What’s New in Practical Patient Monitoring and Support Equipment

The author discusses state-of-the-art technology for patient monitoring in office-based anesthesia. New technology includes bispectral index monitoring to evaluate the depth of anesthesia, signal extraction for more accurate oxygen saturation monitoring, and online S-T segment analysis for monitoring multiple electrocardiographic leads.

Increased use of ambulatory surgery facilities and office-based anesthesia (OBA) in the performance of outpatient surgery has resulted in increased concern for patient safety.1 It is critically important that those responsible for developing, maintaining, and working in such facilities be aware that specific guidelines do exist for patient care in these settings. The standard of care in an office-based setting or in an ambulatory facility should certainly equal that required in a hospital setting when similar procedures are performed; toward this end, the American Society of Anesthesiologists has created guidelines for OBA. These can be viewed at the Society’s Web site, www.asahq.org.2-4 These guidelines cover administration and facility care, clinical care, and emergencies and transfers.

One important segment of these guidelines concerns patient monitoring and appropriate equipment, including the use of electrocardiography (EKG) and pulse oximetry. Although adherence to such basic guidelines is important, the use of currently available equipment that is technologically more advanced than basic monitoring devices can help detect problems and determine clinically relevant physiologic alterations in patients undergoing surgery. Another advance in monitoring technology that is frequently being used in the hospital setting is tracking of the depth of anesthesia. These 3 monitoring areas—depth of anesthesia, advances in pulse oximetry, and EKG evaluation—are addressed in this article.

Patients are frequently concerned about the possibility that they might be aware of their surroundings and of the procedure during surgery. Determining the level of consciousness as it correlates with the sedative-hypnotic state would hopefully avoid episodes of patient awareness and recall. Although electroencephalographic (EEG) evaluation would accomplish this, it is a cumbersome task. There is a new technology that can evaluate the depth of anesthesia through the use of bispectral index (BIS) monitoring.5 This technology involves evaluation of the patient’s EEG and correlation with the state of the brain as related to hypnosis, sedation, and sleep.5 An indication of the depth of anesthesia can be obtained through the use of a sensor applied to the patient’s forehead and connected to the BIS monitor. Levels of sedation, consciousness, and ability to recall have been quantified and expressed through use of a simple system; the values range from 0 (no brain activity at all) to 100 (totally awake).6 Levels below 40 indicate a deep hypnotic state; levels between 40 and 60, a low probability of consciousness; levels between 60 and 70, a low probability of explicit recall; and levels from 70 into the 90s, a light hypnotic state. In addition to monitoring the depth of anesthesia as a method of avoiding awareness, the BIS monitor has been advocated as a tool for decreasing anesthetic requirements, providing faster emergence from anesthesia, and ultimately resulting in faster discharge from the postanesthesia care unit—all issues of significant interest in the ambulatory setting.7 Though still quite new and expensive, it is hoped that the cost of such monitoring will be reduced to make it practical in an office-based setting.

Pulse oximetry is one of the most significant advances in patient safety. Early and accurate detection of diminished oxygen saturations can result in interventions to help prevent untoward incidents. As important as this is in the hospital setting, it is even more important in the ambulatory or OBA setting, in which additional anesthesiologists might not be available to lend a helping hand should an oxygenation or airway problem arise. Although con-
Conventional pulse oximetry works well in most patients, it can fail to provide accurate readings during patient motion and with low perfusion states—two situations in which accurate readings are urgently needed.8,9

Oxygen saturation is determined by a comparison of the amount of saturated hemoglobin with the total saturated and unsaturated hemoglobin pulsating through the artery being analyzed. Nonpulsatile oxygen—that present in veins and tissues—is not evaluated as part of the percent saturation. Unfortunately, with motion, blood present in veins can be misinterpreted as pulsating or moving blood and saturation readings can become inaccurate.

A pulse oximeter can also provide erroneous readings (or even no reading at all) during low perfusion states. Masimo Corporation (Irvine, CA), one of the companies involved in developing pulse oximetry equipment, has devised signal extraction technology that allows for more accurate oxygen saturation monitoring during periods of low perfusion and with motion artifact.8,9 I have successfully used their equipment when I could not obtain readings with other pulse oximeters. Less anecdotally, others have demonstrated Masimo technology to be superior to conventional pulse oximetry.8,9 Another advantage to the use of more accurate equipment is that false-alarm frequency is diminished,10 so the person monitoring the patient is more likely to respond to a monitor alarm as a serious event. Although Masimo Corporation manufactures a stand-alone unit for pulse oximetry, many of the companies that make cardiac and blood pressure monitors include Masimo technology in their equipment.

Heart rate and rhythm are important parameters that are monitored perioperatively. Technology has surpassed the single-lead EKG monitor with advances in monitoring, including the ability to monitor multiple leads and to observe for evidence of myocardial ischemia. In patients with cardiac disease, leads II and V5 are frequently monitored for signs of ischemia. Other EKG leads can be monitored on the basis of the site of cardiac disease. In the past, S-T segment changes noted on a monitor were considered inaccurate, and a 12-lead EKG had to be obtained for the sake of an accurate analysis. Newer technology allows for online S-T segment analysis. The Datascope Passport 2 monitor (Datascope Corp., Paramus, NJ) is but one example of a monitor that can provide multiple EKG lead analysis for rhythm and S-T segment changes.

As more patients undergo surgical procedures in ambulatory and OBA settings, it is important that those involved in rendering care be cognizant of advances in monitoring equipment. Advances in pulse oximetry, EKG monitoring, and the monitoring of patient consciousness levels should all be critically evaluated to determine how they can help you care for your patients. ■

The author has served as a noncompensated consultant for Masimo Corporation and has received from them a pulse oximeter to evaluate.

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References

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