The Relationship Between Postoperative Pneumonia and Endotracheal Suctioning Under General Anesthesia in Ophthalmic Surgery: A Retrospective Study

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Objective: Postoperative pneumonia is the third most common postoperative complication. It may result from aspiration of secretions accumulating in the subglottic space during general anesthesia (GA). However, the relationship between endotracheal suctioning (ETS) during extubation from GA emergence and postoperative pneumonia has not been well investigated. Therefore, the aim of this study was to investigate the effectiveness of ETS during extubation in prevention of postoperative pneumonia in ophthalmic surgery under GA in our medical center from 2011 through 2015.

Methods: Three thousand, seven hundred and ninety-four patients receiving ophthalmic surgery under GA were included and divided into two groups by the anesthesiologists. The first group underwent the conventional ETS during extubation, while the other group was extubated without ETS. The incidences of postoperative pneumonia were compared between the two groups to find the correlation between ETS during extubation and postoperative pneumonia. In addition, other complication such as postoperative hemorrhage was also recorded.

Results: Of the 3,794 patients undergoing ophthalmic surgery under GA, 2,187 (58%) patients underwent extubation with ETS, whilst 1,607 (42%) patients were extubated without ETS. The incidence rates of postoperative pneumonia with or without ETS during extubation were both 0%. Besides, the incidence rates of postoperative hemorrhage were also both 0% in two groups.

Conclusion: Extubation from GA without ETS seemed not to increase the risk of postoperative pneumonia. Thus, no routine ETS during extubation seemed not to be a risk factor for postoperative pneumonia under GA in ophthalmic surgery.

Keywords: postoperative pneumonia, endotracheal suctioning, general anesthesia, ophthalmic surgery

Introduction

The incidence of postoperative pneumonia was from 0.5% to 5.3% due to the different surgical subspecialties and the cardiothoracic surgery had the highest incidence.1 Up to now, however, the incidence of postoperative pneumonia following minor surgeries such as ophthalmic or breast surgeries is still uncertain.

During endotracheal tube (ETT) intubated general anesthesia (GA), secretions accumulate in the subglottic space posing an aspiration risk during cuff deflation and extubation. To minimize this risk, both endotracheal suctioning (ETS) during tube removal and applying positive pressure with a manual resuscitator have been advocated.2 However, coughing related to ETS is very common during emergence from GA and is accompanied by hypertension, and
tachycardia, and it may result in postoperative hemorrhage, intracranial hypertension, or intraocular hypertension. Many strategies have been studied to prevent coughing during emergence, including extubation in a deep plane of anesthesia, the use of laryngeal mask airway (LMA), and topical or intracuff application of lidocaine. These strategies are generally considered to increase the risk of aspiration, or they proved unreliable.

ETT intubation and use of a LMA are the commonest methods used for managing the airway in elective ophthalmic cases. Previous studies demonstrated the use of a LMA, extubated without any ETS, in patients undergoing ophthalmic surgery. And in these LMA studies, there was no postoperative pneumonia being reported. Pedersen et al. also reported that routine ETS was not suggested in intensive care patients based on ETS associated with complications and risks. Besides, ETS was not a benign procedure, and operators might remain sensitive to possible hazards and complications and take all necessary precautions to ensure patient safety. Therefore, the benefit of ETS in minor surgeries and low risk patients was need to investigate further.

As our best knowledge, a rigorous comparison of the incidence of postoperative pneumonia between ETS and non-ETS during extubation from emergence of GA has not yet been performed in ophthalmic surgery. Therefore, in this study, we retrospectively investigated the incidence of postoperative pneumonia with or without ETS during extubation in ophthalmic surgery under GA.

Methods

This retrospective study was approved by the Ethics Committee (TSGHIRB No: 1-106-05-057) of Tri-Service General Hospital, Taipei, Taiwan (Chairperson, Professor Mu-Hsien Yu) on May 5, 2017. Institutional Review Board (IRB) allow waiving the requirement for obtaining informed consent and patient records was anonymized and de-identified prior to analysis. The information was retrieved from the medical records and the electronic database of Tri-Service General Hospital (TSGH; Taipei, Taiwan). All methods were performed in accordance with the relevant guidelines and regulations by our IRB. We retrospectively analyzed 4,218 patients (American Society of Anesthesiologists [ASA] class I–III) who received elective ophthalmic surgery from January 2011 to December 2015. The incidence of postoperative pneumonia was identified as the total number of cases under each identifying International Classification of Diseases, Ninth Revision (ICD-9) or ICD-10 codes for postoperative pneumonia, and end of follow-up in August 2017. We followed up these patients at least 4 weeks postoperatively, and all of them visited our outpatient department without pneumonia after surgery. Patients with smoking, chronic obstructive pulmonary disease (COPD), morbidly obese (body mass index [BMI] ≥ 40 kg/m²), obstructive sleep apnea (OSA), and older age have higher risks for postoperative pulmonary complications such as postoperative pneumonia or respiratory failure. Accordingly, patients were excluded if incomplete data, smoking, COPD, morbidly obese (BMI ≥ 40 kg/m²), and age < 20 years or > 80 years.

