

Nonuniform expansion of the LOTUS Edge intra-annular transcatheter aortic valve seen on intravascular ultrasound as a mechanism of prosthesis–patient mismatch

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An 85-year-old man with symptomatic severe aortic valve stenosis, with a EuroSCORE II of 7.6%, was deemed eligible for transfemoral transcatheter aortic valve replacement based on multislice computed tomography findings that revealed an annular area of 4.58 cm², an annular perimeter of 73 mm, and a single calcified nodule (6 × 7 mm) extending into the left ventricular outflow tract (LVOT) that measured 4.58 cm² (FIGURE 1A–1C). Heavy calcification of the right coronary cusp was also visualized (FIGURE 1D). A 25-mm LOTUS Edge intra-annular aortic valve (Boston Scientific Corp., Marlborough, Massachusetts, United States) was deployed after predilatation with no regurgitation and a well-expanded valve frame (FIGURE 1E). A Vision PV.035” intravascular ultrasound (IVUS) catheter (Philips North America Corporation, Andover, Massachusetts, United States) with a 60-mm imaging field, tracking an over 0.035-inch guidewire, was used for the online assessment of valvular function (leaflets) and frame geometry (FIGURE 1E).^{1–3} Intravascular ultrasound confirmed the elliptical shape of the LVOT systolic cross-section with diameters of 18.7 mm and 25.8 mm (eccentricity index, 1.38) and an area of 4.31 cm² with a well visualized calcified nodule (FIGURE 1F). The valve inflow stent frame was elliptical, with outer frame diameters of 20.8 mm and 28.1 mm (eccentricity index, 1.35) and 92% expansion of the nominal area (451/490 mm²) (FIGURE 1G) and 98% expansion of the nominal annular area. All 3 leaflets were

clearly seen in diastole and systole (FIGURE 1G and 1H, respectively). The angles between the neocommissures measured in the coaptation center were varied: 105°, 120°, and 135° (FIGURE 1G), which indicated their asymmetrical movement. The corresponding minimal geometric cross-sectional area of the valve orifice was 2.38 cm² (13.26 × 21.1 mm; eccentricity index, 1.59) (FIGURE 1H), which constituted 52% of the LVOT area. The valve outflow was circular in shape and measured 25.8 × 25.9 mm (FIGURE 1I). The size of the ascending aorta was 28.8 × 32.6 mm (FIGURE 1J). The LVOT had a diameter of 2 cm on transthoracic echocardiography (calculated area, 3.14 cm²). A substantial increase in blood flow velocities and pressure gradients were noted across the valve (FIGURE 1K and 1L), and the calculated effective orifice area (EOA) was 1.2 cm². According to the Valve Academic Research Consortium-2 definition of device success, the procedure was considered successful (with only mild valvular regurgitation) and the operator decided not to postdilate the valve. The indexed EOA was 0.71 cm²/m², which indicated moderate prosthesis–patient mismatch. Therefore, a long-term clinical follow-up was scheduled. Using large-field IVUS offering an online tomographic perspective, we assessed the actual expansion of the valve frame (and calculated 3 indices: nominal, annular, and LVOT relative expansion) and leaflet geometry that differed from the nominal value. The mechanism of valve asymmetry seemed to be mostly related

