

Mechanism of transcatheter heart valve deployment for right ventricular outflow tract insufficiency after surgical reconstruction in childhood as assessed with intravascular ultrasound

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Introduction: Transcatheter heart valve (THV) deployment can be used to treat right ventricular outflow tract (RVOT) insufficiency.

Purpose: To study deployment mechanism of a balloon expandable THV (Melody or Edwards SAPIEN [ES] 3) implanted for pulmonary homograft insufficiency using intravascular ultrasound (IVUS) with Visions PV.035 Digital Catheter (Philips) offering an imaging field of 60mm.

Methods: Sequential (baseline and post-THV) IVUS was performed in 6 pts (median age 33 [20–44] yrs, 3 ♀, all with Tetralogy of Fallot) who had undergone prior corrective surgery (4 transannular patch, 1 bioprosthetic valve or 1 pulmonary homograft), but who presented with significant RVOT insufficiency. IVUS-visualized homograft cross-sections were perpendicular to its long axis and were obtained along the entire homograft length (Fig. 1). Volumetric measurements included the native pulmonary homograft (inner lumen and outer dimension) and the corresponding inner-stent/inner-THV cross-sections post-THV for a total of 16 evenly spaced cross-sections per analyzed region. Each THV (1 Melody [Ø 22mm, 28mm

nominal length] and 5 ES3 [Ø 23mm, 18mm height; 4 Ø 29mm, 22.5mm height]) was implanted after pre-stenting using stents of 36, 39, or 48mm length, deployed on a 24mm (n=1) or 30mm (n=4) balloon-in-balloon catheter.

Results: Overall, there were 96 paired cross-sections. There was significant increase in average lumen dimension after THV deployment (Δ of 97.5mm²) accompanied by the similar increase in outer pulmonary homograft dimensions (Δ of 84.0mm²) (Table 1). Whereas the maximal lumen diameter was unchanged, the minimal lumen diameter increased significantly resulting in substantial decrease in the ratio of max/min lumen diameter of 1.41±0.20 vs 1.16±0.13 (p<0.001) representing a reduction in lumen eccentricity.

Conclusions: During balloon-expandable THV implantation to treat RVOT insufficiency, there is a significant increase in baseline lumen dimensions accompanied by a substantial outer RVOT dimension increase to normalize lumen eccentricity.

Table 1. Serial volumetric measurements with IVUS

	Baseline pulmonary homograft (n=96 cross-sections)	Post-THV deployment (n=96 cross-sections)	p-value
Lumen cross-sectional area (mm ²)	445.7±208.1	543.2±118.7	0.004
Minimal lumen diameter (mm)	19.5±4.9	24.6±3.3	<0.001
Maximal lumen diameter (mm)	27.1±6.7	27.9±3.6	ns
Outer pulmonary homograft cross-sectional area (mm ²)	920.1±373.2	1004.2±272.5	0.011

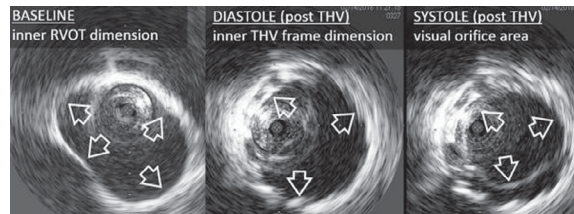


Figure 1. IVUS intraprocedural visualisation