

Readmission rates after transcatheter aortic valve replacement in high- and extreme-risk patients with severe aortic stenosis



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ABSTRACT

Objective: In high- or extreme-risk patients undergoing transcatheter aortic valve replacement, readmissions have not been adequately studied and are the subject of increased scrutiny by healthcare systems. The objectives of this study were to determine the incidence of 30-day and 1-year cardiac and noncardiac readmissions, identify predictors of readmission, and assess the association between readmission and 1-year mortality.

Methods: A retrospective review was performed on 714 patients who underwent transcatheter aortic valve replacement from September 2007 to January 2015 at Emory University.

Results: Patients' median age was 83 years, and 46.6% were female. Early all-cause readmission for the cohort was 10.5%, and late readmission was 18.8%. Anemia was related to both early all-cause (hazard ratio [HR], 0.74) and cardiovascular-related readmission (HR, 0.60). A 23-mm valve implanted was associated with early all-cause readmission (HR, 1.73). Length of hospital stay was related to late all-cause (HR, 1.14) and cardiovascular-related readmission (HR, 1.21). Postoperative permanent stroke had an impact on late cardiovascular-related readmission (HR, 3.60; 95% confidence interval, 1.13-11.49). Multivariable analysis identified anemia as being associated with 30-day all-cause readmission, and anemia and postoperative stroke were associated with 30-day cardiovascular-related readmission. Readmissions seemed to be related to 1-year mortality (HR, 2.04; 95% confidence interval, 1.33-3.12).

Conclusions: We show some baseline comorbidities and procedural complications that are directly associated with early and late readmissions, and anemia and postoperative stroke were associated with an increase in mortality. Moreover, we found that readmission was associated with double the hazard of death within 1 year. Whether treatment of identified risk factors could decrease readmission rates and mortality warrants further investigation. (*J Thorac Cardiovasc Surg* 2017;154:445-52)

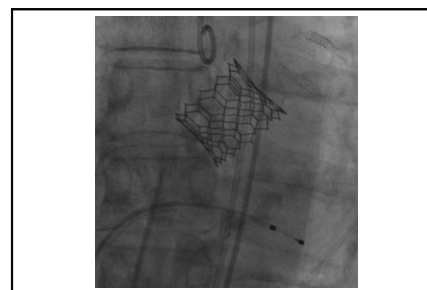
Transcatheter aortic valve replacement (TAVR) is an alternative to conventional open surgical aortic valve replacement (SAVR) in high-risk patients¹⁻³ and is the

procedure of choice in extreme-risk patients ([Video 1](#)).^{4,5} Few reports concerning TAVR and outcomes have evaluated rehospitalization after procedure discharge.^{6,7}

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TAVR seen under fluoroscopy after its deployment.

Central Message

Readmission after TAVR is associated with an increased risk of 1-year mortality in a high-risk cohort of patients.

Perspective

In this study, rates of early and late readmission after TAVR in a high-risk cohort of patients were 10.4% at a median of 19 (13-25) days and 18.8% at a median of 129 (55-214) days, respectively. The majority were not related to a CV cause. Moreover, it was found that readmission was associated with double the hazard of death within 1 year.

See Editorial Commentary page 453.

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Abbreviations and Acronyms

CI	= confidence interval
CV	= cardiovascular
HR	= hazard ratio
PARTNER	= Placement of Aortic Transcatheter Valve
PROM	= Predicted Risk of Mortality
SAVR	= surgical aortic valve replacement
STS	= Society of Thoracic Surgeons
TAVR	= transcatheter aortic valve replacement

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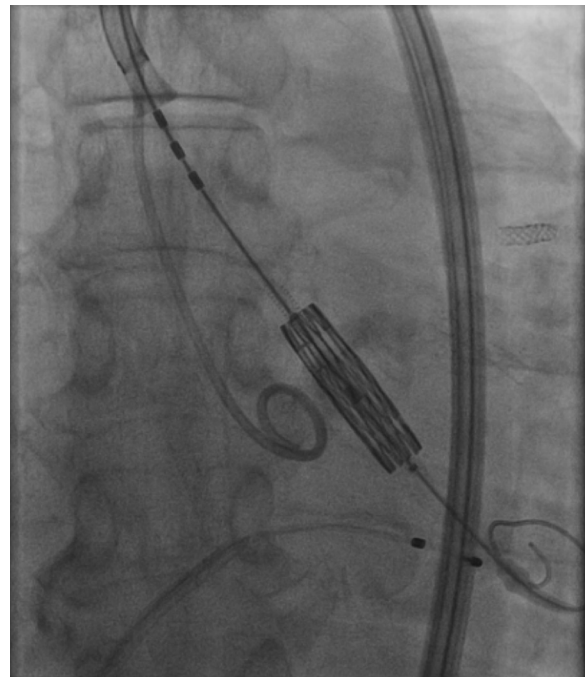


