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Original contribution

Less postoperative sore throat after nasotracheal intubation using a fiberoptic bronchoscope than using a Macintosh laryngoscope: A double-blind, randomized, controlled study☆

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ABSTRACT

Study objective: To evaluate whether nasotracheal intubation using a fiberoptic bronchoscope reduces postoperative sore throat.
Design: Prospective, double-blinded, randomized, and controlled study.
Setting: Postoperative areas and surgical ward of a university hospital.
Patients: Seventy-four patients with American Society of Anesthesiologists physical status I-II who were scheduled for elective general anesthesia requiring nasotracheal intubation.
Interventions: Patients were randomized to one of two intubation groups, F (fiberoptic bronchoscope–guided) and M (Macintosh laryngoscope–guided), and after induction of general anesthesia, the patients' tracheas were intubated via the nose.
Measurements: The intensity of postoperative sore throat was evaluated using a numerical rating score (0 = none, 10 = severe) at 24 hours postoperatively, and the incidence of nasal mucosal trauma, time to completion of intubation, and hemodynamic responses were recorded and compared between groups.
Main results: The numerical rating score value was significantly lower in group F than in group M ($P = .0047$), but the incidence of nasal mucosal trauma was comparable between the two groups. The median time to completion of intubation was shorter for group F than group M ($P < .0001$). Hemodynamic responses were not significantly different.
Conclusions: Fiberoptic bronchoscope–guided intubation is associated with less sore throat after nasotracheal intubation than M intubation. The time to completion of intubation was significantly shorter using the fiberoptic bronchoscope than that using the Macintosh laryngoscope.

1. Introduction

Postoperative sore throat is one of the most common complications of endotracheal intubation after general anesthesia. The incidence of postoperative sore throat is 40%-66% in different surgical and anesthetic situations [1,2]. Although many treatments, such as intravenous steroids, oral magnesium lozenges, gargles, or lidocaine, application on the tube cuff have been attempted to reduce the occurrence of this complication, none of them are completely effective by themselves [3,4]. Prevention of postoperative sore throat improves patient satisfaction and affects their activities after discharge from the hospital [5]. Therefore, minimizing its occurrence is essential. Several factors, such as mucosal injury by the airway device, endotracheal tube size [6], design of the tube cuff (size, shape, characteristics of the cuff, such as pressure/volume) [7], excessive cuff pressure, and unexpected movement during surgery [8,9], may cause sore throat postoperatively. Hence, although the mechanism of this complication is multifactorial, tissue damage is one possible causative factor, which the use of fiberoptic bronchoscopic guidance for nasotracheal intubation may reduce compared with Macintosh laryngoscope with Magill forceps guidance. We hypothesized that the main cause of postoperative sore throat is tissue damage by the airway device, especially that caused by the blade of the Macintosh laryngoscope at the time of exposing the larynx. In addition, nasotracheal intubation using a Macintosh laryngoscope can be a complicated procedure that requires the use of Magill forceps. A longer time to completion of intubation may be associated with greater tissue damage. On the other hand, fiberoptic bronchoscope–guided intubation can be performed without stimulation of oropharyngeal structures, and in the case of nasotracheal intubation, fiberoptic bronchoscope–guided intubation might be easier than oropharyngeal intubation because of the nasal anatomy. Therefore, fiberoptic bronchoscope–guided nasotracheal intubation has the potential to reduce postoperative sore throat compared with the use of the Macintosh

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laryngoscope. However, no studies have compared the effects of using fiberoptic bronchoscopes and Macintosh laryngoscopes on the incidence of postoperative sore throat after nasotracheal intubation. The purpose of this study was to evaluate whether postoperative sore throat occurs less frequently after fiberoptic bronchoscope–guided nasotracheal intubation than after Macintosh laryngoscope–guided intubation.

2. Materials and methods

The protocol of this study was approved by the institutional review board of our hospital (ethics committee no. 23-152), and written informed consent was obtained from each patient. In a double-blind, randomized, controlled manner, patients (American Society of Anesthesiologists physical status I-II) scheduled for elective oral surgery under general anesthesia requiring nasotracheal intubation were enrolled. All the surgical procedures performed in this study were tooth extractions. There were no cases in which the therapeutic procedure would have led to damage to the throat. Patients were excluded if they were younger than 18 years or older than 80 years, weighed less than 40 kg or more than 100 kg, and had tracheas that were known to be difficult to intubate, preoperative Mallampati scores of III or greater, a history of nasal surgery, or a history of taking anticoagulant drugs preoperatively. Using a sealed envelope technique, patients were randomly assigned to the following two groups according to the airway device used to guide nasotracheal intubation: group M, intubation using a Macintosh laryngoscope; group F, fiberoptic bronchoscope–guided intubation. In all cases, intubation was performed by several anesthesiologists with 2-9 years of experience. Patients were not premedicated. In the operating room, they were monitored using electrocardiography, noninvasive and invasive arterial blood pressure, oxygen saturation, and end-tidal carbon dioxide concentration. General anesthesia was induced with 1.5-2 mg/kg of intravenous propofol and 1-2 μg/kg fentanyl, and muscle relaxation was achieved by intravenous administration of 0.6 mg/kg of rocuronium bromide. Before intubation, manual ventilation was performed with 100% oxygen and 5% sevoflurane via a face mask. The nasal cavities were cleaned with a cotton swab dipped in normal saline, and 2-4 drops of naphazorine nitrate (Privina solution 0.05%; Novartis, Basel, Switzerland) were instilled into the nasal cavities for prevention of bleeding. Males and females were, respectively, intubated with 7.0-mm and 6.0-mm endotracheal tubes with high-volume, low-pressure cuffs (Covidien, Dublin, Ireland). The right nasal cavity was selected for the approach because of the shape of the distal tip of the endotracheal tube, but if the right nasal cavity was narrow on preoperative computed tomography, the left side was selected.

