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Case Report

A successful airway management using laryngeal mask airway assisted distal tracheal intubation in patients with severe tracheal stenosis-a case report

Hyungseok Seo[1], Eun-Jin Moon[1], Yong-Heon Choi[1], Jun-Young Chung[1], Dae-Hyun Kim[2], Jae-Woo Yi[1], Bong-Jae Lee[1]

[1]Department of Anesthesiology and Pain Medicine, Kyung Hee University Hospital at Gangdong, Kyung Hee University College of Medicine, Seoul 02447, Korea; [2]Department of Thoracic Surgery, Kyung Hee University Hospital at Gangdong, Kyung Hee University College of Medicine, Seoul, Korea

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Abstract: We report a successful airway management in a patient with severe tracheal stenosis using the laryngeal mask airway (LMA) assisted technique. After anesthesia induction, the patient was temporarily ventilated with LMA, and tracheal intubation was performed distal to the stenotic lesion. After tracheal anastomosis was achieved, a tracheal tube was inserted through the LMA. Finally, the tracheal tube was replaced with an LMA to allow for fiberoptic bronchoscopy to visualize the anastomosis site. We demonstrated that LMA can be a less invasive and useful conduit for temporary ventilation before tracheal intubation, or bronchoscopy in tracheal reconstruction surgery.

Keywords: Tracheal stenosis, airway, laryngeal mask airway

Introduction

Tracheal stenosis is a serious complication of long-term intubation [1]. For anesthesia management in patients with tracheal stenosis, a ventilation strategy for adequate gas exchange is crucial. According to the severity of stenosis, invasive ventilation techniques such as jet ventilator or percutaneous cardiopulmonary support can be required [2]. However, a laryngeal mask airway (LMA) can be used as a safe and efficacious airway management device, even in case of severe tracheal stenosis [3]. In the present case, we described successful airway management using LMA assisted distal tracheal intubation technique in a patient with severe subglottic stenosis.

Case description

A 47-year-old man, 180 cm tall and 69 kg, was scheduled to undergo tracheal resection and anastomosis. Three months earlier, he underwent coronary artery bypass graft surgery and was hospitalized for 1 month. He had a history of prolonged intubation for 13 days.

A computed tomography of the trachea revealed 1 cm-long severe tracheal stenosis 3.5 cm distal from the vocal cords; the narrowest diameter was 4.8 mm (**Figure 1**). Despite the patient having dyspnea on exertion, peripheral oxygen saturation was maintained at 99 to 100% with 2 L/min oxygen supply via nasal prongs. Tracheal intubation was attempted during preoperative bronchoscopy but failed.

Intraoperative monitoring included a 3-lead electrocardiography, pulse oximetry, end-tidal carbon dioxide detection, and invasive arterial blood pressure monitoring at the radial artery. Intravenous etomidate (0.2 mg/kg) was administered to induce anesthesia, and rocuronium bromide (0.6 mg/kg) was given for muscle relaxation. Face mask ventilation was accomplished without incident. LMA assisted distal tracheal intubation technique proceeded by following 4 steps (**Figure 2**): 1) A size 4 Ambu® AuraGain™ LMA (Ambu Inc., Glen Burnie, MD, USA) was inserted at the first attempt using the standard insertion technique, and the cuff was inflated with 30 ml of air. Anesthesia was