At 1 year, Leon and colleagues⁴ noted a significant decrease in the rate of hospitalization in inoperable patients with TAVR (22%) compared with medical therapy (44%). When comparing SAVR and TAVR in high-risk patients, Smith and colleagues² noted similar rates of rehospitalization at 1 year (TAVR 18.2%, SAVR 15.5%). Although these reports note the overall rates of rehospitalization, studies evaluating the predictors for rehospitalization are uncommon. Readmission is an important health concern, and the rationale for investigation for these predictors remains essential in that they may improve patient outcomes, reduce resource use, and lessen the economic burdens related to TAVR.

The primary objective of this study was to estimate the early (30-day) and late (between 1 month and 1 year) all-cause and cardiovascular (CV)-related readmission rates in high- and extreme-risk patients in a single, high-volume US center. Furthermore, we identified the predictors of all-cause and CV-related readmissions in this cohort of patients. Last, we assessed the association between readmission and 1-year mortality.

MATERIALS AND METHODS

We retrospectively analyzed 758 patients who underwent TAVR from 2007 to 2015 and are listed in the prospectively entered Emory Society of Thoracic Surgeons (STS) Database. We excluded patients who had died before discharge (28 [3.7%]) and patients who had incomplete follow-up data at 1 year (16 [2.0%]), leaving 714 patients for our analysis (Figure 1). Extracted records from the database included basic demographic information, preexisting comorbidities and other risk factors, and periprocedure and postprocedure clinical outcomes. The study was approved by the Emory University Institutional Review Board in compliance with Health Insurance Portability and Accountability Act regulations and the Declaration of Helsinki. The Institutional Review



VIDEO 1. Deployment of a TAVR prosthesis. Video available at: [http://www.jtcvsonline.org/article/S0022-5223\(17\)30705-5/addons](http://www.jtcvsonline.org/article/S0022-5223(17)30705-5/addons).

Board waived individual patient consent because of the retrospective nature of the study.

Patients included in this study were classified as high and extreme risk. High-risk patients were defined as patients with an STS score of more than 8% with no other comorbidities or anatomic factors that made them inoperable. For extreme-risk patients, we adopted the definition used in the Placement of Aortic Transcatheter Valve (PARTNER) B trial for “inoperable” patients. It includes patients with an STS risk score of 10% or greater, patients who had coexisting conditions that would be associated with a predicted risk of death of 15% or greater by 30 days after surgery, or patients who were not considered to be suitable candidates for surgery because they had coexisting conditions that would be associated with a predicted probability of 50% or more of death by 30 days after surgery or a serious irreversible condition.⁴

Before analysis, preoperative risk factors were identified and extracted from the Emory STS database (which includes 30-day outcome data). Standard STS definitions for risk factors and outcomes were used. Race was dichotomized as Caucasian or non-Caucasian. New York Heart Association heart failure class was dichotomized as class III/IV or I/II. STS discharge location was used to determine where the patients were discharged after their procedure. Valve Academic Research Consortium-2 criteria were used to define major and minor stroke.⁸ Renal failure was defined, according to STS criteria, as an increase in serum creatinine level more than 4.0 mg/dL or 3 times greater than the baseline creatinine; acute increase must be at least 0.5 mg/dL or a new requirement for dialysis postoperatively. Other clinical outcomes used were defined according to STS criteria.²

The access sites for the procedure were transfemoral, transapical, direct transaortic, and other (including transcaval or transcarotid). Patients' charts were reviewed for the subsequent rehospitalizations in any Emory University Hospital. The date, causes of readmission, and discharge location after the hospitalization for readmission were recorded in our database. Follow-up visit or emergency visit notes during the 1-year period after their procedure were reviewed. We also reviewed the notes from our valve nurse navigator or valve coordinator who received phone calls from

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