

The Awake Tracheostomy Approach for Difficult Airway Management in a Thyroid Carcinoma Patient with Severe Tracheal Lumen Narrowing: A Case Report

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Abstract

Background: Invasive thyroid carcinoma that compresses or infiltrates the trachea poses a significant challenge for anesthesiologists due to the high risk of difficult ventilation and intubation. Central airway obstruction can rapidly progress to a "cannot intubate, cannot oxygenate" (CICO) scenario upon induction of general anesthesia.

Case Presentation: We present a case of a 55-year-old female with a right T4aN1bM1 (lung) papillary thyroid carcinoma. She had a history of left isthmulobectomy and presented with a progressively enlarging neck mass, hoarseness, and stridor. Preoperative CT scan revealed a large mass destroying the cricoid cartilage and infiltrating the trachea, reducing the tracheal lumen to a critical 2.5 mm x 7.7 mm. Due to the severe airway compromise and the risk of bleeding from tumor manipulation, an awake tracheostomy under local anesthesia was performed as the definitive airway management strategy before inducing general anesthesia. The procedure was successful, and the patient underwent total thyroidectomy and right functional neck dissection.

Conclusion: In cases of severe tracheal stenosis secondary to invasive thyroid carcinoma, where conventional awake intubation techniques carry a high risk of failure or precipitating total obstruction, awake tracheostomy is a safe and reliable definitive airway management strategy.

Keywords: Difficult airway, awake tracheostomy, thyroid carcinoma, tracheal stenosis, airway management.

Introduction

Airway management is a cornerstone of anesthesiology, involving the evaluation, planning, and execution of procedures to maintain or restore a safe and effective pathway for oxygenation and ventilation [1]. Patients with severe airway obstruction, particularly those with invasive neck masses such as thyroid carcinoma, present a profound clinical challenge. These masses can compress or infiltrate the trachea, leading to central airway obstruction, making both mask ventilation and tracheal intubation exceedingly difficult or impossible [2].

According to the American Society of Anesthesiologists (ASA) Practice Guidelines for the Management of the Difficult Airway, a difficult airway includes situations in which a trained practitioner has difficulty with facemask ventilation, direct laryngoscopy, supraglottic airway device (SAD) placement, or tracheal intubation [3]. Preoperative airway assessment using mnemonics like MOANS (Mask seal, Obesity/Obstruction, Age > 55, No teeth, Stiff lungs/Snoring) and LEMON (Look externally, Evaluate 3-3-2 rule, Mallampati score, Obstruction, Neck mobility) can help identify potential difficulties [4,5].

In cases where difficulty with both ventilation and intubation is anticipated, awake intubation techniques are often indicated. However, in the presence of critical tracheal stenosis and a friable tumor, blind techniques or awake fiberoptic intubation (AFOI) may precipitate total airway obstruction or severe bleeding [6]. In such perilous scenarios, awake tracheostomy may be the safest route to secure a definitive airway before inducing general anesthesia [7].

The management of an anticipated difficult airway requires a comprehensive approach that considers the patient's clinical condition, airway anatomy, severity of obstruction and available expertise. The American Society of

Anesthesiologists (ASA) Practice Guidelines for Management of the difficult airway emphasize the importance of developing an airway management strategy before initiating anesthesia, particularly in patient with an anticipated difficult airway and an increased risk of complications if ventilation or intubation fails[8]. This case report describes the successful management of a difficult airway using an awake tracheostomy in a patient with a massive, invasive thyroid carcinoma and critical tracheal narrowing.

Case Presentation

A 55-year-old female (weight 55 kg, height 157 cm) presented with a right-sided neck mass, hoarseness, and dyspnea on exertion. She had a history of a left isthmulobectomy performed in February 2024 for papillary thyroid carcinoma. By January 2025, a new mass appeared on the right side of her neck, which progressively enlarged to 5 x 4 cm. She reported no history of allergies, asthma, diabetes, or hypertension. Preoperative physical examination revealed an airway compromised by a visible neck mass, hoarseness, and stridor. Her respiratory rate was 20 breaths/minute with oxygen saturation at 98% on room air. There was no retraction, but she reported difficulty taking deep breaths.

