



Vena cava backflow and right ventricular stiffness in pulmonary arterial hypertension

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In 62 patients with pulmonary arterial hypertension, timing of maximal backflow in the vena cava was in late diastole, during the right atrial contraction. The amount of backflow was associated with right ventricular stiffness. Stroke volume was reduced. <http://bit.ly/2Y8YKg8>

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ABSTRACT Vena cava backflow is a well-recognised clinical hallmark of right ventricular failure in pulmonary arterial hypertension (PAH). Backflow may result from tricuspid regurgitation during right ventricular systole or from impaired right ventricular diastolic filling during atrial contraction. Our aim was to quantify the forward and backward flow in the vena cava and to establish the main cause in PAH.

In 62 PAH patients, cardiac magnetic resonance measurements provided volumetric flows ($\text{mL}\cdot\text{s}^{-1}$) in the superior and inferior vena cava; time integration of flow gave volume. The “backward fraction” was defined as the ratio of the backward and forward volumes in the vena cava, expressed as a percentage. Time of maximum vena cava backflow was expressed as a percentage of the cardiac cycle. Right ventricular volumes and aortic stroke volume were determined. Right heart catheterisation gave right ventricular and right atrial pressures. Right ventricular end-diastolic stiffness was determined with the single-beat method.

The median (interquartile range) backward fraction was 12% (3–24%) and it was >20% in 21 patients. Maximum backflow occurred at near 90% of the cardiac cycle, coinciding with atrial contraction. The backward fraction was associated with maximal right atrial pressure (Spearman’s $r=0.77$), right ventricular end-diastolic stiffness ($r=0.65$) and right ventricular end-diastolic pressure ($r=0.77$), and was negatively associated with stroke volume ($r=-0.61$) (all $p<0.001$).

Significant backward flow in the vena cava was observed in a large group of PAH patients and occurred mostly during atrial contraction as a consequence of impaired right ventricular filling due to right ventricular diastolic stiffness. The backward flow due to tricuspid regurgitation was of significance in only a small minority of patients.