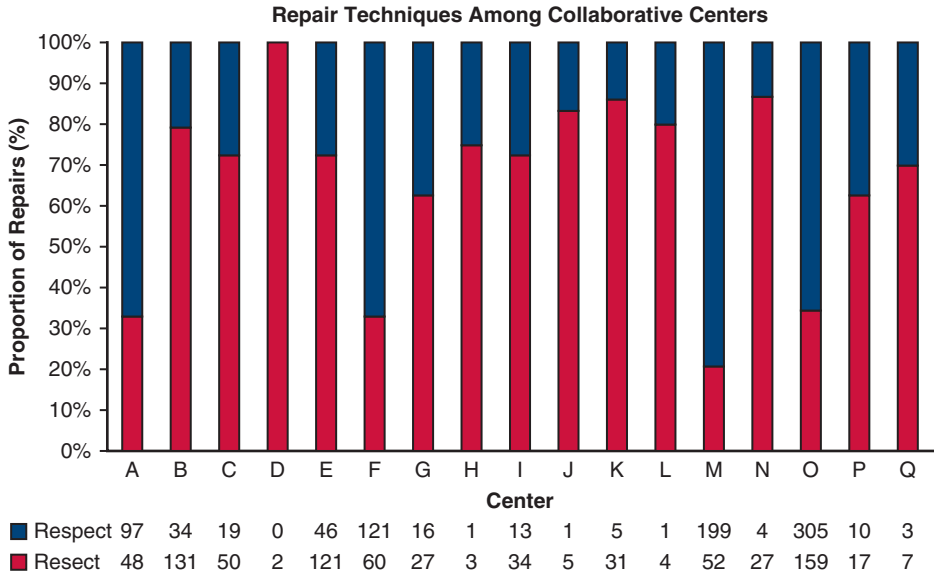

FIGURE 2. Repair technique proportions by centers A to Q.

bileaflet prolapse compared with anterior prolapse (4 [2-4] vs 4 [2-4] vs 2 [1-3], $P = .003$) if artificial chordae were used in the case. There was no difference in age or acuity of operation between the groups, although there was a significant difference in the proportion of female patients with bileaflet prolapse compared with posterior and anterior prolapse (33.0% vs 46.4% vs 37.9%, $P < .001$).

Risk-Adjusted Associations

A variety of preoperative characteristics were included in the logistic regression analysis based on significance on univariate analysis and known clinical contributions with graphical demonstration via Forest plot (Figure 5). Anterior leaflet prolapse (odds ratio [OR], 11.16 [6.34-19.65], $P < .001$), minimally invasive approaches (OR, 6.40 [5.06-8.10], $P < .001$), bileaflet prolapse (OR, 3.65 [2.70-4.94], $P < .001$), and history of cardiac surgery (OR, 2.37 [1.24-4.52], $P = .009$) were found to be associated with use of a no resection approach (Table E2).

DISCUSSION

Through use of a regional collaborative capturing 99% of adult cardiac surgeries in the commonwealth of Virginia, we did not find a timewise trend in the use of the "respect" MVr technique over the past decade. Additionally, 30-day outcomes between the 2 groups were similar including

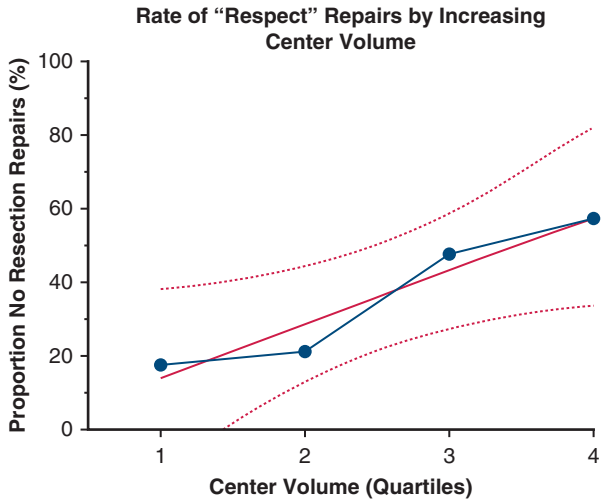

FIGURE 3. Increasing center volume of mitral repairs by quartiles with proportion of "respect" technique. $R^2 = 0.92$, $P = .04$.

