In their Viewpoint article, Percy et al. suggest that the rapid expansion of transcatheter aortic valve replacement (TAVR) will have minimal effect on the volume of surgical aortic valve replacement (SAVR) and the role of the cardiac surgeon in treating aortic stenosis (AS).\textsuperscript{1} I agree with the authors that TAVR will continue to grow exponentially owing to the favourable outcomes seen in those centers involved with the original PARTNER (Placement of Aortic Transcatheter Valves) trial. Patients sent for TAVR were actually found to be operable but at higher risk and therefore underwent SAVR. It was estimated that for every 4 patients referred for TAVR, 3 actually received SAVR. This is no longer the case. I disagree that the effect on SAVR volumes and cardiac surgeons will be minimal. The sky is indeed falling—for now.

The Effect of TAVR on SAVR Volume

The increase in SAVR volumes during the early years of TAVR was due to the ‘halo effect’ seen in those centers involved with the original PARTNER (Placement of Aortic Transcatheter Valves) trial. Patients sent for TAVR were actually found to be operable but at higher risk and therefore underwent SAVR. It was estimated that for every 4 patients referred for TAVR, 3 actually received SAVR. This is no longer the case.

In 2012, the number of SAVRs performed in the United States was \( \sim 30,000 \), in 2017 it dropped to 26,000. The vast majority of SAVRs were performed in low-risk patients, the majority of which would now undergo TAVR under the new guidelines. In 2020, the volume of SAVR is expected to decrease to 22,000, a 25% decrease over 8 years. The increased prevalence of AS in older patients, and emerging evidence to show that AVR is best performed in patients with low or intermediate risk will continue to undergo SAVR, the majority of which using a minimalist approach in patients with AS and AF who are at high risk for bleeding has been the implantation of a left atrial appendage closure device; which eliminates the need for anticoagulation.\textsuperscript{3}

Bicuspid AS has been a relative contraindication for TAVR because of the increased incidence of perivalvular leaks (PVLs). However, newer-generation devices have been associated with decreasing rates of PVLs and a higher device success rate than seen with earlier-generation devices and will be used more frequently for these patients.\textsuperscript{6}

Traditional Indications for SAVR May No Longer Be Traditional

I disagree with Percy et al. that traditional SAVR will remain the treatment of choice for a significant proportion of patients who require concomitant procedures with an AVR. In patients with AS and significant MR, the severity of baseline mitral regurgitation (MR) has been shown to be reduced by \( > 50\% \) following TAVR; especially in those patients with functional MR.\textsuperscript{7} Furthermore, patients with significant functional nonorganic MR are now being successfully treated with the percutaneous Mitra Clip system (Abbott Laboratories, Abbott Park, IL).\textsuperscript{3} Similarly, patients with significant tricuspid regurgitation also can be approached with the use of transcatheter techniques. While patients with AS and severe multivessel coronary or left main disease who are low or intermediate risk will continue to undergo SAVR, percutaneous coronary interventions (PCI) for proximal and midcoronary lesions, either before or during TAVR, is commonly performed worldwide without an increased risk of short-term mortality.\textsuperscript{4} In patients with concomitant permanent or paroxysmal atrial fibrillation (AF), percutaneous ablation procedures can be performed with TAVR. A novel approach in patients with AS and AF who are at high risk for bleeding has been the implantation of a left atrial appendage closure device; which eliminates the need for anticoagulation.\textsuperscript{7}

The Surgeon’s Role in TAVR

The surgeons role in TAVR will continue to diminish—at least for the near future. Two surgeons are no longer required to evaluate patients for TAVR as part of the heart team. Because 93% of all TAVRs are now being performed via a percutaneous femoral artery approach with the use of lower-profile devices, the majority of which using a minimalist approach, there will be a decreased need for surgeons to obtain vascular access for TAVR.\textsuperscript{8} Because of the decreasing incidence of catastrophic complications during TAVR, and the increase in lower-risk patients, surgeon and pump standby may become unnecessary, as was the case with standby for PCI. In Europe, there is evidence that the absence of an
on-site surgical team did not increase TAVR morbidity or mortality.7 Having a full surgical team on standby increases costs and may not be justifiable since the conversion rate to SAVR is < 1%, especially with the transfemoral minimalist approach with conscious sedation.8

Although Percy et al. encourage surgeons and trainees to acquire the skills needed to perform TAVR, they fail to tell us how this will be accomplished. Formalized structured training programs for surgeons to acquire TAVR skills are currently nonexistent. Cardiac surgical trainees will need to acquire wire-catheter skills and at the same time master surgical technical skills in an age of increasing high-risk complicated surgical cases and decreasing volumes of cardiac surgery in general. It will be difficult to do both. Cardiac surgical trainees must compete with interventional cardiology trainees for time in the catheterisation lab to acquire TAVR skills. This will undoubtedly require additional postgraduate training because the current American Board of Thoracic Surgery guidelines require only 10 TAVR cases as an assistant and 5 as a primary operator, not enough to become proficient to perform TAVR. Once cardiac surgery trainees complete additional TAVR training, it is unclear what role they will have in the catheterisation lab, as was the case with surgeons seeking to perform both CABG and PCI procedures. Furthermore, the new TAVR guidelines have mandated that TAVR surgeons have performed either 100 SAVRs in their lifetime or 50 SAVRs in the past 2 years.9 In the face of decreasing SAVR volumes, it will be difficult for new trainees to meet these requirements. These obstacles are not insurmountable, but they will not be solved overnight.

**TAVR vs SAVR—Where Do We Go from Here?**

In 2010, in an editorial to response to the original PARTNER trial, I noted that in view of the benefits of TAVR in patients who are not candidates for SAVR, there will be a temptation to expand this technology to all patients with AS.10 We now have sufficient data to show that TAVR can be safely performed in most patients with AS with good short-term outcomes compared with SAVR. Although the sky is currently falling for SAVR, there are rays of sunshine on the horizon.

One of the major questions regarding the role of TAVR is the durability of these prostheses. Although the 5-year follow-up for the PARTNER 1 trial reported no episodes of structural deterioration requiring replacement, and that valve hemodynamics remained stable, no 10-year data are available.11 In most studies, fewer than 15% of the patients receiving TAVR have follow-up beyond 5 years. In bioprosthetic SAVRs, 10-year freedom from valve replacement due to deterioration is 90%, and in patients > 70 years of age it is > 95%.12,13 The durability of TAVR prostheses will need to be carefully monitored, especially in younger patients, because the benefits of valve-in-valve procedures remains unknown. Other issues that may curtail the growth of TAVR include:

- The increased need for permanent pacemaker insertion and subsequent lead extraction procedures, and how long-term pacing will affect long-term survival.
- The increased cost of TAVR prostheses, which together with the added cost of pacemakers may offset savings from decreased operating room time and hospital length of stay. In addition, the added costs for readmission following high-risk TAVR, which can be > 20%, will need to be monitored.
- The concern for leaflet thrombosis on TAVR prostheses and the possible need for prolonged anticoagulation or antiplatelet therapy and its potentially harmful side-effects, especially in older patients.

Surgeons and cardiologists will need to continue to carefully monitor these results in patients enrolled in Society of Thoracic Surgeons/American College of Cardiology transcatheter valve therapy registries. However, this will take time, and data regarding these issues may not become available for another 5-10 years, as was the case with studies examining the benefits of CABG vs PCI that were incorporated into best practice guidelines. In the meantime, for SAVR, the sky will continue to fall—for now.

**Funding Sources**

The authors have no funding resources to declare.

**Disclosures**

The author has no conflicts of interest to disclose.

**References**


