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Case Report

Successful anesthetic management of a patient with thyroid carcinoma invading the trachea with tracheal obstruction, scheduled for total thyroidectomy

Jing-Yang Liou, Lok-Hi Chow, Kwok-Hon Chan, Mei-Yung Tsou*

Department of Anesthesiology, Taipei Veterans General Hospital, National Yang-Ming University School of Medicine, Taipei, Taiwan, ROC

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Abstract

We report a case of large thyroid carcinoma with tracheal and esophageal invasion who presented with preoperative stridor scheduled for total thyroidectomy and segmental tracheal resection. Careful and comprehensive preoperative anesthetic planning was done. Extracorporeal circulation membrane oxygenation (ECMO) was set up and running prior to induction under local anesthesia, due to an increased international normalized ratio (INR) and fear of bleeding in the airway. Fiberoptic bronchoscopy (FOB) is the first choice in many circumstances of difficult airway. However, we twice failed to intubate under FOB guidance. Successful intubation was done with traditional laryngoscopy and a Glidescope. The operative course was smooth. The oral endotracheal tube (ETT) was changed to a nasal ETT after surgery with the Glidescope. FOB-assisted intubation carries a chance of failure, and in critical patients, the presence of other intubating modalities such as video-assisted or fiberoptic-assisted technology or safety measures, including ECMO, will greatly increase the safety of anesthesia and surgery.

Keywords: extracorporeal membrane oxygenation; fiberoptic bronchoscopy; tracheal tumor

1. Introduction

Endotracheal tumors always pose a challenge to anesthesiologists. Thyroid carcinoma is not uncommon and carries a 1–13% chance of complication with tracheal invasion,[1,2] which is the major cause of mortality in such a population. Various methods for airway management during anesthesia for endotracheal tumor have been described.[4,13–17] Here, we describe successful anesthetic management in a patient with thyroid cancer and tracheal invasion.

2. Case Report

A 76-year-old male, who weighed 67 kg and was 167 cm tall, had a medical history of bipolar disorder, chronic atrial fibrillation under warfarin and verapamil control, and hyperthyroidism with transformation to hypothyroidism receiving levothyroxine supplement. He had received colonic resection for cancer in August 2008; at that time, no anesthetic problem was encountered. He had experienced intermittent dysphagia and shortness of breath in the past 10 years, but ignored it and had not sought any medical help. Progressive dyspnea and hemoptysis developed 2 years after the colonic resection, and the patient came to our emergency department (ED), where a hard neck mass and respiratory distress with stridor were identified. A computed tomography (CT) scan showed a huge mass lesion (7.2 cm × 7.2 cm) over the left neck, with extension into the superior mediastinum and trachea, causing

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* Corresponding author. Dr. Mei-Yung Tsou, Department of Anesthesiology, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, ROC.

E-mail address: mytsou8095@gmail.com (M.-Y. Tsou).

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marked narrowing and deviation of the trachea. The narrowest segment of the trachea measured 0.38 cm, and the tumor was located 7.32 cm above the carina, spanning 2 cm in length (Fig. 1). In addition, bronchoscopy done by a thoracic surgeon revealed a mass nearly occluding the trachea about 2 cm below the vocal cords (Fig. 2). No attempt to bypass the narrowed segment of the trachea was made due to an increased international normalized ratio (INR) of 2.31. Thyroid carcinoma was diagnosed after needle biopsy under local anesthesia in the ED. Thyroidectomy and tracheal resection were scheduled by general and thoracic surgeons.

A cardiovascular surgeon was consulted for extracorporeal mechanical oxygenation (ECMO) placement under local anesthesia on the day of the operation for possible massive bleeding from the endotracheal tumor mass after intubation, due to an increased INR. A venovenous mode ECMO via bilateral femoral veins was smoothly placed. Baseline activated clotting time was 202 seconds, and no further heparin was given. After setting up the ECMO machine and monitors, including an arterial line, epinephrine 0.3 mg and 2% lidocaine (5 mL) for inhalation, intravenous dexamethasone 10 mg, tramadol 100 mg, and oral clonidine 150 μg were given to the patient before induction. Arterial blood gas (ABG) analysis showed pH 7.435, PaO_2 92 mmHg, and $PaCO_2$ 37 mmHg under room air. Fiberoptic bronchoscopy (FOB) performed before induction revealed a small pathway, located anterior to the broad-based fixed tumor, which might provide a passage for an endotracheal tube (ETT). Laryngoscopic examination revealed a Mallampati-IV airway. A two-anesthesiologist technique was initially performed, with one handling the classic 3.0 Macintosh laryngoscope (Timesco Sirius, London, England) and 5.5-mm-ID (internal diameter) cuffed ETT threaded with a white malleable stylet, while the second anesthesiologist focused on the FOB view and orally guided the orientation of the ETT controlled by the first anesthesiologist. Because the lesion was only 2 cm below the vocal cords, the one performing the FOB had to maintain its stability to prevent sliding back out the vocal cords. However, by doing so, mobility for both anesthesiologists was limited and intubation failed. A second intubation attempt was then performed with awake laryngoscopic intubation after molding the stylet, which made the tip of the ETT point anteriorly. After successful intubation, FOB examination was done again to ensure ETT bypass of the stenotic portion and the extent of bleeding. Minimal bleeding was observed. The patient was anesthetized by further intravenous administration of fentanyl 150 μg, lidocaine 60 mg, propofol 90 mg, and rocuronium 50 mg, and maintained with sevoflurane. Oral ETT was secured at 25 cm at mouth angle. The ventilator was set to a tidal volume of 450 mL, at 5 breaths/minute due to partial support of the ECMO. Reanalysis of ABG at 30 minutes after induction showed pH 7.526, PaO_2 207.1 mmHg, and $PaCO_2$ 26 mmHg at 60% FiO_2. Readjustments of the ventilator settings were made.

