Transapical mitral valve-in-valve implantation: a novel approach guided by three-dimensional transoesophageal echocardiography

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Prosthesis deterioration rate, years after a previous surgical valve replacement, is rising. Usually, the standard management is reoperation, but for very high risk patients an alternative has arisen: the valve-in-valve approach. We present an 84-year-old Caucasian woman with a mitral bioprosthesis (Mosaic II, number 29) since 1994. Over the last few months the patient displayed worsening heart failure symptoms, until her current admission in NYHA III–IV functional class, because of a severely degenerated mitral prosthesis (severe regurgitation, severe pulmonary hypertension). The transapical access, conventionally used for transcatheter aortic valve implantation (Edwards SAPIEN THV 23) was chosen, guided by transoesophageal echocardiography (TOE) with a new three-dimensional (3D) probe. After the procedure, the mitral regurgitation completely disappeared, an appropriate valve opening was achieved (valve area >2 cm²) and the patient was discharged 6 days later, remaining well in the outpatient follow-up. Only a restricted number of patients have been submitted to mitral transcatheter valve-in-valve implantation and to the best of our knowledge this is the first accurate description of the 3D TOE part, focusing on the surgeon requirements.

Keywords Valve in valve • Transcatheter aortic valve implantation • Transoesophageal • Heart failure • Three-dimensional

Along with the population aging the incidence of valvulopathies is rising, and thus, the number of valve replacement procedures is also rising. Therefore, prosthesis deterioration rate, years after the surgical valve replacement, has been increasing as well. Usually, the standard management is reoperation, even for very high risk patients, due to the lack of alternatives. Nowadays, a new hope has arisen for patients with bioprosthesis deterioration, in the form of transcatheter valve-in-valve procedures.

We present an 84-year-old Caucasian woman with a mitral bioprosthesis (Mosaic II, number 29) since 1994, because of rheumatic mitral valve stenosis. Over the last few months the patient displayed worsening heart failure symptoms, until her current admission in NYHA III–IV functional class. A transthoracic echocardiogram demonstrated normal left ventricular ejection fraction, but a severely thickened degenerated mitral prosthesis, with severe mitral regurgitation with moderate stenosis, and severe pulmonary hypertension (Systolic PAP 85). These findings were also double checked by right cardiac catheterization (PAP 52, PCWP 33, CO 2.6, PVR 7 WU). The surgical team deemed the patient as high risk and she was rejected for conventional prosthetic replacement, since the standard Euroscore was 13 (logistic value 39.79%) while the STS score calculated a mortality >25% with a morbidity/mortality beyond 60%. After debate, the patient was included in a transcatheter valve-in-valve procedure compassionate protocol. The transapical access, conventionally used for transcatheter aortic valve implantation (TAVI) was followed, as described elsewhere. The procedure was guided by transoesophageal echocardiography (TOE) using the new X7–2t probe (ie33 echocardiography system, Philips Medical Systems, Eindhoven, The Netherlands) and fluoroscopy. The TOE confirmed data from transthoracic echocardiography, showing severe mitral regurgitation because of prosthesis leaflet degenerative rupture (Figure 1, Movie 1), provided data on the feasibility of the procedure, exploring the 3D prosthesis structure (Figure 2), the
valve position, the calculated area and the inner ring diameters where the new prosthesis had to be supported (Figure 3). The bioprosthesis inter-valve struts distance and the leaflets end-diastolic position was determined in order to estimate if a balloon dilatation would be warranted. The measurement of the apex–valve struts distance (in diastole and systole) was performed, for an estimation of the catheter length necessary to introduce into the ventricle. A careful catheter-positioning through the prosthesis was issued by Live 3D TOE (Figure 4), and after a balloon predilatation the new bioprosthesis was successfully placed (Edwards SAPIEN THV 23) (Figure 5, Movie 2). It is essential to pay careful attention to the fact that the guidewire crosses through the valve orifice and not through a leaflet perforation, which could lead to an embolism after the balloon inflation. After the procedure, the mitral regurgitation completely disappeared and an appropriate valve opening was achieved (valve area >2 cm²) (Movie 3). No pericardial effusion or other complications were detected and the patient was successfully weaned and extubated 6 h later. The patient was discharged from hospital 6 days later without recording any adverse events. She remained doing well, without signs or symptoms of heart failure in her last outpatient follow-up, 3 months later.

The new transcatheter approaches are creating a broad change in real life valve management. Three-dimensional transoesophageal echocardiography has been establishing its role for TAVI, in respect of patients’ selection and for guiding the procedure. However up to now, only a restricted number of patients have been submitted to mitral transcatheter valve-in-valve implantation and to best of our knowledge this is the first accurate description of the 3D TOE part. Although further studies are needed, preliminary data, from cases
such as ours, point out the safety and the feasibility of these procedures, supported by the new cardiovascular imaging modalities.

**Supplementary data**

Supplementary data are available at *European Journal of Echocardiography* online.

**Conflict of interest:** none declared.

**References**


**Figure 5** Three-dimensional transoesophageal echocardiography with three-dimensional zoom showing an Edwards SAPIEN prosthesis successfully placed inside the degenerated bioprosthesis. (A) ‘Surgeon view’ from the left atrium. (B) View from the left ventricle.