# TAVI With the Edwards Sapien Valve

An update on the latest trial data and the future of aortic valve technology.

BY MARTYN THOMAS, MD, FRCP

The first transcatheter aortic valve implantation (TAVI) was performed in 2002.[1] During the last 8 years, the procedure has been refined and is now relatively predictable in terms of immediate outcomes. The Edwards Sapien transcatheter heart valve (Edwards Lifesciences Corporation, Irvine, CA) can be delivered via the transfemoral (TF) or transapical (TA) route and is a balloon-expandable valve.

## PATIENT SELECTION

The TAVI procedure is indicated for patients who represent high risk for standard open surgical aortic valve replacement (SAVR) and usually have a logistic EuroSCORE of > 20 or a Society of Thoracic Surgeons score of > 10. Other potential indications include a porcelain aorta and previous mediastinal radiotherapy. Patients should be selected for TAVI by a multidisciplinary team including interventional cardiologists, cardiac surgeons, cardiac anesthesiologists, and imaging specialists. It is generally agreed that patients undergoing the TA approach represent a higher-risk group than those undergoing TF. In cohort 1 of the SOURCE registry,[2] the logistic EuroSCORE was 29.1 with TA compared to 25.7 with TF ($P < .001$). Therefore, the outcomes of the two procedures cannot be directly compared. The principal determinant on whether a patient undergoes the TF or TA approach is the presence of significant peripheral vascular disease. Because of the large French size of the TF delivery catheter, a minimum luminal diameter of the femoral and iliac vessels (8 mm for the 26-mm valve and 7.5 mm for the 23-mm valve) is required for this approach. Screening imaging before patient selection should include transthoracic echocardiography, aortic computed tomography, and coronary/peripheral angiography.

## THE PROCEDURE AND 30-DAY OUTCOMES

The Edwards Sapien valve is currently commercially available in 23- and 26-mm sizes. Most of the published literature and presentations for the TF approach use the Edwards Sapien valve and require a 22- or 24-F sheath, and for the TA approach, a 26-F TA delivery system is used. Procedural results are now highly acceptable, with a success rate of > 95% and a very low on-table mortality rate. Valve embolization rates (aortic and ventricular) are low (0.3%), as are coronary obstruction rates (0.6%).[2] If coronary obstruction occurs, it is generally due to a native valve leaflet covering the coronary ostium rather than because of the device itself. This

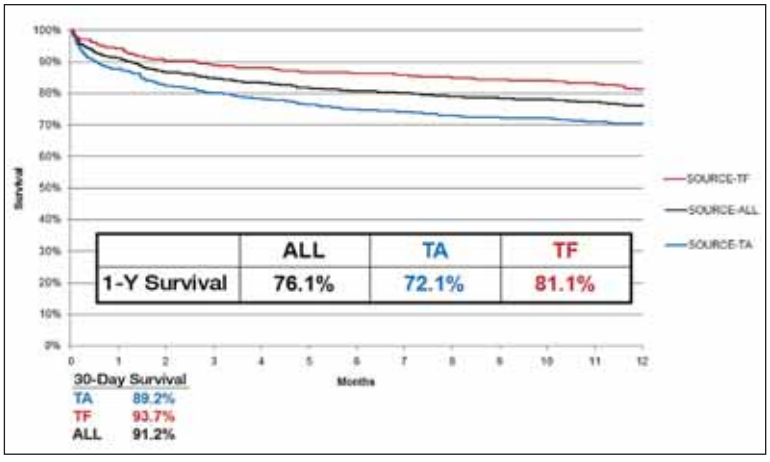


**Figure 1. One-year Kaplan-Meier survival curves for cohort 1 of the SOURCE registry.**

complication can often be predicted by the height and bulkiness of the native leaflets, the "depth" of the sinuses of Valsalva, and the distance between the leaflets and the coronary ostia. Therefore, careful attention should be paid to the preprocedural morphology of the native valve and to the anatomy of the aortic root and sinuses of Valsalva.

The most important potential complication of both the TF and the TA approach is major vascular access site complications. With the TF approach, this occurs in approximately 8% to 13% of cases.[2-4] Major vascular access site complications include obstructive dissections with limb-threatening ischemia and femoral or iliac rupture. These complications can now be managed with vascular occlusion balloons and stents (both covered and uncovered).

