Assessment of right ventricular function at rest and during exercise by echocardiography in patients with pulmonary hypertension


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Background.— Standard echocardiography and 2D speckle tracking imaging method (2DSTI) allow a functional and morphologic non-invasive evaluation of the right ventricle (RV). The aim of this study is to evaluate RV function during stress testing in patients with pre-capillary pulmonary hypertension (PHT).

Methods.— Fifteen patients with pre-capillary PHT (13 PAH, two thromboembolic PHT) had right heart catheterization with measurements of right atrial pressure (RAP), pulmonary artery pressures, cardiac index and calculation of pulmonary vascular resistance (PVR) at rest and during exercise. They also underwent a stress echocardiography with an ergo-cyclometer within 48 hours from RV catheterization. The following RV function parameters were measured during echocardiography: RV fractional area change (RVFAC), tricuspid annular plane systolic excursion (TAPSE), Tissue Doppler maximal systolic velocity of the tricuspid annulus (Sm), tricuspid regurgitation (TR) velocity, and mean strain values by 2DSTI from the lateral (4C view) and inferior (2C view) RV walls. Inferolateral strain was calculated as the mean of the value of those six segments. Results of exercise echocardiography were compared to those of 28 normal patients.

Results.— Standard parameters of RV function progressively increased during exercise in normal patients, but lateral, inferior and inferolateral strain progressively decreased. In patients with PHT, right heart catheterization showed an increase in PAP and cardiac index during exercise but PVR remained unchanged. During exercise echocardiography, there was no significant variation in any of RV function parameters between rest and exercise. At exercise, inferolateral strain significantly correlated with hemodynamic PAP, systolic stroke volume, and RVP (R = 0.61, P = 0.01).

Conclusion.— Analysis of RV function during exercise echocardiography is feasible in patients with PHT. Strain values during exercise mirror the changes of PVR, which decrease in normal patients and remain unchanged in patients with PHT, confirming their load dependency. In normal patients, the decrease in longitudinal strain coupled with the increase of other RV function parameters may suggest that longitudinal contraction of RV is not the prominent factor of RV response to exercise. In patients with PHT, the lack of decrease in longitudinal strain probably witnesses a kind of RV contractile reserve that counterbalances the increased afterload during exercise (as shown by elevated PAP and stable RVP).

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Early changes in ventricular-arterial coupling in acutely decompensated systolic heart failure (ADSHF): An echocardiography and arterial tonometry study

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