

Valvular Heart Disease Treatment in Challenging Patients

Until recently, surgical therapies such as valve replacement or valve reconstruction have been recommended for most severe valvular diseases. For many patients, however, surgery was not a viable option due to the high risks of advanced age or the existence of concomitant diseases. Interventional valve therapies can offer an alternative as demonstrated here by a complex case from the Heart Center at University Hospital Bonn.

Courtesy: University Hospital Bonn, Heart Center, Germany

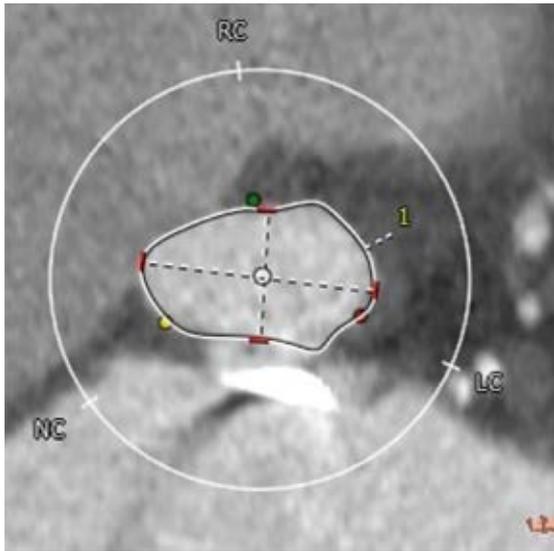
Interventional treatments such as interventional valve therapies are saving lives and improving quality of life for many patients. This is especially true of patients at high risk who cannot undergo surgical valve therapies. In most cases, however, the guidelines still recommend these as the preferred treatment. Advanced age and the existence of severe concomitant diseases such as heart failure, chronic obstructive lung disease, diabetes mellitus or renal failure are the most important contributors to high surgical risk.

Precise and rapid cardiac imaging technologies combined with analytical guidance software – including applications that overlay critical clinical information on real-time images – are making it easier for cardiologists to plan and carry out treatment strategies with greater confidence in challenging cases, reducing risk and improving clinical outcomes. A case study from the Heart Center Bonn in Germany demonstrates how an integrated set of advanced tools was used to improve diagnosis, evaluation, and treatment of a high-risk patient.

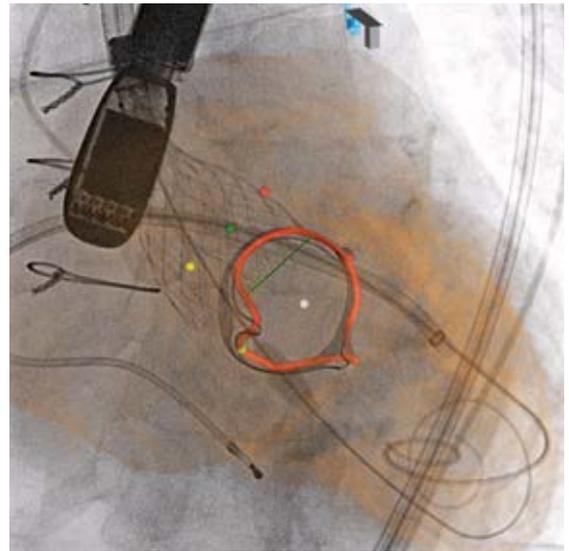
Patient history

A 74-year-old female patient presented to the Heart Center Bonn with severe dyspnea (NYHA class III). She was suffering from two-vessel CHD with a history of PCI RCA (1/2018) and CABG (2014). In 2014, she underwent surgical mitral valve replacement with implantation of a Perimount 27 prosthesis. She was also suffering from atrial fibrillation with elevated risk of stroke (CHADS-VASC score 5), chronic obstructive lung disease, and terminal kidney failure with chronic transplant failure after renal transplantation in 1999. Since then, she has been on hemodialysis.

Initial diagnostic evaluation with echocardiography found a normal-sized LV with an EF of 68%, combined aortic valve disease with leading stenosis (AVA 0.7 cm²) and deterioration of the mitral valve prosthesis with a residual valve opening area of 1.4 cm². These findings were confirmed using real-time 3D TEE. Coronary angiography excluded progress of the known CAD and no significant coronary stenoses were present.

