

Short-term Right Ventricular Remodeling after Transcatheter Pulmonary Valve Replacement

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Introduction: Transcatheter pulmonary valve replacement (TPV) has been used with increasing frequency in patients with dysfunctioning right ventricular (RV) outflow conduits. Conduit dysfunction adversely impacts both RV size and performance. Our objective was to evaluate RV reverse remodeling by both transthoracic echocardiography (TTE) and cardiac magnetic resonance imaging (cMR), in the first 6 months following TPV implantation.

Methods: TTE and cMR studies were performed before and 6-months after TPV implantation. Subjects were participants in the U.S. Melody® TPV (Medtronic, Inc., Minneapolis, MN) investigational device exemption trial. Recorded digital images were analyzed at the core laboratory by observers blinded to the clinical situation. RV strain values were obtained using retrospective speckle tracking software (syngo® Velocity Vector Imaging™, Siemens AG). Paired pre- and 6 month follow up studies were compared to assess changes in RV size and performance.

Results: Paired studies of adequate quality for analysis were available for 81 patients. Primary indications for TPV placement were pulmonary regurgitation (n=44), pulmonary stenosis (n=20), and mixed (n=17). Data are presented in the Table as means ± SD.

Conclusions: TPV implantation was associated with an early reduction in RV volume, apical area, tricuspid valve diameter and systolic time intervals, with slight improvement in tricuspid annular plane systolic excursion (TAPSE). These changes are likely related to reduction in RV pre-load/stroke volume associated with elimination of pulmonary regurgitation. No changes in RV myocardial performance index (MPI), ejection fraction (EF), area change or longitudinal strain values occurred during early follow-up. These data suggest that early RV reverse remodelling after TPV implantation includes advantageous reduction in RV and tricuspid valve size. However, RV systolic performance remained unchanged over the first 6 months after TPV.

	Pre-TPV	6 months post-TPV	P value
TTE parameters			
Tricuspid annular plane systolic excursion (TAPSE; mm)	13 ± 5	16 ± 5	p<0.0001
Fractional TAPSE (f-TAPSE, %)	11% ± 4%	13% ± 4%	p<0.0001
Tricuspid valve closure to opening time (msec)	420 ± 46	400 ± 53	p<0.01
RV ejection time (msec)	372 ± 47	348 ± 41	p=0.001
RV myocardial performance index (MPI)	0.15 ± 0.16	0.14 ± 0.11	p=NS
RV diastolic area (cm ²)	35.4 ± 11.5	31.5 ± 9.3	p<0.0001
RV systolic area (cm ²)	22.1 ± 10.5	20.0 ± 8.6	p<0.002
RV fractional area change (FAC, %)	39 ± 10	38 ± 9	p=NS
Tricuspid valve annulus diameter (cm)	3.5 ± 0.7	3.4 ± 0.6	p=0.02
Indexed tricuspid valve annulus diameter (cm/m ²)	2.2 ± 0.4	2.0 ± 0.4	p=0.001
RV apical longitudinal strain (6 segments; %)	-13.9 ± 5.5	-14.0 ± 5.1	p=NS
RV septal strain (3 segments; %)	-12.9 ± 6.3	-13.1 ± 5.6	p=NS
RV free wall strain (3 segments, %)	-15.1 ± 5.8	-15.0 ± 5.6	p=NS
cMR parameters			
RV end-diastolic volume (EDV, ml)	213 ± 92	175 ± 80	p<0.0001
RV end-systolic volume (ESV, ml)	129 ± 84	107 ± 71	p<0.0001
RV ejection fraction (EF, %)	43 ± 12	42 ± 13	p=NS
TPV, transcatheter pulmonary valve replacement; TTE, transthoracic echocardiography; cMR, cardiac magnetic resonance imaging			