

Diagnostic value and prognostic impact of various invasively derived hemodynamic parameters in patients with severe aortic stenosis undergoing TAVI

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Background: Ejection time (ET) and Acceleration time (AT) have been described as echocardiographic markers for aortic stenosis (AS).¹ Moreover, in a recent study time between invasively measured left ventricular and aortic systolic pressure peaks (T-LVAo) was associated with anatomic AS severity.² However, the diagnostic value of these parameters has not been validated in a larger patient cohort and their prognostic impact in AS patients undergoing transcatheter aortic valve implantation (TAVI) remains unknown.

Purpose: We aimed to assess the diagnostic value and prognostic impact of ET, AT, and T-LVAo as assessed by invasive measurements in patients undergoing TAVI for severe AS.

Methods: This retrospective single-centre analysis studied 1478 patients undergoing TAVI from 2014 to 2019 for severe AS. All patients received echocardiographic, multislice computed tomography (MSCT) and invasive hemodynamic evaluation with simultaneous pressure measurements in left ventricle and aorta prior to TAVI. Anatomic AS severity was assessed according to MSCT-derived aortic valve calcification density (AVCd) defined as calcium volume per annulus area. All hemodynamic parameters were calculated offline using a dedicated software.

Results: Median patients' age was 81.2 (76.8–84.7) years and 807 (54.6%) were women. Predicted operative risk for mortality was 3.8 (2.6–5.7)% according to STS Score. Medians of invasively derived param-

eters were 70.0 ms (46.0–98.0) for T-LVAo, 308.0 ms (276.0–336.0) for ET, 180.0 ms (146.0–206.0) for AT. In spline analysis correlation of T-LVAo (Spearman: $r=0.35$; $p<0.001$) and ET (Spearman: $r=0.18$; $p<0.001$) with AVCd was significant but weak. AT showed negligible correlation with AVCd (Spearman: $r=-0.05$; $p=0.089$). The optimal cutoff for death (CD) according to C-statistic was 274 ms for ET and 158 ms for AT. Patients with ET or AT \geq CD showed lower short and mid-term mortality rates compared to patients with ET or AT $<$ CD (ET \geq vs. $<$ CD: mortality at 1-year: 14.5 vs. 31.9%, 3-years: 28.3 vs. 53.5%, all $p<0.001$; AT \geq vs. $<$ CD: mortality at 1-year: 15.5 vs. 25.9%, $p<0.001$, 3-years: 34.0 vs. 41.0%, $p=0.0032$). Moreover, multivariate analysis for mortality identified ET (HR 0.58 [95% CI 0.43–0.77; $p<0.001$]) and AT (HR 0.65 [95% CI 0.49–0.86; $p=0.0027$]) to be associated with beneficial outcome after TAVI, independent from clinical risk factors and echocardiography-derived parameters like LVEF, mean gradient or stroke volume index. In contrast, T-LVAo showed no prognostic impact according to uni- or multivariate analyses.

Conclusion: T-LVAo provides the highest diagnostic value among the investigational hemodynamic parameters, however correlation with AVCd was weak. ET and AT are strong independent outcome predictors beyond clinical risk factors and standard echocardiographic parameters in AS patients following TAVI. Accordingly, use of ET and AT might improve risk assessment in patients scheduled for TAVI.