Analysis of SpO2 and PaO2 Correlation in Adult Patients with ALI/ARS: A Retrospective Comparison of Two Pulse Oximetry Systems.

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Background

Pulse oximetry should be a reliable and accurate non-invasive method of assessing changes and trends in oxygenation and PaO2. Following multiple episodes of poor correlation of SpO2 readings and measured PaO2 a retrospective analysis of SpO2 and PaO2 correlation using different pulse oximetry systems was conducted as a quality improvement project.

Method

Retrospective review of SpO2 and PaO2 data was recorded from patients electronic medical records. Data from ALI/ARDS patients monitored with Philips (Hewlett Packard) pulse oximeter modules, software version 17.62, using Nellcor sensors was compared to data from patients monitored with Masimo pulse oximeters and sensors. The data sample includes SpO2 and PaO2 recorded after changes in patient condition, changes in ventilator settings, and routine monitoring during the ICU admission. The ability for each pulse oximetry system to correctly detect hypoxic conditions, defined as SpO2 Â£ 92% with a PaO2 Â£ 60 mm Hg, and non-hypoxic conditions, defined as SpO2 â©¥ 98% with a PaO2 â©¥ 80 mm Hg was assessed. The sensitivity (rate of true positives), specificity (rate of true negatives), false positive rate, false negative rate, and total error rate was determined for each condition. The study was approved by the UCSF Committee on Human Research.

Results

A total of 506 measurements in nine patients from 2003-2004 using the Philips (Hewlett Packard) system and 752 measurements in ten patients from 2008 using the Masimo system were reviewed. The sensitivity, specificity, false positive rate, false negative rate, and total error rate for determining hypoxic and non-hypoxic events were similar for each pulse oximetry system. True positive rates were 58% to 69% for hypoxic conditions and 70% to 78% for non-hypoxic conditions. Total error rate (false positives plus false negatives) for both hypoxic and non-hypoxic conditions ranged between 37% to 48%. Neither pulse oximetry system was superior in detecting both hypoxic or non-hypoxic conditions.

Conclusion

This data demonstrates the limitations of pulse oximetry as a reliable correlate to the measured PaO2 in patients with ALI/ARDS using two different monitoring systems. Until a more reliable non-invasive method of assessing oxygenation and PaO2 becomes available, pulse oximetry measurements need to be validated by arterial blood gas sampling in ALI/ARDS patients.