In group M, the endotracheal tube was inserted and advanced blindly into the nasal cavity and passed into the pharynx. If resistance was felt, the tube was rotated counterclockwise and the proximal end was also gently tilted in a cephalad direction. After the induction of general anesthesia, the tube was passed into the pharynx, and the patient was ventilated several times with 100% oxygen and 5% sevoflurane. The anesthesiologist then estimated nasopharyngeal tissue damage by observing the tip of the endotracheal tube for the presence of blood while exposing the larynx with a Macintosh laryngoscope (Welch Allyn, Inc, Skaneateles Falls, NY) (group M). The tube was then inserted with or without Magill forceps, as required. After intubation, the endotracheal tube cuff was inflated with air to achieve a seal at 20 mm Hg peak airway pressure. Successful intubation was then confirmed with the measurement of end-tidal carbon dioxide and via bilateral auscultation of the lungs. The time for intubation in group M was calculated from insertion of the endotracheal tube into the nostril to confirmation of successful intubation, minus the time spent in administering the several breaths after the tube was passed into the pharynx.

In group F, before intubation, the anesthesiologist applied water-soluble lubricating jelly over the distal end of the flexible fiberoptic bronchoscope (Olympus LF-DP; Olympus, Tokyo, Japan) and slid the scope through the endotracheal tube. The proximal end of the tube was fixed to the proximal end of the fiberscope with sticky tape. After muscle relaxation, the fiberoptic bronchoscope was inserted via the nasal cavity, while observing its passage past the intranasal structures and through the nasopharynx, oropharynx, larynx, and carina during jaw lift by the caregiver through the eyepiece of the scope. The endotracheal tube was then slid off the fiberscope. If resistance was felt, the tube was rotated counterclockwise, and the proximal end was also gently tilted in a cephalad direction. After intubation, the distance from the carina to the distal end of the tube was checked to ensure that it was 2.0-3.0 cm, after which the fiberscope was removed from the tube. The anesthesiologist estimated nasopharyngeal tissue damage with or without bleeding during withdrawal of the fiberoptic bronchoscope through the endotracheal tube. This helped to rule out the possibility of bleeding due to surgery resulting in blood staining of the tube at the time of extubation. As in group M, successful intubation was confirmed by the measurement of end-tidal carbon dioxide and by bilateral auscultation of the lungs. The time for intubation was calculated from the stage of fiberoptic bronchoscope insertion via the nasal cavity until successful intubation was confirmed. Thereafter, anesthesia was maintained with remifentanil infused at a rate of 0.1-0.2 μg/kg per min and a mixture of air and sevoflurane (end-tidal concentration, 1%-1.5%) in oxygen (40% inspired concentration). Nitrous oxide was not used. At the end of the surgery, neuromuscular blockade was reversed with 2 mg/kg sugammadex intravenously. After full recovery and awakening, the endotracheal tube was removed after gentle intratube and oral suctioning.

At 24 hours after the surgery, the intensity of postoperative sore throat was evaluated using a numerical rating scale (NRS) (0 = none, 10 = severe) by a blinded nurse. The study subjects remained blinded to their group assignment through the follow-up study period. Because all the patients were hospitalized overnight, the patients were still in the hospital when the assessment of postoperative sore throat was performed. The time to intubation was measured by a nurse who assisted the anesthesia. Thereafter, the incidence of nasal mucosal trauma, sore throat, time to completion of intubation, and blood pressure and heart rate measurements after the induction of anesthesia (one minute before intubation) and at the time of completion of nasotracheal intubation was compared between the two groups.

On the basis of preliminary data, power analysis was performed using postoperative sore throat as the primary outcome variable. The aim was to achieve a between-group mean difference in NRS of 2.5 when comparing the reduction in pain scores between the two groups (from NRS 6.5 to NRS 3.5, with standard deviation of 2.5), with a type 1 error rate of two-tailed $\alpha = .05$, and the alternate hypothesis that the null hypothesis would be retained with a $\beta = .2$. Based on this analysis, it was estimated that a sample size of 27 patients per group would be sufficient. Ten more patients were included in each group to compensate for possible dropouts.

Data on the NRS and time to completion of intubation are presented as medians (interquartile range), and other data are presented as means ± standard deviations. The χ^2 test was used to analyze demographic data and the numbers of patients with nasal mucosal trauma and complaints of postoperative sore throat. The Mann-Whitney *U* test was used to analyze the NRS for postoperative sore throat and the time for intubation. Hemodynamic responses were analyzed by Student *t* test. Values of $P < .05$ were considered significant.

3. Results

Seventy-five patients were enrolled in this study. One patient in group M was excluded because of unexpected difficult intubation. This patient was ultimately intubated using a fiberoptic bronchoscope. Thus, 37 patients in each group were analyzed in this study (Fig. 1). The patients' characteristics are shown in the Table. No significant differences in age, sex ratio, height, weight, body mass index, Mallampati score, or duration of anesthesia were observed between the two groups. The number of patients who complained of postoperative sore throat