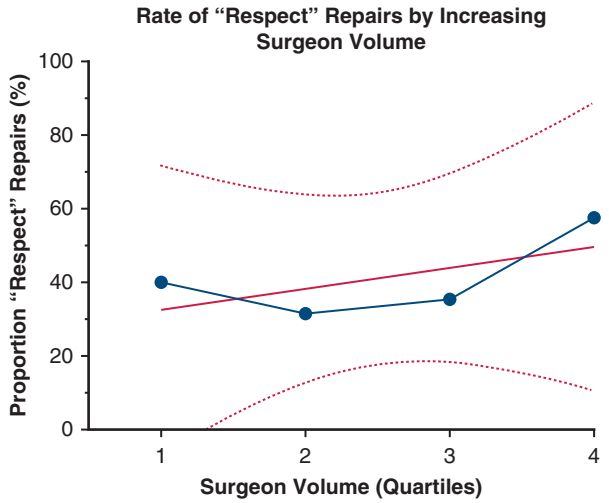

FIGURE 4. Increasing surgeon volume in quartiles with proportion of "respect" technique. $R^2 = 0.41$, $P = .36$.

TABLE 1. Univariate analysis of baseline demographics and characteristics

	Respect (n = 875)	Resect (n = 778)	*P* value
Age (y)	63 [54-70]	62 [55-70]	.95
Body mass index (kg/m^2)	26.6 [23.6-30.1]	26.3 [23.2-30.3]	.36
Female	335 (38.3%)	253 (32.9%)	.02
African American	100 (11.4%)	61 (7.8%)	.01
Hemoglobin A1c	5.4% [5.2-5.7%]	5.4% [5.2-5.7%]	.20
Median predicted risk of mortality or morbidity	7.7% [5.5-11.7%]	7.7% [5.6-11.0%]	.66
Median predicted risk of mortality	0.6% [0.3-1.1%]	0.6% [0.3-1.0%]	.75
Preoperative albumin	4.1 [3.8-4.4]	4.0 [3.8-4.4]	.054
Prior heart failure	174 (19.9%)	138 (17.7%)	.27
Chronic lung disease	171 (19.5%)	136 (17.5%)	.28
Diabetes	82 (9.4%)	56 (7.2%)	.11
Dyslipidemia	333 (38.1%)	325 (41.8%)	.12
Home oxygen	15 (1.7%)	6 (0.8%)	.09
Hypertension	472 (53.9%)	459 (59.0%)	.04
Preoperative dialysis	5 (0.6%)	1 (0.2%)	.73
Elective status	822 (93.9%)	704 (90.5%)	.009
Atrial fibrillation or atrial flutter	447 (51.1%)	385 (49.5%)	.52
Atrial ablation	308 (35.2%)	272 (35.0%)	.92
LAAL	225 (25.7%)	244 (31.4%)	.011
Atrial ablation or LAAL	328 (42.2%)	328 (38.9%)	.17
Minimally invasive approach	537 (61.4%)	192 (24.7%)	<.001
Thoracotomy	535 (99.6%)	183 (95.3%)	
Hemi-sternotomy	1 (0.2%)	3 (1.6%)	
Port access	1 (0.2%)	6 (3.3%)	
Prior cardiac surgery	44 (5.0%)	17 (2.2%)	.002
Prior mitral surgery	6 (0.7%)	4 (0.5%)	.65
Posterior prolapse	558 (63.8%)	674 (86.6%)	<.001
Anterior prolapse	107 (12.2%)	16 (2.1%)	<.001
Bileaflet prolapse	210 (24.0%)	88 (11.3%)	<.001

LAAL, Left atrial appendage ligation.

major morbidity and mortality, although there was a slightly higher rate of reoperation for valve dysfunction in the leaflet resection group.

