Transapical Angiography in a Patient With Severe Aortic Stenosis Undergoing Transapical Transcatheter Aortic Valve Implantation

Norbert Franz, MD, Steffen Hofmann, MD, Michael Billion, MD, Abbas Ferdosi, MD, Marek Kowalski, MD, Peter Bramlage, MD, PhD, and Henning Warnecke, MD

Abteilung für Kardiologie, Schüchtermann Klinik, Universität Witten—Herdecke, Bad Rothenfelde; Abteilung für Herzchirurgie, Schüchtermann Klinik, Universität Witten—Herdecke, Bad Rothenfelde; and Institut für Pharmakologie und präventive Medizin, Mahlow, Germany

Transapical transcatheter aortic valve implantation (TA-TAVI) is the method of choice in patients with severe stenosis of the aortic valve, high operative risk, and an adverse peripheral vasculature. The procedure is generally guided by peripheral arterial access angiography. We report on a 71-year-old patient in whom, because of the absence of an alternative peripheral arterial access route, TA-TAVI was supported by the apical insertion of the angiography catheter. This approach was effective and safe, and proper valve deployment was feasible without unexpected procedural complications. (Ann Thorac Surg 2013;96:e151–3) © 2013 by The Society of Thoracic Surgeons

Transapical transcatheter aortic valve implantation (TA-TAVI) is the method of choice in patients with severe stenosis of the aortic valve, high operative risk, and an adverse severe peripheral vascular disease, as well as inaccessible tortuous iliac artery disease or history of extensive major vascular operations. The procedure requires repeated angiography of the aortic bulb, for which an additional peripheral access is commonly used. We report on a patient in whom, because of the absence of an alternative peripheral arterial access route, TA-TAVI was supported by the apical insertion of the angiography catheter. This approach was effective and safe, and proper valve deployment was feasible without unexpected procedural complications.

The 71-year-old patient presented to the Schüchtermann-Klinik heart team with recurrent cardiac decompensation because of severe aortic stenosis. After decompensation was resolved, it was shown by echocardiography that the left ventricular ejection fraction was 60%, the mean gradient was 50 mm Hg, and the maximal gradient was 90 mm Hg (0.7 cm² aortic valve opening). In addition, the patient had moderate regurgitation of the mitral and tricuspid valves with a systolic pulmonary artery pressure of 60 mm Hg. Relevant anamnestic details were a stroke about 4 years previously with no residual effects and chronic hemodialysis because of chronic renal failure. The shunt connection was located on the right arm. More recently, the patient received a DDD pacemaker with a high degree of stimulation because of third-degree atrioventricular block.

Because there was no clinical suspicion of relevant peripheral artery disease and the ankle brachial index was greater than 1.3, transfemoral coronary angiography was scheduled. This proved not to be feasible because of complete occlusion of the common iliac artery (Fig 1). Next, the left brachial artery was chosen as the access route. Again, this access was heavily calcified; the aorta was reached by a TERUMO guidewire (TERUMO Medical Corp, Somerset, NJ) only, and a subtotal stenosis of the left subclavian artery was detected. This was successfully treated (after predilation) by stent implantation (Invatec Scuba 9–30 mm; Medtronic, Inc, Minneapolis, MN). Finally, coronary angiography revealed no coronary stenosis in either vessel. A large hematoma of the left arm developed as a procedure-related complication.

On computed tomography (CT) a massive calcification of the total aorta, and the ascending aorta in particular, was found with a substantial and symmetrical...
calcification of the aortic valve. The distance between the coronary orifices and the aortic valve annulus was 12 mm in either case. The annulus itself had a diameter of 24 mm (determined by CT and transesophageal echocardiography [TEE]).

Because of the complex patient history with a logistic EuroSCORE of 30, a consensus was reached within the heart team to replace the aortic valve using TA-TAVI and a 26-mm Edwards SAPIEN XT valve (Edwards Lifesciences, Irvine, CA). The procedure was performed in our dedicated hybrid operating room and was modified because of the lack of peripheral artery access.

For this purpose, the left ventricular apex was surgically exposed, an epicardial pacemaker probe positioned, and the apical suture prepared. The apex was then punctured and a guidewire placed in the left ventricular cavity and advanced through the aortic valve into the aorta. Using the guidewire, the apex opening was dilated to accommodate a 14F sheath, which was introduced up to the midventricular cavity.

