Case Study

Transcatheter Aortic Valve Implantation

Supported by *syngo* DynaCT Cardiac and *syngo* Aortic ValveGuide

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Transcatheter Aortic Valve Implantation

Courtesy of Gernot Brockmann, M.D., Department for Cardiac and Vascular Surgery, German Heart Center, Technical University Munich, Munich, Germany

Patient History
A 85-year-old female (168 cm, 70 kg) Logistic EuroScore 33.9 % suffered from atrial fibrillation, massive aortic calcifications, A. carotis stenosis, NYHA grade IV, pulmonary hypertension, osteoporosis, hypertension, and diabetes.

Diagnosis
Angiography presented the right coronary artery with 40 % stenosis.
CT and ultrasound were performed to evaluate the size of the aortic valve. Annular measurement by TTE 24 mm, TEE 25 mm and CT 25 mm. Effective aortic valve orifice area was calculated to 0.6 cm^2. The pressure gradient between the left ventricle and the aorta was determined by ultrasound with a maximum 83 mmHg and mean 46 mmHg.
According to the image (Fig. 1) the access was determined to be transfemoral (right side, 6 - 7 mm).
Clinical data were collected to choose either transfemoral, subclavian, or transapical access. A minimally invasive transcatheter aortic valve implantation (TAVI) was planned for a CoreValve (26 mm).

Treatment
The procedure was performed under general anesthesia to assure stable hemodynamics and to avoid patient movement during valve implantation. *syngo* DynaCT Cardiac images were acquired during rapid pacing.

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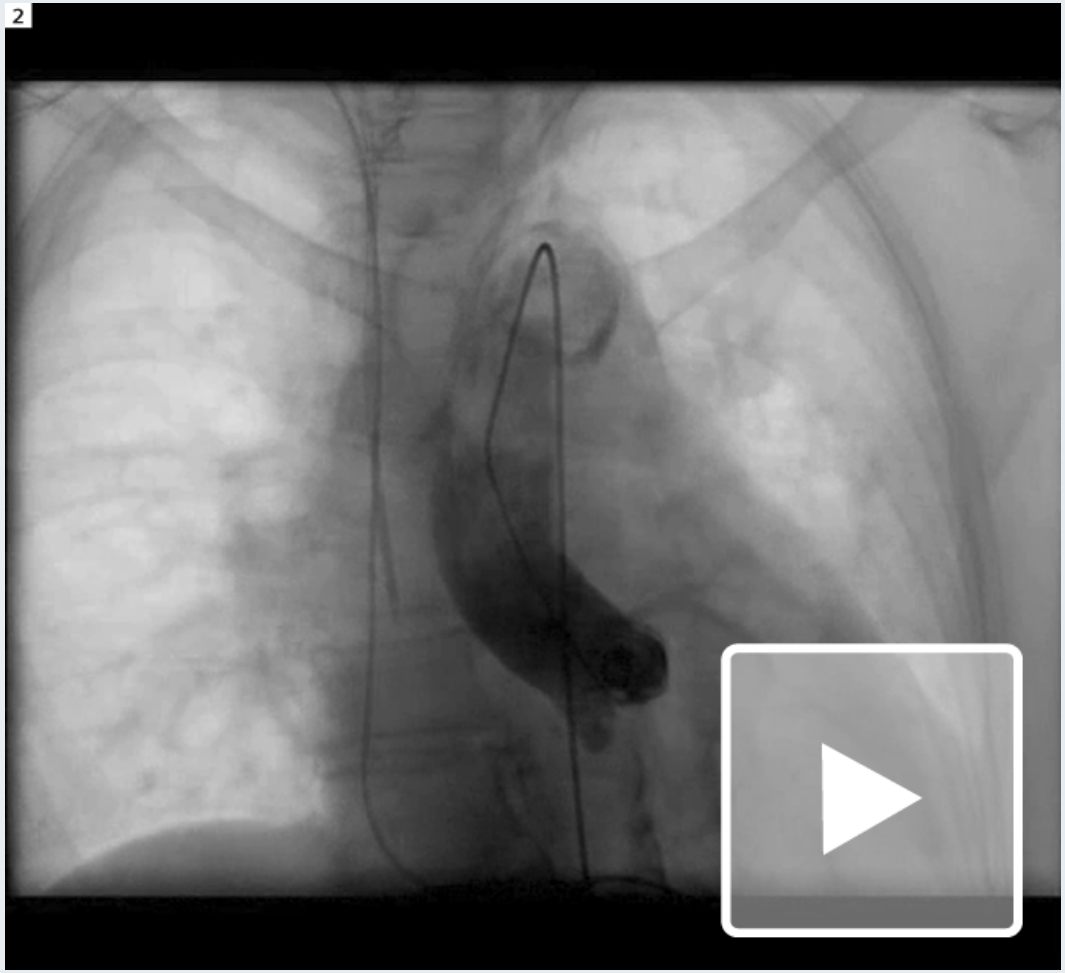
1 Pre-procedural CT for access and procedure planning.



