Pleth variability index (PVI) vs. pulse pressure variation (PPV) and stroke volume variation (SVV): an observational study on agreement with PVI including a derivation of comparable thresholds. The climate-III study

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Introduction:
Pulse pressure variation (PPV) and stroke volume variation (SVV) predict fluid responsiveness. In addition, numerous non-invasive devices provide other dynamic indices such as Pleth variability index (PVI) which is derived from the pulse oximetry plethysmography waveform. Although several studies showed prediction of fluid responsiveness by PVI, the data are conflicting, and the cut-offs of PVI range from 7 to 20%.

Methods:
We compared 240 measurements of PVI (Massimo; USA) with PPV and SVV simultaneously derived with the PiCCO-device (Pulsion, Germany) in 30 ICU-patients.
Primary endpoint: Concordance of measurements within the categories <9%, 9-13% and >13%. Secondary endpoint: Derivation of corrected thresholds for PVI.

Results:
n=30; 15 female, 15 male; mechanical ventilation 240/240 (100%); vasopressors 156/240 (65%). PVI could not be derived in 1 of 240 measurements (0.4%).

PVI (14.8±9.3%) was higher (p<0.001) than PPV (11.1±9.0%) and SVV (12.6±7.3%).
Classifications within the categories <9%, 9-13% and >13% agreed in 117 of 239 (49%) measurements for PVI vs. PPV (Kendall-tau r=0.435; p<0.001) and in 131 of 239 (55%) cases for PVI vs. SVV (r=0.431; p<0.001).

PVI-values of 14% and 17% had the highest sum of sensitivity and specificity (ROC-analysis; Youden-Index) to predict the established PPV-cut-offs of 9% and 13%.

PVI in the corrected categories <14%, 14-17% and >17% substantially better agreed (166/239; 65%; r=0.500) with the PPV-categories <9%, 9-13% and >13% compared to the uncorrected PVI categories <9%, 9-13% and >13% (agreement 117 of 239 measurements (49%); p<0.001 vs. 166 of 239; chi-square-test).

Conclusion:
PVI was significantly higher than PPV and SVV. Only 49% and 55% of PPV- and SVV-values are classified in the same categories <9%, 9-13% and >13% as PVI.
Adjusting the PVI thresholds to 14% and 17% instead of 9 and 13% significantly improves the agreement PVI-with PPV-categories.