

Cost per unit provides some rudimentary form of case-mix adjustment while using data that are already collected by anesthesia groups for the purposes of billing for their services.

Dr. Atkin states that "the authors' work demonstrates the need to commit to building databases of relevant information." Although we believe that information technologies will contribute to a reduction in perioperative costs, anesthesia groups do not need to purchase new information technologies to use our method. Anesthesia groups have two choices to achieve cost control for drugs and supplies:

Strategy 1.

Purchase information technologies to track drug and supply usage by individual anesthesiologists. Set quantitative cost goals within the anesthesia group on a cost-per-unit basis. Use information systems to provide quantitative feedback to individual anesthesiologists regarding how well they are satisfying group requirements. The advantage of this strategy is that anesthesiologists continue to have flexibility in their clinical practice. The disadvantage is that anesthesiologists are responsible for the cost outcome of their practice. As a result, individual assignment of cost may lead to inappropriate economic credentialing. In addition, an individual anesthesiologist's efforts to decrease costs associated with a practice may contribute to an increase in costs or a decrease in revenue for the institution. In any case, our manuscript provides a methodology to assist in this option, but it does not require that this option be selected.

Strategy 2.

Use clinical pathways or practice guidelines, or both, to suggest or regulate (not monitor), or both, appropriate usage within the anesthesia group. The advantage of this strategy is that it does not require the use of an as-sophisticated information system, because only deviation from the clinical pathways or practice guidelines, or both, need to be recorded. The disadvantage of this strategy is that it decreases anesthesiologists' flexibility in clinical practice. In addition, the impact of clinical pathways and practice guidelines on education is unclear. In any case, the use of cost per unit applies equally to this strategy as to the preceding strategy.

Our manuscript did not address the relative benefits of each of these two strategies.

Dr. Stonemetz suggests that the use of more comprehensive methods to adjust for variations in case mix may do a better job at evaluating the "costs of delivering care." If an anesthesia group has these data available, then using such data is rational. We cannot determine whether the hypothesis is true using our data. It is our opinion that it is not known yet whether anesthesia groups will benefit from purchasing more sophisticated information technologies to track these measures of perioperative risk. Studies need to be performed showing that incorporating these measures of risk into assessments of anesthesia drug and supply costs improves the accuracy of predicting these costs and that the improvement in accuracy is cost-effective relative to the cost required to collect the data. An advantage of monitoring cost per unit at the level of an anesthesia group is that the data are already collected (*i.e.*, quarterly costs divided by quarterly units).

Dr. Stonemetz points out that cost per unit cannot only be used to adjust drug and supply costs for variations in case mix, but can also adjust labor costs (*i.e.*, anesthesiologist and anesthetist salaries). We agree completely. The use of cost per unit is an exceedingly rational, straight forward, and inexpensive approach to measure anesthesia work. The fact that we focused our analysis on drug and supply costs should not mislead others into thinking that we were focusing on the most important issue. Measuring labor costs (salaries) using costs per unit is far more important, because the majority of perioperative costs are accounted for by salaries.

Finally, table 1 does have a typographic error. The correct value is 12 ± 7.4 .

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Critical Hemoglobin Desaturation Can Be Delayed by Apneic Diffusion Oxygenation

To the Editor:—We read with interest the article by Benumof *et al.*¹ and the related correspondence^{2,3} concerning the development of critical hemoglobin desaturation after neuromuscular block with 1 mg/kg succinylcholine. Benumof *et al.*¹ suggested that achievement of functional recovery from succinylcholine block before significant desaturation is not a realistic possibility and a rescue option should be instituted aggressively and early,¹ whereas Bourke² considered that this assumption may not be entirely justified and may, in some cases, lead to premature or potentially hazardous interventions.

We agree with the recommendations of Benumof *et al.*¹ that whenever attempts at tracheal intubation after preoxygenation and rapid-sequence induction of anesthesia fail, we should not wait for recovery from succinylcholine block. Ventilation must be promptly initiated because the risk of critical hemoglobin desaturation if apnea is prolonged is far more serious than the risk of regurgitation associated with controlled ventilation while cricoid compression is performed.

To delay critical hemoglobin desaturation during apnea in a

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patient with a suspected difficult airway, we suggest combining preoxygenation with apneic diffusion oxygenation. This can be easily achieved by pharyngeal insufflation of oxygen throughout the period of apnea.⁴ During apneic diffusion oxygenation, oxygen will diffuse from the lung to the pulmonary capillaries according to its concentration gradient. The oxygen molecules can diffuse from the pharynx into the alveoli, even in the "cannot-intubate, cannot-ventilate" situation, in which the airway may not be completely patent. The combination of preoxygenation and apneic diffusion oxygenation can be particularly advantageous in patients with a suspected difficult airway and in patients with a decreased safety margin secondary to decreased functional residual capacity (FRC) or increased oxygen consumption, or both, such as small children, pregnant women, obese persons, and patients with respiratory distress syndrome.

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In Reply:—Drs. Baraka, Salem, and Ninos make an interesting and valid point, *i.e.*, apneic oxygenation *via* insufflation of oxygen through a pharyngeal catheter is a low-risk, possible high-benefit method of increasing the duration of Normoxia during apnea that follows preoxygenation. I assume that Drs. Baraka, Salem, and Ninos use this method when they have a high index of suspicion of difficulty with management of the airway (for any reason) preoperatively, because one would not want to need to locate an appropriate catheter (and connections to an oxygen source) while trying to solve a "cannot-ventilate, cannot-intubate" situation. Another method that I have used very occasionally to prolong the duration of normoxia during apnea is to insert a 2-inch 16-gauge catheter through the cricothyroid membrane preinduction, electively, using local anesthesia and achieve apneic oxygenation by insufflation of oxygen through this catheter.¹ In addition, the transcricothyroid-membrane, 16-gauge catheter provides an immediate-ventilation plan B by connection to a jet ventilator preset at 25 psi using a 0.5-s inspiratory time.² Wishing to avoid further trivial semantic debates,^{3,4} I would be the first to admit that this preproblem solution could also be considered as an atraumatic form of a very early, aggressive postproblem solution.

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