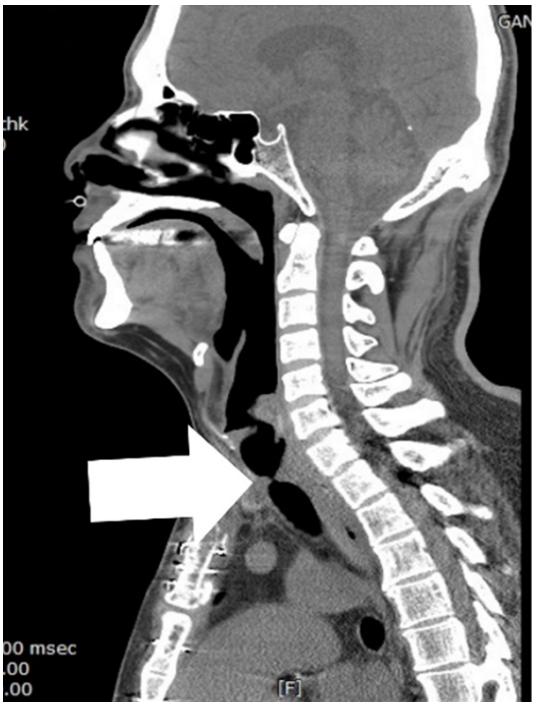

Figure 1. Preoperative head and neck computed tomography. The patient exhibited an extrathoracic tracheal stenosis (A white arrow).

maintained with sevoflurane and continuous infusion of remifentanil. The patient was ventilated with a tidal volume of 6 ml per an ideal body weight, and the respiratory rate was adjusted to maintain end-tidal CO_2 between 35 and 40 mmHg. 2) After LMA insertion, the tracheal stenosis site was visualized with a fiberoptic bronchoscope, and the surgeon could localize the stenotic area in the surgical field by the light emitted by the bronchoscope. After dissection of distal cricoid cartilage and proximal trachea, the trachea was opened distal to the stenosis, and a sterile reinforced tube (internal diameter, 6.0 mm) was placed in the lower trachea (**Figure 3**). Then, patient was ventilated via distal tracheal tube, and the stenotic lesion including distal cricoid cartilage was resected. 3) When end-to-end anastomosis was achieved, a silastic tracheal tube (internal diameter, 6.0 mm) was inserted via the LMA, and the distal tracheal tube was removed. An air leakage test on the anastomotic line and bleeding control were performed. 4) Before wound closure, the tracheal tube was replaced with an LMA for visualization of the anastomosis site with fiberoptic bronchoscopy.

After the surgery, 200 mg sugammadex was administered to reverse the neuromuscular blockade. As soon as the patient became fully conscious, the LMA was removed. The patient was transferred to the intensive care unit and discharged on postoperative day 8. Follow-up bronchoscopy was performed on postoperative day 12, and there were no complications.

Discussion

Airway management for tracheal resection is complex and hazardous [2]. Various ventilation techniques have been described including jet ventilation [4], percutaneous cardiopulmonary support [5], distal tracheal intubation [6].

The jet ventilation technique consists of placing the jet cannula below the stenotic area. Although jet cannula can pass the stenotic area and induce a successful ventilation, jet ventilation has risks such as barotrauma, inadequate gas exchange in patients with severe lung pathology, and necrotizing tracheobronchitis [7].

Although percutaneous cardiopulmonary support can ensure gas exchange, systemic anticoagulation increases the risk of bleeding, especially if the dissection is extensive; injury to other organs such as the lung or kidney is also possible. Thus, it should be used only when the trachea is almost completely blocked or no other method is available.

Distal tracheal intubation consists of initial oro-tracheal intubation with the cuff placed above the stenotic area and subsequent placement of a second tracheal tube below the stenotic area through the cervical surgical incision. When resection is complete, the second distal tube is removed, and the initial proximal tube is advanced into the distal trachea to allow completion of the anastomosis. Problems associated with this technique are: 1) The gap between the vocal cords and the stenotic area can be too short to accommodate the cuff of a tracheal tube, 2) The tracheal tube can cause coughing on emergence, which can threaten the surgical anastomosis, and 3) The inflated cuff of the tracheal tube can compromise blood flow to the tracheal mucosa, which might hinder healing of the surgical anastomosis [8].

