Pulmonary arterial wave reflection as a novel estimate of pulmonary vascular resistance

Hayama H.[1]; Uejima T.[2]; Okazaki T.[1]; Hara H.[1]; Hiroi Y.[1]

[1]National Center for Global Health and Medicine, Tokyo, Japan
[2]Cardiovascular Institute, Tokyo, Japan

Funding Acknowledgements: Type of funding sources: Public hospital(s). Main funding source(s): International Medical Research and Development Fund

Background: Measuring pulmonary vascular resistance (PVR) is essential for diagnosing pulmonary hypertension. PVR can be estimated from a simple ratio of tricuspid regurgitation velocity (TRV) to time-velocity integral of flow through right ventricular outflow tract (RVOT) (Abbas equation), but this relationship has been shown to be unreliable in patients with high PVR. Once PVR is elevated, there is an increased pressure wave reflected from the peripheral of pulmonary artery (PA). We tested the hypothesis that assessing PA wave reflection could be an alternative method for estimating PVR.

Methods: This study recruited 83 patients (69 ± 14 years old, 44 men), including 41 patients with left-sided heart disease, 23 patients with pulmonary arterial hypertension and 19 patients with chronic thromboembolic pulmonary hypertension. PA wave reflection was assessed by separating PA pressure waveform derived from a Doppler tracing of TRV into forward and backward pressure (Pf and Pb), using a velocity profile at RVOT. This separation was based on the concept of wave intensity. PVR was estimated using Abbas equation. Pb and PVR by Abbas equation were compared for the correlations with direct measurement of PVR by right heart catheterisation within 48 hours after echocardiography.

Results: Figure A illustrates Pb and Pf waveforms obtained from a patient with chronic thromboembolic pulmonary hypertension. Pb increased from mid systole and formed a late peak of PA pressure waveform. Pb correlated strongly with PVR by catheter (figure B), whereas PVR by Abbas equation underestimated PVR especially when PVR was high, resulting in a moderate correlation (figure C). Receiver-operator characteristic curves showed a higher accuracy of Pb for identifying PVR > 3WU as well as 6WU, compared with PVR by Abbas equation (figure D and E).

Conclusions: This novel echocardiographic method for assessing PA wave reflection helps diagnose the severity of pulmonary hypertension.

Abstract Figure.