Laryngeal mass induced severe ventilatory impairment during induction of anesthesia

ABSTRACT
A 77-year-old man with laryngeal cancer was scheduled for total laryngectomy and lymph node dissection surgery under general anesthesia. The patient did not present with airway obstruction signs, including dyspnea or wheezing sounds during spontaneous respiration, and the laryngeal opening could be easily identified on the fiberoptic bronchoscope examination preoperatively. Due to his poor cognition and cooperation, we decided not to try awake fiberoptic intubation. During the induction of general anesthesia, total airway obstruction occurred a few minutes after muscle relaxation. The patient could not be ventilated by mask ventilation; nevertheless, tracheal intubation using a conventional laryngoscope was performed without difficulty. It turned out that even a laryngeal mass that does not cause obstructive symptoms, not large in size or totally blocking the airway, can cause difficulty in mask ventilation.

Key words: Airway obstruction, laryngeal cancer, mask ventilation

Introduction
A laryngeal mass lesion can lead to a life-threatening situation by obstructing the airway during any part of the procedure, including sedation, face mask ventilation, tracheal intubation, and emergence. In this case report, we describe a severe mask ventilation impairment during induction of general anesthesia with a laryngeal mass, which was not very large nor did it cause obstructive signs during spontaneous respiration.

Case Report
A 77-year-old, 165 cm tall, 65 kg, man was referred to our hospital for dysphonia for 2 weeks. He had a medical history of chronic obstructive pulmonary disease (COPD) and Parkinson’s disease with severe cognitive impairment. Flexible nasoendoscopy was performed, and he turned out to have an irregular mass lesion on the larynx [Figure 1]. MRI was taken to establish the surgical plan [Figure 2].

On preoperative evaluation, the patient’s Mallampati score was class I, and there was no evidence of respiratory difficulty or signs of obstruction. Due to patient’s cognitive dysfunction, we excluded awake intubation or tracheostomy prior to anesthetic induction. We decided to perform conventional laryngoscopic intubation with preparing of
videolaryngoscope, supraglottic airway devices, fiberoptic bronchoscopy (FOB), and emergency surgical airway kit. It was also accompanied by sufficient backup anesthesiologists and otolaryngologists.

In the operating room, his pulse oximeter oxygen saturation (SpO₂) was 98%. The face mask fits well to the patient’s face without leakage. After preoxygenation, propofol 40 mg, remifentanil 0.1 µg/kg/min, and 50 mg of rocuronium bromide were administered, and mask ventilation was performed. Soon after, ventilation using a face mask showed an obstructive pattern. The peak airway pressure was checked over 25 cmH₂O, but the tidal volume gained approximately 150–200 mL. An oral airway was inserted, and two-handed bag mask ventilation was attempted. However, the patient’s end-tidal CO₂ was not checked after a while, and tidal volume measurements were not obtained. His SpO₂ gradually decreased to less than 80%, and we quickly attempted conventional laryngoscopic intubation. The Cormack–Lehane grading was graded as grade 1, and the vocal cord could be easily exposed. He was successfully tracheal intubated. Meanwhile, the patient’s SpO₂ was below 70%, showing cyanotic skin color change, but after proper oxygenation through the endotracheal tube, his SpO₂ and skin color recovered to normal. On auscultation, his lung sounds were clear. A nasogastric tube was inserted for decompression of gastric insufflation. The peak airway pressure attained was 12 cmH₂O.

After surgical tracheostomy, total laryngectomy was performed [Figure 3]. After a few days, the patient was discharged without any other complications.

Discussion

Anesthesiologists occasionally encounter patients with laryngeal mass lesions, with or without airway difficulties. Some of them may unexpectedly run into a situation of acute airway obstruction. Although we experienced unexpected ventilatory impairment due to laryngeal mass without preoperative airway obstructive signs, we could avoid the worst scenario through immediate and appropriate management.

Difficult mask ventilation occurs because of an inadequate mask seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.[1] If there is no problem with the mask seal and there is no gas leak, airway obstruction of either the upper or lower airway should be considered. In our patient, the nasal cavity, oral cavity, and pharynx were intact on nasoendoscopic findings. Bronchospasm can be a
possible cause considering the history of COPD, but his lung sound was clear and the airway pressure was within normal limits after intubation. Therefore, it could be inferred that upper airway obstruction due to supraglottic cancer was the cause of this event. We realized that even in a patient with a laryngeal mass that does not obstruct the airway and has no preoperative airway resistance, severe airway obstruction can be caused during anesthetic induction.

Moorthy et al.2 studied evaluation and management methods for securing the airway of patients with various types of laryngeal tumors. They classified airways into four categories based on the FOB findings and clinical symptoms and described airway management in each grade. According to the classification, the patient in this case can be classified as grade 2a (vocal fold visible and laryngeal opening identified with ease), and any intervention including rapid sequence tracheal intubation or fiberoptic intubation is available. Our patient had no symptoms of breathing difficulty, and his laryngeal opening could be easily identified; thus, tracheal intubation could be performed without difficulty. However, there was an unexpected difficulty in mask ventilation, which was not considered in Moorthy’s study. Further studies are needed to determine the incidence, grade, or management of difficult mask ventilation in patients with laryngeal masses.

Some reports have described airway obstruction due to various types of laryngeal mass.3-6 Among them, Zhang et al.6 presented three cases of difficult airway during anesthetic induction. The first case was an unanticipated scenario about failure of both ventilation and intubation, while difficulty in airway management was predicted in the second and third cases, considering large-sized tumor (6 cm), swelling in mandible, inspirational apnea, or neck immobility. Although the first case was similar to our case in that there was no prediction of a potentially difficult airway, our report has a difference in that the tracheal intubation was performed without any difficulty. Our point is that severe impairment of mask ventilation can occur in patients with laryngeal masses, although tracheal intubation is not difficult. In addition, evaluating the patient’s airway using an FOB before anesthesia can be helpful in identifying difficult airway management. However, fiberoptic examination performed by otolaryngologists could be mainly focused on the local lesion, and global visualization of airway structures might not be available.6 Accordingly, it should be noted that difficult mask ventilation can occur; although tracheal intubation may not seem difficult based on FOB findings.

In summary, laryngeal mass lesions can be a cause of difficult airway management during anesthetic induction, including sedation, mask ventilation, and tracheal intubation. It is important to be aware that even a laryngeal mass that remains asymptomatic and does not severely obstruct the patient’s airway during the awake state can cause severe impairment of mask ventilation regardless of the ease or difficulty of tracheal intubation.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Acknowledgements
We would like to thank Editage (www.editage.co.kr) for English language editing.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2013;118:251-70.
2. Moorthy SS, Gupta S, Laurent B, Weisberger EC. Management of airway in patients with laryngeal tumors. J Clin Anesth 2005;17:604-9.
3. Aidonis I, Skalimis A, Kirodimos E. Surgical and anesthetic considerations of laryngeal saccular cyst: A case report. J Med Case Rep 2011;5:283.
4. Nakahira J, Sawai T, Matsunami S, Minami T. Worst-case scenario intubation of laryngeal granuloma: A case report. BMC Res Notes 2014;7:74.
5. Dalmeida RE, Mayhew JF, Driscoll B, McLaughlin R. Total airway obstruction by papillomas during induction of general anesthesia. Anesth Analg 1996;83:1332-4.
6. Zhang X, Cauus O, Zhou Y, Dusitkasem S. Airway management during anesthetic induction of secondary laryngectomy for recurrent laryngeal cancer: Three cases of report and analysis. Front Med (Lausanne) 2018;5:264.