Mitral valve repair versus replacement in the elderly: Short-term and long-term outcomes

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Objective: To compare the short-term and long-term outcomes of mitral valve repair (MVP) versus mitral valve replacement (MVR) in elderly patients.

Methods: All patients, age 70 years or greater, with mitral regurgitation who underwent MVP or MVR with or without coronary artery bypass graft (CABG), tricuspid valve surgery, or a maze procedure between 2002 and 2011 were retrospectively identified. Patients with a rheumatic cause or who underwent concomitant aortic valve or ventricular-assist device procedures were excluded.

Results: Overall, 556 patients underwent MVP and 102 patients underwent MVR. The mean age of the patients in the MVR group was 78 years versus 77 years for those in the MVP group ($P < .02$). The patients in the MVR group had a better mean left ventricular ejection fraction than those in the MVP group (60% vs 55%, $P = .04$). The incidence of concomitant CABG, tricuspid valve operations, and atrial fibrillation ablation procedures was similar in both groups, but perfusion time was significantly longer for the MVR group (median 177 minutes vs 146 minutes for MVP, $P = .001$). Postoperatively, patients in the MVR group had a higher incidence of stroke (6% vs 2%, $P < .10$) and significantly longer intensive care unit stay (median 86 hours vs 55 hours, $P = .001$) and hospital stay (9 days vs 8 days, $P < .01$). Operative mortality of patients was significantly higher for the MVR group (8.8% vs 3.6%, $P = .03$) and remained significant long-term on Kaplan-Meier analysis. Cox regression analysis of all 658 patients and propensity-matched analysis of 96 patients also confirmed these results.

Conclusions: Elderly patients with mitral regurgitation who undergo MVP have better postoperative outcomes, lower operative mortality, and improved long-term survival than those undergoing MVR. MVP is a safe and more effective option for the elderly with mitral regurgitation. (J Thorac Cardiovasc Surg 2014;148:1400-6)

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Mitral regurgitation (MR) is becoming more common with the aging population in the United States.[1,2] However, because of the increased risk of mortality, these patients are often not considered for surgery.[3,4] Mitral valve valvuloplasty (MVP) has superior results compared with mitral valve replacement (MVR) both in short-term and long-term results in young patients.[5,6] Although some clinicians consider older patients to be poor surgical candidates for MVP because of potentially longer cardiopulmonary bypass (CPB) and ischemic times and difficulty of repair compared with valve replacement,[7,8] others do not.[9,10] Reconstruction of valvular apparati includes a combination of chordoplasty, posterior leaflet resection, sliding valvuloplasty, foldoplasty, commissuroplasty, Alfieri stitch repair, and/or annuloplasty with a complete or a partial ring, and therefore may require longer CPB times; elderly patients especially may not tolerate a failed repair.[7] Another factor is that elderly patients often have more friable or calcified tissues and poor preoperative ventricular function compared with younger patients, making repair technically more challenging, thereby increasing the risk of failure and/or need for reoperation.[7,11] The shorter life expectancy of elderly patients may decrease the benefit of MVP over MVR. There is also a belief that elderly patients have slower structural valve deterioration of bioprosthesis compared with the younger patients who receive MVR, which would lower the risk of reoperation.[12] A recent study from the Society of Thoracic Surgeons (STS) database showed that the overall repair rate in patients undergoing isolated mitral valve surgery was 61%,[2] but when limited to those older than 65 years of age, less than 50% received repair.[1]

The recent literature, however, suggests that the elderly benefit from the high success rates of MVP over MVR.[7,10,13] Benefits include avoiding foreign tissue, avoiding long-term anticoagulation, lower risks of hemolysis and infection, improved left ventricular (LV) remodeling with native tissue, and reduced operative morbidity and mortality.[7,14,15] Opponents still question the uncertainty of repair and its durability,[11,16] but

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Disclosures: Authors have nothing to disclose with regard to commercial support.
Received for publication Sept 5, 2013; revisions received Jan 7, 2014; accepted for publication Jan 24, 2014; available ahead of print Feb 28, 2014.
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0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2014.01.032

Abbreviations and Acronyms

CABG	= coronary artery bypass graft
COPD	= chronic obstructive pulmonary disease
CPB	= cardiopulmonary bypass
IABP	= intra-aortic balloon pump
ICU	= intensive care unit
IQR	= interquartile range
IRB	= Institutional Review Board
LOS	= length of stay
LV	= left ventricular
MR	= mitral regurgitation
MVP	= mitral valve repair
MVR	= mitral valve replacement
NYHA	= New York Heart Association
RBC	= red blood cell
STS	= Society of Thoracic Surgeons

long-term follow-up studies have demonstrated comparable survival and freedom from reoperation for the 2 surgical groups even after propensity-matched analysis.[7]

At the Brigham and Women's Hospital, we have been performing MVP regardless of age for both myxomatous and functional causes and the current study reports our experience with patients more than 70 years of age with MR undergoing MVP or MVR.

