Use of noninvasive volume assessment methods to predict acute blood loss in spontaneously breathing volunteers

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Abstract

Objective: The use of noninvasive volume assessment methods to predict acute blood loss in spontaneously breathing patients remains unclear. We aimed to investigate changes in the pleth variability index (PVI), vena cava collapsibility index (VCCI), end-tidal carbon dioxide (EtCO2), pulse pressure (PP), and mean arterial pressure (MAP) in spontaneously breathing volunteers after acute loss of 450 mL blood and passive leg raise (PLR).

Methods: This prospective observational study enrolled healthy volunteers in the blood donation center of an academic hospital. We measured the PVI, EtCO2, VCCI, MAP, and PP before blood donation; at the 0th and 10th minute of blood donation; and after PLR. The primary outcome was the changes in PVI, EtCO2, VCCI, MAP, and PP.

Results: We enrolled thirty volunteers. There were significant differences among the four obtained measurements of the PVI, EtCO2, and MAP (P<0.001, P<0.001, P<0.001, respectively). Compared to the predonation values, post-hoc analysis revealed an increase in the PVI at the 0th min postdonation (mean difference [MD], 5.4±5.9; 95% confidence interval [CI], -7.6 to -3.1; P<0.001); a decrease in the EtCO2 and MAP at the 0th and 10th minute postdonation, respectively (MD, 2.4±4.6; 95% CI, 0.019 to 4.84; P=0.008 and MD, 6.4±6.4; 95% CI, 3 to 9.7; P<0.001, respectively). Compared with EtCO2 at the 10th minute, the value increased after PLR (MD, 1.8±3.2; 95% CI, 0.074 to 4.44; P=0.006).

Conclusion: The PVI and EtCO2 could detect early hemodynamic changes after acute blood loss. However, it remains unclear whether they can determine volume status in spontaneously breathing patients.