After proper positioning of the patient, the operation was performed by both general and thoracic surgeons. The general surgeons removed the bulk of the thyroid. Intraoperative findings showed tumor invasion of the first to third tracheal

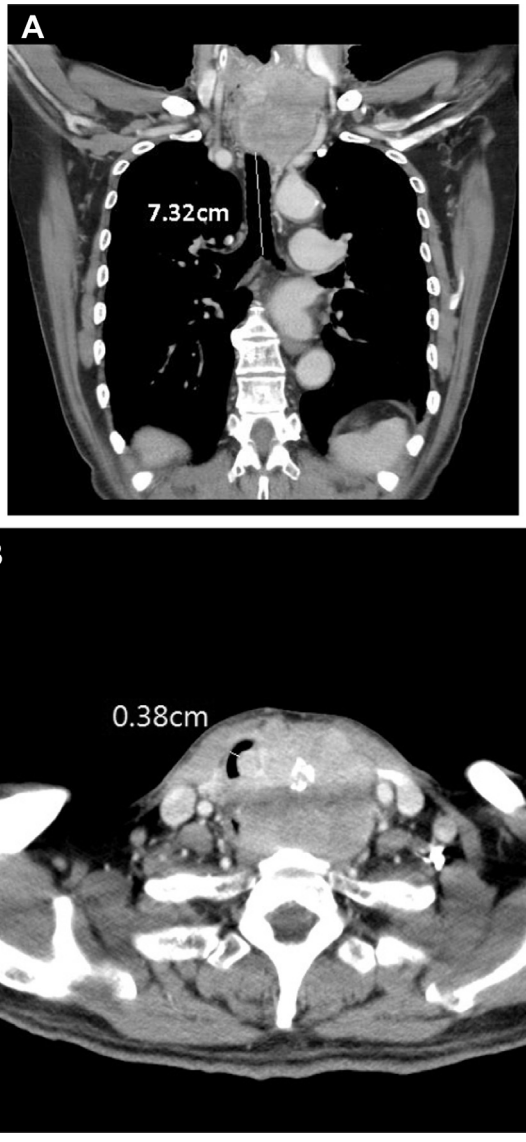

Fig. 1. Computed tomography (CT) scan of the neck and chest. (A) Coronal section shows the tumor lying 7.32 cm above the carina and causing significant airway obstruction; (B) horizontal section shows the narrowest point of the trachea measuring 0.38 cm. Rightward deviation of the trachea is observed.

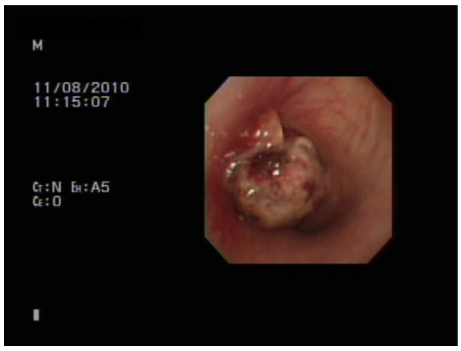

Fig. 2. Bronchoscopy reveals intratracheal mass nearly totally occluding the trachea. Further inspection beyond the tumor was precluded due to fear of bleeding.

rings and esophagus, which were resected and repaired with primary closure by the thoracic surgeons. At the end of the surgery, the patient's head was fixed at a flexed position to facilitate tracheal healing and prevent tearing of the anastomoses. Meanwhile, nasal ETT intubation was requested by the surgeons for postoperative patient comfort in the intensive care unit (ICU). Due to suboptimal positioning of the neck, a Glidescope (Saturn Biomedical Systems, Burnaby, BC, Canada) was used to guide the exchange. Glidescope examination was done before extubation of the oral ETT to ensure adequate visualization of the vocal cords. A 7.0-mm-ID nasal ETT was placed successfully and confirmed by end-tidal CO_2. ECMO was weaned in the operation room and the patient sent to the ICU. The patient was extubated 3 days later and transferred to a ward 5 days after surgery. Turbid fluid in the drainage was observed and minor esophagus leakage was suspected. It was treated medically, and after 30 days, the patient was discharged. Pathology confirmed the diagnosis of thyroid papillary carcinoma.

