

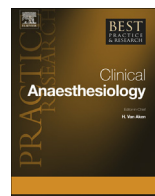


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Intraoperative mechanical ventilation strategies to prevent postoperative pulmonary complications in patients with pulmonary and extrapulmonary comorbidities



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A variety of patient characteristics and comorbidities have been identified, which increase the risk of postoperative pulmonary complications (PPCs), including smoking, age, chronic obstructive pulmonary disease, pulmonary hypertension, obstructive sleep apnea, cardiac and neurologic diseases as well as critical illness. In contrast to the variety of conditions, evidence for specific intraoperative ventilation strategies to reduce PPC is very limited for most comorbidities. Here, we provide an overview of and discuss possible implications for the intraoperative ventilatory management of patients with comorbidities.

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Introduction

The term “postoperative pulmonary complications” (PPCs) summarizes several different clinical problems, such as pneumothorax, atelectasis, or pleural effusion, but also bronchospasm and pneumonia, as well as weaning failure, prolonged mechanical ventilation, respiratory failure, and need for reintubation [1,2]. PPCs affect up to 40% of patients, and their occurrence is associated with an increased length of stay in hospital, and an increased mortality [3].

This review focuses on the following conditions in adult patients: severity score, age, smoking, pulmonary, cardiac and neurologic diseases, and critical illness.

Search of the literature

We searched PubMed using the words “postoperative pulmonary complication” as well as each disease and “lung-protective ventilation” or “intraoperative mechanical ventilation” as search terms. Search results were carefully screened for the purpose of this review. Evidence from the literature for benefits from intraoperative ventilation strategies in patients with specific comorbidities is limited. If available, the literature is reviewed here; otherwise, general considerations will be discussed. Table 1 summarizes the main findings in the literature per comorbidity.

“Lung-protective ventilation” is increasingly recommended for intraoperative ventilation, and it typically includes low tidal volumes of ≤ 8 ml/kg predicted body weight (PBW) with a positive end-expiratory pressure (PEEP) of ≥ 5 mbar and recruitment maneuvers [4,5]. Although the use of recruitment maneuvers has been introduced years ago, it remains unclear when and how often these maneuvers should be performed during surgery, and whether there is an ideal airway pressure or recruitment regimen. For instance, intraoperative recruitment maneuvers have been performed within two large clinical trials through very different approaches. In one trial, tidal volume was increased stepwise until the plateau pressure was 30–35 cm H₂O. Then, three mechanical breaths were applied [6]. By contrast, recruitment maneuver consisted of applying a continuous positive airway pressure of 30 cm H₂O for 30 s in the other study [4].

Results

Comorbidities are seldom referred to in trials on intraoperative mechanical ventilation. Table 2 provides an overview of studies on intraoperative mechanical ventilation and the inclusion of patients with comorbidities.

Table 1

Scope of comorbidities.

Comorbidity	Occurrence of postoperative pulmonary complications
Moderate comorbidities, ASA class ≥ 2	Odds ratio 2.9–4.9 [1]
Smoking	Odds ratio 1.1, smoking cessation also benefits other postoperative outcomes [2]
Age >65 year	Odds ratio 2.1, independent risk factor, not only an indicator of cumulating comorbidities [1,2]
COPD	Odds ratio 1.8, risk depends on stable condition and optimal individual treatment [1]
Asthma	Well-controlled asthma is not a risk factor for postoperative pulmonary complications [1,34]
Pulmonary hypertension	Up to 7-fold increase in respiratory failure [37,38]
Obstructive sleep apnea	Odds ratio 1.86, cardiac complications are also more frequent [48]
Cardiac disease	New scoring systems refer to ASA class
Congestive heart failure	Odds ratio 2.93 [1]
Chronic neurologic diseases and neurosurgery	Not quantified
Critically ill patients	Not quantified

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