Cardiovascular Intervention and Therapeutics (2019) 34:80–82
https://doi.org/10.1007/s12928-018-0519-8

IMAGES IN CARDIOVASCULAR INTERVENTION

Repeat transcatheter aortic valve replacement using a 23 mm Evolut R in a small patient with a failed 20 mm SAPIEN XT

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Received: 14 November 2017 / Accepted: 20 March 2018 / Published online: 26 March 2018

An 85-year-old small woman (body surface area of 1.0 m^2) presented with acute heart failure requiring non-invasive positive pressure ventilation. Her past medical history included rheumatic arthritis with immunosuppression therapy. She previously had a successful transfemoral transcatheter aortic valve replacement (TAVR) with the 20 mm SAPIEN XT (Edwards Lifesciences) in 2011 without complication. Her symptom was improved. However, follow-up transthoracic echocardiography (TTE) demonstrated maximal aortic valve velocity of 2.9 m/s at discharge, although the leaflets were fully opened. In emergent admission 6 years after the first TAVR, TTE demonstrated maximal aortic valve velocity of 6.2 m/s with calcified leaflets of the 20 mm SAPIEN XT which resulted in decompensated heart failure (Fig. 1a), and salvage intervention was required. Transfemoral Valve-in-Valve TAVR using the 23 mm Evolut R (Medtronic) was urgently planned based on the computed tomography (Fig. 1b). Severely calcified bioprosthesis required very careful pre-dilation with 16 mm Z-MED II balloon (NuMED), and the 23 mm Evolut R was deployed in the SAPIEN XT (Fig. 1c–f). Despite postprocedural computed tomography showing inner diameter of 13.0 mm in the Evolut R at the level of overlap with the 20 mm SAPIEN, TTE showed aortic valve area of 1.3 cm^2 (Fig. 1g, h). She dramatically had improvement in heart failure following Valve-in-Valve TAVR and was discharged to home without symptom.

Residual gradient and small annulus is related to the early valve deterioration. Surgical aortic valve replacement with root enlargement was not indicated for her due to high surgical risk, and transcatheter treatment was only the option [1]. A supra-annular designed Evolut R rather than SAPIEN 3 is preferable alternative for Valve-in-Valve TAVR to get larger effective orifice area and lower pressure gradient particularly in such patient with a small transcatheter valve [2].

Computed tomography (CT) had not been validated at the time of her first TAVR (2011) as a standard modality of TAVR anatomical assessment in the world, device size was determined by transesophageal echocardiography which showed aortic annulus of 18 mm. Considering her postprocedural electrocardiogram showing left bundle branch block and transthoracic echocardiography showing very trace paravalvular leak left following TAVR, 20 mm SAPIEN XT was considered best option for her due to acceptable oversizing, while the 23 mm SAPIEN XT might give her a larger valve area; however, it was the too oversized valve for her which can result in catastrophic complications in the elderly patient. In addition, under-expanded 23 mm SAPIEN XT valve with 1 or 2 cc less expansion may result in structural valve deterioration due to suboptimal leaflet coaptation or incomplete frame expansion leading to leaflet-frame interaction, although its mechanism remains unclear [1].

Pre-dilatation using 16 mm balloon might be one of the causes of underexpansion of Evolut, although it is very hard to decide to use 18 mm balloon which had possibility to have severe acute aortic regurgitation requiring mechanical support and collapse due to destroy of the bioprosthetic leaflet in the uncompensated heart failure and frail patient with left ventricular hypertrophy. However, pre-procedural CT may be useful to decide size of balloon for pre-dilatation in selected patients. Post-dilation was not performed because of the pre-dilation, suggesting that further dilation might result in balloon rupture due to extremely high pressure. In addition, postprocedural pressure gradient was considered overestimation due to continuous dobutamine injection and volume overload due to uncompensated heart failure. Decision was made to wait until its "self" expansion of the 23 mm Evolut R. As expected, mean pressure gradient after