MATERIALS AND METHODS

Patient Selection

All patients, age 70 years or greater, who underwent MVP or MVR between 2002 and 2011 were retrospectively analyzed. A total of 1230 patients were identified. Patients undergoing mitral valve surgery for mitral stenosis or reoperative surgeries were excluded from the analysis. Patients undergoing concomitant aortic valve surgery, ascending aortic surgery, or ventricular-assist device placement were also excluded. However, patients undergoing concomitant coronary artery bypass grafting (CABG), tricuspid valve surgery, or ablation procedures for atrial fibrillation were included. A total of 658 of the 1230 patients met our selection criteria. This study was approved by the Institutional Review Board (IRB) of Brigham and Women's Hospital. Patient consent was waived by the IRB for this study.

Operative Strategy

All operations were performed using either full sternotomy or lower hemisternotomy. Arterial cannulation was performed centrally in all patients; venous cannulation was performed centrally in the full sternotomy group and peripherally by femoral vein for the hemisternotomy group. In this elderly population, epiaortic ultrasonography was used in all cases to avoid crossclamping a calcified aorta. Standard repair strategies were used such as leaflet resection, foldoplasty, and ring annuloplasty. Our previous article provides the details of the repair techniques used.[17]

Data Presentation and Analysis

Patient demographics and hospital outcomes were recorded at the time of presentation and coded according to the STS Adult Cardiac Surgery Database specifications, version 2.52. Our primary outcomes of interest included postoperative stroke, reoperation for bleeding, time in the intensive care unit (ICU, in hours), postoperative length of stay (LOS, in days), and operative mortality. Long-term survival was also evaluated. Mortality data were collected by routine patient follow-up and query of the Social Security Death Index.

Normally distributed continuous variables are presented as means and standard deviations. Nonnormally distributed continuous variables are presented as medians with interquartile ranges (IQR). Analyses of continuous variables was done using the Student *t* test with the Levine homogeneity of variance or Mann-Whitney *U* tests as appropriate. Dichotomous variables are presented as the number and percentage of cases, and were evaluated using the Fisher exact test. Survival and time to outcomes of interest were analyzed by Kaplan-Meier analysis. All statistical analyses were done using SPSS 13.0 (SPSS, Inc, Chicago, Ill).

Propensity-Matched Cohort

A matched group analysis was conducted using propensity-matched cases (MVR) and controls (MVP). Propensity scores were generated using logistic regression analyses, done in 2 steps. Variables for the logistic regression analysis were selected based on literature review, known covariates and confounders of the outcomes of interests, differences between the 2 patient groups (Table 1), and clinical judgment. A forward stepwise regression analyses was conducted, including examinations for interaction effects. An interaction variable between the surgeon and the year of surgery was included to control for differences in patient mix and comorbidity loads. Any variable with a *P* value of .15 or less was entered into a final model, which was an enter-method logistic regression. The resulting adjusted predicted probability for each patient was then used to select matched groups. Groups were matched using the following a priori algorithm: within a probability score less than .01, followed by age, gender, and previous cardiac surgery.

RESULTS

The final analysis included 658 patients: 556 patients who underwent MVP and 102 patients who underwent MVR. Total patient years of follow-up was 2811 years, with a median time per patient of 4.1 years (IQR, 1.6-6.8 years).

Preoperative Characteristics

As seen in Table 1, the patients in the MVR group were older than those in the MVP group (77.9 years vs 76.6 years, $P = .018$) and had a higher incidence of renal failure (15.5% vs 7.6%, $P = .019$) and cardiogenic shock (10.8% vs 2.5%, $P = .001$), although with a higher ejection fraction (median, 60% [IQR, 50%-65%] vs median, 55% [IQR, 40%-60%] $P = .042$). All other preoperative risk factors were similar between the 2 groups. There was significantly lower percentage of ischemic MR in the MVR group (16.7% vs 27.5% for MVP; $P = .026$) and higher percentage of endocarditis in the MVR group (8.8% vs 1.1%; $P = .001$). Distribution of the remaining causes were substantially similar.

