Early deterioration of right ventricular strain in patients undergoing transcatheter tricuspid valve intervention

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Background: Severe tricuspid regurgitation (TR) leads to volume overload and increased wall stress causing detrimental right ventricular (RV) remodelling and dysfunction and is associated with excess mortality. Transcatheter tricuspid valve interventions (TTVI) emerged to treat patients with severe TR and high surgical risk, but predictors of outcome remain largely unknown. RV free wall longitudinal strain (RVFWLS) is a sensitive parameter for RV dysfunction and has shown prognostic value in patients with functional TR treated conservatively. Periinterventional changes in RVFWLS and right atrial (RA) strain have not been evaluated in patients undergoing TTVI.

Purpose: To analyse the effect of transcatheter tricuspid valve annuloplasty (TTVA) and transcatheter edge-to-edge repair (TEER) on RVFWLS and RA strain, assessed by speckle tracking echocardiography, and their association with outcome.

Methods: We retrospectively analysed consecutive patients with severe TR that underwent TTVI at our centre between 2020 and 2022. 126 patients were included (n=48 underwent TTVA with the Cardioband system, n=78 underwent TEER with the PASCAL system). Established parameters for RV function (TAPSE, FAC) as well as RVFWLS and RA reservoir strain (RASR) were analysed at baseline and one month after TTVI.

Results: All patients (median age 80 years, 69% female, 79% in NYHA III/IV functional class) were at prohibitive surgical risk. RV function at baseline was slightly reduced according to FAC (34% [29-39]) and preserved according to TAPSE (18mm [15-20]), whereas RVFWLS (-18.6 ±5.7%) and RASR (10.0% [7.0-14.0]) were severely reduced in markedly dilated right heart chambers (RV basal 45mm [41-49], RA area 34 cm² [28-41]). TR reduction following TTVI to TR grade ≤2 was achieved in 77%. Right heart chamber size significantly decreased after one month (RV basal 41mm [38-45], RA area 29cm² [25-38], P<0.001), with no improvement of FAC (37% [30-40], P=0.668) or RASR (10% [7-13], P=0.143) but deterioration of RV longitudinal function (TAPSE 17mm [13-20], P=0.002; RVFWLS -16.1±5.7%, P=0.001) compared to baseline. RVFWLS reduction occurred irrespective of the procedure performed (TEER [-9.2±41.4] vs. TTVA [-7.0±31.3], P=0.783). RVFWLS deterioration occurred in 63%, whereas it improved in 37% of patients. Symptomatic and clinical outcome did not differ in patients with deteriorated vs. improved RVFWLS (improvement of at least one NYHA class 61.9% vs. 58.3%, P=0.569, one-year mortality 13.7% vs. 12.3%, P=0.940, one-year heart failure rehospitalization 10.8% vs. 17.1%, P=0.701).

Conclusion: Deterioration of RVFWLS after TTVI possibly reflects the decreased wall stress due to TR and consecutive preload reduction. However, symptomatic and clinical outcomes did not differ in patients with deteriorated RVFWLS vs. patients with improved RVFWLS. Reduction of RA size after TTVI did not translate into improvement of RASR, indicating an already advanced pre-existing RA dysfunction.