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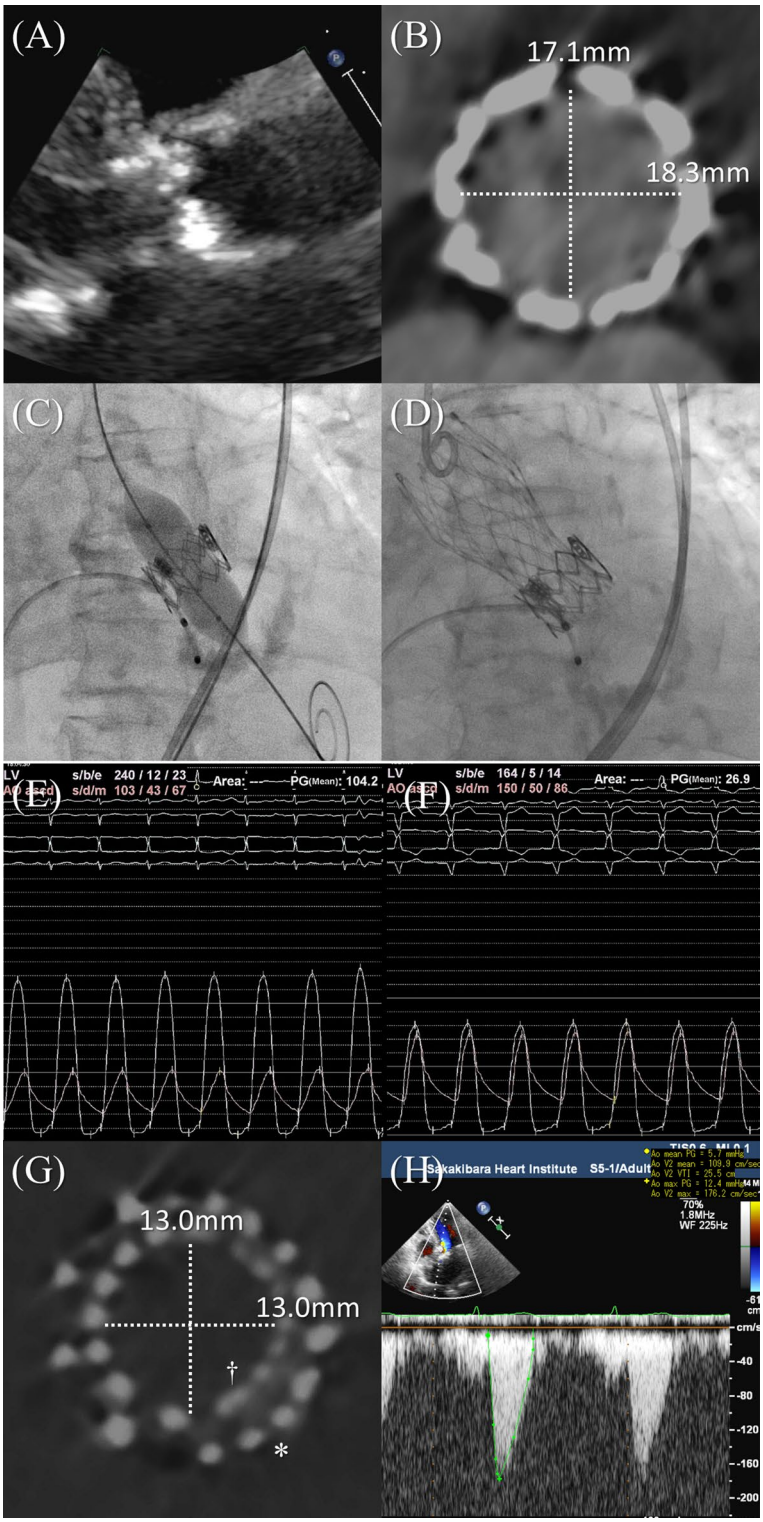

Fig. 1 **a** Transthoracic echocardiography demonstrating the calcified SAPIEN XT with mean pressure gradient of 96 mmHg. **b** Computed tomography demonstrating inner diameter (17.1 × 18.3 mm) of the SAPIEN XT. **c** Angiogram demonstrating balloon valvuloplasty using the 16 mm balloon in the 20 mm SAPIEN XT. **d** Angiogram demonstrating successful deployment of 23 mm CoreValve Evolut R. **e**, **f** Hemodynamics demonstrating mean pressure gradients decreased from 104 to 26 mmHg. **g** Computed tomography demonstrating inner diameter (13.0 × 13.0 mm) of the 23 mm Evolut R (dagger symbol). **h** Transthoracic echocardiography demonstrating pressure gradient of 5 mmHg in the 23 mm Evolut R following Valve-in-Valve TAVR. Asterisk indicates the failed 20 mm SAPIEN XT

dobutamine stopped and heart failure well controlled was 5 mmHg on TTE.

Since there have been no patients reported who had 23 mm CoreValve Evolut R in 20 mm SAPIEN XT due to valve deterioration, medium-to-long-term outcomes remain unknown. Follow-up TTE at out-patient clinic is essential to avoid recurrent unrecognized high-pressure gradient leading to sudden uncompensated heart failure, although final echocardiographical finding in her hospitalization was considered optimal.

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