

Evaluation of a New Reflectance Forehead Sensor in Detecting Oxygen Desaturation in Patients Undergoing Polysomnography.

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Introduction

In polysomnography, pulse oximetry provides a critical parameter in the diagnosis of patients with sleep apnea. Traditionally, digital sensors have been the sensor of choice in monitoring the sleeping patient. Forehead reflectance sensors in the past were plagued with inaccuracy related to venous pulsations in the forehead in supine patients. We compared SpO₂ data during polysomnography simultaneously using the Max-Fast forehead sensor connected to an N595 oximeter (Nellcor, Pleasanton, CA) and an LNOP-Adt digit sensor connected to a Radical Oximeter (Masimo Corp., Irvine, CA.).

Methods

In 20 patients undergoing polysomnography, both a Max-Fast forehead sensor and a LNOP-Adt digit sensor were applied according to manufacturer's instructions. The oximeters were turned on simultaneously at the start of the study and turned off simultaneously at the end of the study. Data from the oximeters were downloaded into the PROFOX oximetry analysis software (version PFWS 08/99). Mean saturation, lowest saturation, and time with saturation less than 90% were extracted.

Results

Artifact was clearly identifiable in the graphic output of the saturation profile in 8 of 20 studies using the forehead sensor. This artifact was characterized by a sudden shift in saturation that was maintained for a substantial time period not characteristic of desaturation profiles associated with sleep apnea. No such artifact was observed in any of the studies for the digit sensor. The data pairs were divided into two categories, one category compared the data from the two oximeters for the 8 studies with artifact with the forehead sensor, and a second category with the remaining 12 studies in which no artifact was observed in either sensor. In the artifact group, comparing the forehead sensor to the digit sensor, mean saturation was slightly lower for the forehead sensor ($94.0 \pm 2.6\%$ and $96.2 \pm 2.0\%$). Lowest saturation was lower by a mean of 10% in the forehead sensor ($73 \pm 11\%$ and $83 \pm 8\%$). The percent of time with saturation less than 90% was significantly greater for the forehead sensor ($14.9 \pm 17.4\%$ and $0.5 \pm 1.3\%$), the largest difference being 47.8% with the forehead sensor reading lower (51.4% and 3.6% for the forehead sensor and digit sensor respectively). Comparing the forehead sensor to the digit sensor for the non-artifact group shows similar mean saturation ($94.2 \pm 2.7\%$ and $94.6 \pm 2.3\%$). Lowest saturation was slightly higher for the forehead sensor ($82 \pm 11\%$ and $78 \pm 14\%$). The percent time with saturation less than 90% was similar between the two sensors ($7.1 \pm 15.5\%$ and $5.5 \pm 12.3\%$), the largest difference being 10.6% with the forehead sensor reading lower (54.5% and 43.9% for the forehead sensor and digit sensor respectively).

Conclusion

The Nellcor Max-Fast reflectance forehead sensor failed to provide accurate SpO₂ data in 40% of the patients undergoing polysomnography. In these cases, the forehead sensor registered a significantly greater percent of time with saturation less than 90%. The use of this sensor during anesthesia could greatly impact the therapeutic approach in patients with sleep apnea during pre-anesthesia and during post-anesthesia recovery.