

The Effect of Positive End-Expiratory Pressure and Tripled Tidal Volume on Pleth Variability Index during Hypovolaemia in Conscious Subjects: A Volunteer Study.

Nilsson L.M., Lindenberger D.M., Hahn R.G. *Eur J Anaesthesiol.* 2013 Nov;30(11):671-7.

Background

The pulse oximeter measurement pleth variability index (PVI) can detect hypovolaemia during positive pressure ventilation. *Objectives:* We studied whether PVI can detect a hypovolaemic state in spontaneously breathing humans and whether better discrimination is obtained by modifying the breathing patterns.

Design

Experimental study. *Setting:* Clinical physiology department in a university hospital. *Participants:* Fourteen healthy volunteers aged between 18 and 27 (mean 21) years. *Interventions:* A hypovolaemic state was induced by lower body negative pressure (LBNP) of 40 mmHg (LBNP40) and 15 mmHg (LBNP15). Data were collected in four separate series with normal breathing and application of positive end-expiratory pressure (PEEP) 5 cmH₂O, with and without tripling of the tidal volume. *Main Outcome Measures:* PVI (mean \pm standard deviation), heart rate, arterial blood pressure and cardiac index (CI).

Results

Cardiac index decreased from 2.4 to 1.7 and 2.1 l min⁻¹ m⁻² at LBNP40 and LBNP15, respectively ($P < 0.001$). The mean PVI for the four breathing modes increased with the degree of LBNP, from $23.5 \pm 5.9\%$ at baseline to $27.9 \pm 9.3\%$ at LBNP40, and to $25.2 \pm 6.9\%$ at LBNP15 ($P < 0.01$). The greatest increase in PVI, to $31.7 \pm 12.3\%$, was recorded for the PEEP and tripled tidal volume breathing mode when hypovolaemia was induced by LBNP40. However, there was considerable overlap between the LBNP levels.

Conclusion

The PVI increased significantly for higher LBNP, but overlap was common regardless of breathing mode. The PVI can be used to indicate a hypovolaemic state during spontaneous breathing in groups but not in individuals.