Reoperation rate for recurrent mitral disease is low after robotically assisted mitral valve repair

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Mayo robotic team (left to right): Richard C. Daly, MD, Joseph A. Dearani, MD, and Simon Maltais, MD, PhD.

Video clip is available online.

Central Message

Reoperation rate after robotic MV repair is low and continues to decline. Series assessing outcomes and complications will continue to improve results for this innovative technique for MV repair.

See Editorial Commentary page e17.

The last few decades have seen significant progress in mitral valve repair (MVR) surgery. With a growing trend toward minimally invasive cardiac surgery, robotically assisted MVR (RA-MVR) has become an increasingly popular alternative approach. MVR is a common procedure, and several authors have previously discussed mechanisms of repair failure and reoperation for recurrent mitral disease.¹⁻³ Suri and colleagues⁴ recently applied the time-tested techniques of open MVR through a robotically assisted approach and demonstrated excellent midterm outcomes for severe degenerative mitral regurgitation (MR), with a very low reoperation rate. In this report, we further shed light on reoperation for recurrent mitral valve disease in patients undergoing RA-MVR. We detail causes for reoperation and individually assess their impact on outcomes.

CLINICAL SUMMARY

After approval from the Mayo Clinic institutional review board, we retrospectively reviewed patients who underwent RA-MVR between January 2008 to September 2016 at our institution. From a total cohort of 619 consecutive consenting patients, 12 (1.9%) patients had moderate or greater recurrent MR develop. Of these, 5 patients required a reoperation; 3 patients had a ruptured anterior mitral leaflet chord, 1 had an annuloplasty band dehiscence in addition to a ruptured anterior mitral leaflet chord, and 1 had an elongated posterior mitral leaflet chord in addition to an annuloplasty band dehiscence. Of note, all chordal failures occurred at the leaflet edge. During follow-up, another 2

patients required reintervention for indications other than recurrent MR; 1 patient had mitral valve infective endocarditis, and 1 had a left atrial mass in the vicinity of the mitral valve.

Median time from RA-MVR to reoperation was 182 days (range, 2-1834 days). Only 1 patient required reoperation within the early postoperative period. Incidentally, this was the only patient who underwent a robotic reintervention; all other reinterventions were approached through a median sternotomy. Among the 5 patients with recurrent MR, successful reoperative MVR was achieved in 3 patients, and the other two underwent mitral valve replacements (Table 1).

DISCUSSION

With a growing use of the robotic technology for MVR, an increased understanding of the determinants of success and causes for recurrent MR after primary RA-MVR is essential to continued improvement in patient management. Similar to conventional MVR,^{3,5} our series demonstrates that the most prevalent cause of recurrent MR is indeed native mitral valve disease progression (4 of 5 reoperations for recurrent MR).

Early landmark studies in patients undergoing RA-MVR have reported mitral valve–related reoperation rates of 3% to 5%.⁶⁻⁸ In 2014, Yoo and colleagues⁹ described a non-

TABLE 1. Characteristics of patients requiring a reoperation after robotically assisted mitral valve repair

No.	Age (y)	Sex	First operation	Original pathology	Symptoms and degree of MR
Reoperation for recurrent MR					
1	65	M	Triangular P2 resection + PAB	Simple	Asymptomatic, severe MR
2	76	M	Neochordae to AML + ALC + PAB	Complex	Symptomatic, severe MR
3	48	M	Neochordae to AML + ALC + PMC + PAB	Complex	Symptomatic, moderate MR
4	44	M	PAB, severe myxomatous disease	Complex	Symptomatic, severe MR
5	53	M	Neochordae to AML + PMC + PAB	Complex	Symptomatic, severe MR
Reoperation for reasons other than recurrent MR					
6	64	M	Triangular PML resection + PMC + PAB	Complex	—
7	46	M	Triangular PML resection + PAB	Simple	—
Time from first surgery to reoperation (d)		Reason for reoperation (technical failure/new pathology/mixed)		Reintervention approach	Procedure performed
1835		New PML chord elongation + ABD (mixed)		Median sternotomy	Rerepaired with neochords to PML, new annuloplasty band, and ALC
55		New AML chord rupture. Neochords were intact (new pathology)		Median sternotomy	Bioprosthetic MVR
2		Neochord + native chord rupture (mixed)		Robotically assisted	Rerepaired with additional neochords
63		New AML chord rupture + ABD (mixed)		Median sternotomy	Mechanical MVR
624		Neochord to AML rupture (technical failure)		Median sternotomy	Rerepaired with PMC and cleft closure in PML
182		Infective endocarditis		Median sternotomy	Bioprosthetic MVR
410		Left atrial mass and thrombus		Median sternotomy	Mass removal