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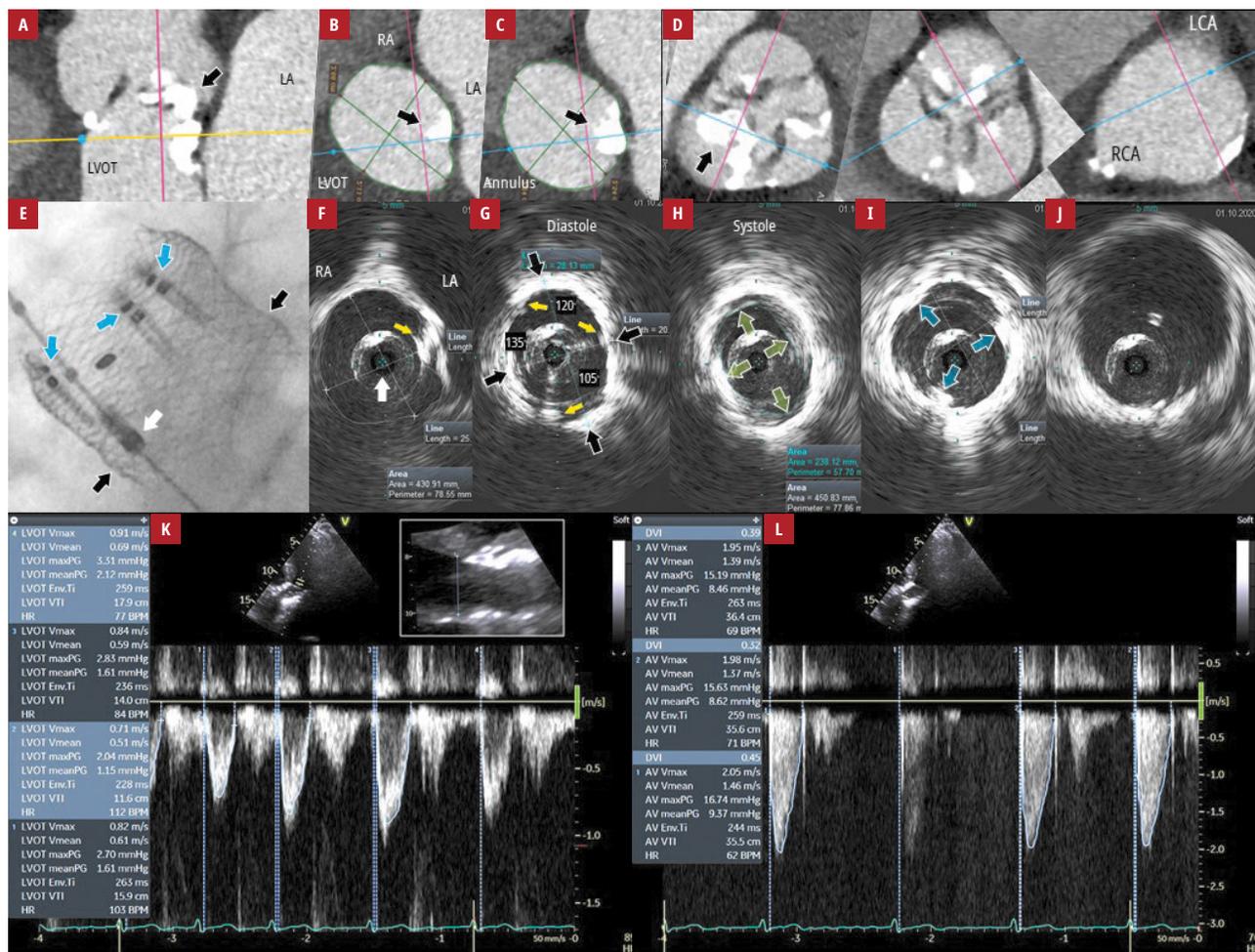


FIGURE 1 A–D – baseline computed tomography showing a calcified nodule (arrows); E–L –postprocedural assessment by means of angiography (E; black arrows indicate the stent frame diameter in the valve inflow; blue arrows show the locking mechanism; and the white arrow indicates the coaxial location of the transducer), intravascular ultrasound (F–J): the white arrow [F] indicates the transducer, and the yellow one [F], the calcified nodule; black arrows [G] indicate the outer stent frame dimension in the valve inflow, and yellow arrows [G] show neocommissures; green arrows [H] show geometric minimal cross-sectional area of the valve orifice; and blue arrows [I], the locking mechanism), and transthoracic echocardiography (K, L)
 Abbreviations: LA, left atrium; LCA, left coronary artery; LVOT, left ventricular outflow tract; PG, pressure gradient; RA, right atrium; RCA, right coronary artery

to the target zone calcium load and its location. There was close concordance between aortic root anatomy assessed with multislice computed tomography and IVUS yet not with angiography or transthoracic echocardiography. Our findings could partially explain why a smaller EOA, and not a smaller nominal geometric orifice area, is associated with higher residual pressure gradients and worse clinical outcomes following aortic valve replacement.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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