Am J Transl Res 2022;14(4):2497-2500
www.ajtr.org /ISSN:1943-8141/AJTR0140877

Case Report

Awake fiberoptic intubation in a patient with a large thyroid tumor invading the trachea: a case report

Guo Ran[1*], Meng Ning[2*], Xu Zhang[1]

[1]Department of Anesthesiology, The Eye and ENT Hospital of Fudan University, Shanghai, P. R. China; [2]Department of Anesthesiology, The First Affiliated Hospital of Anhui Medical University, Hefei, Anhui Province, P. R. China. [*]Equal contributors.

Received December 30, 2021; Accepted March 22, 2022; Epub April 15, 2022; Published April 30, 2022

Abstract: This case report aims to raise awareness about the risk of challenging airway problems in patients with thyroid tumors. We report a case of a patient with a large thyroid tumor invading the trachea, causing trachea narrowing and resulting in breathing difficulties, who required awake tracheal intubation (ATI). A 54-year-old woman underwent surgery for the removal of a thyroid tumor under general anesthesia. The tumor was invading and compressing the trachea, causing difficulty in breathing. To facilitate surgery, thyrocricocentesis and nerve block were considered, but they were difficult to implement. Extracorporeal membrane oxygenation (ECMO) is expensive and has risks of several complications, such as failure of the oxygenation membrane, rupture of the circuit, coagulation of the system, intracranial hemorrhage, acute kidney injury, and infections. The placement of a tracheal stent may worsen airway problems. In this case, the airway was established without ECMO or tracheal stent placement. Local anesthesia of the airway could be an alternative to avoid expensive options and complications, as successful ATI would reduce healthcare costs.

Keywords: Awake tracheal intubation, fiberoptic intubation, thyroid tumor, trachea, case report

Introduction

Thyroid cancer is a common endocrine malignancy, and its incidence has been increasing for nearly three decades in most developed countries, although the overall mortality has decreased [1, 2]. Patients with advanced stage thyroid cancer often have difficulty in breathing as the thyroid tumor presses on the trachea. However, little research has been conducted on the risk of malignant thyroid tumors invading the trachea, which can cause trachea narrowing and breathing difficulties. Thus, we report a case of successful awake tracheal intubation (ATI) in a patient with a large thyroid tumor.

Case description

A 54-year-old woman, who consented to the reporting of this case, presented with a thyroid tumor in May 2021, which involved the trachea. On admission, the patient reported repeated dyspnea for 5 years and aggravation for more than 10 days. Ultrasound examination revealed a thyroid tumor that needed immediate surgery. Computerized tomography (CT) scan showed that the trachea was significantly compressed, and the patient could not breathe lying on her back. The tracheal stenosis caused by tumor invasion was located at C7 to T1 and was only 2 mm wide at its narrowest point and 3 cm long (**Figure 1A** and **1B**). Three-dimensional reconstruction of CT images with minimum intensity projection clearly showed the stenosis of the airway (**Figure 1C**). The patient's medical history included hypertension, which was controlled by medication. Preoperative fiberoptic laryngoscopy revealed that the tumor invaded and protruded into the trachea under the glottis (**Figure 1D**).

Once in the operating room, the patient was placed at 30° head up, and supplemental oxygen was given by mask at a rate of 5 L/min. Standard monitoring was performed; the BP was 134/81 mmHg; the heart rate (HR) was 86

