

Feasibility and reproducibility of right ventricle stress echocardiography and its capability to assess the right ventricle contractile reserve of patient with at least trivial tricuspid regurgitation

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BACKGROUND. Stress echocardiography (SE) is widely used for the assessment of left ventricular (LV) function, diagnostic and prognostic stratification of patients with coronary artery disease and for assessment of mitral and aortic valve disease. However, the assessment of the right ventricle (RV) in general, and in particular in regard to the contractile reserve of the RV in patients with tricuspid valve (TV) disease is an area that has not been previously explored in adult patients. The physiology and function of the RV is different than that of the LV and the use of SE provides the possibility to test both systolic and diastolic function of the RV in response to increased loading conditions. This can potentially be used to assess the RV function prior to surgery and to predict which subset of patients may benefit from intervention on the TV before the RV displays signs of failure

PURPOSE. We therefore propose a study to investigate the potential use of SE for the assessment of RV function in adult patients. The aim is to evaluate the feasibility of RV SE in any patients with more than trivial tricuspid regurgitation (TR) and to assess the presence and degree of RV contractile reserve.

METHODS. We enrolled 81 patients undergoing a physical or dobutamine SE for CV risk stratification or chest pain. Inclusion criteria were age \geq 18 years, normal baseline RV function (FAC $>$ 35%, TAPSE $>$ 16 mm). Exclusion criteria were presence of RV dysfunction, pulmonary stress hypertension, positive stress test for left myocardial ischemia, presence of moderate or severe valvular disease, grade III or higher diastolic dysfunction at baseline, severe respiratory, renal or hepatic dysfunction. We evaluated the average values of TAPSE, fractional area change (FAC), S wave, sPAP (pulmonary systolic blood pressure), RV strain during baseline and at the peak of the effort. We also assessed the reproducibility of these measurement between two different expert operators (blind analysis).

RESULTS. We were able to measure the RV parameters both during baseline and at the peak of the effort in all patients, demonstrating an excellent feasibility. Differences in parameters collected at baseline and at peak were assessed using paired Wilcoxon signed rank test. All variables showed a statistical significant increase ($p < 0.001$) at peak compared to the baseline. Average percentage increases at peak were 31.1% for TAPSE, 24.8% for FAC, 50.6% for S wave, 55.2% for PAPS and 39.8 % for RV strain. Bland-Altman method was used to evaluate the agreement between measurements collected by two separate operators and it showed good Intraclass Correlation Coefficients (Figure).

CONCLUSIONS. RV SE proved to be feasible and showed little inter-operator variability in patients with at least trivial TR. It provided valuable informations about RV contractile reserve that may help stratifying the risk of RV failure in patients undergoing TV surgery.

Abstract Figure

Parameters	ICC (95% CIs)	P value
TAPSE at baseline	0.88 (0.63-0.97)	P<0.001
TAPSE at the peak of the effort	0.94 (0.79-0.98)	P<0.001
FAC at baseline	0.8 (0.43-0.94)	P<0.001
FAC at the peak of the effort	0.74 (0.36-0.94)	P=0.002
S wave at baseline	0.78 (0.36-0.94)	P=0.002
S wave at the peak of the effort	0.88 (0.65-0.97)	P<0.001
sPAP at baseline	0.86 (0.57-0.96)	P<0.001
sPAP at the peak of the effort	0.86 (0.56-0.96)	P<0.001
RV strain at baseline	0.93 (0.77-0.98)	P<0.001
RV strain at the peak of the effort	0.74 (0.2-0.94)	P=0.008

Figure. Intraclass Correlation Coefficients (ICCs) of the parameters measured by the two operators. Abbreviations: FAC, fractional area change; RV, right ventricle; sPAP, pulmonary systolic blood pressure.