



# Right ventricular-pulmonary artery coupling in patients undergoing transcatheter aortic valve replacement: is it relevant?

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Transcatheter aortic valve replacement (TAVR) is now the preferred treatment strategy for patients with symptomatic aortic stenosis who are either high-risk, in-operable or intermediate-risk patients (1-3). The role of TAVR in low-risk patients is still not well established, and current evidence is limited to retrospective studies (4). However, several trials are underway which will hopefully address this knowledge gap (5-8). Undoubtedly, TAVR has transformed the landscape of management in AS patients, and its role is expected to expand in the years ahead. As matter of fact, some believe that the risk stratification should be altered to “high-risk TAVR patients” especially if low-risk trial shows positive outcomes.

Sultan and colleagues utilized their retrospective single-center experience of 457 patients from 2011 to 2016 (9). In their study, all patients had echocardiographic and Doppler images that were independently reviewed to avoid subjective bias. Importantly, their study highlighted several findings. First, they demonstrated the utility of right ventricular (RV)-pulmonary artery (PA) coupling (or baseline tricuspid annular plane systolic excursion to PA systolic pressure ratio or TAPSE/PASP ratio) in predicting all-cause mortality after TAVR, as it evaluates RV systolic performance at a given degree of afterload. Second, their study demonstrated a dose-response relationship of TAPSE/PASP quartiles with survival (hazard ratio for lowest quartile *vs.* highest quartile =2.21, 95% CI, 1.07 to 4.57; P=0.03) even after adjusting for patient age, left ventricular ejection fraction, stroke volume index and society of thoracic surgeons (STS) score. Not surprisingly however, patients with worse RV-PA

uncoupling had higher comorbidity burden such as higher STS risk score, concomitant  $\geq$  valvular regurgitation (mitral, tricuspid), lower left ventricular ejection fraction and stroke volume index (9).

Conventionally, the European System for Cardiac Operative Risk Evaluation (EuroSCORE) or the STS scores have been used to risk stratify patients undergoing TAVR, and have been the basis for enrollment in the various randomized control trials (1-3). However, the STS score does not account for RV dysfunction nor pulmonary hypertension as a risk factor variable. According to one study for instance, RV dysfunction was found in 29.1% of patients undergoing TAVR, and was associated with almost 3-fold increased risk of cardiovascular death at 1-year (adjusted HR 2.9), with a gradient of risk according to recovery of RV dysfunction (10). In addition to RV function, the impact of pulmonary circulation has also been explored. A recent study found that patients with residual pulmonary hypertension had a higher risk of all-cause mortality at 30 days (HR 3) and long term (HR 2.5) (11).

While the prognostic significance of RV dysfunction and pulmonary circulation has been examined separately in TAVR patients, the relationship between pulmonary circulation and RV function has been largely unknown until more recently. In heart failure patients, the non-invasive TAPSE/PASP ratio has been validated to predict worse outcomes (12,13). For instance, one study in patients with heart failure preserved ejection fraction (HFpEF) found that TAPSE/PASP terciles (from highest to lowest) correlated strongly with increasing levels of natriuretic

peptides, worse pulmonary and systematic hemodynamics, abnormal exercise capacity. TAPSE/PASP ratio was inversely correlated with NYHA functional class, and was also independent predictor of worse outcomes in heart failure patients (12). TAPSE often relates to severity of RV dysfunction while RV-PA coupling highlights impairment (since it is indexed to afterload).

The findings of the study by Sultan *et al.* are significant since RV-PA coupling has not been previously evaluated in TAVR patients (9). However, its clinical relevance is highly questionable and remains to be determined. This is because we may soon be entering an era where TAVR will be considered the first option for all aortic stenosis patients. Only the “high-risk TAVR” cases, such as patients who are high-risk for permanent pacemaker or paravalvular leak might be considered for surgical AVR. Unless additional treatment is found to improve the outcomes in worse RV-RA uncoupling patients, this will be another variable that may be lost in translation.

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### Footnote

*Conflicts of Interest:* The authors have no conflict of interest to declare.

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