

Alveolar recruitment maneuver as an important part of protective one-lung ventilation

Seiji Ishikawa

Received: 28 March 2012 / Accepted: 10 April 2012 / Published online: 3 May 2012
© Japanese Society of Anesthesiologists 2012

Keywords One-lung ventilation · Arterial oxygenation · Alveolar recruitment maneuver · Positive end-expiratory pressure

To the Editor:

I read the article by Kim et al. [1] with great interest regarding the effects of tidal volume and positive end-expiratory pressure (PEEP) on arterial oxygenation during one-lung ventilation (OLV). The authors reached the conclusion that a high tidal volume of 10 ml/kg can prevent hypoxemia more effectively than a low tidal volume of 6 ml/kg with or without PEEP 5 cmH₂O, suggesting that the conventional OLV is better than the protective OLV from the perspective of arterial oxygenation during OLV. However, I would like to address the clinical importance of alveolar recruitment maneuver (ARM) as one of the components of protective OLV and the possibility that arterial oxygenation may have been improved by applying ARM before starting OLV, even with a low tidal volume and PEEP.

Arterial oxygenation is considered to deteriorate during OLV mainly for two reasons: shunt flow through the nondependent lung and the development of low ventilation–perfusion and atelectatic areas in the dependent lung. Absorption atelectasis may occur in regions of the dependent lung when they are exposed to high inspired oxygen

concentration. Furthermore, the volume of the dependent lung is reduced because of the circumferential compression by the weight of the mediastinum from above, by the abdominal contents pressing against the diaphragm from the caudad side, and by suboptimal positioning effects pushing in from the operating room table [2]. As one of the measures to treat hypoxemia, ARM with an inspiratory pressure of up to 40 cmH₂O has been shown to improve arterial oxygenation by reexpanding these low ventilation–perfusion and atelectatic areas in the dependent lung during OLV [3]. In fact, ARM before instituting OLV has been shown to improve arterial oxygenation during OLV in patients undergoing elective open thoracotomy [4].

Alveolar recruitment maneuver with PEEP may also be useful to decrease postoperative pulmonary complications in high-risk patients undergoing thoracic surgery. Because ventilation of atelectatic areas can result in cyclic opening and closing of lung units, leading to release of inflammatory cytokines causing atelectrauma, it may be crucial to reexpand the atelectatic areas in the dependent lung to prevent postoperative pulmonary complications. In fact, Licker et al. [5] demonstrated that vital capacity maneuvers with the inspiratory pressure up to 35 cmH₂O for 7–10 s combined with lower tidal volume and PEEP during OLV decreased the incidence rate of postoperative pulmonary complications, including atelectasis and acute lung injury.

Taking these issues into consideration, I would recommend the authors use ARM, not only as one of the options to treat hypoxemia during OLV but also as one of the components of protective OLV, rather than concluding that conventional OLV is better from the perspective of arterial oxygenation. I presume applying ARM to the dependent lung before starting OLV could have improved arterial oxygenation during OLV even in the low tidal volume groups in the authors' clinical settings.

S. Ishikawa (✉)
Department of Anesthesiology, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8519, Japan
e-mail: ishikawa.mane@tmd.ac.jp

References

1. Kim SH, Jung KT, An TH. Effects of tidal volume and PEEP on arterial blood gases and pulmonary mechanics during one-lung ventilation. *J Anesth* (in press).
2. Benumof JL. Conventional and differential lung management of one-lung ventilation. In: Benumof JL, editor. *Anesthesia for thoracic surgery*. 2nd ed. Philadelphia: Saunders; 1995. p. 406–31.
3. Tusman G, Böhm SH, Melkun F, Staltari D, Quinzio C, Nador C, Turchetto E. Alveolar recruitment strategy increases arterial oxygenation during one-lung ventilation. *Ann Thorac Surg*. 2002;73:1204–9.
4. Unzueta C, Tusman G, Suarez-Sipmann F, Böhm S, Moral V. Alveolar recruitment improves ventilation during thoracic surgery: a randomized controlled trial. *Br J Anaesth*. 2012;108:517–24.
5. Licker M, Diaper J, Villiger Y, Spiliopoulos A, Licker V, Robert J, Tschopp JM. Impact of intraoperative lung-protective interventions in patients undergoing lung cancer surgery. *Crit Care*. 2009;13:R41.