Transcatheter Aortic Valve Replacement: A Review

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KEYWORDS

• Transcatheter aortic valve replacement • Surgical aortic valve replacement
• Aortic stenosis • Valvular heart disease • Catheter

KEY POINTS

- The treatment of aortic stenosis is changing and being treated more with catheter-based technology: inoperable, high risk, and intermediate risk are now approved.
- Gated multislice CT angiogram has emerged as the gold standard for assessment of valve anatomy and sizing of the transcatheter heart valve.
- Long-term results are needed before its use in lower risk categories.

Video content accompanies this article at http://www.surgical.theclinics.com/.

INTRODUCTION

With the recent approval of the intermediate-risk category for transcatheter aortic valve replacement (TAVR), medicine is undergoing a dramatic paradigm shift in the way aortic valve stenosis is treated. At this time, cardiac surgeons with their expertise in valve replacement remain the gatekeepers for TAVR; however, cardiac surgeons are no longer the sole providers for the advanced treatment of aortic stenosis (AS). The Centers for Medicare and Medicaid Services (CMS) in conjunction with the Food and Drug Administration (FDA) developed detailed criteria to ensure the best adoption of this new technology. A threshold of surgical experience and structural heart procedural experience was required to be a TAVR center.[1] Not only did CMS and the FDA selectively choose centers based on experience, they required a collaborative, multidisciplinary team approach to treatment decision making and participation in the

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Transcatheter Valve Therapy (TVT) Registry. This national registry was created in collaboration between the Society of Thoracic Surgery (STS) and American College of Cardiology (ACC), which mirrors the collaborative approach mandated by CMS and the FDA.

HISTORY

The paradigm shift in treatment of AS did not occur overnight but started in the laboratory with catheter-based concepts that transformed into catheter-based interventions and eventually translated into clinical trials. The first catheter-based therapy was performed in September 1977 in Switzerland by Andreas Gruentzig,[2,3] ushering in the era of interventional cardiology for the treatment of coronary disease. Within 10 years, the first balloon valvuloplasty was performed on a child for treatment of pulmonic stenosis.[4] In 1985, Cribier and coworkers[5] performed the first in-human balloon aortic valvuloplasty on an inoperable 77-year-old man. Cribier and coworkers[6,7] later went on to create the first percutaneous valve, which was subsequently acquired by Edwards Lifesciences (Irvine, CA). The Cribier-Edwards valve was further refined to become the Sapien, balloon expandable transcatheter heart valve (THV).

The Initial Registry of Endovascular Implantation of Valves in Europe[8] and the Registry of Endovascular Critical Aortic Stenosis Treatment were the first trial registries that evaluated feasibility of TAVR. The initial TAVR procedures were done on a compassionate basis. An antegrade approach with transseptal puncture was used for implantation. Although less than perfect, the results demonstrated that patients suffering from severe AS could be helped with a catheter-based procedure. The next several years were spent on refining the devices and implantation technique to produce a safer, more successful procedure.

THE HEART VALVE TEAM

The heart valve team approach has become the standard of care for the treatment of aortic valve stenosis, more specifically TAVR, in the United States.[9,10] CMS has mandated that a team of professionals have joint treatment decision making for these patients. This mandate by CMS clearly puts the patient at the center of the care model.

There are many stakeholders within the multidisciplinary heart valve team. A typical valve team consists of one or more each of the following physicians: cardiothoracic surgeon, interventional cardiologist, imaging specialist/radiologist, cardiac anesthesiologist, and noninvasive cardiologist. However, the most important stakeholder within the team is not one of these physicians but rather is the valve clinical coordinator. The coordinator is typically a registered nurse or advanced practice nurse that understands and oversees all processes within the valve clinic and aims to keep the patient at the center of care. This individual is responsible for overseeing the patient from the initial referral into the valve clinic through the entirety of the diagnostic process. The coordinator also oversees and coordinates the procedural process. He or she is available for coordination of hospital care and ensures all aspects of the follow-up care are arranged. The valve clinical coordinator is responsible for managing and collecting information for the TVT Registry.

The heart valve team should also include other ad hoc members for special, patient-specific circumstances, such as an oncologist for newly diagnosed malignancies, a gerontologist to help address complex medical issues, or a neuropsychologist for evaluation of cognitive impairment. Backup with additional cardiac and noncardiac services, such as a heart failure team, a vascular surgery team, and social services, is a force multiplier and only serves to strengthen the program.[11]