The optimal technique for MVr remains debated with new schools of thought suggesting no resection repairs may provide a larger area of coaptation and therefore reduce annular stress, allowing for a more durable repair. A recent meta-analysis by Sá and colleagues[7] evaluated more than 6000 patients and demonstrated the no resection repair approach to result in less risk of permanent pacemaker implantation and lower mean mitral valve gradients after surgery. Lower mean mitral valve gradients after surgery may influence annular stress over time and longer-term outcomes, although this has yet to be demonstrated. However, the authors agreed that technique use should be decided upon by a case-by-case basis to ensure the best possible repair.

Despite increasing interest in no resection repair techniques, we did not find evidence of a linear trend for no resection repair over resection repair, suggesting a mixture of the techniques across centers. Our study uniquely spans 10 years of mitral operations over a diverse cohort of cardiac surgical centers and does not suggest a trend toward one approach. This is further confirmed when looking at each center individually because the technique proportions vary substantially. Interestingly, there was a significant trend of the highest volume centers performing a larger proportion of no resection repairs. There may exist more patient referrals to higher-volume centers of patients with anterior or bileaflet prolapse pathology that might not

TABLE 2. Univariate analysis of intra and postoperative outcomes

Intraoperative and postoperative outcomes	Respect (n = 948)	Resect (n = 710)	*P* value
Crossclamp time (min)	101 [83-119]	86 [64-113]	<.001
Cardiopulmonary bypass time (min)	140 [117-167]	122 [91-159]	<.001
Implant size (mm)	34 [31-36]	32 [30-34]	<.001
Artificial chordae number	4 [2-4]	1 [1-3]	<.001
Edge-to-edge repair	129 (14.7%)	52 (6.7%)	<.001
Ring annuloplasty	644 (73.6%)	540 (69.4%)	.06
Band annuloplasty	214 (24.5%)	228 (29.3%)	.03
Total ventilator hours	4.3 [3.2-6.8]	4.5 [3.4-6.4]	.19
Total ICU hours	29 [22-69]	45 [24-71]	<.001
Reintubation	11 (1.3%)	5 (0.6%)	.20
Prolonged ventilation	35 (4.0%)	32 (4.1%)	.91
Readmission intensive care unit	19 (2.2%)	14 (1.8%)	.59
Deep sternal wound infection	0 (0.0%)	0 (0.0%)	>.99
Postoperative renal failure	11 (1.3%)	7 (0.9%)	.48
Postoperative dialysis	7 (0.8%)	5 (0.6%)	.78
Dialysis after discharge	1 (0.1%)	0 (0.0%)	>.99
Postoperative permanent pacemaker	13 (1.5%)	15 (1.9%)	.49
Permanent stroke	7 (0.8%)	3 (0.4%)	.35
Postoperative atrial fibrillation	181 (20.7%)	196 (25.2%)	.03
Postoperative pneumonia	8 (0.9%)	8 (1.0%)	.81
Reoperation for bleeding	14 (1.6%)	14 (1.8%)	.75
Reoperation for valve dysfunction	0 (0.0%)	5 (0.6%)	.02
Length of stay (d)	5 [4-6]	5 [4-7]	<.001
Operative mortality	10 (1.1%)	8 (1.0%)	.82
Readmission	57 (6.5%)	50 (6.4%)	.94
Discharge to home	806 (92.1%)	709 (91.1%)	.47

ICU, Intensive care unit.

warrant a resection. Anterior prolapse is traditionally a more difficult form of mitral regurgitation to repair; therefore, these patients may have increased referral to higher-volume centers. Additionally, this technique occurred more often in minimally invasive approaches that are typically only performed by more experienced mitral surgeons and centers with teams dedicated to this approach.

