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Is supplemental oxygen necessary for intraoperative lung protective ventilation?

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The management of Postoperative Pulmonary Complications (PPCs) has recently received increasing research attention. PPCs, which can lead to serious morbidity, mortality and longer hospital stays, occur at a rate of approximately 5% in general surgical populations and may exceed 20% in high-risk patients [1]. Factors known to affect PPC development include patients' co-morbidity, surgical procedures and anaesthetic factors, particularly mechanical ventilation.

Intraoperative lung protective strategies, which comprise low tidal volume, Positive End-Expiratory Pressure (PEEP), and recruitment manoeuvres, have been reviewed. The results of two randomised controlled trials in patients undergoing abdominal surgery suggest that these approaches improve postoperative respiratory function as well as the incidence of PPCs [2,3]. Findings of two systematic reviews also revealed that low tidal volume with PEEP is associated with improved clinical pulmonary outcomes and reduced hospital stays in patients undergoing general surgery [4,5]. On the contrary, the PROVHILO study indicated that a high level of PEEP (12cmH_2O) and recruitment manoeuvres were comparable with a low level of PEEP (≤2cmH_2O) without recruitment manoeuvres for PPCs [6]. Despite mounting evidence of the benefits of low tidal volume and PEEP in lung protective strategies, optimal PEEP levels and the role of recruitment manoeuvres remain uncertain during general anaesthesia.

Supplemental oxygen is an essential component of ventilator management. However, it remains to be included in lung protective strategies. Reportedly, a high inspired oxygen fraction (F_IO_2) can be harmful and cause increased absorption atelectasis and lung injury. Worse clinical outcomes caused by high F_IO_2 have been reported in critically ill adults, including patients with chronic obstructive pulmonary disease, myocardial infarction, cardiac arrest, stroke and traumatic brain injury [7-10]. Therefore, a conservative oxygenation strategy was proposed and evaluated in mechanically ventilated patients. It should be noted that conservative oxygen therapy has been associated with lower mortality, decreased incidence of atelectasis and earlier weaning from mandatory ventilation in the ICU [11,12].

On the contrary, research on intraoperative conservative oxygen management is insufficient. A meta-analysis of randomised controlled trials showed that high F_IO_2 did not increase the risk of atelectasis [13]. However, a recent registry report stated that high intraoperative F_IO_2 was associated with major respiratory complications and 30-day mortality in a dose-dependent manner [14]. Moreover, a post hoc analysis of the PROXI trial suggested increased long-term mortality and higher incidence of myocardial infarction with higher F_IO_2 [15,16].

Recently, we investigated the current practice of ventilator settings during One Lung Ventilation (OLV) and its association with PPCs [17]. We noted that a higher F_IO_2 during OLV was applied in the majority of patients and was associated with the increased incidence of PPCs. Thus, growing evidence supports the requirement for randomised controlled trials for evaluating the safety and feasibility of conservative oxygen therapy during general anaesthesia.

Current oxygen management practices during general anaesthesia must be re-evaluated for preventing PPCs and protecting patients from unnecessary overdose treatment.

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