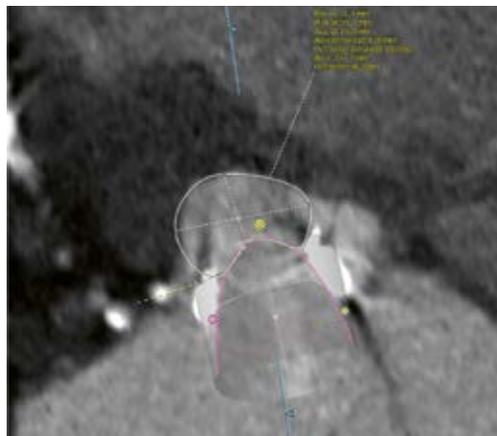
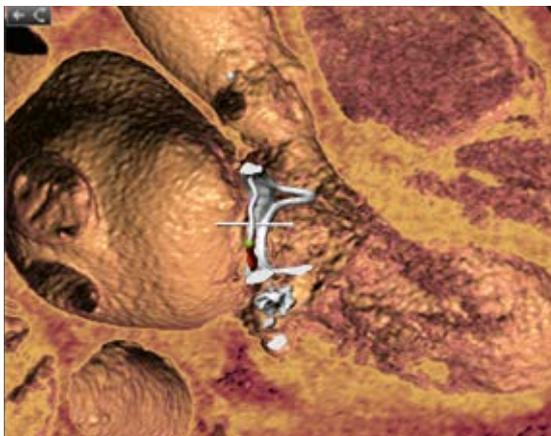
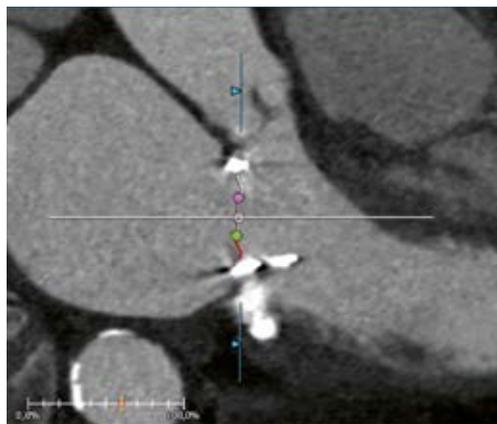
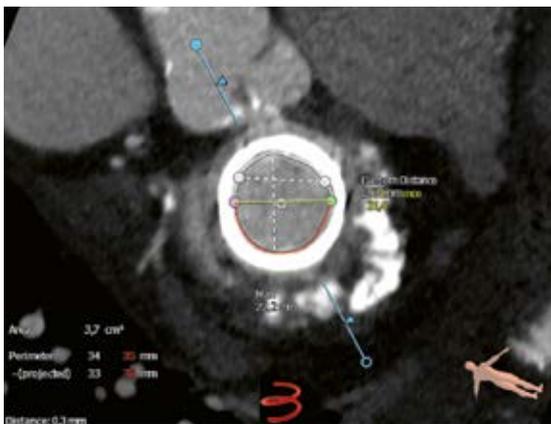


Preprocedural assessment of the aortic valve using CT imaging.



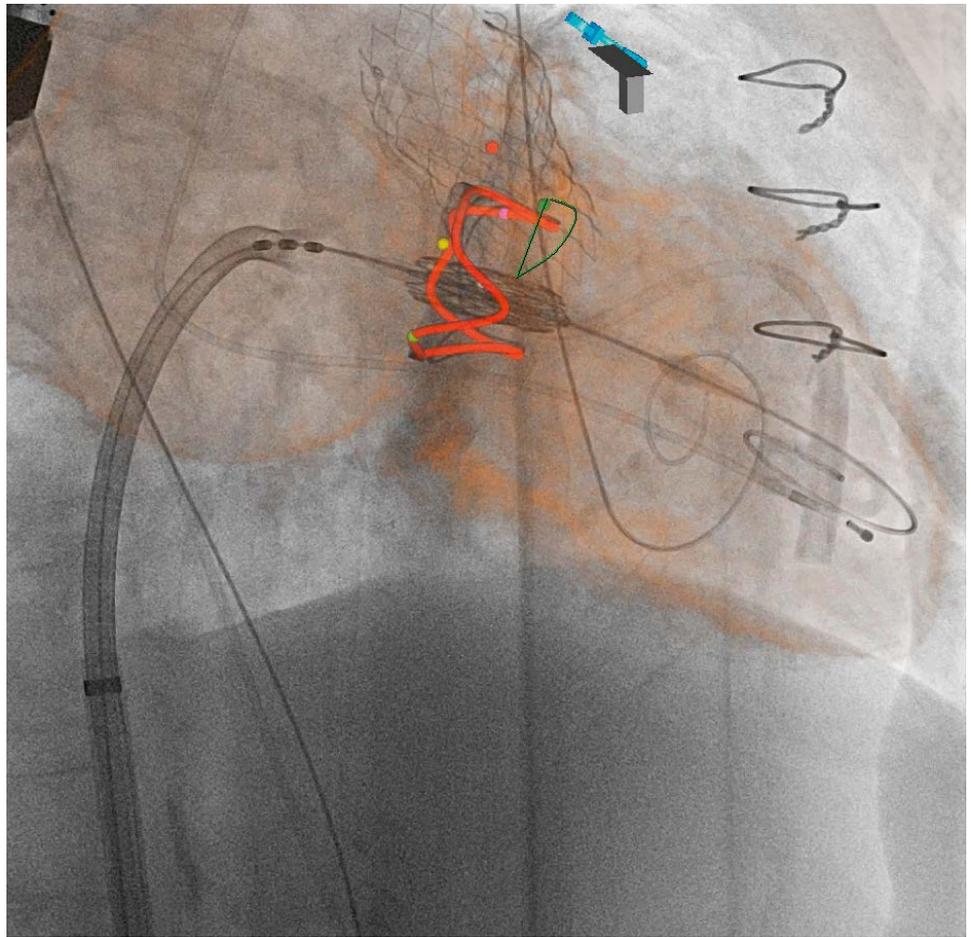
Positioning and deployment of the aortic valve prosthesis (Medtronic CoreValve) with optimized guidance through overlay of CT-derived landmarks.

