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Selecting the Level of Positive End-expiratory Pressure for One-lung Ventilation: "By Formula" or "By Feel"?

To the Editor:

Blank *et al.*[1] confirm that one-lung ventilation (OLV) is not without risk, but I have grave doubts about whether it is reasonable to conclude that "advances in our understanding of protective ventilation during OLV are likely to derive from well-designed randomized trials controlling for variables of inherent pathophysiologic significance." The latter proviso, "controlling for variables of inherent pathophysiologic significance," identifies the difficulties presented by the wide variety of respiratory pathophysiology seen in thoracic surgical patients, as has recently been pointed out in relation to another, unrelated issue of OLV.[2]

Perhaps the quest for optimal protective ventilation should be directed more toward basic physiologic issues such as those identifiable in the now largely disregarded "art" of OLV. This particular "art" relied on three key aspects of two-handed manual ventilation with the adjustable "pressure relief valve" carefully adjusted to ensure that ventilation does not result in the standard adult 2-l reservoir bag progressively emptying or overfilling. First, judiciously applied manual ventilation enables the lung to be ventilated at the perceived optimal respiratory system dynamic compliance, as assessed by the ease with which gas is squeezed into it. (Incidentally, in the era before fiberoptic bronchoscopy was in clinical use for OLV, the clinical assessment of compliance [of both the ventilated lung and the "operated" lung] was invaluable for the optimal placement of a double-lumen tube.)

Second, the rate at which gas vents from the lung can also be readily assessed "by feel." (A delay in venting [from either the ventilated or the "operated" lung] could be caused by pathophysiology as varied as chronic airway obstruction or emphysema, by bronchospasm or secretions, or by a bronchial cuff partially obstructing gas flow.) This assessment of the "expiratory gas flow rate" can be facilitated by temporarily reducing the "fresh gas flow" into the ventilating "system/circuit" to say 0.5 to 1.0 l/min, whereupon the gas returning to the reservoir bag during the expiratory phase of manual ventilation is coming predominantly from the lung. Where the "expiratory gas flow rate" as assessed is low, a lesser level or no positive end-expiratory pressure (PEEP) is likely to be indicated.

Third, the "inspiratory gas flow rate" can also be usefully assessed. To me, manual ventilation during OLV has always felt intuitively most satisfying (easiest) when generated with a "square wave" airway pressure; and because a monitored "square wave" airway pressure can be generated instantaneously by conscientious two-handed manual ventilation, the rate at which gas empties from the reservoir bag enables the specific assessment of the well-accepted "physiologic" decelerating pattern of inspiratory gas flow. Furthermore, when manually ventilating (with an *instantaneously* applied "square wave" airway pressure) at a relevant predetermined respiratory rate and a suitably low tidal volume for a given patient (and with the monitored tidal volume maintained at a *constant* level), I believe that it is possible to identify a level of applied (extrinsic) PEEP at which the delivery of the "decelerating gas flow" into the ventilated lung is easiest. (Such a level of PEEP will be expected in those patients with an initial "flat" component of the static compliance plot.) But does this perceived ease of delivering gas from a 2-l reservoir bag (at a decelerating pattern of flow) correlate with a high *initial* (peak) inspiratory gas flow rate? Would it not, therefore, be both interesting and potentially clinically relevant to undertake a study plotting the level of applied PEEP against the *initial* (peak) inspiratory gas flow rate (as accurately recorded at the airway) in patients with differing respiratory pathophysiologies?

Many years of varied thoracic surgical experience has led me to believe that the greater the respiratory pathophysiology, the more important is carefully monitored, conscientiously performed manual ventilation in determining the initial settings for the mechanical ventilator, as described in just one interesting case report.[3]

To me, it seems most unlikely, considering the wide variety of respiratory pathophysiology seen in thoracic surgical

This letter was sent to the author of the original article referenced above, who declined to respond.—Evan D. Kharasch, M.D., Ph.D., Editor-in-Chief.

patients, that "standardized guidelines"[1] for mechanical ventilation (OLV "by formula") will emerge from large clinical studies on patients not serving as their own controls. On the other hand, several of the physiologic issues inherent in intuitive two-handed manual ventilation (OLV "by feel") may well be worthwhile studying in depth.

Competing Interests

The author declares no competing interests.

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