Ability of pulse power, esophageal Doppler, and arterial pulse pressure to estimate rapid changes in stroke volume in humans

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Introduction: Measures of arterial pulse pressure variation and left ventricular stroke volume variation induced by positive-pressure breathing vary in proportion to preload responsiveness. However, the accuracy of commercially available devices to report dynamic left ventricular stroke volume variation has never been validated.

Methods: We compared the accuracy of measured arterial pulse pressure and estimated left ventricular stroke volume reported from two Food and Drug Administration-approved aortic flow monitoring devices, one using arterial pulse power (LiDCOplus) and the other esophageal Doppler monitor (HemoSonic). We compared estimated left ventricular stroke volume and their changes during a venous occlusion and release maneuver to a calibrated aortic flow probe placed around the aortic root on a beat-to-beat basis in seven anesthetized open-chested cardiac surgery patients.

Results: Dynamic changes in arterial pulse pressure closely tracked left ventricular stroke volume changes (mean r .96). Both devices showed good agreement with steady-state apneic left ventricular stroke volume values and moderate agreement with dynamic changes in left ventricular stroke volume (esophageal Doppler monitor -1 +/- 22 mL, and pulse power -7 +/- 12 mL, bias +/- 2 sd). In general, the pulse power signals tended to underestimate left ventricular stroke volume at higher left ventricular stroke volume values.

Conclusion: Arterial pulse pressure, as well as, left ventricular stroke volume estimated from esophageal Doppler monitor and pulse power reflects short-term steady-state left ventricular stroke volume values and tract dynamic changes in left ventricular stroke volume moderately well in humans.