Outcomes of repeat mitral valve replacement in patients with prior mitral surgery: A benchmark for transcatheter approaches

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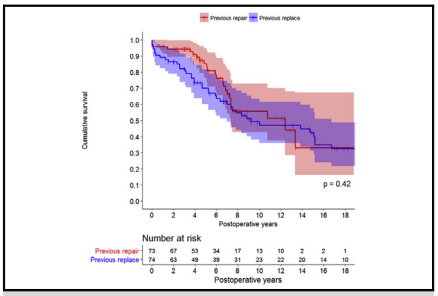
ABSTRACT

Objectives: With the emergence of transcatheter mitral valve-in-valve/ring replacement for deteriorated bioprostheses or failed repair, comparative clinical benchmarks for surgical repeat mitral valve replacement (re-MVR) are needed. We present in-hospital and survival outcomes of a 24-year experience with re-MVR.

Methods: From January 1992 to June 2015, 520 adult patients underwent re-MVR; 273 had undergone prior mitral valve repair (pMVP) and 247 had undergone prior MVR (pMVR). A benchmark cohort of isolated re-MVR was defined based on potential eligibility for transcatheter mitral valve-in-valve/ring replacement, resulting in 73 pMVPs with previous annuloplasty rings and 74 pMVRs with previous bioprosthetic valves for comparison.

Results: For the entire cohort, mean age was 64 ± 12 years for pMVP patients and 63 ± 15 years for pMVR patients ($P = .281$), which was similar for the benchmark cohort. Overall operative mortality was 14 out of 273 (5%) for pMVP versus 23 out of 247 (9%) for pMVR ($P = .087$). There were 3 operative deaths (4.1%) in both groups of the benchmark cohort ($P = 1.0$). For the benchmark cohort, median time to reoperation was 9.8 years for pMVP and 9.1 years for pMVR. Cox proportional hazard analysis showed that chronic kidney disease (hazard ratio [HR], 2.47; 95% CI, 1.77-3.44), endocarditis (HR, 1.49; 95% CI, 1.07-2.07), pMVR (HR, 1.45; 95% CI, 1.12-1.89), early reoperation ≤ 1 year (HR, 1.49; 95% CI, 1.02-2.17), and age (HR, 1.04/y; 95% CI, 1.03-1.05) were associated with decreased survival after re-MVR.

Conclusions: A re-MVR is a high-risk operation, but in carefully selected patients such as our benchmark population, it can be performed with acceptable results. Patients undergoing pMVP also have better long-term survival compared with patients undergoing pMVR. These results will serve as a benchmark for transcatheter mitral valve-in-valve/ring replacement. (J Thorac Cardiovasc Surg 2018;■:1-9)



Kaplan-Meier survival curve for isolated reoperative-mitral valve replacement (re-MVR) in the benchmark cohort (subgroup).

Central Message

Repeat MVR in patients with prior MV procedures is a high-risk operation, but in carefully selected patients such as our benchmark population, it can be performed with acceptable result.

Perspective

With the emergence of transcatheter mitral valve-in-valve/ring (TMVIV/R) replacement for deteriorated bioprostheses, comparative clinical benchmarks for surgical repeat mitral valve replacement (re-MVR) are needed. In this study, outcomes of an entire re-MVR cohort, as well as a benchmark cohort of patients undergoing isolated re-MVR, defined based on potential eligibility for TMVIV/R are reported.

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ADULT

Mitral valve repair (MVP) remains the preferred treatment strategy for a variety of mitral valve pathologies, with the evidence strongest for myxomatous degeneration.[1,2] The durability of MVP in this disease population is also

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Abbreviations and Acronyms

CABG = coronary artery bypass graft
CKD = chronic kidney disease
MVP = mitral valve repair
MVR = mitral valve replacement
pMVP = prior mitral valve repair
pMVR = prior mitral valve replacement
PROM = predicted risk of mortality
re-MVR = repeat mitral valve replacement
STS = Society of Thoracic Surgeons
TMVIV/R = transcatheter mitral valve-in-valve/ring

excellent, reportedly with an 80% to 95% freedom from reoperation 10 to 20 years after surgery.[1,3-6] According to the Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database summary, there were 12,792 MVPs and 4548 mitral valve replacements (MVRs) performed in the United States during 2015.[7]

