

Strategies to Reduce Postoperative Pulmonary Complications in Adults: Systematic Literature Review

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Received: September 28, 2020; **Published:** September 30, 2020

Abstract

This review is aiming to discuss the strategies that decrease the postoperative pulmonary complications in adults, the presented review was conducted by searching in Medline, Embase, Web of Science, Science Direct, BMJ journal and Google Scholar for, researches, review articles and reports, published over the past years. were searched up to May 2020 for published and unpublished studies and without language restrictions, if several studies had similar findings, we randomly selected one or two to avoid repetitive results. On the basis of findings and results this review found the use of Sugammadex, PCV and VCV.

Keywords: Strategies; Postoperative; Pulmonary; Complications

Introduction

Neuromuscular blockade in general anesthesia, maintain an appropriate surgical condition and patient safety by straining movement of the patient, but it is also increases the risk of immediate post-operative critical respiratory events, such as upper airway obstruction and hypoxemia, mainly due to remaining neuromuscular blockade [1-4].

Agents such as neostigmine are used for reversal, but these agents have some limits. Neostigmine increases cholinergic side effects such as bronchoconstriction, bradycardia, and post-operative vomiting and nausea. Neuromuscular reversal guidelines recommend administering neostigmine when a train of four (TOF) count of at least two is confirmed [5]. Also, neostigmine overdose recognized to cause a paradoxical neuromuscular block [6,7]. Sugammadex formulae a complex with Aminosteroidal agents to induce the fast and complete reversal of even deeper neuromuscular blockade, and it also reduces post-operative remaining blockade [8-10].

Sugammadex allows deep neuromuscular blockade to improve the score of the surgical condition and the surgeon satisfaction, especially in laparoscopy operation [11,12].

On the other hand, sugammadex does not have cholinergic side effects. Although there are many advantages, the effects of sugammadex on post-operative outcomes (e.g., complications, morbidity, and death) are controversial [13-15].

Mortality and morbidity are reduced in cases of ARDS by ventilating their lungs with a combination of relatively small tidal volumes, (PEEP) and low plateau pressures [16].

Lung ventilation, controlled by the volume than pressure, may adjust the rate of pulmonary complications postoperatively, whereas researches in patients with acute pulmonary injury have not revealed significant differences [17,18]. Pulmonary postoperative complications are linked with intra-operative PEEP, ventilatory driving pressure and oxygen partial pressure [19-24]. Findings have stated the effects of PCV vs. VCV intra-operatively on physical variables but not clinical lung outcomes [25,26].

Materials and Methods

The present review was conducted May 2020 in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) declaration standards for systematic reviews. We reviewed all the topics on the strategies that decrease the pulmonary complications postoperatively in adults, such as the use of Sugammadex, PCV and VCV. To achieve this goal, we searched Medline, Embase, Web of Science, Science Direct, and Google Scholar for, researches, review articles and reports, published over the past 15 years.

Our search was completed without language restrictions. Then we extracted data on study year, study design, and key outcome on the strategies that decrease the pulmonary complications postoperatively. The selected studies were summarized and unreproducible studies were excluded. Selected data is shown in the table 1.

Author and year	Sample	Postoperative strategy	Key point
Jiwon Han, 2020 [27]	Data obtained from 3802 patients submitted laparoscopy gastrectomy in (Jan 2013 - Dec 2017).	Sugammadex, Neostigmine.	Sugammadex use was related to less incidence of post-operative pleural effusion in laparoscopic gastrectomy
A. Bagchi 2017 [28]	Data recorded for 109,360 adults, whose lungs were mechanically ventilated during surgery	Pressure-controlled ventilation, volume-controlled ventilation.	During operation VCV is used specifically for the patients who are likely to develop pulmonary complications postoperatively.

Table 1: Results from sequencing studies.

Inclusion criteria

Inclusion criteria were the Strategies to reduce postoperative pulmonary complications, adults.

Exclusion criteria

Irrelevant articles [not related to the aim of this review and articles that did not meet the inclusion criteria in this review].

Data extraction and analysis

Information relating to each of the systematic review question elements was extracted from the studies and collated in qualitative tables. Direct analysis of the studies of strategies that decrease pulmonary complications postoperatively.

Results and Discussion

At the Hospital of Seoul National University Bundang in (January 2013 - December 2017), a total of 3802 case of laparoscopy gastrectomy participate in a cohort study, (1363) participants delivered Sugammadex, and the (1898) patients who delivered Neostigmine were involved in the study whereas 541 participants were omitted. The statistical significant differences were $p < 0.05$ between the groups (Sugammadex and Neostigmine) through numerous variables, including (operation type, anesthetic drug, PEEP, blood loss amount; intra-operative colloid infusion amount, urine output; intraoperative receiving of (Ephedrine, Esmolol). PSM were implemented for the whole measured variables. (1232) patients consisting of (616) per group were lastly analyzed after matching. The patients' features and values of SMD for the matched (cohort) were listed and all SMD values were < 0.1 , indicating that a balance was achieved between the groups. There was a statistically significant difference in the pleural effusion rate: 18% in the group of Sugammadex vs. 23.4% in the neostigmine group ($p = 0.02$). These patients received 3 - 5 L/min oxygen according to the surgical treatment policy, but no patient developed further symptoms or signs of infection, or required invasive treatment, such as thoracentesis. No statistically significant differences were observed in terms of overall and other pulmonary complications between the groups, and the groups did not differ significantly of secondary outcomes, such as: re-operating in 90 days after operation, ICU admission post-operatively, re-admission or an ER visit in (30) days after discharging, hospital stay, and death within (90) days post-operatively [27].

PCV was used for (18,268) from (109,360) patients and (18,085) participants of 91,092 patients ventilated with VCV, within the caliper limit of the propensity score. Both (the pressures and volumes) provided to the 2 ventilator modes were differ from each other: PCV provided more diverse, as well as greater, driving pressures and tidal volumes than VCV. Complications of lungs were more after the PCV in unmatched and matched cohort for tendency score. Pulmonary complications postoperatively were common after PCV.

The study showed that the rate of pleural effusion postoperatively was less in Sugammadex participants in comparison to Neostigmine ones. However, the incidence of other pulmonary complications and the secondary outcomes did not vary significantly in the both (2 groups). Sugammadex was revealed to decrease nausea and vomiting post-operatively for the reason of the rapid recovery of muscle strength and the absenteeism of cholinergic side effects of Neostigmine. Studies presented that Sugammadex prolonged coagulation profiles and affected operation bleeding, however these observations still controversial. A study revealed that Sugammadex was associated to a lesser incidence of re-admission, decrease hospital stay period, and reduced medical costs. On the other hand, pulmonary complications post-operatively have been studied [27].

In this study the rate of pulmonary complications postoperatively was greater when intra-operative ventilation was controlled by (pressure) than when it was controlled by (volume). The pulmonary complications rates are greater after PCV than VCV, due to more variable and higher driving pressures and tidal volumes, aggravated by low or no PEEP. Our data VCV during operation, specifically for those who are likely to develop pulmonary complications postoperatively [28].

Conclusion

Finally, the results of this studies show the strategies that decrease pulmonary complications postoperatively in adults. On the basis of findings and results this review found the use of Sugammadex, PCV and VCV.

Conflict of Interest

The authors of this article hasn't receive and support for this work and it was completely self-funded.

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Volume 16 Issue 10 October 2020

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