A Gift That Keeps on Giving: Transcatheter Aortic Valve Implantation and the Birth of the Multimodality/Interventional Imager

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The year was 2002; the skeptics were many, and the concept was already over 10 years old. One executive famously said, “This is the most stupid project I ever heard of.” That did not stop Dr. Alan Cribier performing the first-in-man Transcatheter Aortic Valve Implantation (TAVI)1 using a technology imagined by then fellow-in-training Henning Rud Andersen back in 1989.2 Twenty years later TAVI has surpassed surgery as main treatment for aortic stenosis,3 with an ever-increasing number of patients benefiting from this life-saving procedure. TAVI itself has changed a lot in the process, with dedicated TAVI Clinics streamlining patient selection, deployment under conscious sedation rather than general anesthesia, and the replacement of transesophageal echocardiography (TEE) by transthoracic studies as the main imaging modality for intra-procedural assessment.

Going beyond the tremendous benefits offered to patients worldwide, TAVI is the gift that keeps on giving. Indeed, the close interaction between the interventional and imaging cardiologists needed to perform TAVI, together with the momentous progress in transcatheter structural interventions, lead to the emergence of a new subspecialty: interventional imaging. This was not an easy process—as they say it is hard for old dogs to learn new tricks. The interventionist became quite proficient in interpreting complex echocardiographic studies and the echocardiographer learned that “periprosthetic regurgitation at five o’clock” does not provide good directions in the 2D world of fluoroscopy; we had to create a common language to be able to communicate effectively.4 Both interventionist and echocardiographer called their radiology friends to help them dip into the high-resolution world of 4D Cardiac CT angiography. The echocardiographer had to learn how to properly image the tricuspid valve on TEE during transcatheter edge-to-edge repair; in the process we also learned that intracardiac echocardiography may be needed for leaflet grasping in a significant proportion of patients. In a recognition that no single imaging modality can answer all questions, the European Association of Echocardiography joined forces with all imagers to morph into the European Association of Cardiovascular Imaging.

What then do we tell cardiology fellows who are considering a career in imaging? Three major items come to mind:

**Nothing can replace knowledge.** In a post–2D-imaging world, multimodality imaging training is a must, and I would caution any junior fellow against focusing on a single modality, even if that means extending their fellowship by one year. Indeed, formal training in echocardiography, nuclear, CT, and MRI will allow trainees gain deep understanding of each technology. Armed with that knowledge—and not bound by their own limitations—future imagers will be able to choose the right imaging for the right indication. Furthermore, these fellowships should include direct exposure to interventional imaging, which is technically very different from standard TTE/TEE. Not only is the scanner positioned differently than in the echocardiography laboratory, but the imager must also know how to navigate around the multiple catheters, wires, and devices obscuring the imaging field during percutaneous interventions. We must push for National Societies to acknowledge these changes in imaging and create formal training programs and accreditation exams.

**Nothing can replace experience.** While the interventionists of today are very well versed in interpreting the location and severity of valvular pathology on echocardiographic images, echocardiographers frequently look at 4D CT datasets, and radiologists look at complementary echocardiography data when analyzing complex peri-valvular regurgitation, none of us has become an omnipotent, all-knowing physician. The echocardiographer may miss the metastatic lung lesion on CT, the interventionist may overestimate the severity of late-systolic regurgitation of mitral valve prolapse, and the radiologist may not notice the fine periprosthetic leak that leads to hemolysis and that is so obvious on Color Doppler. As such, we must all admit our limitations and ask our colleagues to provide their complementary individual expertise. Experience in a field matters; much like playing on a flight simulator does not make one a bona fide pilot, the interventionist cannot become the imager, the imager cannot become the interventionist, and neither should play a surgeon in real life.

**Nothing can replace the team.** The emergence of TAVI also led to the “heart team” concept now at the center of all decision-making in structural heart interventions. For the first time cardiac surgeons, interventional cardiologists, and imagers started working together during TAVI for the benefit of the patient. Rather than feeling threatened by the emergence of intracardiac echocardiography as a complement to transesophageal imaging guidance, the interventional imager should embrace the technology and assist the interventionist with their expertise in image optimization and 3D dataset manipulations; the interventionist can then focus on performing the procedure alone. Rather than feeling threatened by

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TAVI, surgeons have now learned percutaneous techniques and are revolutionizing their approach to minimally invasive surgical interventions. I cannot imagine a future without an interaction of these team members, nor can I envisage future interventions being performed by a single physician.

So, what can we say twenty years after the first TAVI? We have more than an extraordinary procedure to celebrate: we also have the birth of the multimodality/interventional imager. At the heart of structural interventions, this new breed of cardiologists guides our interventionists and surgeons do what they do best: perform the procedures our patients need. Happy Birthday Interventional Imager. I am sure there are many more to come!

**Conflict of interest**

none declared.

**REFERENCES**