Operative Outcomes

Table 2 shows the operative outcomes for the analysis. Of the 102 patients in the MVR group, 92.2% had a bioprosthetic valve implanted and 7.8% had a mechanical

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TABLE 1. Demographics of the 658 patients selected for the study

Characteristics	MVP (n = 556)	MVR (n = 102)	*P*
Age, mean (SD)	76.6 (4.6)	77.9 (5.2)	.018
>80 y, % (n)	28.6 (159)	36.3 (37)	.056
Women, % (n)	49.5 (275)	46.1 (47)	.590
Hypertension, % (n)	69.4 (386)	75.5 (77)	.239
Diabetes, % (n)	17.3 (96)	18.6 (19)	.777
Renal failure, % (n)	7.6 (42)	15.5 (16)	.019
History of arrhythmia, % (n)	22.7 (126)	18.6 (19)	.436
Previous CVA, % (n)	5.9 (33)	6.9 (7)	.656
PVD, % (n)	6.9 (38)	8.1 (8)	.842
Mild COPD, % (n)	11.7 (65)	15.7 (16)	.234
Moderate to severe COPD, % (n)	1.5 (8)	2.0 (2)	.658
NYHA class 1, % (n)	15.6 (87)	10.8 (11)	.064
NYHA class 2, % (n)	38.1 (212)	29.4 (30)	.094
NYHA class 3, % (n)	39.6 (220)	49.0 (50)	.083
NYHA class 4, % (n)	6.7 (37)	10.8 (11)	.148
Ejection fraction, median % (IQR)	55 (40-60)	60 (50-65)	.042
Cardiogenic shock, % (n)	2.5 (14)	10.8 (11)	.001
Preoperative IABP, % (n)	3.8 (21)	6.9 (7)	.178
Cause			
Ischemic, % (n)	27.5 (153)	16.7 (17)	.026
Functional, % (n)	14.7 (82)	20.6 (21)	.140
Myxomatous, % (n)	56.3 (313)	52.9 (54)	.588
Endocarditis, % (n)	1.1 (6)	8.8 (9)	.001
Other, % (n)	0.4 (2)	1.0 (1)	.397

MVP, Mitral valve repair; *MVR*, mitral valve replacement; *SD*, standard deviation; *CVA*, cerebrovascular accident; *PVD*, peripheral vascular disease; *COPD*, chronic obstructive pulmonary disease; *NYHA*, New York Heart Association; *IQR*, interquartile range; *IABP*, intra-aortic balloon pump.

TABLE 2. Operative characteristics of 658 patients undergoing MVP versus MVR

Operative characteristics	MVP (n = 556)	MVR (n = 102)	*P*
Urgent, % (n)	30.9 (172)	41.2 (42)	.054
Emergency/salvage, % (n)	2.5 (14)	7.8 (8)	.012
Bioprosthesis, % (n)		92.2 (94)	
Mechanical valve, % (n)		7.8 (8)	
CABG, % (n)	48.7 (271)	50.0 (51)	.830
Vessels operated, median (IQR)	3.0 (2-3)	2.0 (1-3)	.007
TVP, % (n)	16.9 (94)	25.5 (26)	.050
TVR, % (n)	0.2 (1)	1.0 (1)	1.000
Maze, % (n)	23.0 (128)	19.6 (20)	.998
Pulmonary vein isolation, % (n)	20.5 (114)	20.1 (21)	1.000
PFO, % (n)	8.5 (47)	4.9 (5)	.316
Perfusion time, median min (IQR)	146 (106-173)	177 (125-219)	.001
Crossclamp time, median min (IQR)	96 (73-126)	124 (95-155)	.001
Intraoperative IABP, % (n)	3.2 (18)	1.0 (1)	.336
Transfused with RBCs, % (n)	23.6 (131)	29.4 (30)	.212

MVP, Mitral valve repair; *MVR*, mitral valve replacement; *CABG*, coronary artery bypass graft; *IQR*, interquartile range; *TVP*, tricuspid valvuloplasty; *TVR*, tricuspid valve replacement; *PFO*, patent foramen ovale; *IABP*, intra-aortic balloon pump; *RBC*, red blood cell.

