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Echocardiographic estimation of right ventricle wall tension: hemodynamic comparison and long term follow up

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Introduction: Prognosis in pulmonary hypertension (PH) is strictly linked to right ventricle (RV) failure, which results from uncoupling between RV and the superimposed pressure load; in first phases, coupling between these two actors still be preserved, at the price of augmented right ventricle wall tension (RVWT).

Purpose: We sought to describe how to estimate RVWT with echocardiography, how it correlates with RV hemodynamics and if it may predict prognosis.

Methods: A total of 190 patients without overt RV failure, with suspected pulmonary hypertension (PH) to a previous echocardiography, underwent to right heart catheterization (RHC) and nearly-simultaneous echocardiography. We estimated RVWT according to Laplace law (RV length × tricuspid regurgitation peak gradient [TRPG]), in order to predict initial RV stress, and was correlated with RV hemodynamic profile; its potential prognostic impact was tested along with canonical RV function parameters.

Results: In patients enrolled in our study, RVWT correlated significantly with invasive estimation of right ventricle end diastolic pressure (R 0.343, $p<0.001$); a significant relationship between RVWT and several hemodynamic variables was observed (mean pulmonary artery pressure, pulmonary artery compliance, transpulmonary gradient, pulmonary vascular resistance, RV telediastolic pressure, right atrial pressure, RV stroke work index; all $p<0.001$). At a mean follow up of five years and three months, only RVWT predicted all-cause mortality (p 0.036), while TAPSE, TAPSE/TRPG, RV fractional area change and RV S' wave did not.

Discussion: We identified a novel bedside echocardiographic predictor of altered RV hemodynamic, which results precociously altered in patients without overt RV failure, and able to predict all cause mortality at a long term follow up. Further studies are needed to confirm its role in PH patients.

Correlation: RWVT and RV hemodynamic

Hemodynamic variable	R	R^2	p value
Mean pulmonary artery pressure	0.742	0.550	<0.001
RV differential pressure	0.794	0.630	<0.001
Pulmonary artery pulsatory pressure	0.740	0.547	<0.001
Mean right atrium pressure	0.326	0.106	<0.001
Cardiac index/right atrial pressure	0.209	0.044	0.012
RV stroke work index	0.588	0.346	<0.001
Pulmonary artery compliance	0.449	0.202	<0.001
Pulmonary vascular resistance	0.531	0.282	<0.001
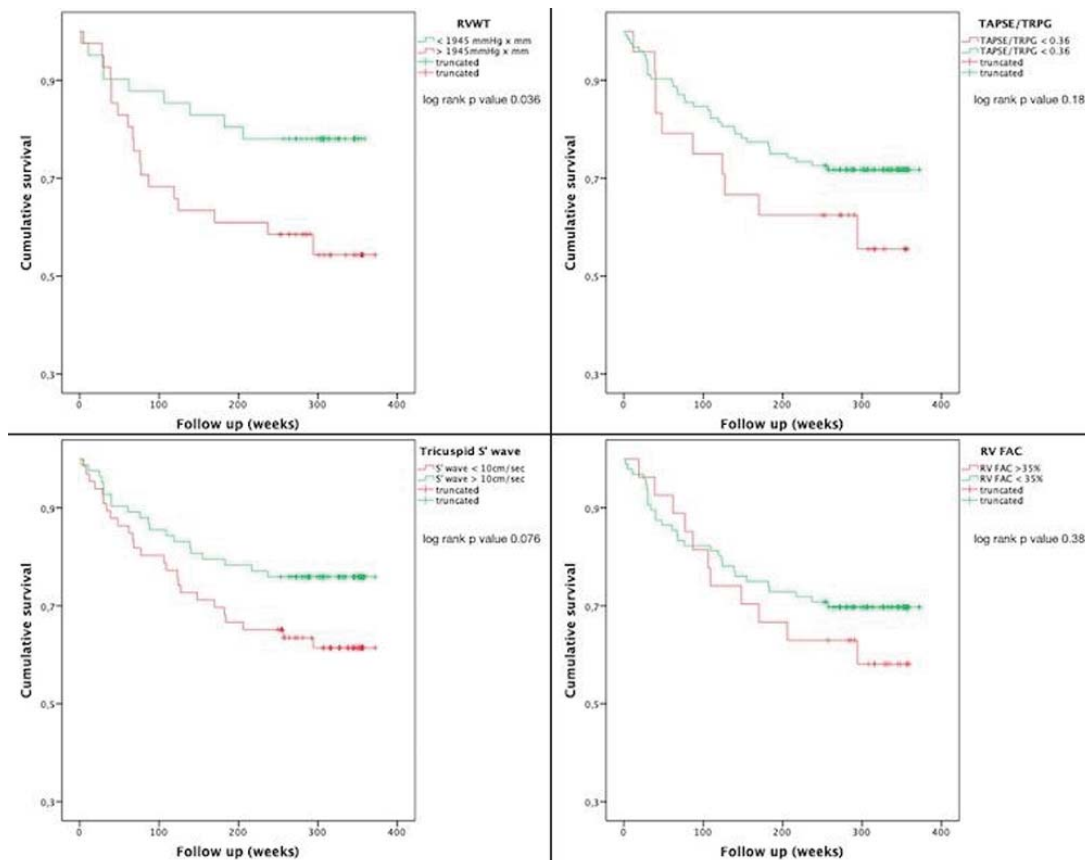
Prognosis: different RV variables