Is There Anything New About Preoxygenation? Duh, Yeah!

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How, and how long, should you preoxygenate your next patient before induction of anesthesia? This is a very difficult question. Respiratory physiology is complicated. If you think the answer is simple, you don't understand the question. However, you make this complex decision for each patient and you probably do it multiple times every working day. Among the many factors that go into this decision are the following: How rapidly is this particular patient going to desaturate if there is a delay establishing ventilation? Is there likely to be difficulty with ventilation and/or intubation? What is the safe level of desaturation in this specific patient?

The review article by Nimmagadda et al[1] in this issue of *Anesthesia & Analgesia* helps the clinician to make this potentially very important decision about preoxygenation. For the majority of patients, the authors suggest that 3 minutes of normal tidal breathing FIO_2 1.0 with a fresh gas flow that exceeds the resting minute ventilation (approximately 5 L/min) is adequate and reliable. Longer periods and forced deep breathing are unlikely to add a clinically useful extra reserve of oxygen in the patient's lungs or blood.

The authors elaborate on 4 specific clinical populations: pregnant women need a higher fresh gas flow (10 L); obese patients benefit significantly from a head-up position; pediatric patients only need 2 minutes of preoxygenation; and elderly patients may require 5 minutes.

Nimmagadda et al finish the review by debunking several myths about the risks of preoxygenation: a diagnosis of accidental esophageal intubation is not more likely to be missed because of preoxygenation (does anyone actually believe this?); absorption atelectasis can be easily reversed by a routine recruitment maneuver at the start of ventilation; and there is no good evidence for the harmful effects of reactive oxygen species because of a transient high FIO_2.

However, there are several potentially negative aspects of complete preoxygenation that the authors do not discuss: applying a tight-fitting face mask for 2 minutes to a 2-year-old is likely to be stressful for the patient, his or her parents, and the anesthesiologist; and in some dire emergencies, such as a prolapsed cord, the time for full preoxygenation may not be possible without undue risk to the patient(s). Also, I do not know the optimal method of preoxygenation for a patient who has received bleomycin (I use FIO_2 0.4 if I do not anticipate a problem with intubation, but I cannot offer any science to back up my practice).

In the middle of the review article, in the section on technique, are (what I believe to be) the 2 key points:

1. We can simply and routinely monitor the adequacy of our preoxygenation. If the end-tidal O_2 concentration (ETO_2) is ≥90%, the patient has been adequately preoxygenated. Induction can commence. Do you watch this number routinely? I confess I do not, but I plan to start, and I believe the next generation of anesthesiologists will monitor this faithfully.
2. In critical situations, we can improve our preoxygenation with the use of high-flow nasal oxygen. This is a very interesting technique that is starting to move into the operating room from the intensive care unit, where it has been introduced as noninvasive ventilatory support for infants and now for adults. Humidified oxygen flows of up to 50–70 L/min provide not only a high FIO_2 but also seem to decrease airway deadspace and to provide a level of continuous positive airway pressure CPAP (see Table).[2] This concept has been given the unfortunate name of transnasal humidified rapid insufflation ventilator exchange, and the acronym THRIVE[3] (which sounds like a geriatric dietary supplement). I think just calling it high-flow nasal O_2 would suffice. I believe we are going to soon see this device used for oxygenation and ventilation support before and after extubation in chronic obstructive pulmonary disease, sleep apnea, obese patients, and others at risk of desaturation. This device is already well known among the difficult airway subgroup of anesthesiologists. It may become a game changer.

Table. Proposed Benefits of High-Flow Nasal Oxygen[2]

Achieve a high and stable FIO_2
Decreased upper airway anatomical deadspace
Decreased work of breathing
Warmed and humidified inspired gas
Continuous positive airway pressure (up to 8 cm H_2O)
Lung recruitment

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