In our hospital, the non-ETS patients were given GA by Dr. Wu and Dr. Lai due to their bad experiences about postoperative hemorrhage consistent with the previous research. By contrast, the conventional ETS patients were given GA by the other anesthesiologists routinely, and that was proved by anesthetic practitioners privately.

No medication was administered before induction of anesthesia; however, regular monitoring, such as electrocardiography (lead II) and measurement of pulse oximetry, noninvasive arterial blood pressure, respiratory rate, and end-tidal carbon dioxide pressure (EtCO₂), was performed. In all patients, anesthesia was induced with propofol and fentanyl. The patients were then tracheally intubated and maintained with the anesthetics desflurane or propofol and the analgesic fentanyl.

The patients were induced with intravenous (i.v.) fentanyl, lidocaine, and propofol. When patients lose of consciousness, i.v. rocuronium or cisatracurium was administered, followed by ETT intubation. Anesthesia was maintained by using desflurane or continuous infusion of propofol delivered subsequently by using Schneider’s kinetic model of target-controlled infusion (TCI) (Fresenius Orchestra Primea, Fresenius Kabi AG, Bad Homburg, Germany). In addition, there was no glycopyrrolate or atropine used for the induction.

Maintenance of the propofol or desflurane concentration was adjusted to keep mean blood pressure at 80–100 mmHg or within 20% of baseline. The
EtCO₂ pressure was maintained at 35–45 mmHg by adjusting the ventilation rate and maximum airway pressure below 30 cmH₂O. Repetitive bolus injections of i.v. rocuronium or cisatracurium were prescribed as required throughout the procedure.¹⁵⁻²³

At the end of surgery, propofol or desflurane was discontinued, and the lungs were ventilated with 100% oxygen at a fresh gas flow of 6 L/min. Reversal of neuromuscular function was achieved by administering neostigmine (i.v.) with glycopyrrolate (i.v.) once spontaneous breathing returned to prevent residual paralysis. When the patient regained consciousness by name with spontaneous and smooth respiration, the ETT were ready to removed.¹⁵⁻²³ In the ETS group, the cuff was deflated and the ETT was removed together with ETS. By contrast, the cuff was deflated and the ETT was removed together without ETS in the non-ETS group. Then, the patient was sent to the post-anesthesia care unit for further care.

Data are presented as the mean and standard deviation (SD), number of patients, or percentage. Demographic and surgical time were compared using Student’s t-tests or Mann-Whitney test while the data were not normally distributed. Categorical variables were compared using chi-square test. Statistical significance was accepted for two-tailed p values of < 0.05. The statistics was performed by using SigmaStat 3.5 for Windows.

Results

Four hundred and twenty-four patients were excluded from the analysis. Of those excluded, 281 patients with smoking, 16 patients with COPD, 19 patients with morbidly obese (BMI ≥ 40 kg/m²), 26 patients with OSA, 65 patients with age < 20 years or > 80 years, and 17 patients had incomplete data. Our study included 3,794 patients, with 2,187 receiving ETS and 1,607 receiving non-ETS during extubation in ophthalmic surgery under GA. Table 1 showed patient’s characteristics and surgical procedures. And there was no significant difference in patient’s gender, age, height, weight, and surgical time. Ophthalmic surgical procedures included vitrectomy, glaucoma surgery, and other surgeries.

Analysis of the medical records revealed no patient with postoperative pneumonia among 3,794 operations, indicating a postoperative pneumonia incidence of 0% in ophthalmic surgery under GA. The age of the entire ophthalmic surgery was 55.3 ± 16.2 years.

The incidence rates of postoperative pneumonia showed both 0% in the two groups. Thus, the incidence rates of postoperative pneumonia revealed no significant difference between the two groups. However, 1 case in ETS group received second operation on the same eye due to vitreous hemorrhage within 1 month, and the discharge note reported no surgical complication at the first time of surgery.

The incidence rates of postoperative hemorrhage showed both 0% in the two groups. Thus, the incidence rates of postoperative hemorrhage revealed no significant difference between the two groups.

Table 1. Patient’s characteristics and surgical procedures

<table>
<thead>
<tr>
<th></th>
<th>ETS (n = 2,187)</th>
<th>Non-ETS (n = 1,607)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (M/F)</td>
<td>1,285/902</td>
<td>926/681</td>
<td>—</td>
</tr>
<tr>
<td>Age (years)</td>
<td>55.3 ± 16.3</td>
<td>55.2 ± 16.2</td>
<td>0.85</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>163.6 ± 6.7</td>
<td>163.7 ± 6.5</td>
<td>0.65</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.2 ± 8.6</td>
<td>62.3 ± 8.2</td>
<td>0.72</td>
</tr>
<tr>
<td>Surgical procedures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitrectomy</td>
<td>745 (34.1)</td>
<td>591 (36.8)</td>
<td>—</td>
</tr>
<tr>
<td>Glaucoma surgery</td>
<td>1,031 (47.1)</td>
<td>699 (43.5)</td>
<td>—</td>
</tr>
<tr>
<td>Other surgeries</td>
<td>411 (18.8)</td>
<td>317 (19.7)</td>
<td>—</td>
</tr>
<tr>
<td>Surgical time</td>
<td>129.2 ± 45.2</td>
<td>129.1 ± 39.3</td>
<td>0.94</td>
</tr>
</tbody>
</table>

