Validation of noninvasive pulmonary artery pressure / flow relationship: echocardiography vs right heart catheterization

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Topic(s):
Pulmonary Circulation, Pulmonary Embolism, Right Heart Failure – Diagnostic Methods

Citation:
Background. Invasive pressure-flow (P/Q) relationship of the pulmonary circulation can detect the presence of pulmonary hypertension (PH) during exercise and provide information on patients’ symptoms and assess disease severity. Doppler-echocardiography was reported to provide accurate but imprecise noninvasive estimates of both resting and exercise pulmonary haemodynamics. However, data on the direct comparison of invasive vs noninvasive approaches to build pressure-flow relationship are scarce.

Purpose. To compare echocardiographic estimates with invasive measurements of P/Q relationship of the pulmonary circulation during exercise.

Methods. Patients undergoing a clinically indicated right heart catheterization and echocardiography were studied at rest and during exercise. The ratio between mean pulmonary artery pressure and cardiac output at peak exercise (TPR), as well as P/Q slope throughout exercise were calculated. Both TPR and P/Q slope are abnormal when = 3 mmHg/L/min. Echocardiographic estimates were compared with invasive measurements.

Results. Sixty patients were included (mean age 65±14 years, 73% female). PH was present at rest in 38 cases (63%), of precapillary origin in 23 (61%). Heart failure with preserved ejection fraction was diagnosed in 23 patients, of which 17 had no PH at rest. TPR at peak exercise and P/Q slope were abnormal (= 3 mmHg/L/min) in the majority of patients (56 and 45 subjects, respectively). Echocardiographic estimates of P/Q slope and TPR correlated significantly although weakly with invasive measurements (R²=0.38 and 0.56, respectively, p<0.001). Bias of echocardiography for P/Q slope and TPR was 1.1±4.2 and 0.4±2.9 mmHg/L/min, respectively (figure). Sensitivity of echocardiography to detect an abnormal TPR or P/Q slope (i.e. =3 mmHg/L/min) was 100 and 98%, respectively, faced by low specificity (0 and 33%, respectively).

Conclusions. Doppler-echocardiography can provide rather accurate and sensitive but imprecise estimates of pressure-flow relationships of the pulmonary circulation during exercise. This intrinsic imprecision may limit its use in clinical practice.
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![Graph showing comparison of echocardiographic estimates with invasive measurements of P/Q slope and TPR at peak exercise.](image-url)