2 5 second *syngo* DynaCT run for acquisition under rapid pacing. As contrast medium is critical for these very sick patients only 10 cc of diluted contrast were used.

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Contrast dilution was injected into the aortic root via a pigtail catheter (Fig. 2). The contrast agent remains in the aortic root during rapid pacing and *syngo* DynaCT Cardiac imaging. Only 10 cc of contrast are needed to achieve an image resolution sufficient for segmentation.
Based on the *syngo* DynaCT Cardiac reconstruction the new *syngo* Aortic ValveGuide software automatically segments the aortic root in only a few seconds (Fig. 3). Furthermore, it detects and marks the coronaries and derives a circle parallel to the plane spanned by the three lowest points of the aortic cusps (see red circle in last image of Figure 3). Visually, this perpendicularity circle degenerates to a straight line if and only if the three lowest cusp points are aligned (see Figure 4) which corresponds to an optimal perpendicular angulation for valve implantation. No additional fluoroscopy is needed to find this projection as the C-arm angulation can automatically be synchronized with the 3D view. For balloon valvuloplasty a 25 mm balloon was used. During transfemoral TAVI the valve is inserted retrograde via the femoral artery and the aortic arch.
An overlay of the 3D segmentation results onto the real-time fluoroscopic images with *syngo* iPilot facilitates orientation during the valve deployment (Fig. 4). The 3D volume is inherently registered to the fluoroscopic images because both images are acquired on the same system. The overlay dynamically adapts to C-arm rotations and table movements.