Unsurprisingly, no resection repairs were strongly associated with anterior leaflet prolapse, whereas leaflet resection approaches were associated with posterior prolapse. Resection of the anterior leaflet is rarely performed in the setting of mitral valve prolapse. However, the main question remains about management of the posterior leaflet and whether or not leaflet resection techniques are still the most appropriate to perform compared with preservation techniques using solely neochordae placement. Koprivanac and colleagues[15] suggest their preferred approach to the posterior leaflet is resection of the prolapsing segment in the setting of small, prolapsing segments. The authors use artificial chordae in the setting of larger segment prolapses or multisegment prolapses of the posterior leaflet. Mazine and colleagues[16] performed a meta-analysis looking at isolated P2 prolapse and the ideal approach to this pathology. Similar to our study, they found that either technique resulted in similar freedom from mitral regurgitation and comparable short-term outcomes. The rate of recurrent moderate or severe mitral regurgitation on variable degrees of follow-up was similar between groups, although on unadjusted analysis, leaflet-sparing repairs with neochordae had a lower rate of reoperation.

One randomized trial looked at posterior leaflet prolapse in minimally invasive repairs using either neochordae versus leaflet resection and use of a complete annuloplasty ring for all patients.[10] Repair was successful in both groups with no difference in operative times. Echocardiographic data demonstrated a larger area of coaptation in the neochordae group with no differences in morbidity or mortality. The effective orifice area was similar between groups on echocardiographic follow-up at 1 year postdischarge. The authors again suggested longer-term follow-up would be

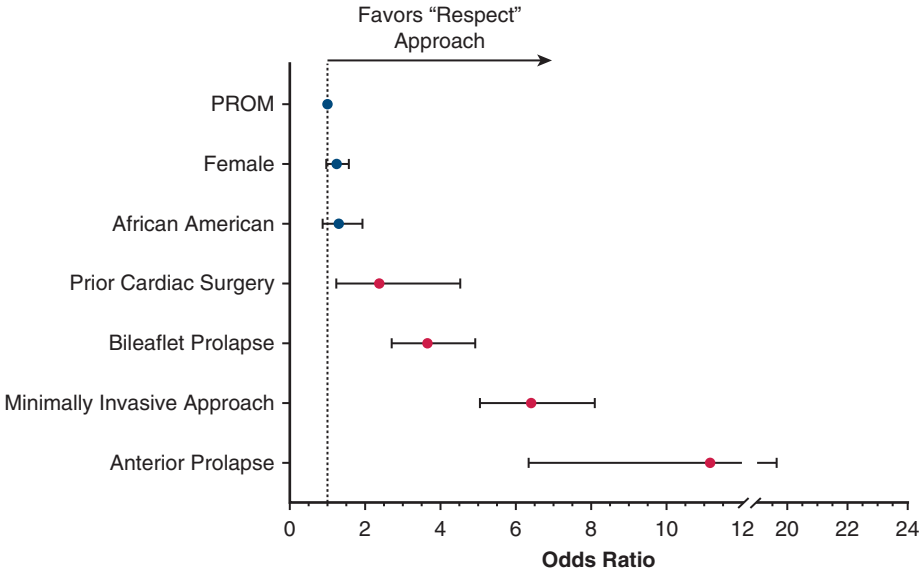

FIGURE 5. Forest plot of no resection repair technique predictors from multivariable logistic regression. *PROM*, Predicted risk of mortality.

necessary to determine any differences in patient outcomes including recurrence of mitral regurgitation and need for reoperation.