3. Discussion

Here, we present a successful anesthetic management of thyroid papillary carcinoma invading the trachea with tracheal obstruction, scheduled for total thyroidectomy. ECMO was placed before induction and intubation for fear of tumor bleeding by intubation due to an increased INR.

Tracheal invasion by thyroid cancer is not uncommon. Every so often, anesthesiologists come face to face with such a clinical challenge. Preoperative bronchoscopy was performed in our patient; no attempt to bypass the lesion was made due to an extremely narrowed tracheal lumen. Airway challenges occurred twice during the entire anesthetic course: one was during induction, and the second was immediately before emergence. The first was successfully managed after FOB examination and direct laryngoscopy. The second airway challenge occurred after the conclusion of the surgery, because the neck was fixed in an extremely flexed position and nasal ETT intubation was requested by thoracic surgeons. Initially, FOB-assisted intubation was attempted, but proved difficult due to suboptimal positioning and loss of pharyngeal muscle tone. Three anesthesiologists tried and failed. While the oral ETT was still in place, Glidescope examination was performed and served as a guide toward the vocal cords. A nasal 7.0 mm ETT was then placed smoothly.

Initially, we did not adopt awake FOB nasal intubation, because the patient had prolonged INR. Bleeding from a mucosal injury is a very common complication during nasal intubation. Excessive bleeding is unwanted and may severely interfere with subsequent intubation.

Awake fiberoptic intubation is the gold standard in anticipated difficult airways.[3,4] In our case, FOB failed twice and intubation was carried out with other modalities. FOB-assisted intubation carries a certain failure rate in difficult airways, even reaching 66% in one report.[4] However, it is a technique that requires training and experience. A well-organized placement under experienced hands may greatly improve the success rate.

Recent literature suggests that video-assisted devices can be incorporated into the difficult airway algorithm to improve patient outcome, either in anesthesia[5] or prehospital emergencies.[6] With the advent of video devices, a great variety of choices is available during airway management. Video devices increase the success rate of intubation, especially by specialists that do not frequently perform classic laryngoscopic intubation.[7,8] Even when the oral, pharyngeal, and tracheal axis cannot be aligned, these devices may ease the effort for intubation.[9] In our case, despite the fixed flexion posture of the neck, the patient's airway was successfully managed with a Glidescope.

Emergent tracheostomy is considered a definitive treatment for significant situations of difficult airway and possible loss of airway situations.[10,11] In our case, emergent tracheostomy was not prepared due to the enlarged thyroid mass and deviated trachea. The process seemed to be difficult, or even impossible, complicated by bleeding diathesis.

For patients with large thyroid cancer, airway management can be complicated by both regional invasion and intrathoracic extension, due to mass effect on the airway and major vessels. The tissue of regional invasion may occupy with tracheal, esophageal, or even atrial areas.[12] Many different methods to manage tracheal tumors, including awake intubation with or without extracorporeal circulation assistance, laryngeal mask airways,[14,15] a tracheal stent, high-frequency jet ventilation,[13] or even regional anesthesia, if the airway is not the site of surgery,[16] have been reported in the literature. On rare occasions, intubation must be performed in various positions, including sitting or even lateral decubitus.[17]

ECMO set up prior to induction is advised, but not necessary, and it is a decision made jointly by experienced anesthesiologists, general surgeons, and thoracic surgeons. ECMO placement takes time, and if installed after an airway catastrophe has occurred, it may be insufficiently fast enough to avoid hypoxic brain injury. Reports have suggested that extracorporeal assist devices may be kept on standby if the airway tumor is limited to one main bronchus.[18] The setup and maintenance of ECMO are not without risks. Potential risks include vascular injury, puncture site bleeding, bleeding caused by heparinization, air or thrombotic emboli, lipid deposition on the oxygenator membrane from propofol infusion and sequestration of other drugs in the circuit,[19] and mechanical failure resulting in hypoxia. Provided with such resources, we carefully selected ECMO before induction after weighing the risks and benefits of the procedures.

Airway protection is still needed to prevent blood from flooding the lungs and aspiration of gastric contents or saliva. Intubating the trachea after anesthesia is more dangerous, because loss of smooth muscle tone will decrease the diameter of the patent lumen and thus increase the risk of bleeding.

In conclusion, we successfully managed a case of thyroid carcinoma with tracheal invasion and resultant stridor. FOB intubation is the first choice in anticipated difficult airways, but it also carries a low failure rate. Presence of video-assisted airway devices and ECMO[20–22] will greatly increase the safety profile during anesthesia if prepared in advance.

Practice of different modalities for airway management should be carried out in either daily practice, or simulation sessions, thus ensuring a higher success rate of difficult intubation when actually needed.

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