Role of Pulse Oximetry in the ICU

In this issue of Chest (see page 542), Inman et al report the impact of pulse oximetry on the utilization of arterial blood gas (ABG) analysis in an ICU. By means of a combined prospective and retrospective study, they tested their hypothesis that pulse oximetry would have little effect on the frequency of ABG analysis unless there were specific guidelines for the latter. The study is well designed and appears to accomplish its goal, within the limitations of a study that compares prospective and retrospective data. Some investigations have reached different conclusions on ABG utilization; one ICU study predicted a 48 percent reduction in the number of ABG analyses used for ventilator management.1

This article raises important issues regarding both the effectiveness of pulse oximetry and the ethics of clinical studies. From the scientific viewpoint, the study would have been more rigorous if it had been entirely prospective, comparing simultaneous matched patient groups with and without pulse oximetry. Despite the fact that "no published investigation has demonstrated that pulse oximetry makes a difference in morbidity or mortality,"2 the authors chose to use a retrospective control group. Thus, they acknowledge the importance of pulse oximetry in the ICU by stating that "it was . . . deemed unethical to randomly assign patients to not receive this mode of monitoring."

Let us consider the purpose of pulse oximetry and some of the evidence of how effectively it accomplishes its goals.

One purpose of pulse oximetry may be that stated by Rutledge et al: to reduce the required number of ABG analyses. A more important purpose is to improve safety by providing continuous arterial oxygenation data in patients who are at risk for hypoxia. Is there evidence that it does this? In the operating room, clinical studies have shown that the use of pulse oximetry reduces the number of "hypoxic events," which are arbitrarily defined as SpO2 values below a critical threshold (eg, 75 percent).3 This result clearly does not prove that pulse oximetry improves patient safety. However, it is strongly suggestive when coupled with retrospective studies showing a decrease in unexpected admissions to the ICU4 and closed-claim studies showing that many injuries and deaths may have been preventable if pulse oximetry had been used.5 For these reasons, and because it is inexpensive and nearly risk-free, pulse oximetry has become a minimum standard of care in US operating rooms and recovery rooms (according to a resolution passed by the House of Delegates of the American Society of Anesthesiologists in 1991).

If pulse oximetry is a minimum standard in both the operating room and the recovery room, can we justify not using it in the ICU? Admittedly, there are no clinical studies showing decreased morbidity or mortality in the ICU setting, but neither are there any such studies in the operating room. Some forms

control groups. The practical limitations of this approach are enormous, especially in the areas of the world that need a simple diagnostic test the most.

The study by Delacourt et al is thoughtful and expands our knowledge about humoral responses to mycobacterial antigens in children. Unfortunately, it also reveals the shortcomings of the serodiagnosis of tuberculosis that have precluded its wide acceptance and application. Accurate diagnostic techniques for tuberculosis in children remain elusive, and serodiagnosis will not be a panacea in the near future.

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of morbidity may be very difficult to measure (eg, how many IQ points does a patient lose when he is hypoxemic for a few hours?). One cost-benefit analysis concluded that pulse oximetry "pays for itself" if only one in 40,000 hypoxemic episodes were to result in death. The medical community uses a commonsense approach to monitoring standards; it has never waited for outcome studies to mandate new modalities that have obvious lifesaving potential. There are no well-designed studies showing that intraoperative monitoring of blood pressure reduces mortality, yet no one would administer anesthesia today without a blood pressure monitor.

Thus, while Rutledge et al show that pulse oximetry may have a limited effect on the utilization of ABG analysis, their study raises a more important question: is pulse oximetry becoming a standard of care in the ICU? I suspect that the answer is yes, and that it will become a standard in the absence of definitive outcome studies. The authors have acknowledged this fact in the design of their study by using retrospective controls. Hypoxia is not good for people, and it occurs often in the critically ill. How can we afford not to monitor arterial oxygenation in these patients?

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Cellular Characterization of Lung Cancer

A Caveat

Lung cancer is increasingly being characterized at the cellular and molecular level, with a corresponding convergence of the traditional differences between small cell anaplastic and non-small cell lung cancers. The cell surface glycoproteins expressed on lung cancer cell lines can be detected by monoclonal antibodies, both in the cell lines and in clinical specimens. Expression of these glycoproteins appears to precede traditional cytoplogic evidence of malignancy by approximately 2 years. Gastrin-releasing peptide, a growth factor for lung cancer cell lines, has been demonstrated to be elevated in the bronchial washings and urine of smokers compared with non-smokers. Variations in the expression of the tumor suppressor gene, p53, are related to the risk of developing malignancy in several settings, including lung cancer, and the current report of Mitsudomi et al (see page 362) will greatly enhance its assessment in lung cancer.

As the authors note, the ability to obtain adequate tissue for analysis of "early" lung cancer lesions has been hindered by the clinical use of fiberoptic bronchoscopy, which provides extremely small tissue specimens. The use of polymerase chain-reaction technology and a single-strand conformation polymorphism assay allows detection of point mutations, a critical need for understanding changes in p53 expression.

While exploitation of this technology will allow increasing study of premalignant bronchial lesions, there is an important caveat to be kept in mind. Most of the growth factors described for cancer are, in fact, variations on growth factors involved in normal tissue repair and inflammation. We must be alert to the flood of articles that will describe changes "specific" to lung cancer. The boundary between "reversibly premalignant" and "early cancer" needs careful definition before these markers become widely used clinically.

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