

Prediction of fluid responsiveness with plethysmographic variability index in cardiac surgery patients: a comparison of three anatomical sites

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Background and Goal of Study: Digital plethysmographic variability index (PVI) has been shown to predict fluid responsiveness in high-risk surgical patients and in critically-ill patients. However, alterations in finger perfusion can markedly decrease the accuracy of measurements.

We tested the hypothesis that cephalic PVI sensors placed on the ear (PVI_{ear}) and the forehead (PVI_{forehead}) would be more discriminant than usual digital PVI (PVI_{digital}) to predict fluid responsiveness in cardiac surgery patients.

Materials and methods: Consecutive patients scheduled for fluid loading (500 mL hydroxylethyl starch 6% 130/0.4 over 15 min) were included postoperatively. Patients with left and/or right ventricular dysfunction were excluded. Three anatomical sites of PVI measurement (PVI_{digital}, PVI_{ear}, PVI_{forehead}) were simultaneously assessed and compared with the respiratory arterial pulse pressure variation (PPV). A positive response to fluid loading was defined as a 15% increase in cardiac index (bolus transpulmonary thermodilution). Relationships among all dynamic indices and between baseline PVI and changes in cardiac index after fluid loading were analyzed with linear regression. The area under the receiver operating characteristic curves (ROCAUC) for PVI_{digital}, PVI_{ear}, PVI_{forehead} and PPV to predict fluid responsiveness were calculated.

Results and discussion: Eighty-one consecutive patients were enrolled in the study. Thirty-one patients were excluded and the remaining 50 patients were analyzed. Due to the absence of signal, PVI_{digital} and PVI_{forehead} could not be obtained in one and three patients, respectively. Forty-three (86%) patients were responders and seven (14%) patients were non-responders to fluid loading. A positive significant relationship was found between PPV and PVI_{digital} ($r=0.58$, $P<0.001$), PVI_{ear} ($r=0.68$, $P<0.001$) and PVI_{forehead} ($r=0.60$, $P<0.001$). PVI_{forehead} at baseline only was significantly correlated with changes in cardiac index after fluid loading ($r=0.38$, $P=0.008$). ROCAUC were 0.84 (95%CI: 0.70-0.92), 0.70 (95%CI: 0.55-0.82), 0.78 (95%CI: 0.64-0.88) and 0.84 (95%CI: 0.70-0.93) for PPV, PVI_{digital}, PVI_{ear} and PVI_{forehead}, respectively.

Conclusion(s): PVI_{forehead} was more discriminant than PVI_{digital} and similar to PPV in predicting fluid responsiveness following cardiac surgery.