

**Update on Thoracic Anesthesia: Perioperative
Lung Protective Strategies in One- and Two-Lung Ventilation**

2016

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Dr. Alan Jay Schwartz: Hello. This is Alan Jay Schwartz, Editor-in-Chief of the American Society of Anesthesiologists' 2016 *Refresher Courses in Anesthesiology*, the latest research and education information. The focus of the new online format of the *Refresher Courses in Anesthesiology*'s CME program, and the modules featured, is to educate learners on current developments in the science and clinical practice of the specialty of anesthesiology, critical care medicine and pain management. For the first time ever, we will be speaking directly with individual authors to learn about their expertise, perspective and insight regarding their featured module.

Today, we are pleased to present the following one-on-one conversation with fellow *Refresher Courses in Anesthesiology* Editor, Dr. Sam Wald, and author Dr. Peter Slinger. They will be highlighting the module titled, "Update on Thoracic Anesthesia."

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Dr. Samuel Wald: We're here with Dr. Peter Slinger, and he's a Professor in the Department of Anesthesia at the University of Toronto, and he's going to be speaking to us today about perioperative lung protection strategies in one-lung and two-lung ventilation.

Dr. Peter Slinger: Ventilator-induced lung injury is a well-recognized problem in intensive care. For at least 20 years, intensive care physicians have been studying the problem and have come up with a series of strategies that are generally very well known in the anesthesia community. The question has been, do these strategies make any difference in the operating room, when we ventilate patients for periods of two to five hours?

The answer is becoming clearer. Recently, in about the last two to three years, based on multiple different studies from multiple different centers, it looks like there are specific patients who are at risk of perioperative lung injury in the operating room, when we use standard ventilation, as we have been doing for the past 50 years. Specifically, those patients are: patients with restrictive lung disease; patients who receive blood products during their operation; patients who go on cardiopulmonary bypass; and patients who have one-lung ventilation.

There are strategies that are emerging, based on – again, on multicenter studies, the evidence looks good. There are strategies we can use as anesthesiologists in the operating room when we ventilate these patients, to decrease the lung injury. These strategies involve using lower tidal volumes than we used to use. Lower tidal volumes – I'm talking about tidal volumes into the six to eight mils per kilo range, for ideal body weight, for two-lung ventilation; and into the four to six mil per kilo range for one-lung ventilation.

Apart from reducing tidal volumes, airway pressures are equally as important. Certainly, limiting a peak airway pressure to under 30 seems to be very important; and trying to keep plateau pressures under 25. And this applies to both one- and two-lung ventilation. So, one strategy is tidal volume and airway pressure; the other strategy is the use of positive end-expiratory pressure. Essentially, all patients, except those with very, very severe emphysema, will benefit from application of PEEP during surgery. Now, the problem is that the

ideal PEEP probably depends on the individual patient's respiratory mechanics. At the present time, it is not easy to know for a specific patient what the ideal PEEP is. But as a rough guide, for the vast majority of patients it will be somewhere between five and ten centimeters of water pressure.

How do we judge this during the operating room? Myself, personally, I turn down my inspired oxygen concentration to try and get a saturation that's somewhere in the upper 90s—somewhere in the 97, 98, 96 range. And if my saturation falls off, then I usually feel that that PEEP was inadequate, and then I will recruit the lung. So, that's how I choose in the operating room. As I say, with our operating room ventilators, choosing the ideal PEEP for an individual patient is not completely obvious at the present time. But it seems very clear that a modest amount of PEEP—again, in the five to ten centimeter range—is much better than no PEEP.

Another strategy to decrease lung injury is restricting fluids. Now, again, we're talking about patients at risk for lung injury. Okay? These strategies are not going to make a difference to most patients that we ventilate in the operating room. But patients who are at increased risk for lung injury definitely benefit from restricting fluids.

Now, whether our fluid restriction management should be based on just common sense—avoiding using any third-space fluids; limiting our fluids to maintenance and replacement of any dehydration—or whether they should be guided based on estimates of cardiac output, at the present time this is not clear, and it's up to the individual practitioner to decide which way he or she wants to manage. However, in patients at risk of lung injury, it definitely seems to be of benefit to use some method of fluid restriction.

And the fourth thing is to try and decrease the inflammatory response. In patients at risk of lung injury, there is always some inflammatory response from

positive pressure ventilation in the operating room. Anything we can do to decrease this inflammatory response seems to be beneficial.

Now, at the present time, the simplest thing seems to be the use of volatile anesthetics. There is good evidence that this is particularly beneficial in patients who go on cardiopulmonary bypass. In the other groups I mentioned—restrictive lung disease, or patients receiving blood product, or one-lung ventilation—there is not hard evidence at the present time; however, there is also not hard evidence the other way. These other groups of patients have not been studied enough, but cardiopulmonary bypass patients have been studied enough, and it seems definitely to decrease lung injury postoperatively in cardiopulmonary bypass patients if we use some volatile anesthetic. At present time, we can't say which volatile. It seems that all of our modern volatile anesthetics—isoflurane, sevoflurane, desflurane—are equally beneficial in this respect.

So, we have the patients at risk, we have identified; and we have the lung-protective strategies that are available to us in the operating room. And really, the risk/benefit of using these lung-protective strategies in the patients at risk seems clearly to be of benefit for these patients.

Finally, it's kind of the principle of, no harm, no foul. If there is no lung injury, then these beneficial techniques are not going to be particularly beneficial. So, for the vast majority of patients that we manage in the operating room—patients who are not specifically at risk for increased lung injury—these techniques – we cannot prove them to be beneficial. However, having said that, we cannot prove them to be harmful either.

So, again, it's up to the individual anesthesiologist to decide whether they would like to use these strategies in patients who are not at increased risk of

lung injury. And that is my view of the risk and management of lung injury in the operating room.

Dr. Samuel Wald: Thank you very much, Dr. Slinger. We appreciate your wonderful insights. And now, Dr. Schwartz, back to you.

Dr. Alan Jay Schwartz: Thank you for joining us today, and participating in this insightful conversation with this month's featured author. Be sure to join us for next month's one-on-one author interview, presented in this new, exciting format.

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