

abdominal surgery were ventilated with 8 ml/kg ideal body weight and randomly assigned to PEEP of 12 cm H<sub>2</sub>O plus multiple recruitment maneuvers or PEEP of 2 cm H<sub>2</sub>O 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<sup>6</sup> or inspiratory oxygen concentration,<sup>7</sup> 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<sup>1</sup> and appreciate the correction regarding the methodology used in their study.<sup>2</sup> 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.<sup>3</sup> 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<sup>3</sup>; in contrast, higher PEEP was associated with higher rates of intraoperative hypotension and vasopressor and fluid administration. However, it has been noted<sup>4</sup> that the levels of PEEP used in this study<sup>3</sup> were high (mean of 12 cm H<sub>2</sub>O). 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.<sup>5</sup> 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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