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Editorial

Is it Time to Move Beyond STS and TVT Scores for Predicting TAVR Mortality?

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Transcatheter aortic valve replacement (TAVR) has proven to be an effective treatment option for patients with severe symptomatic aortic stenosis across all surgical risk levels. Surgical risk is assessed by the Society of Thoracic Surgeons Predicted Risk of Mortality (STS) score or EuroSCORE II, which are estimates of the operative mortality after surgical aortic valve replacement. TAVR has grown exponentially over the past decade to a point where the number of TAVR procedures in the United States now exceeds the total number of surgical aortic valve replacements.[1] The risk assessment of patients being evaluated for TAVR is important not only to help the clinical decision-making process at a local level but also to provide benchmarked risk-adjusted outcomes at a national level to various hospitals and health care systems to support quality improvement.

Using the STS score to estimate TAVR mortality has major limitations because the score was not derived from a TAVR cohort but rather from a surgical cohort of patients; therefore, it is not calibrated for patients undergoing TAVR. When used to predict post-TAVR mortality, the STS score has been shown to overestimate the 30-day mortality rate. A meta-analysis of 24 studies with >12,000 patients who underwent TAVR showed a pooled C statistic for operative mortality to be 0.62 (95% CI, 0.59-0.65) for the STS score and EuroSCORE II.[2] This led to the development of several other TAVR-specific mortality prediction models over the past decade to better estimate mortality after TAVR, such as transcatheter valve therapy (TVT), FRANCE-2, OBSERVANT, $TAVI_2$, CoreValve, and UK-TAVI scores.[3]

The TVT score was derived from 13,718 consecutive patients who underwent TAVR from 265 sites in the United States between 2011 and 2014 from the STS/American College of Cardiology (ACC) TVT Registry.[4] The STS/ACC TVT Registry incorporates all commercial TAVR cases in the United States because the National Coverage Determination from the Centers for Medicare & Medicaid Services specifies that reimbursement is contingent on participation in such a registry. The final validation cohort for the TVT score included 6868 patients from 314 centers. The C statistic for discrimination was 0.67 in the development group and 0.66 in the validation group. This was an improvement over the STS score, EuroSCORE, and FRANCE-2 models applied to TAVR populations.[4] It is important to note that the TVT score was derived from inoperable and high surgical risk patients who underwent TAVR. Another limitation is that frailty indices, such as the 5-Meter Walk Test of gait speed, and quality-of-life measures, such as the Kansas City Cardiomyopathy Questionnaire, which are recognized factors associated with post-TAVR mortality, were incompletely collected and, hence, not included in the TVT score model, but they were subsequently included in another model derived from TVT data.[4,5]

In this study, Al-Azizi et al[6] studied the ability of STS and TVT scores to predict in-hospital, 30-day, and 1-year mortality in a large cohort of 3270 patients who underwent TAVR between 2012 and 2020 within a large health care system. Based on the STS score, 54.2% of the patients were deemed inoperable or high surgical risk, and 39.2% of the patients were deemed intermediate or low surgical risk. In all-comers and surgical risk–stratified analyses, the discrimination of STS and TVT scores in predicting in-hospital, 30-day, and 1-year mortality remained low. When looking at the surgical risk–stratified analysis, the TVT score performed better than the STS score in patients who were at high-risk. This was expected because the TVT score was derived from a cohort of mostly high surgical risk patients who underwent TAVR; however, in the remainder of the cohort, the TVT score did not show a greater predictive power for post-TAVR mortality than the STS score. Although the TVT score show a good discriminative performance in the original validation cohort, it performs poor to modestly when applied to other populations, including the large cohort in the article by Al-Azizi et al.[6]

All existing TAVR mortality prediction models have limitations.[3] They were derived from high surgical risk populations in the early TAVR era, using older-generation TAVR systems. Improvement in TAVR technology, such as lower profile devices to reduce vascular complications, development of external and internal pericardial wrap to reduce paravalvular leak, and growing operator experience coupled with the extension of TAVR to lower risk patients, have undoubtedly contributed to reduction in TAVR mortality over the past decade. We have learned that high surgical risk patients may be at low risk for TAVR

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provided their anatomy is suitable. Surgical risk scores, including the STS score, do not incorporate factors, such as home oxygen use, frailty assessment, liver diseases (eg, cirrhosis), anatomic features, such as porcelain aorta, and TAVR-specific anatomic and procedural considerations and access route. Frailty, defined as a clinical syndrome with reduced homeostatic reserve and decreased resilience to stressors, has emerged as an important predictor of mortality post-TAVR.[7] The "eyeball" test, which has been routinely used by clinicians to judge frailty, is now being discouraged, and objective markers of frailty including but not limited to anemia, albumin level, and 5-m walk speed have been proposed and validated as the markers of mortality risk.[7] Preprocedural cognitive status has emerged as an independent risk factor in patients undergoing TAVR.[3] Most recently, the cardiac damage staging proposed by Genereux et al[8] to assess extravalvular damage related to aortic stenosis, as assessed by echocardiography to indicate left ventricular, left atrial, mitral valve, pulmonary, tricuspid, and right ventricular damage, has emerged as a powerful predictor of mortality after TAVR.

As rightly suggested by the authors, it is time to move beyond STS and TVT scores. Large, multicenter, real-world data from patients undergoing TAVR, which incorporate old and emerging new markers of risk, should be used to create a robust and validated TAVR risk score for a widespread clinical use.

Declaration of competing interest

Sachin Goel is a member of the Speakers Bureau of Abbott Structural Heart and a consultant for Medtronic and W.L. Gore and Associates. Michael J. Reardon is a consultant for Medtronic, Boston Scientific, Abbott, and W.L. Gore and Associates, with all fees to the department.

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