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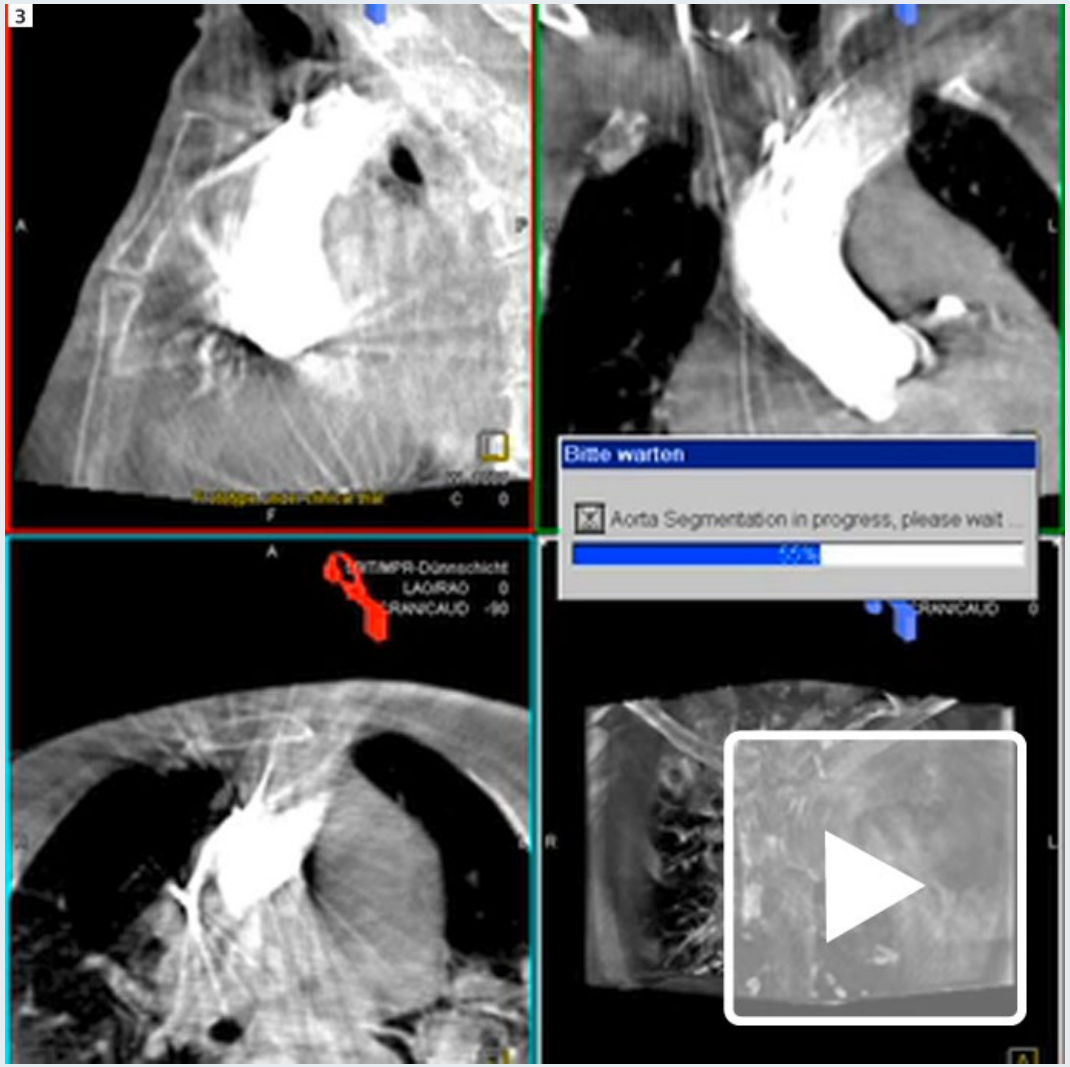

3 Automated segmentation with *syngo* Aortic ValveGuide can be applied even if resolution of 3D reconstruction is limited due to low amount of contrast medium injected.