Ragnarsson and colleagues[17] presented a longer follow-up study of resect versus respect in the setting of isolated posterior leaflet prolapse with a median time of 5.3 years. Again, they demonstrated no difference in short-term morbidity or mortality and excellent survival and freedom from reoperation at 5-year follow-up in both techniques. The longest reported follow-up study of artificial neochordae use arises from Salvador and colleagues,[18] which spanned 20 years of follow-up. The authors looked at all-comers for mitral valve prolapse and demonstrated that artificial neochordae use had excellent survival and freedom from valve-related complications. Previously, the leaflet resection technique had demonstrated excellent long-term outcomes with data spanning greater than 20 years with excellent survival and freedom from reoperation for valve-related complications.[19]

No resection repairs were associated with longer cardiopulmonary bypass and crossclamp times in our study. This is in part confounded by the fact this approach was more often done in patients with a history of cardiac surgery and through minimally invasive approaches, which are known to have longer operative times.[20] Additionally, anterior leaflet and bileaflet prolapse may complicate the intraoperative repair adding to crossclamp and bypass times. However, this did not result in inferior outcomes to leaflet resection with similar 30-day outcomes and resolution of mitral regurgitation, and even a statistically significant reduction in intensive care unit and hospital length of stay, although not necessarily clinically significant. We also found that the use of the Alfieri edge-to-edge technique was used more often in the no resection repair approach. The Alfieri stitch is most often used in the setting of Barlow's disease which may present with bileaflet prolapse or multiple prolapsing segments. Our no resection repair cohort presented more often with bileaflet prolapse and this is likely the reason for undergoing the Alfieri stitch more often. No resection repair approaches were more often associated with less use of a band annuloplasty ring as opposed to a complete ring. This may be related to surgeon preference given that higher-volume surgeons tended to use the no resection repair approach and therefore may always use complete annuloplasty rings in their practice.

MVr can be a complex operation depending on patient etiology and anatomic factors. Therefore, a one size fits all approach may not apply to every case and a more tailored approach is warranted. Additional items to consider, such as the prevention of systolic anterior motion, should be considered with MVr. Posterior leaflet resections may be indicated to prevent left ventricular outflow tract obstruction from a larger posterior leaflet; therefore, it may not always be feasible to "respect" the posterior leaflet. The main objective for this operation is to resolve the mitral regurgitation, prevent systolic anterior motion, and stabilize the annulus. Thus, a surgeon's approach must accomplish these tasks regardless of which technique is used. Our study presents a large number of patients from a diverse number of centers that may allow for a more generalizable conclusion on technique use. It also suggests that either technique can result in resolution of mitral regurgitation with excellent freedom from short-term morbidity or mortality.

Study Limitations

There are limitations to the present study. Because of the retrospective nature of the study, there is risk of unmeasured confounding. There remains a lack of long-term follow-up

that may be necessary to elucidate the superiority of one approach over the other given the similarities in short-term outcomes between the groups. The lack of echocardiographic follow-up also limits the strength of the conclusions. Finally, these results may not apply to other practices or collaboratives, although the commonwealth of Virginia is a socioeconomically diverse region with multiple academic and private hospitals.

CONCLUSIONS

MVr remains the gold standard for the treatment of degenerative mitral valve disease; therefore, identification of the optimal repair technique is crucial to patient outcomes. This study represents a large volume of mitral surgery across a socioeconomically diverse consortium of cardiac surgery centers with similar short-term outcomes between resect and respect approaches, suggesting a tailored approach to the mitral valve based on patient anatomy and other factors. Given the current data, surgeons should continue to use whichever technique they are most comfortable with that will result in eradication of mitral regurgitation. Studies with longer follow-up between the 2 techniques are required to identify the ideal approach for improved long-term results.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: leaflet preserving, leaflet resection, mitral repair techniques

