In Reply:
We are grateful for the valuable comments of Dr. Stapelfeldt on our article titled “Cumulative Duration of ‘Triple Low’ State of Low Blood Pressure, Low Bispectral Index, and Low Minimum Alveolar Concentration of Volatile Anesthesia Is Not Associated with Increased Mortality.” The letter indicated that we included adult patients undergoing “noncardiac anesthesia” and that the “triple low state does not appear to be independently associated with adverse long-term patient outcome following adult noncardiac surgery.” Precise language is crucial in preventing misunderstanding; we would like to clarify that we included patients who underwent general anesthesia for noncardiac surgery, and the findings of our study indicated that there was no association between cumulative duration of triple low state and perioperative or intermediate-term mortality in noncardiac surgery patients.

Much of the letter, from its title forward, seems to use our study of the triple low state as an opportunity to discuss potential effects of intraoperative hypotension. While hypotension contributes to the triple low state, it was not at all the focus of our investigation or the subject of our hypothesis. We freely acknowledge that extended periods of hypotension may be independently associated with adverse outcome, and thus welcome the author’s alert to those who may have failed to distinguish our conclusions about the triple low state from hypotension alone. In our article, we stated that “the low blood pressure component of the triple low state may lead to poor outcome.” Furthermore, we noted that, in a subanalysis comparing effects of the triple low state with low mean arterial pressure, cumulative duration of low mean arterial pressure showed a significant association with risk for 30-day mortality (in a model also accounting for the Cleveland Clinic Risk Index score, age, and duration of low bispectral index). However, we could not find an association between the cumulative duration of low mean arterial pressure and intermediate-term mortality. This latter finding likely indicates that patient- and procedure-related characteristics are more significant determinants of the intermediate-term mortality than cumulative duration of intraoperative low mean arterial pressure.

The letter also questions whether adjusting for “procedural risk” (referring to the Cleveland Clinic Risk Score) is appropriate because some of the procedural risk may be attributable to the triple low state (or to hypotensive exposures). It should be noted first that the risk score is based not only on International Classification of Procedures, version 9, billing codes but also on codes for diseases, thus including comorbidities. The main point here is that our hypothesis, and our analysis strategy, seeks to reveal the independent effect of the triple low state, separate from any overlap with patient- and procedure-related effects. Thus, adjusting for those covariable effects on outcome is critically important. In the search for modifiable factors to improve patient outcomes, we must be as rigorous and specific as our science permits.

Competing Interests
The authors declare no competing interests.

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References
1. Kertai MD, White WD, Gan TJ: Cumulative duration of ‘triple low’ state of low blood pressure, low bispectral index, and low minimum alveolar concentration of volatile anesthesia is not associated with increased mortality. Anesthesiology 2014; 121:18–28

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Aspiration during Monitored Anesthesia Care

To the Editor:
An important study by Savilampi et al.1 demonstrating the rate of pulmonary aspiration in adults undergoing monitored anesthesia care with remifentanil was recently published in Anesthesiology. There is an important limitation of the study worth considering when interpreting the study results. The method of aspiration detection does not differentiate between pharyngeal-to-pulmonary aspiration (either oropharyngeal or nasopharyngeal) and gastric-to-pulmonary aspiration. A radio-nuclide-labeled solution was introduced into the nasopharynx during the study period; therefore, it is not clear whether its detection in the thorax represents aspiration of nasopharyngeal/oropharyngeal secretions, gastric contents, or both. The importance of this point is that gastric-to-pulmonary aspiration (via macroaspiration or gastroesophageal reflux disease) has been implicated in the development of aspiration pneumonitis, pneumonia, and acute respiratory distress syndrome, whereas aspiration of oropharyngeal secretions may contribute to the development of pneumonia but not necessarily pneumonitis or acute respiratory distress syndrome other than acute respiratory distress syndrome secondary to pneumonia.6

Competing Interests
The author declares no competing interests.

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Role of Recruitment Maneuvers 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 protective ventilation 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.\(^5\) 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.\(^6\) In this study, 900 patients undergoing upper surgery were randomized to the high PEEP group of 12 cm H\(_2\)O or the low PEEP group of 2 cm H\(_2\)O, with recruitment maneuvers being performed in both groups. Although patients in the high PEEP group received significantly less recruitment maneuvers than the low PEEP group, patients who received recruitment maneuvers died significantly less frequently than patients who did not receive recruitment maneuvers. This clearly shows that recruitment maneuvers are complementary and not necessarily counterproductive to PEEP.

\(\text{References}\)


(Accepted for publication October 24, 2014.)

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


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