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Diagnosing pulmonary hypertension due to left heart disease using diastolic echo markers: The National Echo Database of Australia (NEDA) PH-LHD predictive formula

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Differentiating Pre-Capillary and Post-Capillary Pulmonary Hypertension by Doppler Echocardiography in a Large Real-world Database

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Abstract

Background: Pulmonary hypertension (PH) is common, dangerous and has multiple causes. Vasodilator therapy has significantly improved the prognosis of patients with pulmonary arterial hypertension (PAH), but the diagnosis can be challenging, requiring right heart catheterisation (RHC). Differentiating pre-capillary PH (prePH) and post-capillary PH (postPH) and measuring pulmonary vascular resistance (PVR) are key steps for diagnosing PAH. A novel echocardiographic parameter, the pulmonary to left atrial ratio (ePLAR), which is derived from the tricuspid regurgitation velocity (TRV) divided by the ratio between the early diastolic filling velocity and the early mitral annulus velocity (E/e’), i.e., ePLAR=TRV/E/e’, has been described as a surrogate for RHC. This retrospective cohort study tests the ability of ePLAR to differentiate prePH and postPH, in a large real world database.

Methods: The data from all RHC performed within a 5-year period (January 2010 to February 2015) were extracted from the hospital database. The closest corresponding echocardiograms (echos) were searched in the national echo database Australia (NEDA) using the identifiers from RHC data. The performance of ePLAR in differentiating two PH physiologies was compared against the gold standard RHC using various statistical methods.

Results: 887 pairs of echos and RHCs were merged and analysed in our study. The median time difference between RHC and echocardiography was 7 (IQR 1-62) days. The ePLAR was calculable in 184 cases (21%). Median (IQR) ePLAR values were significantly different between prePH and postPH groups: 0.35 (0.13-0.50) m/s vs 0.17 (0.12-0.23) m/s (P=0.003), despite both groups having similar mean pulmonary artery pressures. The optimal ePLAR cut-off of 0.28m/s had a positive predictive value of 94% for postPH, with sensitivity of 83% and specificity of 67%.

Conclusions: ePLAR helps to discriminate postPH from prePH and may be useful in evaluating these patients.
List of Publications/Presentations

Publications

Presentations
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Dr Pyi Naing

24.11.2017
Declaration and Disclosure of Contributions by Co-authors

I declare that

- This thesis is my own work and contains no material which has been accepted for the award of any other degree or diploma in any university or institution.
- The contribution by co-authors have been indicated and acknowledged.
- The permission has been granted by all the contributing co-authors of publications included in this thesis.

Author contributions

Paper 1: Non-invasive Assessment of Pulmonary Vascular Resistance in Pulmonary Hypertension: Current Knowledge and Future Direction
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Yours sincerely,

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List of Abbreviations

PVR  Pulmonary Vascular Resistance
WU   Wood Units
TPG  Transpulmonary Gradient
DPG  Diastolic Pulmonary Gradient
CO   Cardiac Output
RHC  Right Heart Catheterisation
Echo Echocardiography
mPAP Mean pulmonary artery pressure
PCWP Pulmonary Capillary Wedge Pressure
ePLAR echocardiographic Pulmonary to Left Atrial Ratio
HFpEF Heart Failure with Preserved Ejection Fraction
HFrEF Heart Failure with Reduced Ejection Fraction
TRV  Tricuspid Regurgitation Velocity
PASP Pulmonary Artery Systolic Pressure
RVSP Right Ventricular Systolic Pressure
PH or PHT Pulmonary Hypertension
PAH  Pulmonary Arterial Hypertension
PH-LHD Pulmonary Hypertension due to Left Heart Disease
CTEPH Chronic Thromboembolic Pulmonary Hypertension
prePH Pre-capillary Pulmonary Hypertension
postPH Post-capillary Pulmonary Hypertension
TVI_{RVOT} Time velocity integral of blood flow through right ventricular outflow tract
NEDA National Echo Database Australia