

measurements in patients undergoing laparotomy.³ There is a significant negative correlation between perioperative spirometric tests and obesity. The reduction in postoperative lung volumes was significantly greater in obese patients than in normal-weight patients. Also, surgery with general anesthesia may reduce lung volumes and this effect may be greater in the obese patients.⁴ So, we think the authors should give the information about the proportion of the obese patients in the two groups.

Second, the authors state that most patients underwent epidural anesthesia at the T8 to T12 level before general anesthesia and received continuous analgesia after surgery. High thoracic perioperative epidural anesthesia was shown to decrease spirometric measurements by blocking intercostal muscle innervation.⁵ Even if low concentrations of local anesthetics are used, the sensory levels of epidural anesthesia extending from approximately T4 to L1 are likely to be accompanied by some degree of muscle paralysis.⁶ It is more likely to block the muscles of the abdominal wall (innervation T6–L1). Even a subtle decrease in abdominal muscle tone will affect dynamic parameters. To avoid the influence of the epidural anesthesia on spirometric measurements, we think it is necessary to perform a pulmonary functional test after the epidural anesthesia. Or else, the authors should give the information about the epidural anesthesia including the dose of the local anesthetics, the direction of the epidural catheter, and the plane of the epidural anesthesia.

Competing Interests

The authors declare no competing interests.

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Association between Intraoperative Ventilation Strategies and Postoperative Pulmonary Outcomes in Surgical Patients

To the Editor:

In a small-sample, randomized, clinical trial comparing standard and protective ventilation strategies in patients with normal lung function undergoing elective laparotomy, Severgnini *et al.*¹ showed that a protective ventilation strategy during surgery improved the postoperative respiratory function and reduced the clinical signs of postoperative pulmonary infection. Other than strict inclusion and exclusion criteria of patients, the authors should also be applauded for trying to control most of preoperative and intraoperative risk factors that may affect the postoperative respiratory function and pulmonary complications, such as age, body mass index, American Society of Anesthesiologists classification, history of smoking, type of surgery, anesthetic protocol, antibiotic prophylaxis, blood transfusion, intraoperative complications, uses of postoperative analgesia and physiotherapy, and many more.^{2,3} However, to differentiate the effect of one factor on postoperative pulmonary outcomes, all of the other factors have to be standardized. In this study, several important issues were not addressed.

First, perioperative hemoglobin levels are not included in data analysis. Preoperative anemia is common among surgical patients. In a previous study including 227,425 noncardiac surgery patients, 69,229 patients (30.4%) have preoperative anemia, of whom 57,870 (83.6%) are mild anemic and 11,359 (16.4%) are moderate-to-severe anemic.⁴ It has been shown that preoperative anemia is independently associated with the postoperative pulmonary complications.⁵ Furthermore, low preoperative and postoperative hemoglobin levels are associated with increased perioperative mortality, increased postoperative pneumonia, and increased hospital length of stay.⁶

Second, there was no mention of serum albumin level. A low serum albumin level has been shown to be an important predictor of pulmonary complications after major noncardiac surgery.⁷ According to the guideline of the American College of Physicians on risk assessment for and strategies to reduce perioperative pulmonary complications for patients undergoing noncardiothoracic surgery, serum albumin should be measured in all patients who are clinically suspected of having hypoalbuminemia and in those with one or more risk factors of postoperative pulmonary complications.²

Third, the authors did not describe use of nasogastric tubes although 63 to 71.4% of the study population underwent gastrointestinal surgery. A meta-analysis examined evidence from studies regarding selective and routine use of nasogastric tube for gastrointestinal decompression after elective laparotomy and showed that patients receiving selective use of nasogastric tube had a significantly decreased incidence of postoperative pneumonia and atelectasis.⁸

Fourth, mean age of study subjects was more than 65 yr, but their study design did not include the perioperative assessment of patients' cardiac function. Actually, in this study some of the observed endpoints for postoperative pulmonary complications, such as dyspnea, increased tracheal secretions, cough, chest pain, and lung density change in chest x-ray tests, are similar to the clinical features of cardiac insufficiency. Good-quality evidence identifies preoperative cardiac insufficiency as a significant risk factor for postoperative pulmonary complications.² In the noncardiac surgery patients aged 60 yr or more, moreover, incidence of postoperative myocardial injury defined by an increased troponin level is as high as 19% and there is a strong association between postoperative myocardial injury and perioperative morbidity and mortality.⁹ In a cohort study of major abdominal surgery patients,¹⁰ 33% of patients who developed postoperative pulmonary complications also had cardiovascular complications. These results suggest that a significant proportion of patients with postoperative pulmonary complications in the study by Severgnini *et al.*¹ may have cardiovascular complications that are not evaluated.

Thus, we cannot exclude possibility that existence of any imbalance in the above-mentioned factors would have confounded interpretation of their results. Furthermore, small sample size of study population may also have prevented them from excluding a type 2 error when comparing statistical differences between two groups in some endpoints, such as incidences of pulmonary complications on postoperative days 2 and 3, dyspnea, secretions and cough scores on postoperative days 1, 3, and 5, and percentage of patients in hospital on postoperative day 28. We believe that large-sample, randomized, controlled trials are still needed to define association of intraoperative ventilation strategies with postoperative pulmonary outcomes.

Competing Interests

The authors declare no competing interests.

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Lung-protective Ventilation during General Anesthesia: What about the Oxygen?

To the Editor:

We read with great interest the article by Severgnini *et al.*¹ in which the authors evaluated a protective ventilation strategy with low tidal volume (7.7 ± 0.8 ml/kg of predicted body weight), positive end-expiratory pressure (10 cm H₂O), and recruitment maneuvers (RMs) as compared with ventilation with higher tidal volumes (9.5 ± 1.1 ml/kg of predicted body weight), no positive end-expiratory pressure (zero end-expiratory pressure), and no RMs in patients undergoing open abdominal surgery and mechanically ventilated for at least 2 h. Their results showed better pulmonary functional tests, fewer alterations on chest radiograph, and higher arterial oxygenation on different postoperative days. One month later, Futier *et al.*,² one of Severgnini's coauthors, published a similar study on the efficacy of the protective ventilation strategy in intermediate- to high-risk patients undergoing