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Intraprocedural assessment of valve geometry during transcatheter mitral valve replacement by large field-of-view intravascular ultrasound: a case report

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A 59-year-old male 9 years post-surgical mitral valve replacement (29 mm Carpentier-Edwards PERIMOUNT Plus, Edwards Lifesciences, Irvine, USA) for severe mitral regurgitation, presented with significant degenerative bioprosthesis stenosis and severe insufficiency (*Figure 1A*). Due to a EuroSCORE-II of 10.2%, valve-in-valve transcatheter mitral valve replacement (TMVR) was scheduled. Cardiac computed CT angiography (CCTA) revealed a small leaflet calcium deposit (*yellow arrow*) with inner ring diameters of 2.51 cm × 2.73 cm (*Figure 1B*). A 10 MHz Vision PV 0.035 intravascular ultrasound (IVUS, Philips North America Corporation, Andover, USA) with a 60 mm imaging field tracking over a 0.035″ standard guidewire showed calcified commissure (*Figure 1C*; *white arrow indicates the transducer non-coaxial location*) (*yellow arrow*) with thickened, poorly mobile, non-coapting leaflets (*white arrows*).[1–3] Coaptation gap measured 65.8 mm^2 and inner ring 27.3 mm (*Figure 1D*; *asterisk indicates IVUS transducer*). Angiographically successful SAPIEN3 deployment was verified with IVUS (*Figure 1E*; *white arrow indicates the transducer coaxial location*). SAPIEN3 inflow (overlapping the bioprosthesis ring) was elliptical with outer frame diameters of 25.7 mm × 31.8 mm [eccentricity index (EI) of 1.23] and 97% expansion (% of nominal area; 643/660 mm^2; *Figure 1F*). The more round mid-segment (27.8 mm × 30.1 mm; EI of 1.08) had 100% expansion (665/660 mm^2). Angles between the neo-commissures differed (95° vs. 120° vs. 145°). Geometric orifice was elliptical at the valve inflow (405.5 mm^2 in diastole; EI of 1.26) and more round at the mid-segment (343.9 mm^2; EI of 1.12). The transoesophageal echocardiography (TOE) residual transvalvular max/mean diastolic gradient was 4.6/1.8 mmHg with normal leaflet function (3D enface view, *Figure 1G*). On Day 3, the transthoracic echo gradient increased to 15.7/10.1 mmHg despite normal leaflet function.

Unlike TOE, large-field IVUS allows for (i) baseline bioprosthesis evaluation parallel to CCTA anatomy and assessment of (ii) actual expansion of the TMVR frame, (iii) leaflet geometry, and (iv) geometric orifice area (smaller than outer valve frame dimension), potentially affecting restored blood flow patterns.

Lead author biography

Dr Łukasz Kalińczuk, M.D., Ph.D, is a interventional cardiologist in Warsaw, Poland. Recently trying to adopt intravascular ultrasound in structural heart disease.

Consent: The authors confirm that written consent for submission and publication of this case report (including images and associated text) has been obtained from the patient inline with guidelines of Committee on Publication Ethics.

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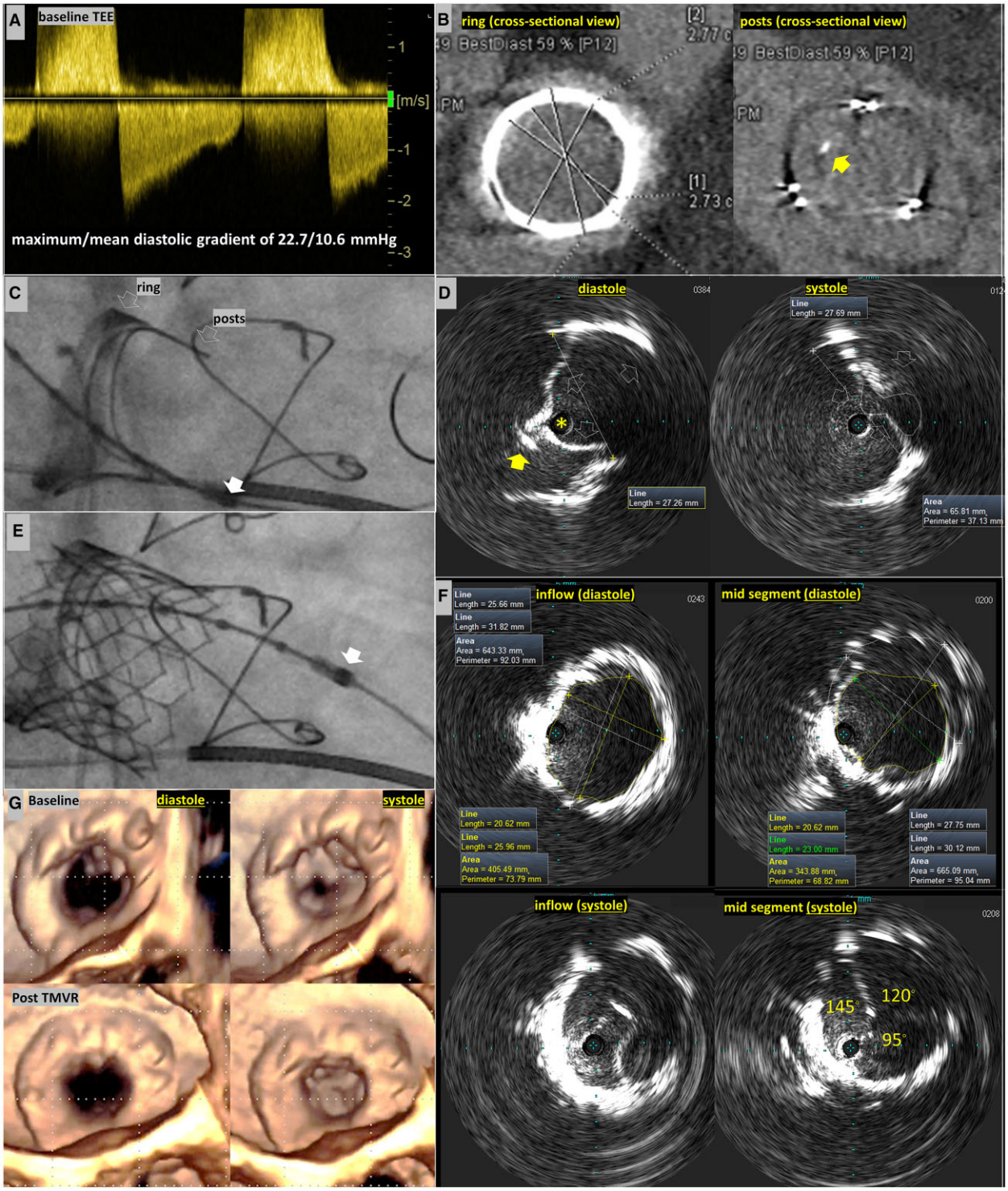

Figure 1 Corresponding transoesophageal echocardiography, cardiac computed CT angiography, angiography, and intravascular ultrasound images recorded pre- (*A–D*), and post-valve-in-valve transcatheter mitral valve replacement with Edwards SAPIEN3 29 mm deployment (*E–G*).

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