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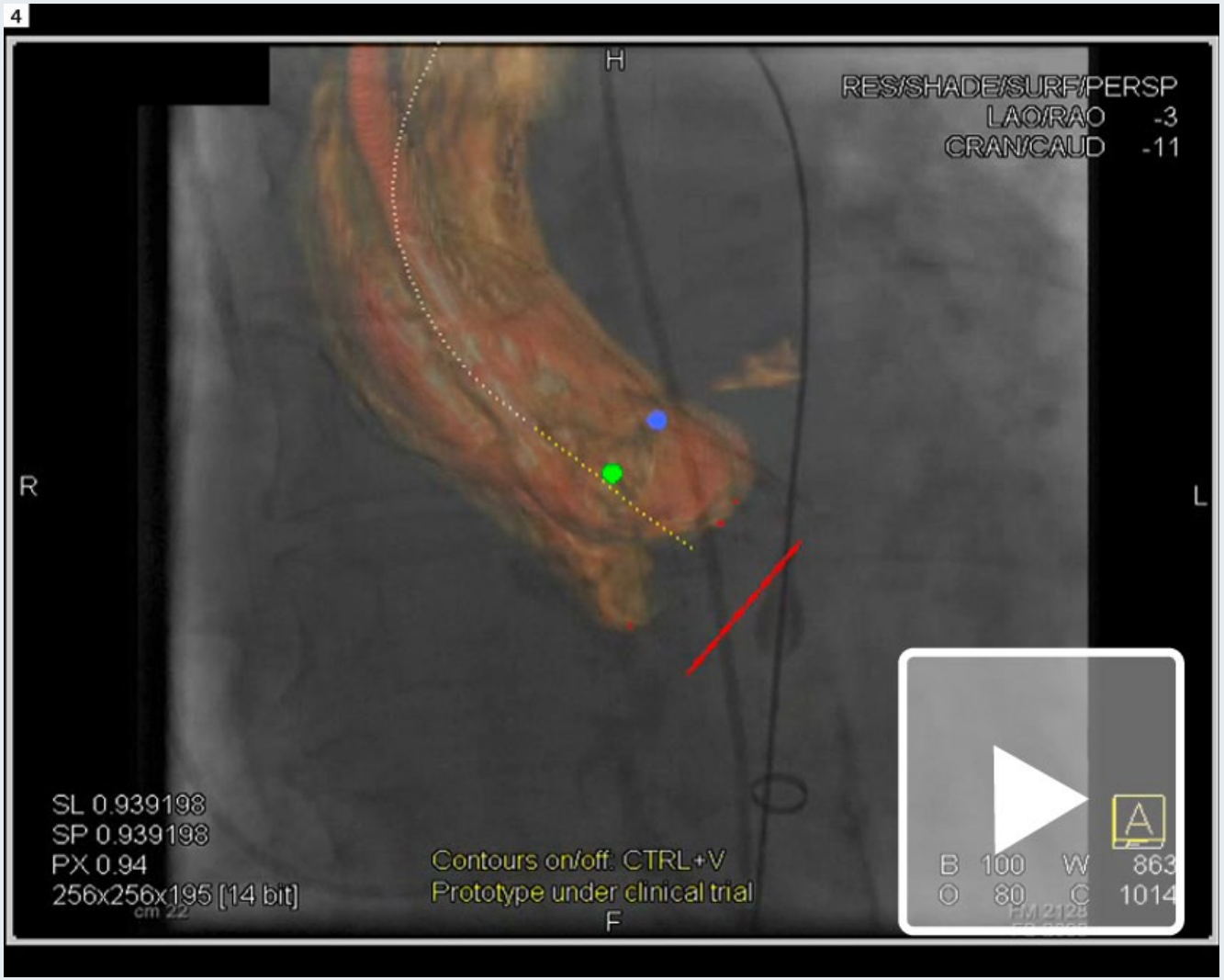
A second *syngo* DynaCT Cardiac run can be performed with very little contrast agent (max. 10 cc, diluted) or even without to confirm the three dimensional position of the implant in the aortic root.
A final contrast agent injection confirms the position of the implant and shows no post interventional aortic valve insufficiency. This result was also confirmed by echocardiography.

Comments
Elderly and high risk patients with a severe aortic stenosis can be treated with TAVI instead of an open-heart surgery including sternotomy, extracorporeal circulation and cardioplegic cardiac arrest. *syngo* DynaCT Cardiac provides 3D guidance to TAVI procedures and safes contrast medium compared to TAVI based on 2D imaging alone increasing the safety of these interventions. Additionally the measurement of critical anatomical parameters by *syngo* Aortic ValveGuide supports an optimal angulation of the C-arm, which again helps to minimize the amount of contrast agent, and to speed up the workflow in the hybrid room.
The new automatic *syngo*-based software facilitates catheter valve positioning and deployment by exact C-arm adjustment orthogonally to the aortic valve plane. The automatic detection and marking of the coronaries may prevent coronary flow impairment by the device. Thus, it improves accuracy of catheter valve implantation procedures.



4 Superimposition of reconstructed 3D volume to live fluoro image generates an overlay.

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