Comparison of Pulse Oximetry Readings From Finger vs. Ear Probe Locations in Anesthetized Patients

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Background

Pulse oximetry (PO) is a standard of care during the administration of general anesthesia (GA) and monitored anesthesia care (MAC). During anesthesia, oxygen saturation sometimes decreases to levels that require diagnostic and/or therapeutic interventions by the anesthesiologist. Though this can occur during GA, it may be more common during MAC, when decreased minute ventilation may impair oxygenation.

Decreases in saturation, during both GA and MAC, may result in responses from the anesthesiologist. During MAC, over-sedation may cause desaturation, due to decreased spontaneous ventilation. Therefore, when desaturation occurs during MAC, the first response of anesthesiologists may be to decrease the dose of a sedative(s). However, if the PO reading is falsely low, decreasing the level of sedation may result in patient movement that impairs performance of the procedure, or unnecessary awareness and/or pain.

When oxygen saturation decreases unexpectedly, the anesthesia provider will sometimes place a second PO probe in a different location. If the second probe confirms a higher saturation, it is generally interpreted as confirmation that the reading from the first probe is falsely low.

The goal of this study is to determine if there are significant differences between PO readings obtained with oximeter probes on a finger versus the ear.

Methods

After IRB approval and informed consent, 50 adult patients undergoing GA or MAC for diagnostic or surgical procedures were studied. A PO probe (Nellcor Max-N) was placed on a finger and the ear. Readings were recorded with a Phillips 1020a PO module. Paired readings were recorded every five minutes. Differences in saturation readings between the finger and ear probe at each time point were entered into one of nine categories (see table 1). The categories began with no difference between ear probe saturation, and increased to differences of 7% or greater. The frequency of paired readings in each category was determined.

Results
83.1% of paired-readings differed by 0 â€“ 2 % (categories IV, V, and VI). 8.3% of paired-readings differed by 3 â€“ 4 % (categories III and VII). 7.7% of paired-readings differed by ≥ 5 % (categories I, II, VIII and IX) (see table 1.)

Discussion

A prior study, performed in awake patients undergoing pulmonary function testing, reported better agreement between finger SpO2 and SaO2, as compared to ear lobe SpO2 and SaO2.(1) However, they applied a finger probe to the ear, not a probe designed for the ear. This calls these results into question, as the quality of contact between the probe and the patient may result in erroneous readings.(2) A study of probe sensors in multiple locations in infants and children with cyanotic congenital heart disease did not find a significant difference in bias (SpO2 â€“ SaO2) between finger and ear probes. (3)

SpO2 readings can be decreased by vasoconstriction, hypothermia, hypovolemia, hypotension and movement. Therefore, it is often assumed that the higher reading from two probes is the accurate saturation. We undertook this study because of clinical instances when finger SpO2 readings were unexpectedly low, and rapid placement of an ear probe often recorded a higher SpO2. We hypothesized that, when there were differences, SpO2 readings from the ear would be higher than the finger, due to the large amount of blood flow to the head, and that fact that causes of erroneously low saturation readings are more likely to impact the periphery (finger) as compared to the head. However, the data indicate that neither the ear probe nor the finger probe provide consistently higher saturation readings. This suggests an intriguing possibility. Could it be that, when differences are measured, each probe may be accurately reading SpO2 in the local vascular bed? If this is so, the ideal method to study this question would be to measure an arterial blood gas in both regions locally, for example, from the radial artery to compare SaO2 to finger probe SpO2, and from the carotid artery to compare SaO2 to ear probe SpO2.

An SpO2 reading that is falsely low by 3 â€“ 4% is unlikely to result in major changes in anesthesia care, unless the saturation was initially quite low. In contrast, an SpO2 reading that is falsely low by ≥ 5 % could result in changes that may impact outcome. For example, if the true saturation is 94% and the finger probe SpO2 reads 87%, this could result in complications such as bleeding from insertion of a nasal airway, or hemodynamic changes due to rapid laryngoscopy and intubation. Complications due to airway manipulation are a known risk of airway management, but it is troubling if airway maneuvers are performed unnecessarily, being triggered by a falsely low SpO2. If SpO2 decreases unexpectedly, usual procedures include checking the probe, seeking possible causes of desaturation, and appropriate corrective airway maneuvers. In addition, placement of a pulse oximeter probe in a second location may provide useful information.

Summary

7.7% of paired SpO2 readings differed by ≥ 5 % (categories I, II, VIII and IX). However, when SpO2 readings differed by ≥ 5 %, neither probe location, ear or finger, consistently provided a higher reading. If saturation decreases during anesthesia, measuring SpO2 with a sensor in a different location may prove useful.
References

