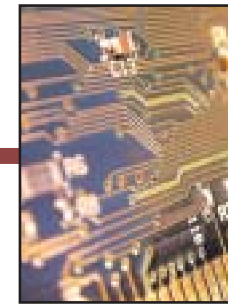

FEELING THE PULSE OF OXIMETRY TRENDS

By Stephanie Richardson

Before the advent of pulse oximetry, clinicians relied on expensive blood gas analyzers and invasive tests to measure oxygen saturation in a patient's blood stream. Decades later, this noninvasive test is available in so many forms that it easily has become the No. 1 choice of measuring SpO2 and detecting hypoxemia in almost all patients.

Pulse oximeters may be used in a variety of situations. They are of particular value for monitoring oxygenation and pulse rates in anesthesia, where oximetry has been shown to increase safety by alerting medical staff to unexpected hypoxia. Additionally, oximeters are used extensively in intensive care units during mechanical ventilation to ensure sufficient oxygen is being given. In these ventilator scenarios, the oximeter can detect oxygenation problems before they are noticed by the care team.

However, conventional pulse oximeters have been known to have difficulty obtaining accurate readings during periods of motion and low perfusion, resulting in frequent alarms. To address the limitations of conventional pulse oximeters, manufacturers have developed next-generation technologies that are able to obtain accurate values when conventional oximeters can't.

Let's look at some of the more recent trends in pulse oximetry.

Continuous pulse oximetry

Continuous pulse oximetry, or CPOX, has the potential to increase vigilance, thus reducing cardiopulmonary complications in the ICU. Diagnostic procedures, including sleep studies, bronchoscopy, catheterizations and endoscopy, all may have complications leading to hypoxia, which could warrant the use of CPOX.

Additionally, some experts have indicated that CPOX may be used to control oxygen flow based on measured oxygen saturation. This was recognized in research in which controllers were linked to CPOX to adjust the delivered fraction of inspired oxygen.

An effective device used for CPOX should at least measure an etiological variable that can be acted upon to measure a patient's outcome. These monitors should measure patients statistics that are accurate, precise and reproducible, and they should be easy to implement without disrupting routine care processes. In addition, they should be easy to consistently apply and interpret, and they should not increase risk to the patient.

Significant findings derive from a study of more than 1,200 post-surgical patients who were randomized to receive CPOX or conventional, intermittent pulse oximetry. 1 Although researched saw no difference in the ICU readmission rate patients readmitted to the ICU had a decreased transfer time with CPOX.

Average costs associated with patient care decreased by more than $28,000. For patients admitted to the ICU, costs for survivors were $29,400 for CPOX compared to $48,600 for intermittent pulse oximetry and $51,400 for non-survivors with CPOX compared to $82,100 for intermittent pulse oximetry.

Signal extraction technology

Although pulse oximetry is a standard of care in operating rooms and most ICUs, its performance in these high motion environments or in patients with low perfusion sometimes isn't ideal. Studies have shown that false alarms stemming from motion artifact, as well as the inability of conventional oximeters to provide physiological data during emergent events, have led to the misnomer that pulse oximeters are unreliable.

One of the most studied advances in pulse oximetry to date is signal extraction technology (SET). This is a distinct method of acquiring, processing and reporting pulse rate and arterial oxygen saturation. SET has been shown to substantially eliminate problems associated with motion artifact, low peripheral perfusion, and many low signal-to-noise scenarios. For those reasons, SET extends the utility of pulse oximetry in high motion, low signal and noise intensive environments such as operating rooms and ICUs.

SET operates using conventional red and infrared photoplethysmographic signals. These signals employ radiofrequency and light-shielded optical sensors, digital signal processing and adaptive filtration to measure SpO2. In contrast to conventional pulse oximetry, which calculates SpO2 from a ratio of transmitted pulsatile red and infrared light, SET pulse oximetry utilizes discrete saturation transform to isolate individual saturation components in the optical pathway.

By applying adaptive filters to real-time monitoring, oximeters equipped with SET can accurately establish a noise reference in the detected signal. This enables a direct calculation of physiologic data.

SET has been evaluated in more than 100 peer-reviewed studies that indicate devices with this technology out-perform many conventional oximeters.

Remote monitoring

Recently, some facilities have implemented pulse oximetry using centralized data displays similar to electrocardiography telemetry stations. These allow several patients to be monitored at once from a nurses station or other central care area.

Some of these systems come armed with a remote notification system with pager. This system augments bedside oximetry alarms by sending them directly to a caregiver's pager. The caregiver will receive SpO2 and pulse rate alarm data clearly and promptly, so they can respond to patients in a timely manner.

The move toward remote monitoring has been prompted by the Joint Commission's establish National Patient Goal No. 6.

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This goal aims to improve the effectiveness of clinical alarm systems. Installing remote monitoring systems helps hospitals comply with this goal because it supplements bedside oximeter alarms by notifying clinicians when and where a pulse oximeter is alarming in the unit.

One study showed that fewer patients transferred from the general care floor to the ICU for respiratory concerns when monitored remotely. Additionally, the study found an almost 50-percent reduction in patient care costs for ICU readmissions among patient who received continuous remote monitoring vs. spot checking.

Co-oximetry for smoking cessation

Pulse Co-oximeters are much like regular pulse oximeters in that they clip to a patient's finger in order to detect the percentage of carbon monoxide in the blood. The device measures absorption at multiple wavelengths to distinguish oxyhemoglobin from carboxyhemoglobin and determine the oxyhemoglobin saturation.

This saturation is the percentage of oxygenated hemoglobin compared to the total amount of hemoglobin, including carboxyhemoglobin, methemeglobin, oxyhemoglobin and reduced hemoglobin. When a patient presents with carbon monoxide poisoning, the co-oximeter will detect this Hb and will report the oxyhemoglobin saturation as markedly reduced.

New research presented at the 2007 meeting of the American College of Chest Physicians indicated that people with 5 to 6 percent carbon monoxide in their blood are almost always smokers.

"In our practice, when the carboxyhemoglobin is 10 percent, it's easy to tell a patient that 10 percent of his or her blood is poisoned and unable to carry oxygen," said Sridhar Reddy, MD, MPH, FCCP. "By doing this, we catch the patient's attention right away and can begin smoking cessation counseling. You could use this device in a school or college, check 100 kids and try to counsel the smokers before they develop COPD or cardiovascular disease."

Detecting smoking status is key to effectively counseling patients regarding smoking cessation. Co-oximetry can be effectively used in this situation. In addition its use may be extrapolated to other public health settings such as adolescent smoking cessation programs within school systems to help prevent smoking in vulnerable populations.

Finally, in outpatient settings co-oximetry can be used as a cheap quick and noninvasive method to detect smoking status.

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"It's Alice Kramden!"