New Algorithm for Automatic Estimation of the Respiratory Variations in the Pulse Oxymeter Waveform.

Cannesson M, Delannoy B, Morand A, Bastien O, Lehot J. *Anesthesiology.* 2007; 107: A451.

Introduction

Decreased ventricular preload (ventricular filling) in critically ill patients may indicate hypovolemia which can be treated by volume expansion. Fluid therapy does not result in increased stroke volume in all patients however. In nonresponsive patients, fluid administration may induce cardiopulmonary complications and hamper tissue healing. Respiratory variation in pulse pressure (△PP) has been established as a dynamic variable of ventricular preload but there is currently no accepted method for continuously and noninvasively measuring ventricular preload or △PP to guide fluid management. This study tests the ability of Masimo's Pleth Variability Index (PVI) measurement to noninvasively reflect changes in ventricular preload in vascular surgery patients under mechanical ventilation. In addition, it was posited that changes in PVI can be used as a noninvasive method for detecting hypovolemia and guiding fluid therapy.

Methods

Twenty vascular surgery patients, after induction of anesthesia and under mechanical ventilation were used for the study. Each patient had a radial arterial catheter for measuring mean arterial pressure (MAP), an internal jugular vein catheter for measuring central venous pressure (CVP) and wore a Masimo LNOP finger sensor attached to a Radical-7 pulse oximeter for measuring PVI. MAP and CVP were recorded at baseline and while patients were in head-down and head-up positions. PVI was continuously recorded. Respiratory variations in the arterial pulse pressure (△PP) was calculated from the maximum and minimum arterial pulse pressure during the same respiratory cycle.

Results

Changes in mean arterial pressure (MAP), central venous pressure (CVP), respiratory variations in pulse pressure (△PP), and pleth variability index (PVI) induced by changes in body position.

	MAP (mmHg)	CVP (mmHg)	△PP (%)	PVI (%)
Baseline	66±11	11±4	13±6	13±7
Anti-Trendelenburg (head up)	60±14*	5±4*	16±7*	18±7*
Trendelenburg (head down)	74±11†	20±6†	10±5†	10±5†

*p<0.05 compared to baseline; †p<0.05 compared to anti-Trendelenburg

There was a significant correlation between changes in PVI and changes in the arterial pulse pressure suggesting that PVI can be utilized as a noninvasive method for detecting hypovolemia.

Authors' Conclusions

"This study is the first to demonstrate the ability of PVI, an index automatically derived from the pulse oxymeter waveform analysis, to detect changes in ventricular preload. This new index has potential clinical applications for noninvasive hypovolemia detection and fluid responsiveness monitoring."