valve. Conversion from MVP to MVR occurred in 10 patients (9.8%). Rates of concomitant CABG and tricuspid valve surgery were similar between the 2 groups. In the operating room, both aortic crossclamp time (124 minutes [IQR 95-155 minutes] for MVR vs 96 minutes [IQR= 73-126 minutes] for MVP) and CPB time (177 minutes [IQR, 125-219 minutes] for MVR vs 146 minutes [IQR, 106-173 minutes] for MVP) were significantly longer in the MVR group (each $P < .001$). Intraoperative intra-aortic balloon pump was placed in 3.2% of the MVP group and 1.0% of the MVR group ($P = .336$). Intraoperative red blood cell transfusion did not differ between the 2 groups. There were no atrioventricular dissociations reported in either group.

Postoperative Outcomes

Table 3 shows the postoperative outcomes for this series. Patients in the MVR group experienced longer ventilation times than those in the MVP group (11.2 hours [IQR 8-22 hours] vs 9.5 hours [IQR 6-16 hours]; $P = .007$) and more patients required prolonged ventilation greater than 24 hours (23.5% vs 15.3%; $P = .043$). The incidence of blood transfusion for the patients in the MVR group was higher (52.9%) than those in the MVP cohort (40.1%; $P = .017$) and those in the MVR cohort also showed a higher trend toward postoperative stroke (5.9% vs 2.3%; $P = .098$). There were no atrioventricular dissociations in either group. Time in the ICU (86 hours [IQR 48-155 hours] vs 55 hours [IQR, 36-95 hours]; $P < .001$) and LOS (9 days [IQR 7-16 days] vs 8 days [IQR 7-12 days]; $P = .008$) were both significantly longer for the MVR cohort than the MVP cohort, respectively. Perioperative mortality for patients in the MVR group was significantly higher at 8.8% (9/102) than the 3.6% (20/556) for patients in the MVP group ($P = .031$).

Case-Control Analysis

To control for inherent differences in the MVR versus MVP populations, a case-control analysis was performed

TABLE 3. Postoperative outcomes of 658 patients undergoing MVP versus MVR

Postoperative outcomes	MVP (n = 556)	MVR (n = 102)	*P*
Operative mortality, % (n)	3.6 (20)	8.8 (9)	.031
Reoperation for bleeding, % (n)	2.5 (14)	2.0 (2)	1.000
Permanent stroke, % (n)	2.3 (13)	5.9 (6)	.098
Heart block, % (n)	2.0 (11)	2.0 (2)	1.000
New onset AF, % (n)	30.0 (167)	27.5 (28)	.639
Transfused with RBCs, % (n)	40.1 (223)	52.9 (54)	.017
Ventilation time, median h (IQR)	9.5 (6-16)	11.2 (8-22)	.007
Ventilation >24 h, % (n)	15.3 (85)	23.5 (24)	.043
ICU stay, median h (IQR)	55 (36-95)	86 (48-155)	.001
Postoperative LOS, median d (IQR)	8 (7-12)	9 (7-16)	.008

MVP, Mitral valve repair; *MVR*, mitral valve replacement; *AF*, atrial fibrillation; *RBC*, red blood cell; *ICU*, intensive care unit; *LOS*, length of stay; *IQR*, interquartile range.

using propensity scores to select study pairs. Using preoperative variables from Table 1, with an interaction term for year of surgery and surgeon, logistic regression analyses were conducted using MVR as the dependent variable, to derive predicted scores for each individual. The resulting model was moderately robust (C-statistic = 0.731). A total of 96 patients in the MVR group were matched within 0.01 places on predicted group scores to corresponding patients in the MVP group (94.1% match).

Table 4 shows the resulting demographics, operative statistics, and postoperative outcomes. The resulting cohorts were substantially similar for all preoperative variables including renal failure, cardiogenic shock, and ischemic and endocarditis cause. Six patients in the MVR group underwent conversion from MVP (6.3%). With 192 patients, this analysis was underpowered to examine low-frequency postoperative outcomes meaningfully. However, perfusion time (142 minutes [IQR, 106-186 minutes] for MVP vs 165 minutes [IQR 125-216 minutes] for MVR; $P = .003$), crossclamp time (95 minutes [IQR, 73-131 minutes] for MVP vs 123 minutes [IQR, 95-155 minutes for MVR; $P < .001$), and ICU stay (61 hours [IQR, 42-93 hours] for MVP vs 96 hours [IQR, 49-161 hours]; $P = .002$) remained significantly longer for patients in the MVR group.