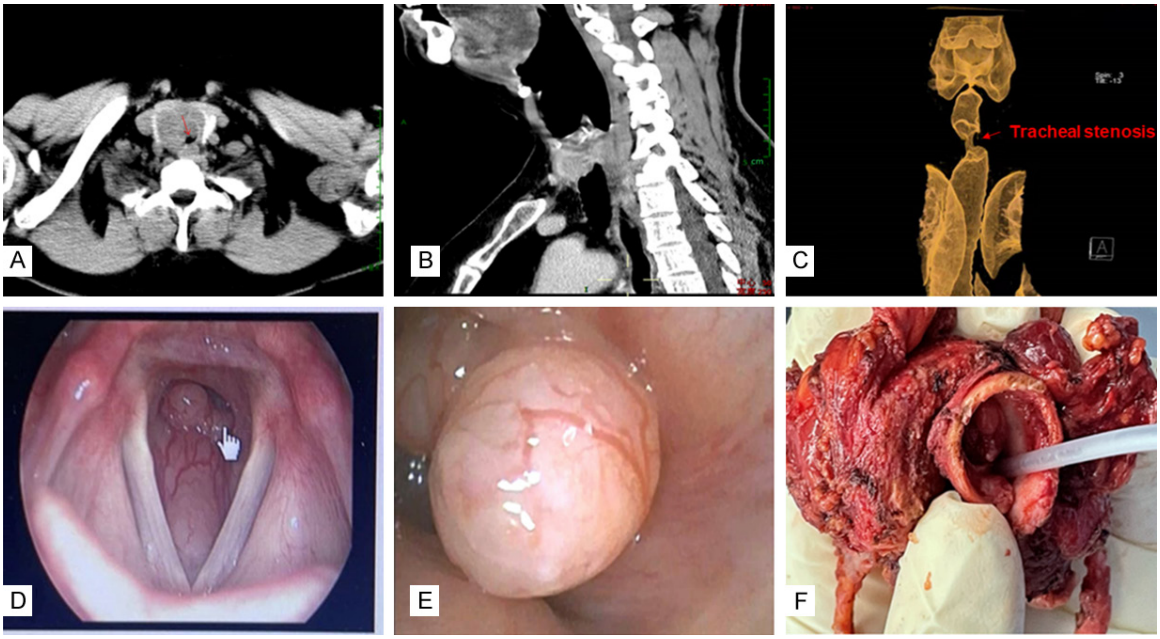

Figure 1. (A) CT scan, transverse section; (B) CT scan, sagittal plane; (C) Three-dimensional reconstruction of CT images with minimum intensity projection (Min-IP); (D) Preoperative laryngoscopy image; (E) Fiberoptic laryngoscopy image during intubation; (F) Postoperative specimen. The patient's CT imaging and three-dimensional reconstruction demonstrated that the trachea was significantly compressed by the tumor, as shown by the arrows in (A-C). The mass can be seen under the glottis by fiberoptic laryngoscopy (D, E). Postoperative anatomy showed that the tumor was compressing the airway, and the space to pass through was very narrow, only enough to accommodate a sputum suction tube (F).

beats per minute, and oxygen saturation (SpO_2) was 99%. After obtaining venous access, dexmedetomidine was infused at a rate of 0.7 μg/kg within 10 min and delivered using an infusion pump. Topical anesthesia of the larynx was achieved with 2% lidocaine by throat spray in three doses: 2 mL each time, over 3 min each. Local anesthetic was sprayed on the tongue, epiglottis, glottis, and oropharynx.

Once the patient was unable to feel discomfort when a sputum suction tube was passed, fiberoptic bronchoscopy commenced. When the bronchoscope reached the glottis, 2 mL of 2% lidocaine was administered through the working channel, and then local anesthesia of the subglottic trachea was achieved. After 2 min, when the local anesthetic had begun to take effect, the fiberoptic bronchoscope passed through the epiglottis, and a circular neoplasm under the glottis was observed (**Figure 1E**). The narrowest point was observed along the left side of the tumor, which was in agreement with the CT, and 2 mL of local anesthesia (1.5 mL of 1% tetracaine and 0.5 mL of 0.01% norepinephrine) was sprayed into the airway.

After 2 min, the patient was instructed to cough gently to expose the glottis, and the bronchoscope successfully crossed the narrowest point and reached the tracheal juga. A 5.5 mm endotracheal tube (ETT) was guided smoothly through the stenotic site over the bronchoscope. After the end-tidal carbon dioxide ($ETCO_2$) waveform was confirmed, induction drugs were given intravenously and immediately, and then surgery commenced. The vital signs were stable: BP of 145/95 mmHg, HR of 78/min, and SpO_2 of 98%. The operation lasted for approximately 7.5 h, and the patient recovered uneventfully.

Discussion

ATI involves placing ETT in an awake, spontaneously breathing patient, most commonly with flexible bronchoscopy. This method allows the airway to be secured before induction of general anesthesia, avoiding the potential risks and consequences of difficult airway management in an anesthetized patient [3]. A thyroid malignancy may make the airway difficult to manage, particularly when the tumor invades

the airway and causes dyspnea. Therefore, establishing an airway is a challenge for anesthesiologists. In this case, establishing an airway was completed without using ECMO or a tracheal stent, and our experiences of the case are summarized in the following discussion.

