The Relationship Between Oxygen Reserve Index and Arterial Partial Pressure of Oxygen During Surgery.

Anesth Analg. 2016 Mar 22. [Epub ahead of print]
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BACKGROUND: The use of intraoperative pulse oximetry (SpO_2) enhances hypoxia detection and is associated with fewer perioperative hypoxic events. However, SpO_2 may be reported as 98% when arterial partial pressure of oxygen (PaO_2) is as low as 70 mm Hg. Therefore, SpO_2 may not provide advance warning of falling arterial oxygenation until PaO_2 approaches this level. Multiwave pulse co-oximetry can provide a calculated oxygen reserve index (ORI) that may add to information from pulse oximetry when SpO_2 is >98%. This study evaluates the ORI to PaO_2 relationship during surgery.
METHODS: We studied patients undergoing scheduled surgery in which arterial catheterization and intraoperative arterial blood gas analysis were planned. Data from multiple pulse co-oximetry sensors on each patient were continuously collected and stored on a research computer. Regression analysis was used to compare ORI with PaO_2 obtained from each arterial blood gas measurement and changes in ORI with changes in PaO_2 from sequential measurements. Linear mixed-effects regression models for repeated measures were then used to account for within-subject correlation across the repeatedly measured PaO_2 and ORI and for the unequal time intervals of PaO_2 determination over elapsed surgical time. Regression plots were inspected for ORI values corresponding to PaO_2 of 100 and 150 mm Hg. ORI and PaO_2 were compared using mixed-effects models with a subject-specific random intercept.
RESULTS: ORI values and PaO_2 measurements were obtained from intraoperative data collected from 106 patients. Regression analysis showed that the ORI to PaO_2 relationship was stronger for PaO_2 to 240 mm Hg ($r = 0.536$) than for PaO_2 over 240 mm Hg ($r = 0.0016$). Measured PaO_2 was ≥100 mm Hg for all ORI over 0.24. Measured PaO_2 was ≥150 mm Hg in 96.6% of samples when ORI was over 0.55. A random intercept variance component linear mixed-effects model for repeated measures indicated that PaO_2 was significantly related to ORI (β[95% confidence interval] = 0.002 [0.0019-0.0022]; $P < 0.0001$). A similar analysis indicated a significant relationship between change in PaO_2 and change in ORI (β [95% confidence interval] = 0.0044 [0.0040-0.0048]; $P < 0.0001$).
CONCLUSIONS: These findings suggest that ORI >0.24 can distinguish PaO_2 ≥100 mm Hg when SpO_2 is over 98%. Similarly, ORI > 0.55 appears to be a threshold to distinguish PaO_2 ≥150 mm Hg. The usefulness of these values should be evaluated prospectively. Decreases in ORI to near 0.24 may provide advance indication of falling PaO_2 approaching 100 mm Hg when SpO_2 is >98%. The clinical utility of interventions based on continuous ORI monitoring should be studied prospectively.