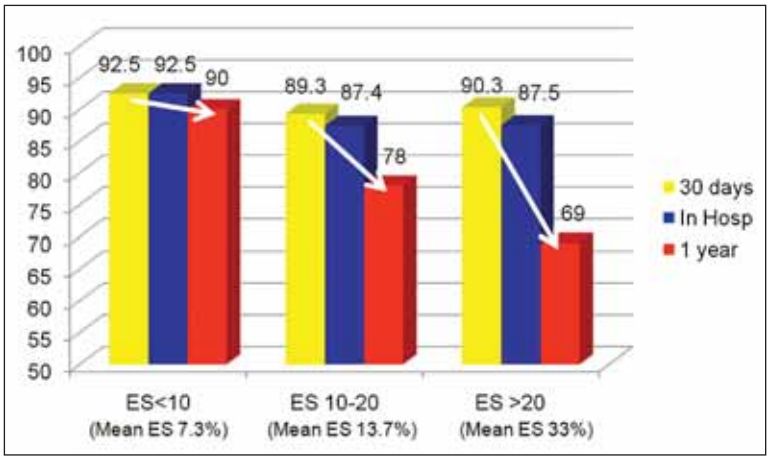


**Figure 2. Early and 1-year outcomes of risk-stratified octogenarians undergoing surgical aortic valve replacement.**

In the SOURCE registry, the improved management of complications means that there was no association between these early complications and 30-day mortality.[2] However, the data are different for the TA approach. A major apical access site complication is associated with a 50% mortality. Permanent pacemaker requirements for both the TF and TA approaches are approximately 5% to 7%.[2,5] The incidence of stroke at 30 days is 2.5%, which is the same for both the TA and TF approach. The exact mechanisms for these strokes are unclear but may be different for the two approaches. The 30-day mortality rate for the TAVI population is now in the region of 6% to 10%.[6,7] In the SOURCE registry, it was 8.5% for the entire population, 6.3% for TF, and 10.8% for TA; this mostly likely reflects the higher-risk nature of the TA patients.[2]

## ONE-YEAR OUTCOMES

The 1-year outcomes for cohort 1 of the SOURCE registry have recently been presented and represent the most up-to-date results using the current technology.[8] The Kaplan-Meier survival curves for the entire cohort, TA patients, and TF patients are shown in Figure 1. Kaplan-Meier survival rates were 76.1% for the cohort as a whole, 72.1% for the TA patients, and 81.1% for the TF patients. These data represent the best 1-year survival rates to date using this technology.

The majority of deaths between 30 days and 1 year were noncardiac and most likely reflect the comorbidities of the patients. There was a very low incidence of myocardial infarction and bacterial endocarditis. The incidence of stroke at 1 year was approximately 4.5%. Additionally, late vascular complications or pacemaker requirements were extremely low.[8]

One important issue in discussing the outcomes of TAVI procedures is the definition of various adverse events. Thus far, there has been no consensus on how to accurately define and measure such events as vascular complication or stroke. This has led to difficulty in interpreting different trials and registries across the current literature. This problem has now been resolved by the agreement of consensus definitions by a large group of expert individuals: the Valvular Academic Research Consortium definitions.[9] It is expected that these definitions will be used for all future trials and registries, which will lead to harmonization of the data and the ability to improve the integration of data.

## ALTERNATIVE VASCULAR ACCESS AND DEVICES

There are two TAVI devices that are currently commercially available: the Edwards Sapien transcatheter heart valve, a balloon-expandable valve, and the Medtronic CoreValve (Medtronic, Inc., Minneapolis, MN), a self-expanding device. Alternative approaches to TF and TA, which have previously been described, are the subclavian and the transaortic. Both the subclavian and transaortic approaches have shown encouraging results in what is by definition a higher-risk patient population than those undergoing a TF approach. The subclavian approach has mainly been reported with the CoreValve device because of its lower profile, and the transaortic approach is still in its infancy.

The outcomes between the two devices at 30 days and 1 year are broadly similar, apart from an increased need for a permanent pacemaker with CoreValve

(4%–7% with the Edwards Sapien device and 20%–40% with the CoreValve device).