Long-Term Outcomes

A Kaplan-Meier analysis of long-term survival revealed a benefit for MVP over MVR amongst the elderly ($P = .005$, Figure 1, *A*). As concomitant CABG can affect perfusion times and underlying LV function and therefore patient outcome, we compared survival between the 2 groups after excluding those who had undergone simultaneous CABG, and obtained similar results with the MVP group outperforming the MVR group, demonstrating a significant long-term survival benefit associated with patients undergoing MVP ($P < .001$, Figure 1, *B*).

Myxomatous Subgroup

Next, we isolated out the myxomatous patients in the matched set: 55 MVP and 52 MVR for subgroup analysis. The benefits of shortened perfusion time (131 minutes [IQR, 97-180 minutes] for MVP vs 170 minutes [IQR, 132-222] for MVR; $P = .004$) and ICU stay (51 hours [IQR, 41-88 hours] for MVP vs 86 hours [IQR, 49-160 hours]; $P = .003$) persisted in this group. However, the number was too small to conduct any long-term survival analysis.

Predictors of Mortality

Using the previously generated propensity score to weight cases, we ran a Cox proportional hazard analysis on survival (Table 5), including additional clinically meaningful variables not incorporated into the propensity model for evaluation. Figure 2 plots the survival curves for these patients. Ejection fraction, age, perfusion time, history of renal failure, and New York Heart Association (NYHA) class III/IV were all predictive of long-term survival ($P < .05$). Notwithstanding, MVR was an independent

TABLE 4. Detailed demographics and postoperative outcome of 192 propensity-matched patients undergoing MVP versus MVR

Characteristics	MVP (n = 96)	MVR (n = 96)	*P*
Age, mean y (SD)	76.8 (4.9)	78.0 (5.2)	.120
>80 y, % (n)	32.3 (31)	36.5 (35)	.649
Women, % (n)	43.8 (42)	45.8 (44)	.885
Hypertension, % (n)	69.8 (67)	78.1 (75)	.250
Diabetes, % (n)	13.5 (13)	18.8 (18)	.433
Renal failure, % (n)	8.3 (8)	14.0 (13)	.355
History of arrhythmia, % (n)	17.7 (17)	18.8 (18)	1.000
Previous CVA, % (n)	4.2 (4)	6.3 (6)	.747
PVD, % (n)	8.3 (8)	7.3 (7)	1.000
Mild COPD, % (n)	12.5 (12)	15.6 (15)	.679
Moderate to severe COPD, % (n)	4.1 (4)	2.0 (2)	.683
NYHA class 1, % (n)	36.5 (35)	31.3 (30)	.542
NYHA class 2, % (n)	41.7 (40)	49.0 (47)	.384
NYHA class 3, % (n)	8.3 (8)	10.4 (10)	.805
NYHA class 4, % (n)	55.0 (53)	60.0 (58)	.559
Ejection fraction, median % (IQR)	55 (40-65)	60 (40-65)	.266
Cardiogenic shock, % (n)	3.1 (3)	9.4 (9)	.133
Preoperative IABP, % (n)	5.2 (5)	7.3 (7)	.767
Cause			
Ischemic, % (n)	15 (14)	18 (17)	.695
Functional, % (n)	24 (23)	22 (21)	1.000
Myxomatous, % (n)	57.3 (55)	54.2 (52)	.772
Endocarditis, % (n)	3.1 (3)	5.2 (5)	.721
Other, % (n)	1.0 (1)	1.0 (1)	1.000
Operative characteristics			
Elective, % (n)	51.0 (49)	54.2 (52)	.773
Urgent, % (n)	42.7 (41)	38.5 (37)	.660
Emergency/salvage, % (n)	6.3 (6)	7.3 (7)	1.000
CABG, % (n)	55.2 (53)	50.0 (48)	.563
TVP, % (n)	17.7 (17)	26.0 (25)	.221
TVR, % (n)	0.0 (0)	1.0 (1)	1.000
Maze, % (n)	0.0 (0)	0.0 (0)	1.000
Perfusion time, median min (IQR)	142 (106-186)	165 (125-216)	.003
Crossclamp time, median min (IQR)	95 (73-131)	123 (95-155)	.001
Postoperative outcomes			
Ventilation time, median h (IQR)	10.2 (6-18)	11.0 (7-23)	.378
Ventilation >24 h, % (n)	19.8 (19)	24.0 (23)	.601
ICU stay, median h (IQR)	61 (42-93)	96 (49-161)	.002
Postoperative LOS, median d (IQR)	9 (7-15)	9 (7-16)	.436
Operative mortality, % (n)	6.3 (6)	8.3 (8)	.782