ETS: endotracheal suctioning; M: male; F: female.
Data shown as mean ± standard deviation (SD) or No. (%).
Discussion

This study is the first study of postoperative pneumonia occurring after ophthalmic surgery with or without ETS during extubation from emergence of GA. The major finding in this retrospective study showed that non-ETS during extubation did not increase the risk of postoperative pneumonia following ophthalmic surgery under GA.

Postoperative pneumonia is the third most common postoperative complication and leading to mortality. However, its epidemiology varies widely and is often difficult to assess. The overall incidence rate of postoperative pneumonia was 0.97% following orthopaedic, urologic, orotolaryngologic, cardiothoracic, neurosurgery, and general surgeries. Chughtai et al. reported that cardiothoracic surgery had the highest incidence (3.3–5.3%). In the literature, however, the incidence of postoperative pneumonia following ophthalmic surgery is still uncertain. In this study, our finding showed that the overall incidence rate of postoperative pneumonia was 0%. Our overall incidence rate of postoperative pneumonia following ophthalmic surgery under GA was lower than that reported in the above mentioned research. There are two possible reasons for this. First, many ophthalmic surgical cases were of minor surgeries and brief durations, and shorter surgical time was associated with lower incidence of postoperative pneumonia. Second, we excluded the patients with smoking, COPD, morbidly obese (BMI ≥ 40 kg/m²), and older age (> 80 years) and we routinely used ETS in these risky patients for postoperative pneumonia.

During GA, secretions accumulate in the subglottic space and then result in an aspiration risk during cuff deflation and extubation. To minimize this risk, both ETS during tube removal and applying positive pressure with a manual resuscitator have been advocated. However, we found that the incidence rates of postoperative pneumonia showed both 0% in the two groups. This result demonstrated that non-ETS did not increase the risk of postoperative pneumonia compared with ETS in ophthalmic surgery under GA. Similarly, Andreu et al. demonstrated that non-ETS resulted in less leakage of oropharyngeal contents than ETS, and that implied that non-ETS during extubation might prevent from the development of postoperative pneumonia. Moreover, Pedersen et al. reported that routine ETS was not suggested in intensive care patients as the ETS associated with complications and risks and without increasing the incidence of ventilator associated pneumonia.

Coughing related to ETS is very common during emergence from GA is often not regarded as a complication because appropriate cough can remove respiratory secretion during emergence. However, severe coughing during ETS is accompanied by hypertension, and tachycardia, and it may result in postoperative hemorrhage, intracranial hypertension, or intraocular hypertension. Thus, ETS is not routinely suggested for patients undergoing some ophthalmic surgeries. In this study, our finding showed that the incidence rates of postoperative hemorrhage showed both 0% in the two groups. However, we found 1 case in ETS group received second operation on the same eye due to severe vitreous hemorrhage within 1 month, and there was no diagnosis of postoperative hemorrhage. Accordingly, we postulated that ETS during extubation might increase the incidence rate of postoperative hemorrhage in ophthalmic surgery, and that was consistent with previous study.

ETT still plays an important role in patients receiving surgery under GA to protect the lungs from regurgitated stomach content, and that was associated with less aspiration and death than LMA. However, recently, LMA is used in pediatric and adult patients receiving ophthalmic surgery under GA, and that was extubated without any ETS with less coughing, less increase in intraocular pressure, and hemodynamics changes compared with ETT.

In these LMA reports, there was no postoperative pneumonia being reported. Moreover, a previous study reported that pulmonary aspiration with the LMA is uncommon and comparable to that with ETT. Therefore, as our result, non-ETS during extubation might be an alternative method to prevent coughing without increase the incidence of postoperative pulmonary complications.

There were limitations in this study. First, information about blood pressure and heart rate during extubation were not available. Our previous study showed that coughing during ETS was accompanied by hypertension, and tachycardia, and it might result in postoperative hemorrhage. However, we found no postoperative hemorrhage in this study. Second, information about intraocular pressure during extu-
bation was not available. A previous study showed that stable intraocular pressure is important for the success of intraocular surgery, as a rise in intraocular pressure intraoperatively can cause prolapse of the iris or lens and loss of vitreous, resulting in permanent visual loss. However, in our clinical practice, the re-operation rate in ophthalmic surgery is very low (<1%).

In conclusion, we did not find any postoperative pneumonia in ophthalmic surgery under GA even without ETS during extubation. Thus, non-ETS seemed not to be a risk factor for pulmonary pneumonia in ophthalmic surgery. Further investigations are needed to understand the impact of the ETS while extubation on the incidence rates of postoperative pneumonia in other minor or major operations with low risk patients.

Conflicts of Interest

No external funding or competing interests declared.

References


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