Assessment of the mitral valve with 3mensio structural heart software. Preprocedural planning for TMViV.

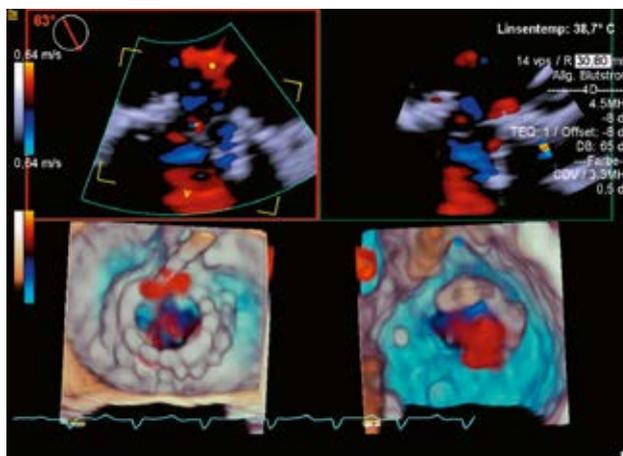


Neo left ventricular outflow tract (LVOT) simulated in an area of 227 mm².

Fusion with preprocedural CT data and annotation of LVOT and 3mensio planning results to guide the mitral valve-in-valve implantation.



Postprocedural real-time volume color Doppler TEE shows good result without indication of paravalvular leakage.



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syngo 2D/3D Fusion

- Enables fusion of preprocedural CT images including 3mensio landmarks with live fluoroscopy
- Improves orientation and helps determine the most appropriate angulation with the potential to reduce contrast and radiation dose

Diagnosis and evaluation

Based on the patient's history, the surgical risk was assessed as too high with a STS score of 19.8 and a STS score of 48.8. Therefore, the cardiac team proposed simultaneous TAVI and a mitral valve-in-valve (ViV) procedure. A combined cardiac and vascular CT scan was performed for further planning. The medical team used CT imaging along with TEE and eSie Valves advanced analysis software, which automatically provides key clinical parameters based on modeling of the mitral or aortic valve.

The CT scan showed calcifications of the iliac arteries; however, there was no contraindication to femoral access (TAVI). CT and 3mensio planning software were used to select the optimal prosthesis size, both for TAVI and mitral ViV intervention. As part of the planning process, the residual LVOT after TAVI and mitral ViV was simulated and showed no significant impairment. The cardiac team chose a Medtronic Evolut Pro (29 mm, TAVI) and an Edwards Sapien 3 (26 mm) for the mitral ViV intervention.

Treatment

The team began with the TAVI in order to clear the aortic stenosis before moving on to the more challenging mitral valve replacement. Positioning and deployment of the aortic valve implantation was guided by fusing CT images and landmarks for the aortic cusp points. Immediate post-procedural real-time 3D TEE demonstrated a good result without indication of paravalvular leakage.

With the aortic valve implantation complete, the team moved on to the mitral valve. The mitral ViV implantation was performed without complications via a venous access

The outcomes by customers of Siemens Healthineers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

route and transseptal puncture. Real-time 3D TEE and the fusion of live fluoroscopy with the 3mensio planning results guided the team with additional visualization of the LVOT while the valve was positioned and deployed.

Follow-up

Postprocedural fluoroscopy and real-time 3D TEE with color Doppler demonstrated a good result of the ViV implantation without evidence of paravalvular leakage. The LVOT was also not obstructed.

Comments

This successful procedure shows how innovative technologies – both devices and imaging – can help to enable cardiac interventions even in the most challenging, high-risk cases. The team at the Heart Center Bonn was confident that they could plan and perform valve replacement, improving the quality of this patient's life.

When performing complex procedures like dual TAVI and mitral ViV implantation in cases such as this one, multimodality imaging is key to supporting a successful outcome. Ultra-fast acquisition provided high temporal resolution, which freezes cardiac motion and therefore allows for accurate diagnosis of the mitral valve anatomy without breath-hold or heart-rate control. This is especially important for patients like in this case, who suffer from dyspnea.

In addition, the ability to fuse CT images with 3mensio guidance landmarks gave the team more confidence that they could position the prosthetic devices optimally for both TAVI and mitral ViV implantation. ●

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ACUSON SC2000 PRIME with real-time True Volume TEE and eSie Valves

Comprehensive analysis of valve function



Dual Source CT scanner SOMATOM Force

- Offers ultra-fast acquisition and low kV protocols for CT studies with a minimum of contrast media
- Freezes cardiac motion for accurate diagnostic scans without the need for breath-holding or beta-blockers