

Low Perfusion-Resistant Pulse Oximetry

Weber WM, Elfadel IM, Barker SJ. *Journal of Clinical Monitoring* 1995;11(4):284

Introduction


“Low perfusion is a major contributor to the high rate of false alarms in pulse oximetry. Reducing the number of false alarms and giving reliable oximetric readings to the practitioner, even in the presence of low blood flow, are two major goals that must be attained by any pulse oximeter destined for use in critical care medicine.” While pulse oximetry has become the standard of care in the operating room, recovery room, and intensive care units, it has been handicapped by its failure to measure oxygen saturation at extremely low blood flow as is often seen in critical surgery and critical neonatal care. This is compounded with patient motion. The main purpose of this paper is to show that reducing false alarms and giving reliable oximetric readings, even in the face of low perfusion, is now an attainable goal.

Methods

Eight healthy volunteers were studied to determine the effects of low perfusion on the readings of five commercially available conventional pulse oximeters (Criticare 504-US, Nellcor N-200 and N-200 C-Lock, Novamatrix Oxypleth, and Ohmeda 3740) and a Masimo SET pulse oximeter prototype. A mechanical device was used to systematically assist each of the subjects in occluding the blood flow in the brachial artery. SpO₂% readings were recorded and compared with the readings of a reference sensor connected to a non-occluded site.

Results

SpO₂% readings were evaluated in terms of error rate (average number of times the absolute value difference between the instrument saturation and the reference saturation was > 3%), failure rate (average number of times SpO₂% display zeroed out), and total error (sum of error rate and failure rate).

| |  Masimo SET | Novamatrix Oxypleth | Nellcor N-200 C-Lock | Ohmeda 3740 | Nellcor N-200 | Criticare 504-US |
|---------------------|--|------------------------|-------------------------|----------------|------------------|---------------------|
| Error Rate | 01.69% | 00.54% | 03.15% | 09.67% | 03.44% | 00.00% |
| Failure Rate | 00.22% | 32.29% | 30.45% | 38.04% | 50.22% | 100.00% |
| Total Error | 01.91% | 32.83% | 33.60% | 47.71% | 53.66% | 100.00% |

Authors' Discussion and Conclusions

“We report on a prototype pulse oximeter designed to compute the correct oxygen saturation of arterial hemoglobin at a very low blood perfusion in the patient’s extremities ... We also show actual oxygen saturation results obtained under a variety of clinical situations in which other pulse oximeters fail to give the correct values ... **By and large, the Masimo prototype device performed the best in the simulated low-perfusion environment.**”