

Respiratory Variations in Pulse Pressure Reflect Central Hypovolemia during Noninvasive Positive Pressure Ventilation

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Background

Correct volume management is essential in patients with respiratory failure. We investigated the ability of respiratory variations in noninvasive pulse pressure (ΔPP), photoplethysmographic waveform amplitude (ΔPOP), and pleth variability index (PVI) to reflect hypovolemia during noninvasive positive pressure ventilation by inducing hypovolemia with progressive lower body negative pressure (LBNP).

Methods

Fourteen volunteers underwent LBNP of 0, -20, -40, -60, and -80 mmHg for 4.5 min at each level or until presyncope. The procedure was repeated with noninvasive positive pressure ventilation. We measured stroke volume (suprasternal Doppler), ΔPP (Finapres), ΔPOP , and PVI and assessed their association with LBNP-level using linear mixed model regression analyses.

Results

Stroke volume decreased with each pressure level (-11.2 mL, 95% CI -11.8, -9.6, $P < 0.001$), with an additional effect of noninvasive positive pressure ventilation (-3.0 mL, 95% CI -8.5, -1.3, $P = 0.009$). ΔPP increased for each LBNP-level (1.2%, 95% CI 0.5, 1.8, $P < 0.001$) and almost doubled during noninvasive positive pressure ventilation (additional increase 1.0%, 95% CI 0.1, 1.9, $P = 0.003$). Neither ΔPOP nor PVI was significantly associated with LBNP-level.

Conclusions

During noninvasive positive pressure ventilation, preload changes were reflected by ΔPP but not by ΔPOP or PVI. This implies that ΔPP may be used to assess volume status during noninvasive positive pressure ventilation.