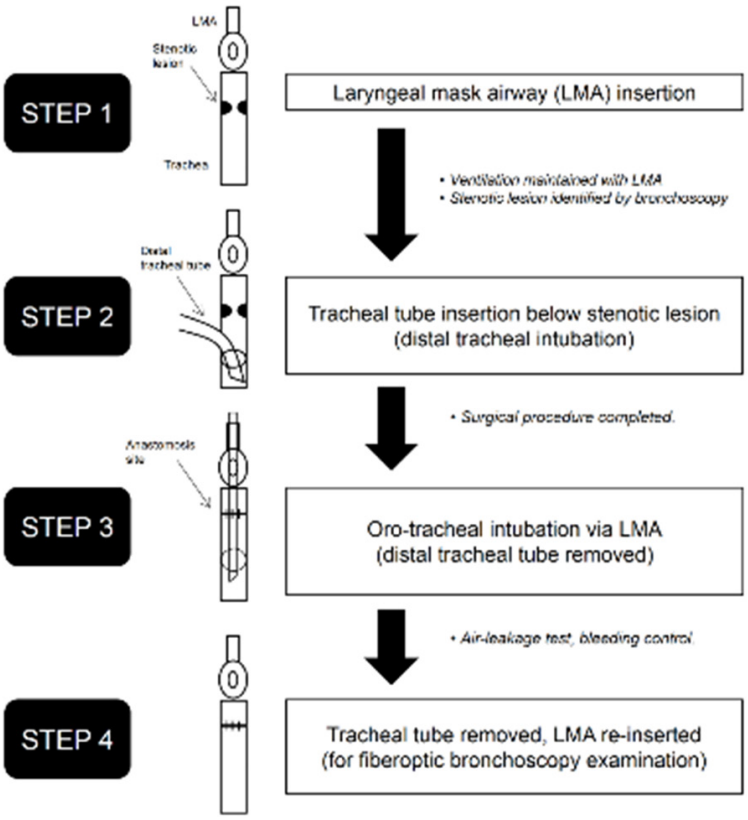

Figure 2. Summary of the laryngeal mask airway assisted distal tracheal intubation technique.

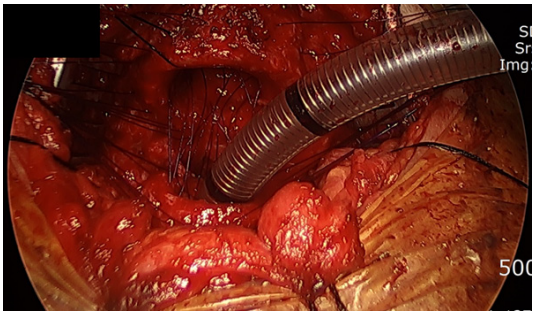

Figure 3. Direct tracheal tube insertion at the distal site of the tracheal stenosis.

In the present case, we devised an alternative method. Although patient had a severe subglottic stenosis, he had been able to breathe spontaneously and we decided to maintain his normal airflow with minimal intervention. Thus, we inserted LMA and provided a consistent airflow during distal tracheal tube insertion by surgical manipulation. In this case, LMA served as an airway conduit and well supported patient's physiological airway structure less invasively. Moreover, by using the LMA as a conduit, we could avoid direct tracheal stimulation and impairment of tracheal mucosal blood flow [8]. In previous reports, LMA also provided an effective ventilation during endoscopic tracheal surgery using CO_2 laser and in a pediatric patient [9, 10]. This LMA assisted technique is thought to be particularly advantageous when the distance between the vocal cords and the stenotic area is too short or when smooth emergence is required. However, in using the LMA for tracheal surgery, there can be risks of aspiration and ventilatory insufficiency due to air leaking around the LMA cuff. Moreover, like other cases of using supraglottic airways, the LMA does not completely secure the airway, so it is not capable of fully responding in cases of unanticipated airway blockages in subglottic stenosis. In such cases, another airway management strategy such as percutaneous cardiopulmonary support should be prepared. Although the LMA assisted distal tracheal intubation technique does not represent a perfect airway management strategy, it is a simple, less invasive, and easily available method. Therefore, it can serve as an alternative airway management method in tracheal reconstruction surgery.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Jae-Woo Yi, Department of Anesthesiology and Pain Medicine, Kyung Hee University College of Medicine, 26, Kyungheedae-ro, Dongdaemun-gu, Seoul 02447, Korea. Tel: 82-2-440-7809; Fax: 82-2-440-7808; E-mail: mdyjwchk@khu.ac.kr

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