Right ventricle to pulmonary artery coupling improves early after transcatheter aortic valve implantation and this is related to improved left atrial function

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Background: Transcatheter aortic valve implantation (TAVI) improves not only left heart remodeling but also has an upstream effect on the right ventricle and pulmonary vasculature. Right ventricle (RV) to pulmonary artery (PA) coupling, a parameter which integrates RV systolic performance at a given degree of afterload, was associated with all-cause mortality in these patients (pts). Our aim was to evaluate the short-term effect of TAVI on RV-PA coupling and the main determinants of RV-PA coupling in pts with aortic stenosis (AS) undergoing transfemoral TAVI.

Methods: We have prospectively enrolled 102 consecutive pts (76±8 years, 57 men) with severe AS undergoing TAVI. All pts underwent a comprehensive echocardiogram both before and 30 days after TAVI, including speckle tracking echocardiography (STE) for myocardial deformation analysis. Peak values of global longitudinal left ventricular strain (GLS), left atrial strain (LAϵ, reservoir function), and late diastolic LA strain rate (ASr, contractile function) were measured. The ratio of tricuspid annular plane systolic excursion (TAPSE) to PA systolic pressure (PASP) was used as an estimate of RV-PA coupling.

Results: Compared with baseline, there was a significant increase in LV ejection fraction after TAVI (54±12% vs 50±13%, p=0.04), a significant reduction in LV mass (147±35 vs 171±44 g/m^2, p<0.001) and increase in absolute GLS values (14±3% vs 12±5%, p=0.007). Indexed LA volumes decreased (49±19 vs 55±19 ml/m^2, p=0.03) while both global LAϵ and ASr improved significantly after TAVI (16±8% vs 13±7%, p=0.01 and –1.2±0.6 vs –0.9±0.6%, p=0.01). A significant improvement of TAPSE/PASP values (0.069±0.026 vs 0.057±0.025 cm/mm Hg, p<0.001) was found after TAVI, indicating an enhanced RV-PA coupling. In multivariable regression analysis global LAϵ was independently related to RV-PA coupling, both before and after TAVI (R=0.54, p=0.003 and R= 0.39, p<0.001). The increase in RV-PA coupling was significantly related to the increase in LAϵ (p=0.005).

Conclusions: Our results confirm that relief of aortic valve obstruction by TAVI has beneficial effects on the RV-PA coupling, that occur early after intervention. This is accompanied by a significant improvement in LV and LA deformation. Moreover, there is a significant correlation between LA function and RV-PA coupling both before and after TAVI. Enhanced RV-PA coupling after TAVI is related to improved LA strain, suggesting the contribution of LA function in modulating right heart function in this setting.