Identifying Patients Who Do Not Benefit From Transcatheter Aortic Valve Replacement

Howard C. Herrmann, MD; Yuchi Han, MD

In this issue of Circulation: Cardiovascular Interventions, investigators from the France 2 Registry confirm other reports that demonstrate that more than moderate pulmonary hypertension is another dichotomous risk factor that is associated with worse outcome after TAVR.14 Patients with systolic pulmonary artery pressure (PASP) ≥40 mm Hg had a 1-year mortality of 28% compared with a mortality of 22% in those with pressure <40 mm Hg. As with other similar studies, functional status of survivors improved, regardless of the preprocedure level of pulmonary pressure.

Pulmonary hypertension, estimated by adding the tricuspid regurgitation gradient and estimated right atrial pressure, does not distinguish between causes of left ventricular systolic or diastolic dysfunction, MR, pulmonary disease, or right ventricular (RV) dysfunction, all of which are prevalent in the TAVR population. Nonetheless, it seems to be a marker of worse outcome in a variety of conditions. In 1 community study of >1000 patients with heart failure, the odds ratio for death was 2.07 for patients in the highest tertile of PASP compared with the lowest tertile.15 Sinning et al16 reported similar findings in patients with TAVR in whom the 2-year mortality was 48.4% with PASP >60 mm Hg compared with 13.9% in patients with PASP <30 mm Hg. Although useful for informing both patients and clinicians about prognosis, this information is of limited value in deciding whether to offer TAVR to an individual patient.

In the France 2 Registry, the survivors with the highest PASP had a greater reduction in PASP post-TAVR (a reduction of 16 mm Hg in median pressure compared with no change in the lowest PASP group and 5 mm Hg in the intermediate group).14 Sinning et al16 demonstrated that a reduction of PASP to <60 mm Hg 90 days after TAVR was associated with improved 2-year survival. These patients likely had reversible pulmonary venous hypertension that was relieved by TAVR, possibly because of MR or left ventricular systolic dysfunction.

How can we improve the usefulness of this risk factor to predict the outcome for individual patients? Although a good noninvasive measure of pulmonary pressure, PASP may be underestimated in patients with severe tricuspid regurgitation because of rapid equilibration of RV and right atrial pressures. We are not provided with any information on the degree or distribution of tricuspid regurgitation in the patients studied. PASP also does not reflect RV function. RV function estimated by tricuspid annular plane excursion or by the fractional area change has been studied in conjunction with PASP.

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

From the Perelman School of Medicine at the University of Pennsylvania, Philadelphia.

Correspondence to Howard C. Herrmann, MD, Interventional Cardiology and Cardiac Catheterization Laboratories, Hospital of the University of Pennsylvania, 9038 West Gates Pavilion, 3400 Spruce St, Philadelphia, PA 19104. E-mail Howard.herrmann@uphs.upenn.edu


© 2014 American Heart Association, Inc.

Circ Cardiovasc Interv is available at http://circinterventions.ahajournals.org

DOI: 10.1161/CIRCINTERVENTIONS.114.001410

In this world, there are only two tragedies. One is not getting what one wants, and the other is getting it.

—Oscar Wilde (1854–1900)
in patients with heart failure in which the combination of RV dysfunction and high PASP conferred the worst prognosis.\textsuperscript{17–19} Perhaps, teasing out the underestimation of PASP because of concomitant tricuspid regurgitation and adding RV functional estimates to PASP would enhance the discrimination between survivors and nonsurvivors after TAVR.

As a result of the limitations of any single factor as a litmus test to discern benefit for patients with aortic stenosis who need therapy, one might surmise that combining factors into a score would be more helpful. Data from the Partner 1B trial demonstrated that patients with a Society for Thoracic Surgery risk score $\geq 15\%$ for predicted operative mortality at 30 days derived no survival benefit from TAVR at 1 year compared with standard therapy.\textsuperscript{1} The Society for Thoracic Surgery risk calculation is not perfect and has limitations. It only includes operated patients for comparison, data are voluntarily submitted and not independently audited, and it does not include several risk factors that influence survival, such as porcelain aorta, hostile chest, advanced liver disease, frailty (both physical and mental), debility, and immobility.

Recently, much attention has focused on frailty as a risk factor for poor outcome after both TAVR and surgery. Defining frailty as an impairment of physiological reserve and decreased resistance to stressors, Green et al\textsuperscript{10} demonstrated in a TAVR population that a combination of frailty measures of slowness, weakness, malnutrition, and inactivity was associated with a 3.5-fold increase in 1-year mortality. Impairment in mental and cognitive ability, mood, and mental health would likely add even greater risk.

As we continue to apply TAVR to sicker and older patients, we must also consider whether mortality is the right outcome to measure. Quality of life in many elderly patients may be even more important. Arnold et al\textsuperscript{20} used the Kansas City Cardiomyopathy Questionnaire to identify 16\% of patients with a poor-quality-of-life outcome 6 months after TAVR, in addition to 19\% who died. In a recent study of 106 survivors after TAVR, functional decline occurred in 21\% and was much better predicted by measures of frailty (including cognitive impairment) than by Society for Thoracic Surgery score or EuroSCORE.\textsuperscript{21} For our sickest patients with aortic stenosis being considered for TAVR, we desperately need scores that not only combine multiple risk factors that are each properly assessed but which also use the factors to predict a combination of mortality and quality-of-life outcome to avoid Oscar Wilde’s potential tragedy in life of getting what one wants.

### Disclosures

Dr Herrmann received institutional research funding from Edwards Lifesciences and Medtronic and consultant fees/honoraria from Edwards Lifesciences. The other author reports no conflicts.

### References


### Table

| Table. Factors Associated With Poor Outcome After Transcatheter Aortic Valve Replacement |
|---------------------------------------------|---------------------------------------------|
| Noncardiac                              | Cardiac                                    | Procedural |
| COPD                                     | Low EF                                     | AKI         |
| CKD                                      | Pulmonary HTN                              | AR          |
| DM                                       | Severe MR                                  | Stroke      |
| Prior CVA                                | CAD                                        | Vascular    |
| Liver disease                            | CPS                                        |             |
| Congalopathy                             | Valve reintervention                       |             |
| High BMI                                 | Male sex                                   |             |
| Frailty                                  |                                            |             |

AKI indicates acute kidney injury; AR, aortic regurgitation; BMI, body mass index; CAD, coronary artery disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; CPS, cardiopulmonary support; CVA, cerebral vascular accident; DM, diabetes mellitus; EF, ejection fraction; HTN, hypertension; and MR, mitral regurgitation.


**Key Words**: Editorials ◼ aortic valve stenosis ◼ hypertension, pulmonary
Identifying Patients Who Do Not Benefit From Transcatheter Aortic Valve Replacement
Howard C. Herrmann and Yuchi Han

doi: 10.1161/CIRCINTERVENTIONS.114.001410
Circulation: Cardiovascular Interventions is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2014 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-7640. Online ISSN: 1941-7632

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circinterventions.ahajournals.org/content/7/2/136

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation: Cardiovascular Interventions can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation: Cardiovascular Interventions is online at:
http://circinterventions.ahajournals.org/subscriptions/