Next we placed a 5F pigtail angiography catheter in the proximal ascending aorta through the apex to determine optimal C-arm position for valve deployment (Fig 2A). In addition, a multipurpose catheter was placed in the ascending aorta through a second 5F sheath in close proximity to the 14F sheath.

We then probed the descending aorta and changed the balloon (Edwards SAPIEN Ascendra balloon catheter 20 × 30 mm; Edwards Lifesciences, Irvine, CA) to finally perform valvuloplasty (Fig 2B). We exchanged the 14F sheath for the Edwards SAPIEN Ascendra introducer sheath and positioned the crimped 26-mm Edwards SAPIEN XT valve (Edwards Lifesciences, Irvine, CA) in the aortic valve annulus (Fig 2C).

After repeated angiography through the multipurpose catheter, we drew back the angiography catheter into the left ventricle (Fig 2D) before inflating the valve completely. The pigtail catheter was then exchanged through the Edwards Ascendra introducer sheath. Final angiography was performed (Fig 2E), and the apex was closed after removing both introducer sheaths.

The procedure resulted in correct positioning of the Edwards SAPIEN XT valve with minimal catheter-associated aortic valve insufficiency (Fig 2E).

---

**Fig 2.** (A) Aortic bulb angiogram for exact native valve orientation, performed with 5F pigtail catheter through 14F introducer apical access. (B) Balloon valvuloplasty of the native aortic valve: 5F multipurpose catheter in place (proximal ascending aorta) introduced through second apical access. (C) Implantation phase 1: aortic bulb angiogram for exact positioning of the SAPIEN XT valve, performed with 5F multipurpose catheter through second apical access. (D) Implantation phase 2: during release of the SAPIEN XT valve, the 5F multipurpose catheter was retracted to left ventricle; residual contrast (rapid ventricular pacing) is sufficient for orientation. (E) Final aortic bulb angiogram performed with 5F pigtail catheter through EDWARDS Ascendra introducer set—apical access.
Comment

Transapical angiography, conducted to enable transapical TAVI, proved to be an effective and safe approach in a patient with no alternative peripheral arterial access route. Proper valve deployment was feasible without unexpected procedural complications and resulted in a good functional outcome.

Advanced age, multiple morbidities, and lack of surgical options in high-risk patients are important criteria to perform transcatheter procedures instead of surgical aortic valve replacement. Using alternative access routes (transapical, transaxillary, transaortic, and rare cases of carotid artery access) [1–3] is frequently mandatory in those with adverse peripheral vascular anatomy (severe peripheral vascular disease, inaccessible tortuous iliac artery disease, or history of extensive major vascular operations). Unfortunately, these comorbid conditions sometimes also prohibit peripheral arterial access to enable angiography, and an alternative mode for guidance is required.

A potential approach to this patient would have been to perform TA-TAVI guided by TEE as the primary imaging technique as suggested by Bagur and colleagues [4]. They documented 100 patients with a mean logistic EuroSCORE of 25.8 who received an Edwards SAPIEN valve. Of these patients, 75 underwent TEE-guided TA-TAVI. They observed no differences in valve malpositioning or valve embolization. Survival rates at 1 year were comparable (88% versus 84%). However, the approach was questioned in an accompanying editorial by Svensson and colleagues [5]. They argued for using different imaging techniques in parallel and maintained that details of the device are much better seen using radiographic imaging. In contrast, noncalcified tissues are better visualized by ultrasonography.

We have reported on a patient in whom we successfully used concurrent transapical angiography to facilitate TA-TAVI. We decided that because of the substantial calcium load of the aorta and the aortic valves, TEE visualization of the situation would be suboptimal. In choosing this approach, we took into consideration the hostile peripheral arterial situation versus the need for aortic valve replacement and the potential for difficulties in occluding the additional apical access or further access-related complications. These potential complications did not arise in our patient, and only larger case series can tell whether using transapical angiography to facilitate TA-TAVI is actually associated with an increased procedural risk. As long as these data are not available, the approach can only be recommended for those with no alternative treatment option or access route.

In conclusion, transapical access for angiography to facilitate TA-TAVI can be considered in patients in whom no alternative peripheral arterial access route is available.

References