Overall, 4% to 10% of patients who undergo MVP will require a second intervention, most frequently a repeat MVR (re-MVR).[1,3,4,6,8] Although the advantages of mitral valve re-repair over replacement may persist at reoperation,[8] re-repair is only feasible in 36% to 85% of these patients.[8-11] Re-repair is also not always feasible in the setting of endocarditis, mitral stenosis, bileaflet prolapse, or severe degenerative progression of native disease. For patients who undergo MVR, the increasing use of bioprosthetic valves[12,13] and the desire to avoid lifelong anticoagulation[2] has resulted in increasing number of structural valve deterioration and subsequent re-MVR.[14] Previous reports suggest that re-MVR is a high-risk procedure with a 5% to 12% operative mortality[15-17] and a 7-year survival of 69%.[18] This has largely been attributed to the increased technical difficulty inherent to reoperations, greater frailty of the reoperative patients, and the fact that prosthetic valve endocarditis is a common indication for reoperation.[19]

Transcatheter valve technology provides a minimally invasive alternative to open cardiac valve replacement in high-risk patients. The existing transcatheter aortic valve has also been creatively utilized in deteriorated mitral valve bioprosthesis or in previous annuloplasty ring as transcatheter mitral valve-in-valve or ring replacement (TMVIV/R).[20,21] The reported outcomes have been favorable and the Food and Drug Administration recently approved the use of TMVIV/R for high risk-patients.[22-28] However, with the emergence of TMVIV/R for failed mitral valve rings/bioprostheses, comparative clinical benchmarks for surgical re-MVR are needed to assess their efficacy, safety, and durability, and determine their role in the therapeutic arsenal for MVR.

Furthermore, the majority of previous reports of reoperative MVR include patients with previous coronary artery bypass grafting (CABG) or nonmitral valve cardiac surgery.[14,16,29,30] Very few studies have actually examined outcomes of patients undergoing re-MVR prior MVP (pMVP) or replacement (pMVR). These studies were limited by small cohorts, older series, and did not stratify outcomes by type of prior mitral valve prosthesis.[6,14,15,29,31-33] We report the contemporary outcomes of a 24-year experience with re-MVR in a cohort of pMVP and pMVR patients. Our study had 2 aims: to report the postoperative outcomes of all patients (ie, entire cohort) undergoing re-MVR and to define a benchmark cohort of re-MVR eligible for TMVIV/R (ie, isolated from the entire cohort), and to provide this cohort's outcomes for TMVIV/R comparisons.

METHODS

Patient Selection

All adult patients aged 18 years or older who underwent re-MVR after pMVP or pMVR between January 1992 and May 30, 2015, at Brigham and Women's Hospital, were identified from our prospective cardiac surgery database and retrospectively reviewed. Patients with a history of any previous cardiac surgery or those undergoing concomitant cardiac surgery procedures were also included in our cohort. This study was approved by the Partners Healthcare Institutional Review Board and informed consent was waived.

Data Collection

Patient characteristics, medications, laboratory values, and in-hospital outcomes of the index surgery were extracted from our institutions electronic medical record. Follow-up data were aggregated from our electronic medical record as well as the patients' primary care physicians or cardiologists. Type of pMVP technique, and the use of ring annuloplasty, bioprosthetic replacement, or mechanical valve replacement was obtained from individual chart review of operative report (if available), preoperative echocardiogram, and pathology reports of the explanted device, if relevant. Long-term survival data were obtained from routine institutional follow-up protocols, our internal research data repository, and the Massachusetts Department of Public Health (Dorchester, Mass). We had 100% follow-up at 30 days and 95% long-term follow-up using our various sources. Patient demographic characteristics and hospital outcomes were coded and defined according to the STS Adult Cardiac Surgery database (version 2.52) specifications. Chronic kidney disease (CKD) was defined a priori as a preoperative creatinine $\geq$2.0 mm/dL or most recent clinical documentation of renal disease. Postoperative stroke was defined as the presence of a central neurologic deficit persisting postoperatively for more than 72 hours. Our primary outcomes of interest were 30-day mortality, postoperative morbidity, and long-term survival, both overall and in the benchmark cohort. Observed-to-expected operative mortality was calculated by dividing the observed mortality by the mean STS predicted risk of mortality (PROM) score for that cohort.

Benchmark Cohort

Because TMVIV/R can only be performed in a subset of pMVP and pMVR patients, a benchmark cohort was defined for comparison. TMVIV/R can be performed in patients with failed bioprosthetic valves and annuloplasty rings. They are contraindicated in the setting of endocarditis, or in patients with multivalve disease, and are seldom used in emergency settings. We excluded patients with endocarditis, concomitant