MVP, Mitral valve repair; *MVR*, mitral valve replacement; *SD*, standard deviation; *CVA*, cerebrovascular accident; *PVD*, peripheral vascular disease; *COPD*, chronic obstructive pulmonary disease; *NYHA*, New York Heart Association; *IABP*, intra-aortic balloon pump; *CABG*, coronary artery bypass graft; *TVP*, tricuspid valvuloplasty; *TVR*, tricuspid valve replacement; *ICU*, intensive care unit; *IQR*, interquartile range; *LOS*, length of stay.

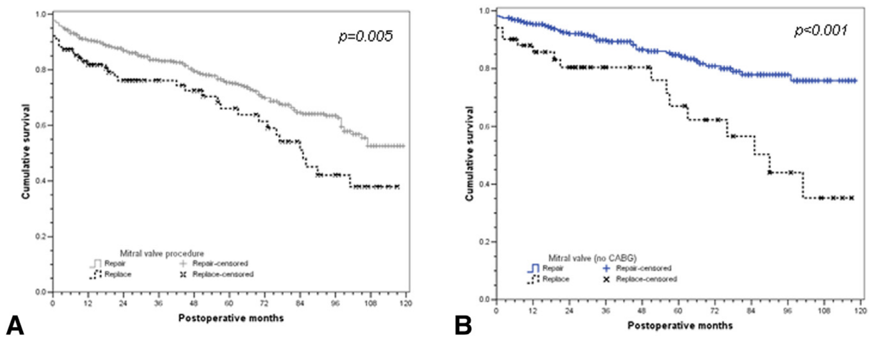

FIGURE 1. Kaplan-Meier survival analysis of all elderly patients undergoing mitral valve repair compared with those undergoing mitral valve replacement with (A) and without (B) coronary artery bypass graft.

predictor of reduced survival (hazard ratio, 1.571; 95% confidence interval, 1.081-2.284; $P = .018$). Preoperative cardiogenic shock, diabetes, arrhythmia, preoperative intra-aortic balloon pump placement, congestive heart failure, endocarditis, and cerebrovascular events were not a risk factor for mortality ($P > .1$).

DISCUSSION

This study confirms that MVP is an acceptable, and perhaps a superior, option to MVR for the elderly, despite the fact that less than 50% of these patients receive repair according to the STS database.[1] Although the advocates of MVR for the elderly claim decreased structural valve deterioration in this group, concerns about not tolerating CPB in cases of difficult repair, and technical difficulty with calcified annulus, flail tissue, and poor ventricular function,[7,11] the maturity and level of experience in the repair technique have certainly made repair faster and durable.[13] MVP allows for better preservation of native LV geometry compared with MVR, with preservation of the subvalvular apparatus and therefore improved LV function and remodeling.[14,15] In addition, our most recent publication on this subject demonstrates the excellent durability of MVP. We reported the results on 1000 patients undergoing minimally invasive mitral valve surgeries with the majority (92%) of the patients undergoing MVP. Overall, there was a 96%, 95%, and 90% freedom from reoperation at 5, 10, and 15 years and

TABLE 5. Results of Cox proportional hazards analyses of long-term survival in 658 patients undergoing MVR versus MVP

			95% CI for HR	
	P	**HR**	**Lower**	**Upper**
Significant predictors of mortality				
Ejection fraction (%)	.000	0.980	0.970	0.990
Age (y)	.001	1.053	1.020	1.087
Perfusion time (min)	.018	1.003	1.001	1.006
Peripheral vascular disease	.005	1.796	1.192	2.704
Nonelective surgery	.004	1.570	1.152	2.139
MVR procedure	.018	1.571	1.081	2.284
NYHA class III/IV	.023	1.530	1.060	2.209
Variables tested not significant in the final equation				
Cardiogenic shock	.108			
Diabetes	.171			
Arrhythmia	.193			
Preoperative IABP placement	.258			
Family history of CAD	.359			
Congestive heart failure	.663			
COPD	.664			
Endocarditis	.770			
Gender	.938			
Cerebrovascular accident	.984			
Overall model performance				
−2 log likelihood	χ^2	P		
2164.696	101.817	.001		

MVR, Mitral valve replacement; *MVP*, mitral valve repair; *HR*, hazard ratio; *CI*, confidence interval; *NYHA*, New York Heart Association; *IABP*, intra-aortic balloon placement; *CAD*, coronary artery disease; *COPD*, chronic obstructive pulmonary disease.