## CONTEXT VERSUS SURGICAL AORTIC REPLACEMENT

Much of the surgical literature on high-risk patients concentrates on inpatient outcomes for patients such as octogenarians. Are there any comparators for the 1-year results of TAVI? The Leipzig group provided data in their article from 2009[10] regarding octogenarian patients undergoing SAVR. The patients were divided into those with a logistic EuroSCORE of < 10, 10 to 20, or > 20. The 30-day survival rates were similar for all risk groups, ranging from 89% to 93%. The pattern for 1-year survival was very similar to TAVI and appears to reflect the risk of the patient rather than the risk of the procedure. Mortality rates between 30 days and 1 year for patients with a log EuroSCORE of < 10 was 2.5% (1-year survival, 90%), a score of 10 to 20 was 11.3% (1-year survival, 78%), and for those with a log EuroSCORE of > 20 (potentially a TAVI population), the mortality rate was 21.3% (1-year survival, 69%) (Figure 2). Therefore, the gold standard for 1-year survival of high-risk (TAVI-type) SAVR might be seen as 69%. The 1-year survival rate for the overall SOURCE cohort of 76.1% (81.1% for TF and 72.1% for TA) is therefore highly encouraging within this context.

## NEW DEVICE DEVELOPMENTS

The latest iteration of the Edwards valve, the Edwards Sapien XT valve with the Novoflex delivery system (Edwards Lifesciences), involves changes for both the TF and TA system. The valve has changed from stainless steel to cobalt-chromium, and the valve leaflet design has been modified. The Novoflex delivery system is now 18 F for the 23-mm valve and 19 F for the 26-mm valve. This has been achieved by a novel concept of loading/aligning the delivery balloon onto the Sapien XT valve in the descending aorta. The new Ascendra transapical delivery system (Edwards Lifesciences) is 24 F and has also been made more ergonomically friendly. Certainly for the transfemoral catheter, it may be expected that the reduction in the French size of the device will result in a higher proportion of patients who are eligible for the TF approach and a reduction in the incidence of vascular complications. Given that these complications have traditionally been associated with increased mortality rates,[8,11] the new XT device may lead to a further increase in the 1-year survival rates. These new devices are currently being tested in PREVAIL TF and TA registries and will be further investigated in the next major European registry, SOURCE XT.

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## THE FUTURE OF TAVI

TAVI is now maturing as an interventional procedure. The procedure itself is becoming predictable, and complication management has greatly improved. The real skill involved with TAVI now is choosing the correct patients to undergo the procedure. The next task of the interventional community is to construct a "TAVI risk measure," which will accurately predict the in-hospital and 1-year outcomes after TAVI. In addition, cost effectiveness needs to be established for the procedure because the current TAVI devices are expensive. It is probable that if new devices begin to appear on the market, the cost of the currently available transcatheter valves will be reduced.

Cost effectiveness is generally measured as the cost per quality-adjusted life year gained. To demonstrate cost effectiveness, TAVI will probably have to improve quality of life and longevity compared to an alternative treatment (ie, medical therapy or open SAVR). Currently, this cannot be measured because there are no randomized data available. Randomized data for the Edwards device (the PARTNER trial) will be available toward the end of 2010 for TAVI versus medical therapy and in 2011 for TAVI versus SAVR in high-risk aortic stenosis patients. Further randomized trials are in the planning phase both in the United States and in Europe. It is likely that these future trials will involve a lower-risk group of surgical patients. It may be difficult to demonstrate cost effectiveness in a low-risk cohort because of the excellent result of SAVR.

If TAVI is performed in lower-risk patients, the issue of paravalvular leak may become more important. Currently, the incidence of > 2+ aortic regurgitation after the procedure is low, and this tends to be reduced with time.[2,6] However, grade 1 to 2 aortic regurgitation is relatively common. In the context of high-risk surgical patients, this may have little clinical relevance. But, in lower-risk patients with greater life expectancy, this type of residual aortic regurgitation may become important. Further technical advances for dealing with paravalvular leaks are required.

The incidence of clinical stroke after TAVI is generally reported to be 2% to 5%.[2,6] However, recently, magnetic resonance imaging has been used to detect new lesions

in 84% of 32 patients undergoing TAVI with both balloon-expandable and self-expanding valves.[12] These were not associated with detectable clinical neurological consequences. Nonetheless, cerebral deflection/protection devices (delivered via the radial artery) are currently under investigation, and hopefully, these will result in a reduction in silent and apparent cerebral ischemia after TAVI.

## CONCLUSION

The results of TAVI are becoming more predictable. Depending on the vascular access site, a patient can now be quoted a 30-day mortality rate of 6% to 10% and a 1-year survival of > 80% with the TF approach. Developments of the device and refinement in patient selection should lead to a further improvement in these outcomes. It appears highly likely that TAVI is here to stay and will establish itself as an important part of the armamentarium available for treating patients with symptomatic aortic valve stenosis. ■

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