In Reply:

We would like to thank Dr. J. Kyle Bohman for his interest in our article \(^1\) and his comments concerning the underlying mechanisms of pulmonary aspiration induced by remifentanil. We fully agree that our study did not reveal whether the radionuclide solution detected in lung fields was directly aspirated from the pharynx, or if it was first swallowed then regurgitated and aspirated. However, we state that even though only pharyngeal-to-pulmonary aspiration would have occurred in our investigation, the findings are important to take into account when using remifentanil for compromised patients with increased risk of reflux by other pathways. The possible risks associated with remifentanil attracted our attention, when in our previous research \(^2,3\) volunteers spontaneously reported swallowing difficulty when receiving the drug; the purpose of our current study thus was to determine whether remifentanil increases the risk for aspiration. Additional investigations are needed to more closely examine which level of defense against pulmonary aspiration is affected. It should be feasible, although logistically difficult, to achieve the dynamic collection of a series of lung scans by having the subject lie in the gamma camera during the entire study session. In this way, the whole pattern could be visualized as a film and show the route of the radionuclide solution.

Competing Interests

The authors declare no competing interests.

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References


Role of Recruitment Manoeuvres for Lung-protective Ventilation in the Operating Room Remains Unclear

To the Editor:

With interest we read the “Clinical Concepts and Commentary” by Goldenberg et al. \(^1\) about lung-protective ventilation in the operating room. We congratulate the authors for their word of caution and farsightedness. We fully agree that low tidal volumes (\(V_T\)) are an essential part of lung-protective ventilation in patients with acute respiratory syndrome, but we would like to point out that even \(V_T\) of 6 ml/kg ideal body weight have been shown to be too high in severe cases.\(^2\) This emphasizes that the concept of protective ventilation is far more complex than often suggested when referred to as using low \(V_T\).

This specifically applies to several publications about intraoperative ventilation in patients with healthy lungs for which the titles often suggest that low \(V_T\) is the main element of protective ventilation.\(^3\) However, only very few trials, including our own study,\(^4\) restricted their intervention to this factor. Goldenberg et al. acknowledged our work but incorrectly stated that “no recruitment maneuvers” were performed. All patients received a lung expansion maneuver consisting of three manual bag ventilations with a maximum pressure of 40 cm H\(_2\)O shortly before extubation.\(^4\) Despite this effort, significantly more patients ventilated with low \(V_T\) had atelectasis directly after surgery. Thus, a single recruitment maneuver with manual bag inflations before extubation is not sufficient to counterbalance the effects of low \(V_T\) when a low positive-end expiratory pressure (PEEP) of 5 cm H\(_2\)O is used. Therefore, we call into question the conclusion by Goldenberg et al. that “during anesthesia, protective ventilation is beneficial when both lower \(V_T\) and a recruitment strategy are included, but not when lower \(V_T\) used alone.” We would rather stress that neither the optimal combination of PEEP and \(V_T\) nor the best recruitment strategy is known yet.

New insight into the role of PEEP and recruitment maneuvers comes from the results of the PROtective Ventilation using High versus LOw positive end-expiratory pressure trial.\(^5\) In this study, 900 patients undergoing upper

References


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abdominal surgery were ventilated with 8 ml/kg ideal body weight and randomly assigned to PEEP of 12 cm H₂O plus multiple recruitment maneuvers or PEEP of 2 cm H₂O or less without recruitment maneuvers. There was no difference in postoperative pulmonary complications between the two groups, but in patients ventilated with high PEEP, intraoperative hypotension was a major problem. As a consequence, neither high PEEP nor regular recruitment maneuvers per se are lung protective with regard to postoperative pulmonary complications but cause clinically important adverse effects.

Goldenberg et al summarize “that the ideal approach to intraoperative ventilation…remains unknown.” Taking into account that so many open questions remain, even without discussing the role of hypercapnia or inspiratory oxygen concentration, we believe that their conclusion cannot be overemphasized.

Competing Interests
The authors declare no competing interests.

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In Reply:
We thank Dr. Treschan et al. for their interest in our article and appreciate the correction regarding the methodology used in their study. Indeed, they indicate that a single recruitment maneuver before extubation does not mitigate the potentially deleterious effects of low tidal volumes in the surgical population.

Their letter refers to important data on the utility and safety of a ventilation strategy in the operating room, published since our commentary went to press. The PROtective Ventilation using High versus Low positive end-expiratory pressure Trial, which randomized 900 patients to low or high positive-end expiratory pressure (PEEP), demonstrated no reduction in postoperative complications from higher PEEP; in contrast, higher PEEP was associated with higher rates of intraoperative hypotension and vasopressor and fluid administration. However, it has been noted that the levels of PEEP used in this study were high (mean of 12 cm H₂O). What is clear at this point is that (1) the optimum level of PEEP for intraabdominal surgery remains unknown, and (2) the addition of PEEP while often beneficial in the critically ill, might cause harm during routine surgery.

An additional recent study also gives pause to the early adoption of low tidal volume ventilation in the operating room. This large retrospective study of more than 29,000 patients undergoing general anesthesia in a U.S. center suggested that the relation between tidal volume and mortality at 30 days was complex (lowest mortality with 8 to 10 ml/kg; higher above or below this range). Although representing an association (and not proof of cause and effect), it does support the need for more data before widespread adoption of low tidal volume during surgery.

Competing Interests
The authors declare no competing interests.

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