MR, Mitral regurgitation; PAB, posterior annuloplasty band; PML, posterior mitral leaflet; ABD, annuloplasty band dehiscence; ALC, anterolateral commissuroplasty; AML, anterior mitral leaflet; MVR, mitral valve replacement; PMC, posteromedial commissuroplasty.

VIDEO 1. Complex bileaflet Barlow repair. Repair was performed with neochords and resection and plication of the posterior mitral leaflet (PL). AL, Anterior mitral leaflet. Video available at: [http://www.jtcvsonline.org/article/S0022-5223\(17\)31901-3/fulltext](http://www.jtcvsonline.org/article/S0022-5223(17)31901-3/fulltext).

bleeding related reoperation rate of only 1% (2/200).⁹ In our current Mayo Clinic experience, we also report a similar reoperation rate of 1.1% (7/619). Importantly, reoperation for recurrent MR alone was observed in 0.8% of patients, highlighting the technical success of the procedure.

Compared with conventional MVr series, which have reported freedom from reoperation rates ranging from 92% to 94% at 1 year^{10,11} and 79% to 95% at 5 years,¹⁰⁻¹⁴ freedom from reoperation rates in our RA-MVr cohort were 99.2% and 98.6% at 1 and 5 years, respectively. We believe that a standardized technique for initial MVr has been a major reason behind our success. We have typically used a simplified approach to the repair, with limited resection and plication as needed. We used neochords or chordal transfers for anteriorly directed problems. Our annuloplasty strategy includes, in most cases, a one size fits all 63-mm posterior flexible annuloplasty band placed from trigone to trigone.

Improvements in overall RA-MVr outcomes have allowed an increasing number of complex mitral repairs in recent years; we performed a complex repair in 257 of 619 patients (42%). Nevertheless, in accordance with published literature,¹⁵ the reoperation rate in these patients was still higher than for simple repairs; 4 of 5 of patients requiring reintervention for recurrent MR in our cohort had an initial complex repair (Video 1).

Previous studies in patients undergoing conventional MVr have demonstrated earlier and improved left ventricular remodeling and a survival benefit in patients with reoperative MVr repair versus replacement.³ Reoperative MVr is often considered technically more challenging but can be accomplished when the mechanism of MR is well understood and is amenable to repair.⁵ Patients who have undergone MVr and have recurrent MR should therefore be thoroughly evaluated by transesophageal echocardiography for accurate determination of the regurgitation mechanism and candidacy for re-repair.⁵

As our familiarity with and mastery of the various minimally invasive cardiac surgical procedures grow, we believe the proportion of re-repair relative to replacement is likely to increase. Technical failures such as ring dehiscence could be proactively addressed by reinforcing annuloplasty sutures in perceived higher risk patients, as well as careful postbypass intraoperative transesophageal echocardiographic evaluation. Ruptured chords early in the postoperative period can be prevented by improved intraoperative identification of pathology with 3-dimensional echocardiographic assessment, allowing increased use of neochords or chordal transfers for flailed or elongated segments and perhaps resulting in a decreased early failure rate. In addition, intraoperative transesophageal echocardiographic assessment of residual MR severity under physiologic blood pressure conditions should be performed, because greater than mild residual MR continues to be an independent predictor of recurrent MR.¹⁶

Supported by encouraging early and midterm outcomes, RA-MVr continues to be a promising alternative to the conventional sternotomy approach. Reoperation rate in these patients is low, and it is likely to decrease further with further experience. Rerepair should be offered as the initial procedure of choice, provided the mechanism of MR is understood and native tissues can withstand rerepair. Results of ongoing comparative studies assessing long-term outcomes for contemporary MVr techniques versus conventional ones will determine the criterion standard for this population.

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