

## Necessary Monitoring in the Postanesthesia Care Unit?

Kevin K. Tremper, PhD, MD\*

Department of Anesthesiology, University of Michigan, Ann Arbor, MI.

Volume 12 of *Anesthesiology* (1951) contained two articles that have ultimately had a tremendous impact on our daily care of surgical patients. Stephen *et al.*<sup>1</sup> published "The oximeter: a technical aid to the anesthesiologist," while Lowenthal and Russell<sup>2</sup> reported on the cost-effectiveness of a "recovery room." Nearly 40 years elapsed before the technical problems involving oximetry were resolved to the point where this monitoring device has become part of our practice.\* The development of recovery rooms such as the postanesthesia care unit (PACU) and, ultimately, the intensive care unit has been progressive in the care of both postoperative patients and the critically ill.

In this issue of the *Journal of Clinical Anesthesia*, Wiklund *et al.*<sup>3</sup> investigate these two developments: the effectiveness of oximetry and other monitors used in recovery rooms. Although oximetry has been generally accepted as a routine monitor in the PACU, it does present significant limitations.<sup>4,5</sup> The current study compares the utility of pulse oximetry, ECG, and respiratory rate (RR) measured by both bioimpedance and nasal sampled capnometry. The authors conclude that nasal sampling of carbon dioxide (CO<sub>2</sub>) is the most effective means of detecting apnea in the PACU. However, there are several problems with this article, not the least of which are the small sample size on which it is based, the inability to determine false negative results appropriately, and the nearly self-fulfilling prophecy of the question asked. In the PACU as in the operating room, expired CO<sub>2</sub> will invariably detect changes in RR. Moreover, the study did not examine which device was most effective in reducing morbidity and mortality in the PACU, or which device provided the most value as a monitor (cost *vs.* effectiveness). In spite of these limitations, this study does pose an important question: what are appropriate noninvasive monitors for routine use in the PACU?

Over the past decade, the pulse oximeter has been adopted as the routine monitor in any setting where oxygenation may be in question. Its broad acceptance can be directly attributed to its basic functions as a continuous-recording, noninvasive, easy-to-use, accurate, and relatively inexpensive device. It monitors two vital parameters—oxygen saturation (SpO<sub>2</sub>) and heart rate (HR)—that can assess the competence of the cardiopulmonary system. One might ask whether apnea, even for a prolonged period of time, with normal HR and SpO<sub>2</sub> is clinically significant?

The data from this study<sup>3</sup> do provide confirmation of an interesting finding regarding patients recovering from anesthesia.<sup>4</sup> The authors noted that apneic episodes, defined as a lack of a capnometer reading of greater than 30 seconds, occurred with nearly equal frequency during the entire PACU stay. That is, these episodes occurred with nearly the same frequency during the 30 minutes prior to discharge as during the 30 minutes immediately following admission. In 1988, Morris *et al.*<sup>4</sup> reported SpO<sub>2</sub> values during admission and prior to

---

\*Professor and Chairman

Address reprint requests to Dr. Tremper at the Department of Anesthesiology, University of Michigan, 1G323 University Hospital, Box 0048, 1500 E. Medical Center Drive, Ann Arbor, MI 48109-0048, USA.

Received for publication September 2, 1993; revised manuscript accepted for publication November 12, 1993.

© 1994 Butterworth-Heinemann

*J. Clin. Anesth.* 6:178-179, 1994.

\*Anesthesia Patient Safety Foundation: Standards for basic intraoperative monitoring. In: *APSF Newsletter*. Park Ridge, IL: American Society of Anesthesiologists, March 1987, vol. 3.

discharge from the PACU. They noted that the percentage of patients with desaturations (below 90%) actually increased from the time of admission (2%) to discharge (9%). Together these findings show that the normal range of apneas and mild desaturations in the immediate postoperative period are really not known. What is known is that the clinical significance, or at least the mortality associated with these episodes, does not appear to be great.

The authors conclude that pulse oximetry produces too many false positive alarms owing to motion and other artifacts to be of clinical utility.<sup>3</sup> It is difficult to assess this conclusion because there is no other oxygenation variable to which pulse oximetry is compared. Therefore, one is not sure whether the false positive rate is accurate, and there is no way of assessing the frequency of false negatives. One could argue that apnea is not clinically significant if it does not result in desaturation. The significance of moderate desaturations in the perioperative period is even questioned. The introduction of pulse oximetry has made us aware of the frequency of desaturations but not necessarily their significance. Even the utility of intraoperative pulse oximetry is being questioned.<sup>6,7</sup>

As medicine moves into an era where cost/benefit as well as risk/benefit are important it is essential to conduct studies such as the one presented by Wiklund *et al.*<sup>3</sup> Essentially, these studies should be designed appropriately to answer the clinical question and to be of sufficient size to ensure that conclusions are valid. Perhaps in the future all studies, whether they meet these criteria or not, will be used in the determination of resource allocation.

## References

1. Stephen CR, Slater HM, Johnson AL, Sekelj P: The oximeter: a technical aid for the anesthesiologist. *Anesthesiology* 1951;12:541-55.
2. Lowenthal PJ, Russell AS: The recovery room: life saving and economical. *Anesthesiology* 1951;12:470-6.
3. Wiklund L, Hök B, Stahl K, Jordeby-Jönsson A: Postanesthesia monitoring revisited: incidence of true and false alarms from different monitoring devices. *J Clin Anesth* 1994;6:182-188.
4. Morris RW, Buschman A, Warren DL, Philip JH, Raemer DB: The prevalence of hypoxemia detected by pulse oximetry during recovery from anesthesia. *J Clin Monit* 1988;4:16-20.
5. Soliman IE, Patel RI, Ehrenpreis MB, Hannallah RS: Recovery scores do not correlate with postoperative hypoxemia in children. *Anesth Analg* 1988;67:53-6.
6. Moller JT, Pedersen T, Rasmussen LS, et al: Randomized evaluation of pulse oximetry in 20,802 patients. I: Design, demography, pulse oximetry failure rate, and overall complication rate. *Anesthesiology* 1993;78:436-44.
7. Moller JT, Johannessen NW, Espersen K, et al: Randomized evaluation of pulse oximetry in 20,802 patients. II: Perioperative events and postoperative complications. *Anesthesiology* 1993;78:445-53.