Systolic Pressure Variation (SPV)

SPV is the difference between the maximum and the minimum systolic pressure (SP) over a single respiratory cycle and can be expressed in millimeters of mercury; SPV (mmHg) = SBP – SMHB, or as a percent; SPV (%) = 100 x (SBPmax – SBPmin)/SBPmax + SBPmin). We calculated the SPV percentage from paper tracings of arterial pressure. All data acquired during irregular heart rate and spontaneous respirations were excluded. SPV > 10% indicates cardiac fluid responsiveness (2).

Figure 1 shows the arterial pressure fluctuations during mechanical ventilation. The systolic pressure is maximal during inspiration and declines during expiration.

Blood Volume (BV) can be measured utilizing a radioactive iodide labeled albumin technique. Blood volume analysis (BVA) provides information on intravascular circulating blood volume and its component values (plasma volume (PV) + red cell volume (RCV)). BVA is measured in critically ill patients. It may be useful to guide clinicians in administering fluid therapy. This study describes the relationship between SPV, a surrogate marker of cardiac fluid responsiveness and BVA, a measurement of intravascular volume.

Hypothesis

There is no relationship between SPV and circulating BV.

Methods

Simultaneous measurement of blood volume and arterial blood pressure were taken on critically ill surgical patients. BVA was done after initial resuscitation on days 1, 2, 3, and 5 if the patients remained in the ICU.

Results

The patients were 50 male: Female (61:39), APACHE II score 24 ± 3.5. Diagnosed included: severe sepsis/septic shock (n=68), ARDS (n=37), cardiovascular collapse (n=21). Regression analysis showed no correlation between BV and SPV (R2=0.004, p=0.254). (See Fig. 3.)

Discussion

Although SPV may reflect cardiac responsiveness to fluid, there was no relationship to intravascular blood volume. While >10% indicated hypovolemia in 12% of the time, SPV >10% indicated adequate circulating blood volume in 84% of the time. While there is no ideal method of assessing intravascular volume status, clinicians must use caution when extrapolating surrogate markers such as hemodynamic parameters to determine intravascular blood volume status.

References


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