

## **Increasing Heart Rate and Tidal Volume Increases Plethysmography Variability Index Values**

Roeth N., Ball T., Atkins M., Bohannon W., Culp W., Johnston W. *Crit Care Med* 2012; 40(12): 267

### **Introduction**

Physiologic changes in heart rate and tidal volume alter preload responsiveness, but these changes have not been assessed by newer, non-invasive monitoring techniques. The non-invasive Masimo Rainbow pulse co-oximeter (Masimo Corporation; Irvine, CA) provides measurements that assess preload recruitable function. We propose that changes in heart rate (HR) and tidal volume (Vt) which alter stroke volume variability (SVV) with the Vigileo monitor (Edwards Lifesciences; Irvine, CA) will be similarly reflected in the plethysmography variability index (PVI). *Hypothesis*: Non-invasive PVI will change in a similar fashion with invasive SVV in differing physiologic states.

### **Methods**

18 vascular surgery patients undergoing general anesthesia and endotracheal intubation were studied. A Masimo Rainbow R25 sensor was placed on one finger to monitor plethysmographic index (PI), pulse oximeter derived hemoglobin (SpHg) and PVI; a Vigileo monitor was connected to a radial arterial line on the contralateral side to measure SVV. A transesophageal atrial pacemaker (CardioComman, Inc. Tampa, FL) was placed to adjust HR. Each patient was assigned a random sequence of four physiologic states of HR and Vt using a 2x2 factorial design: Vt 6mL/kg and 80 bpm, Vt 6mL/kg and 110bpm, Vt 10mL/kg and 80bpm, and Vt 10mL/kg and 110bpm. Measurements were taken three minutes after each intervention allowing for physiologic stabilization.

### **Results**

There was no significant difference in PI or SpHg over the four physiologic changes. Increasing Vt from 6 to 10 mL/kg caused similar increases in SVV (64%) and PVI (44%). Increasing HR from 80 to 110 bpm caused similar increases in SVV (10%) and PVI (4%). Comparison of SVV and PVI in the four groups showed a Pearson R coefficient and bias (95% confidence intervals) of 0.77, -0.6 (-2.4 to 1.3); 0.76, -3.2 (-6.5 to -0.0); 0.67, -4.7 (-7.4 to -1.9); and 0.78, -2.4 (-3.7 to -1.2), respectively.

### **Conclusions**

Under these physiologic changes, PVI and SVV reflect similar changes both in direction and magnitude. With significant correlation of PVI with SVV, non-invasive PVI can be used to assess preload responsiveness in anesthetized patients.