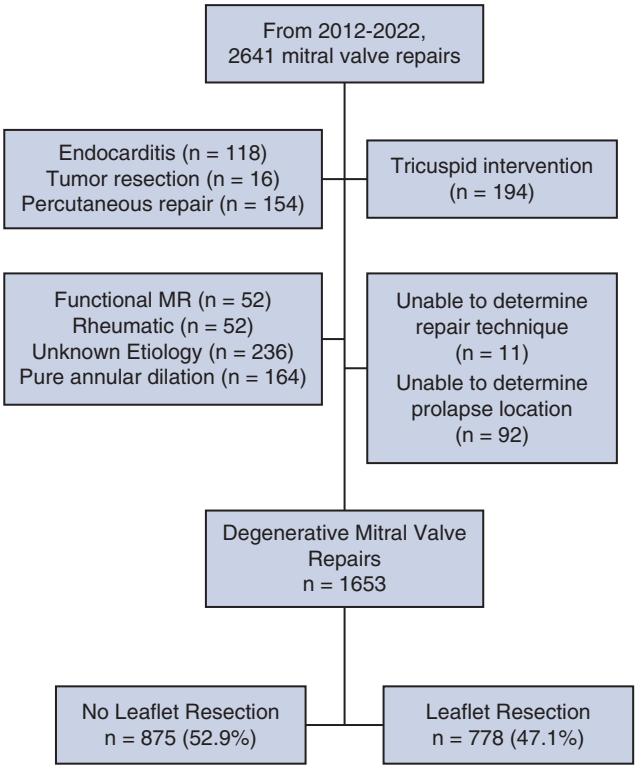

FIGURE E1. CONSORT diagram of patient cohort. *MR*, Mitral regurgitation.

TABLE E1. Analysis of technique use stratified by location of leaflet prolapse

Technique utilized	Posterior prolapse (n = 1232)	Bileaflet prolapse (n = 297)	Anterior prolapse (n = 124)	*P* value
Leaflet resection	674 (54.7%)	87 (29.3%)	17 (13.7%)	<.001
No leaflet resection	558 (45.3%)	210 (70.7%)	107 (86.3%)	<.001
Sliding plasty	106 (8.6%)	28 (9.4%)	0 (0.0%)	.002
Folding plasty	47 (3.8%)	11 (3.7%)	0 (0.0%)	.09
Ring annuloplasty	853 (69.2%)	239 (80.5%)	92 (74.2%)	<.001
Band annuloplasty	361 (29.3%)	52 (17.5%)	29 (23.4%)	<.001
Triangular resection	454 (36.9%)	35 (11.8%)	11 (8.9%)	<.001
Quadrangular resection	121 (9.8%)	26 (8.8%)	0 (0.0%)	.001
Other resection	100 (8.1%)	26 (8.8%)	6 (4.8%)	.38
Implant size (mm)	33 [30-36]	34 [30-38]	32 [30-34]	<.001
Artificial chordae use	497 (40.3%)	118 (39.7%)	76 (61.3%)	<.001
No. of artificial chordae used	4 [2-4]	4 [2-4]	2 [1-3]	.003
Prior mitral surgery	6 (0.5%)	2 (0.7%)	2 (1.6%)	.30
Minimally invasive approach	557 (45.2%)	127 (42.8%)	45 (36.3%)	.14
Age (y)	62 [55-70]	63 [53-70]	65 [55-72]	.46
Female	404 (33.0%)	137 (46.4%)	47 (37.9%)	<.001
Elective status	1137 (92.3%)	274 (92.3%)	115 (92.7%)	.98

TABLE E2. Multivariable logistic regression predictors of no resection approach

Predictors of no resection approach	Odds ratio	95% CI	*P* value
Anterior prolapse	11.16	[6.34-19.65]	<.001
Minimally invasive approach	6.40	[5.06-8.10]	<.001
Bileaflet prolapse	3.65	[2.70-4.94]	<.001
Prior cardiac surgery	2.37	[1.24-4.52]	.009
African American	1.30	[0.88-1.93]	.19
Female	1.24	[0.98-1.57]	.08
Predicted risk of mortality	1.01	[0.99-1.03]	.40