In this case, postoperative anatomy showed that the space of stenosis to pass through was only enough to accommodate a sputum suction tube (**Figure 1F**). ECMO is expensive, and it has several complications during ECMO, such as failure of the oxygenation membrane, coagulation of the system, intracranial hemorrhage, acute kidney injury and infections [4, 5]. Tracheal stent may help in particular cases [6]. However, we do not have facilities to perform such a procedure. ATI may be the preferred solution, but if the process is difficult or has to be repeated a number of times, any further airway swelling or bleeding may increase the difficulty of establishing an airway. Therefore, dynamic evaluation of the airway should be performed by an experienced anesthesiologist. If the airway is lost, then an alternative airway technique may be required, such as low tracheotomy and delayed surgery. Malpas et al. [7] reported a case of a large and extensive thyroid tumor with only 1 mm subglottic stenosis. The authors chose to establish ECMO before intravenous induction; endotracheal intubation was attempted, but it failed. In the current case, patient's brachiocephalic trunk was deformed and compressed on the trachea ring of C6 and T1. The brachiocephalic trunk could have been easily injured once dissection commenced. Tracheomalacia and collapse resulting from the enlargement of the thyroid gland is common. Predicting and determining the possibility of compressed trachea collapse in advance can avoid the risk of tracheomalacia in patients [8].

ATI is a safe airway management strategy for patients with potential technical difficulties in intubation and ventilation [9]. However, it can lead to unnecessary gag reflex and distress when topical anesthesia is not performed appropriately. Constant communication with the patient was essential for reassurance. In addition, a good relationship should be established with the patient to provide encouragement and help build up confidence and cooperation with the procedure. Supplemental oxygen was administered through a bite pad, and no episodes of desaturation were observed. Local anesthesia was administered to obtain full topical anesthesia, particularly to the laryngopharynx and airway. Fiberoptic intubation should be performed gently. Although the narrowest part of the trachea was smaller than the outer diameter of the ETT, the tumor was soft in texture, and the stenosis had good extensibility. The bronchoscope passed through it successfully, and ETT could therefore be inserted into the airway over a bronchoscope, without airway injury or bleeding.

Therefore, ATI has a high success rate and a favorable safety profile, but it is underused in cases of anticipated difficult airway management. Good anesthetic technical skills, a cooperative patient, and adequate topical anesthesia are the three vital components for a successful ATI. ECMO and tracheal stent can also address a number of difficult airway problems [4, 5]. However, a successful ATI could reduce the cost, complications, and the risk of invasive procedures in patients.

Acknowledgements

Assistance with the letter: The authors thank Dr. Naier Lin (Department of Radiology, The Eye and ENT Hospital of Fudan University, Shanghai, P. R. China) for her help in three-dimensional reconstruction of CT images with minimum intensity projection (Min-IP) data analysis.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Guo Ran, Department of Anesthesiology, The Eye and ENT Hospital of Fudan University, Shanghai 200000, P. R. China. Tel: +86-17717403927; E-mail: ranguo@eentanesthesia.com

References

[1] Mirian C, Grønhøj C, Jensen DH, Jakobsen KK, Karnov K, Jensen JS, Hahn CH, Klitmøller TA, Bentzen J and Von Buchwald C. Trends in thyroid cancer: retrospective analysis of incidence and survival in Denmark 1980-2014. Cancer Epidemiol 2018; 55: 81-87.

[2] Pellegriti G, Frasca F, Regalbuto C, Squatrito S and Vigneri R. Worldwide increasing incidence of thyroid cancer: update on epidemiology and

risk factors. J Cancer Epidemiol 2013; 2013: 965212.
[3] Cook TM. Strategies for the prevention of airway complications - a narrative review. Anaesthesia 2018; 73: 93-111.
[4] Hadaya J and Benharash P. Extracorporeal membrane oxygenation. JAMA 2020; 323: 2536.
[5] Xi FC, Song YQ, Li WQ and Yu WK. Extracorporeal membrane oxygenation would provide a new approach to anesthesia for giant thyroid tumor resection: a case report. Asian J Surg 2020; 43: 1123-1125.
[6] Avenia N, Vannucci J, Monacelli M, Lucchini R, Polistena A, Santoprete S, Potenza R, Andolfi M and Puma F. Thyroid cancer invading the airway: diagnosis and management. Int J Surg 2016; 28 Suppl 1: S75-78.
[7] Malpas G, Hung O, Gilchrist A, Wong C, Kent B, Hirsch GM and Hart RD. The use of extracorporeal membrane oxygenation in the anticipated difficult airway: a case report and systematic review. Can J Anaesth 2018; 65: 685-697.
[8] Li N, Zhu L, Sun J, Pan Y and Gao M. Difficulty in tracheal extubation followed by tracheal collapse after balloon dilatation for tracheal stenosis therapy: a case report. Medicine (Baltimore) 2018; 97: e10907.
[9] Collins SR and Blank RS. Fiberoptic intubation: an overview and update. Respir Care 2014; 59: 865-878.