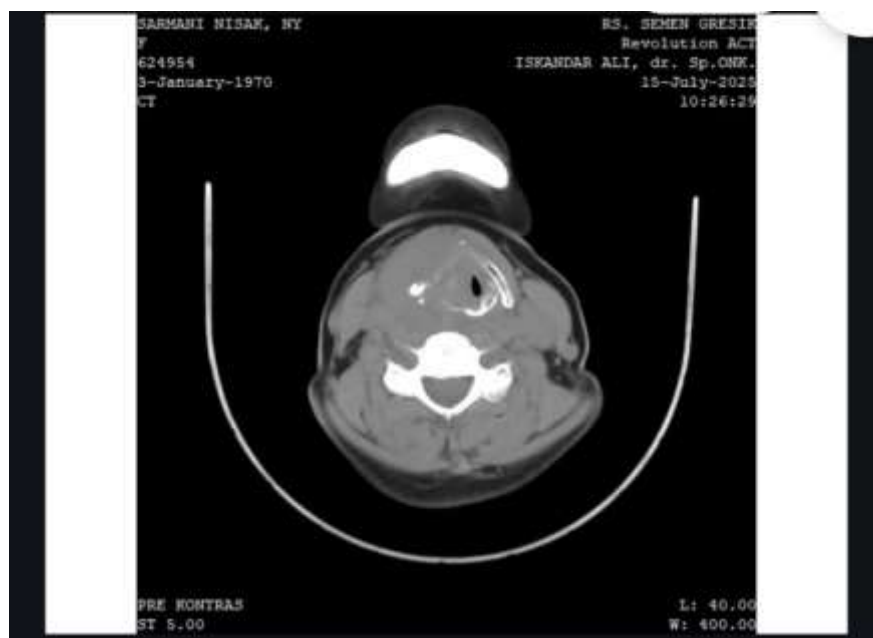


Fig 1. Right-sided thyroid carcinoma, measuring approximately 35.3 x 41.2 mm, which destroys the cricoid cartilage and infiltrates the trachea and rima glottidis, causing narrowing of the trachea.

Airway assessment identified multiple predictors of a difficult airway:

Assessment Tool	Findings	Clinical Implication
MOANS Score	2/5 (Age > 55, Incomplete dentition)	Predicts potentially difficult mask ventilation
LEMON Score	6/10 (Neck mass, Mallampati III, Mouth opening 3 fingers)	Indicates anticipated difficult intubation

Assessment Tool	Findings	Clinical Implication
Cervical CT	Critical luminal stenosis (2.5 mm x 7.7 mm)	Infiltration & destruction of cricoid cartilage; high risk of tumor hemorrhage
Chest X-Ray	Multiple right lung nodules, left parahilar opacity	Suggestive of distant pulmonary metastasis
ASA Physical Status	Class III	Severe systemic disease secondary to metastatic carcinoma

The planned surgical intervention was a total completion thyroidectomy. Given the critical tracheal narrowing and the anticipated difficult airway (both difficult to ventilate and intubate), the anesthesia plan was to secure the airway via an awake tracheostomy under local anesthesia, followed by general anesthesia.

Anesthetic Management



Upon arrival in the operating room, the patient's vital signs were stable (BP 128/72 mmHg, HR 90 bpm, SpO₂ 99% on room air), though stridor was present. The patient was provided with non-pharmacological premedication, reassured, and maintained on spontaneous breathing with supplemental oxygen via nasal cannula at 3 L/min. Preparation for a difficult airway was paramount. The operating room was equipped with a video laryngoscope, flexible fiberoptic bronchoscope, SADs (LMA), oral and nasal airways, and a cricothyroidotomy set. A tracheostomy was performed by the surgical team under local anesthesia while the patient was awake and spontaneously breathing. After visualizing the tracheal lumen, the team inserted a sterile, non-kink 7.0 ETT directly into the trachea through the tracheostomy site. The cuff was inflated, and bilateral precordial auscultation confirmed symmetrical breath sounds. Only after the airway was definitively secured was general anesthesia induced with intravenous agents and inhalational maintenance (isoflurane).

Fig 2 A. Tracheostomy with local anesthesia, 2 B. A size 7.0 non-kinking endotracheal tube (ETT) is inserted into the tracheal lumen via the tracheostomy, and the cuff is inflated.

The surgical team adjusted the ETT depth and fixed the tube with sutures. The surgery proceeded, revealing a hard, fixed right thyroid mass (5 x 4 x 2.5 cm) infiltrating the trachea and paravertebral region (T4b), along with enlarged cervical lymph nodes (N1a). A functional neck dissection and debulking of the thyroid mass were performed, leaving residual mass (R2) on the trachea and paravertebral region. Intraoperatively, hemodynamics remained stable.



Fig 3 A. ETT fixation with sutures performed by the Surgery team; 3 B. Thyroid surgery can be performed.

