Aortic valve replacement (AVR), secondary to calcific aortic stenosis, remains the most common valvular heart surgery with 50,000 procedures performed annually in the US (1,2). Although percutaneous valvuloplasty provides temporary relief (3), valvular stenosis and symptoms typically return within 6 months (4), making valvular replacement the only definitive therapy (5,6). Aortic stenosis prevalence and age-related co morbidities will increase as the population ages (7). Health care providers have been developing novel techniques for addressing symptomatic aortic stenosis, including transcatheter prosthetic valve implantation (8).

Despite the clear benefits of AVR for patients with stenotic valves (9), open AVR surgery in high-risk patients has an associated perioperative mortality of 4-18%, dependent on patient co morbidities (10,11). Consequently, despite the dismal prognosis of symptomatic aortic stenosis (12), open-heart surgery is often withheld from high-risk patients. A less invasive management for valvular stenosis might benefit this patient population. Cribier first described transcatheter aortic valve replacement (TAVR) following transcatheter valvuloplasty in 2002 (13). He chose to approach the aortic valve (AV) via femoral venous cannulation, trans-atrial septal puncture, and antegrade deployment through the left ventricular outflow tract by way of the mitral valve. Since then, and more popularly, prosthetic aortic valves have been deployed retrograde, from the aorta, via cannulation of the femoral artery and antegrade, by puncture of the left ventricular (LV) apex via a small left thoracotomy (14). The Partner Trial is a multicenter, randomized study comparing TAVR to medical management (including balloon valvuloplasty) in patients not considered to be surgical candidates and to conventional AVR in high-risk surgical candidates. Published results showed improved survival with TAVR over medical management (15) and equivalent mid-term survival compared to AVR (16).

In 2011 the FDA approved TAVR with one device for patients with severe AS who are not surgical candidates, and there are ongoing trials comparing TAVR to conventional AVR in high-risk patients with two devices. Recently an expert consensus document addressing TAVR was published in a collaborative effort by the American Heart Association, American Society of Echocardiography, European Association for Cardio-Thoracic Surgery, Heart Failure Society of America, Mended Hearts, Society of Cardiovascular Anesthesiologists, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. (17). It includes an extensive review of the development of TAVR and considerations in evaluating patients for the procedure and the team approach to needed to have a successful TAVI program.
The anesthetic considerations of TAVR have been reviewed (18). We have employed hemodynamic monitoring and general anesthesia with endotracheal intubation on all cases, but some centers have used conscious sedation for transfemoral procedures. Most agree that performing TEE during TAVR is an indication for general anesthesia and intubation. Most cases require some pressor support and a few positive inotropic agents during the procedure. Double lumen endotracheal tubes for one lung ventilation have not been necessary for the transapical cases. A cardiopulmonary bypass machine and a perfusionist team are on standby in the room for transapical cases. We have been able to extubate most of the transfemoral cases more than half of the transapical in the cath lab or OR at the end of the procedure, and our anesthetic is tailored to allow extubation if all goes well. As experience has accumulated, the procedures are taking less time and having fewer problems.

At my institution all patients receive TEE monitoring during valve implantation. The TEE probe is inserted after endotracheal intubation and removed at the end of the procedure. A comprehensive baseline exam is performed to reconfirm the diagnosis, assess baseline ventricular function, and detect associated valvular lesions such as mitral and tricuspid regurgitation. Measurements of the AV annulus are made from 3D views to assist size selection of the prosthetic valve. The annulus must be between 18-21 or 22-25 mm in diameter, for use of the 23 or 26 mm Edwards’ prosthesis, respectively. To prevent obscuring the fluoroscopic image during positioning and inflation of the valvuloplasty balloon, the TEE probe is withdrawn to the level of the aortic arch and then re-advanced to assess the results, focusing primarily on the severity of AR. The TEE probe is again withdrawn for positioning and deployment of the prosthesis under fluoroscopic imaging, and then advanced to assess the results. As with any major cardiac intervention, we found TEE to be invaluable while monitoring procedural cardiac function.

The deployed device is examined with TEE in short and long axis views to assess the position of the device within the AV annulus. Deployment too proximal in the left ventricular outflow tract may cause over expansion of the device and central regurgitation. Distal deployment may cause valve embolization in to the aorta or interference with coronary blood flow. Color flow Doppler assesses AR. TEE can be particularly helpful in differentiating transvalvular AR from perivalvular AR, an important distinction that remains difficult to make using aortic root contrast injection and fluoroscopy. Perivalvular AR may be treated by re-inflating the deployment balloon within the prosthesis, further expanding the valve within the annulus. Significant transvalvular AR suggests over expansion of the prosthesis, which may require deployment of a second prosthetic valve within the first. TEE is also helpful in detecting potential complications such as aortic dissection, myocardial ischemia from coronary artery ostial obstruction or embolization, and hypovolemia. The application of TEE during TAVR has recently been reviewed (19) and guidelines have been published (20).

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