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

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BACKGROUND: The use of intraoperative pulse oximetry (SpO2) enhances hypoxia detection and is associated with fewer perioperative hypoxic events. However, SpO2 may be reported as 98% when arterial partial pressure of oxygen (PaO2) is as low as 70 mm Hg. Therefore, SpO2 may not provide advance warning of falling arterial oxygenation until PaO2 approaches this level. Multiwave pulse co-oximetry can provide a calculated oxygen reserve index (ORI) that may add to information from pulse oximetry when SpO2 is >98%. This study evaluates the ORI to PaO2 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 PaO2 obtained from each arterial blood gas measurement and changes in ORI with changes in PaO2 from sequential measurements. Linear mixed-effects regression models for repeated measures were then used to account for within-subject correlation across the repeatedly measured PaO2 and ORI and for the unequal time intervals of PaO2 determination over elapsed surgical time. Regression plots were inspected for ORI values corresponding to PaO2 of 100 and 150 mm Hg. ORI and PaO2 were compared using mixed-effects models with a subject-specific random intercept.

RESULTS: ORI values and PaO2 measurements were obtained from intraoperative data collected from 106 patients. Regression analysis showed that the ORI to PaO2 relationship was stronger for PaO2 to 240 mm Hg (r = 0.536) than for PaO2 over 240 mm Hg (r = 0.0016). Measured PaO2 was ≥100 mm Hg for all ORI over 0.24. Measured PaO2 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 PaO2 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 PaO2 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 PaO2 ≥100 mm Hg when SpO2 is over 98%. Similarly, ORI > 0.55 appears to be a threshold to distinguish PaO2 ≥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 PaO2 approaching 100 mm Hg when SpO2 is >98%. The clinical utility of interventions based on continuous ORI monitoring should be studied prospectively.