Postoperatively, the non-kink ETT was replaced with a size 7 tracheostomy tube. The patient emerged from anesthesia, was extubated, and maintained adequate spontaneous ventilation via the tracheostomy tube. She was transferred to the recovery room in a stable condition (SpO₂ 99% on room air, RR 18 breaths/min) and subsequently to the Low Care unit.

Discussions

This case illustrates the critical importance of meticulous preoperative airway assessment and the formulation of a safe, definitive airway strategy in patients with severe central airway obstruction. Invasive thyroid masses compressing or infiltrating the trachea pose a high risk for both difficult ventilation and intubation, compounded by an intolerance to apnea [2]. Our patient exhibited several predictors of a difficult airway. The MOANS assessment suggested difficult mask ventilation, while the LEMON score strongly indicated difficult laryngoscopy and intubation [4,5]. Crucially, the preoperative CT scan provided definitive evidence of the severity of the obstruction, revealing a residual tracheal lumen of merely 2.5 mm x 7.7 mm.

The 2022 ASA Practice Guidelines for Management of the Difficult Airway strongly recommend considering an awake intubation technique when there is a predicted difficulty with ventilation (mask or SAD), a high risk of rapid desaturation, or difficult emergency invasive airway access [3]. While awake fiberoptic intubation (AFOI) is a standard approach for the anticipated difficult airway, its application in this specific case was deemed too high-risk. According to the Difficult Airway Society (DAS) 2015 guidelines, while the principles of awake tracheal intubation (ATI) are relevant, the presence of critical or extrinsic intratracheal obstruction near the glottis means that ATI can fail or, worse, precipitate total airway obstruction [3]. Furthermore, Kim et al. described the significant risks associated with managing massive thyroid masses, noting that tumor friability and vascularity pose a severe threat of bleeding during endoscopic airway manipulation, which can quickly turn into a life-threatening airway emergency

[6]. In a lumen narrowed to 2 mm, any manipulation with an ETT or fiberoptic scope could cause trauma to the friable tumor, leading to hemorrhage, edema, or dynamic collapse (tracheomalacia), which would rapidly obscure the airway and precipitate a CICO scenario [2].

Given the severe obstruction, an awake tracheostomy was selected as the safest primary strategy. Awake tracheotomy under local anesthesia maintains spontaneous breathing and bypasses the stenotic laryngeal or tracheal region, offering a life-saving individualized approach for patients with sizable thyroid tumors [7]. This strategy avoids the risks of apnea in a nearly occluded airway that might not be salvageable with mask ventilation or an SAD [8]. By securing the airway below the level of the glottic and upper tracheal obstruction while the patient maintained spontaneous ventilation, we mitigated the risk of sudden airway loss upon induction of general anesthesia.

Airway management in patients with thyroid carcinoma complicated by severe tracheal lumen narrowing represents a significant challenge because of the potential for sudden and life-threatening airway obstruction. Locally advanced thyroid malignancies may compress or directly invade the trachea, resulting in anatomical distortion and a substantial reduction in airway diameter. These changes can make conventional endotracheal intubation difficult and increase the risk of airway compromise during the induction of general anesthesia. In patients with critical tracheal stenosis, even a brief period of apnea may be poorly tolerated, particularly when the remaining airway lumen is insufficient to maintain adequate ventilation [9,10].

A relevant case report by Shallik et al. described the management of a patient with invasive thyroid carcinoma and critical tracheal stenosis, with a minimum tracheal diameter of approximately 4 mm. The authors used spontaneous respiration, high-flow nasal oxygen, and a specialized small-diameter endotracheal tube to secure the airway [3]. This report illustrates the substantial technical challenges of malignant tracheal narrowing and shows that alternative airway techniques may be necessary when conventional intubation or tracheostomy is difficult [11].

Literature supports this approach; reports on tracheal compression due to goiter or thyroid cancer emphasize the high risk of difficult intubation, failure to oxygenate, intraoperative bleeding, and airway collapse post-extubation [2,7]. In cases of severe central airway obstruction, a definitive surgical airway before the loss of muscle tone associated with general anesthesia induction is a highly recommended, safe option.

Conclusions

The management of a difficult airway secondary to invasive thyroid carcinoma with critical tracheal stenosis requires a carefully considered, individualized approach. When severe luminal narrowing is present (e.g., <3 mm) and the tumor involves the tracheal mucosa, conventional awake intubation techniques carry a prohibitive risk of complete obstruction and bleeding. In such high-risk scenarios, an elective awake tracheostomy under local anesthesia is a safe, effective, and sometimes necessary strategy to secure a definitive airway before the induction of general anesthesia, thereby preventing catastrophic hypoxic events.

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