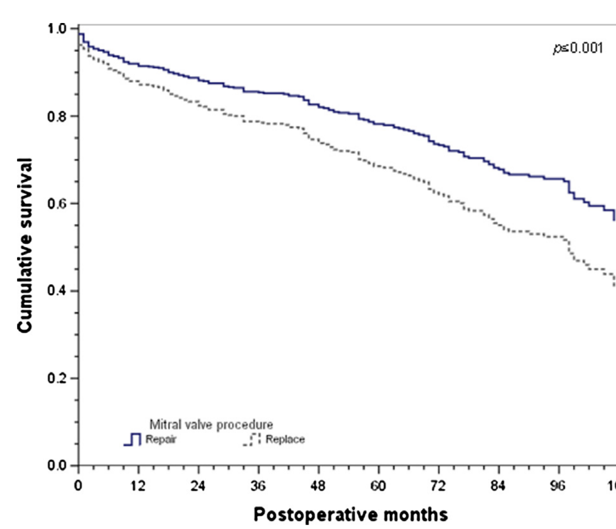

FIGURE 2. Cox regression analysis of 658 elderly patients with mitral regurgitation undergoing mitral valve repair (n = 556) or replacement (n = 102) demonstrates a significantly improved long-term survival of patients undergoing mitral valve repair.

98.5%, 87.3%, and 68.8% freedom from recurrent MR at 5, 10, and 15 years,[17] thus confirming the durability of MVP.

In this study of 556 MVPs and 102 MVRs, there was significantly lower operative mortality and longer median survival for patients undergoing MVP. As the demographic table illustrates, the MVR group had longer perfusion times, perhaps explaining the higher postoperative stroke rate in the MVR group compared with the MVP group (2.3% MVP vs 5.9% MVR; $P = .098$). Risk-matched propensity analysis of 192 patients also confirmed that patients undergoing MVP had lower perioperative morbidity and mortality (Table 3). Recent reports have advocated that early intervention for MR by surgery compared with initial medical management can be associated with greater survival.[18,19] This has been the practice in our institution, however, in this study, 46.3% of patients in the MVP group and 59.8% of the patients in the MVR group presented with NYHA class III and IV symptoms, which emphasizes the importance of early referral before onset of symptoms to further improve repair outcomes.

Given the superior outcome seen with MVP, our practice is to perform MVP in all patients regardless of age, as early as possible. Even in difficult repair situations such as severe mitral annular calcification and difficult valve pathology, our first choice is to repair the valve. However, when the repair is clearly contraindicated by extensive leaflet calcification, we perform MVR to avoid multiple attempts and longer CPB time. In addition, older age does not preclude correction of residual regurgitation after MVP.

Although our study demonstrates superior results for older patients undergoing MVP over MVR, there were several limitations that are worth discussing. Given that it is a retrospective study, no randomization of patients was performed for the 2 groups and the 2 groups were indeed heterogeneous. Although an attempt was made to reanalyze the data using propensity score matching, there was a significant discrepancy between the MVP and MVR cohorts in terms of preoperative renal failure and cardiogenic shock, which would affect patient outcome for the MVR group. In addition, there was no randomization of our patients and the inherent surgical decision making of subjecting patients to repair over replacement rested with the surgeons. Another major limitation to our study was incomplete evaluation of LV remodeling in patients because of incomplete echocardiographic data on patients undergoing MVP versus MVR; this would have been the best mode of gauging which surgical option was better for the elderly.

Our study attempted to target those patients with MR who were not clear-cut candidates for MVP or MVR and confirmed superior results of MVP over MVR for the elderly. With these results and other studies where MVR is labeled as an independent predictor of 6-month mortality, it is becoming more and more desirable to repair the mitral valve in elderly patients with MR.[9,20] A randomized control study would be ideal to balance all the confounding variables.

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