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CASE REPORT

Ultrasound-Guided Superior Laryngeal Nerve Block Combined with Cricothyroid Membrane Puncture for Awake Tracheal Intubation in a Patient with a Laryngeal Tumor: A Case Report and Literature Review

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Background: Airway management for laryngeal tumor surgery is challenging because conventional induction of general anesthesia may worsen dynamic obstruction, whereas prophylactic tracheostomy is more invasive. We describe a minimally invasive awake airway strategy using ultrasound-guided superior laryngeal nerve block (SLNB) combined with cricothyroid membrane puncture.

Case Presentation: A 59-year-old man with a laryngeal tumor, hypertension, diabetes mellitus, and coronary artery stenosis underwent successful awake flexible bronchoscopy-guided tracheal intubation after ultrasound-guided bilateral SLNB combined with cricothyroid membrane puncture, with a front-of-neck surgical airway prepared as backup. At predefined peri-intubation time points, systolic/diastolic blood pressure ranged from 131–183/68–102 mmHg, heart rate from 44 to 78 beats/min, respiratory rate from 14 to 22 breaths/min, and SpO_2 from 96% to 100%. No hypoxemia or airway-related complication occurred.

Conclusion: In selected patients with high-risk laryngeal tumors, ultrasound-guided SLNB combined with cricothyroid membrane puncture may facilitate awake tracheal intubation while avoiding unnecessary surgical airway creation. This technique may serve as a useful alternative when conventional induction is considered hazardous.

Keywords: difficult airway, awake tracheal intubation, ultrasound-guided nerve block, superior laryngeal nerve block, laryngeal tumor

Introduction

Laryngeal carcinoma accounts for a relatively small proportion of all malignancies worldwide but represents an important subgroup of head and neck cancers. Because these tumors arise in close proximity to the upper airway, even a limited lesion can produce clinically significant narrowing, dynamic obstruction, or distortion of airway anatomy. Consequently, perioperative airway management is often the decisive step in anesthetic planning. Failed or delayed airway control in this setting may lead to severe hypoxemia, bleeding, tumor dislodgement, or complete airway obstruction.[1–3]

Traditional strategies each have important limitations. Tracheostomy secures the airway distal to the laryngeal lesion, but it is invasive and carries procedural risks such as bleeding, infection, pneumothorax, pneumomediastinum, tracheal stenosis, and dysphagia.[1,2] In contrast, induction of general anesthesia with loss of spontaneous ventilation may convert partial obstruction into complete obstruction in patients with laryngeal masses.[3] Awake tracheal intubation is therefore an attractive strategy in selected patients with anticipated difficult airways. Its success depends on adequate suppression of airway reflexes while preserving spontaneous breathing and patient cooperation. Ultrasound-guided SLNB has emerged as a useful adjunct because it improves the precision of regional airway anesthesia and may improve intubating conditions during awake fiberoptic intubation.[4]

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However, the combined use of ultrasound-guided SLNB and cricothyroid membrane puncture in a patient with a pedunculated subglottic tumor has been only sparsely described. This case report was prepared in accordance with the CARE guidelines.

Case Presentation

A 59-year-old man (height, 180 cm; weight, 90 kg) presented with hoarseness for more than 30 years, with marked worsening over the previous 2 months. His medical history included hypertension for 20 years, diabetes mellitus for 8 years, and coronary artery stenosis diagnosed 1 year earlier. Preoperative flexible nasopharyngolaryngoscopy demonstrated a pedunculated neoplasm in the subglottic region adjacent to the right vocal cord (Figure 1), with possible prolapse into the subglottic trachea. The patient was scheduled for CO_2 laser resection of the laryngeal mass under microscopic suspension laryngoscopy with general anesthesia.

Preoperative preparation included nebulized budesonide suspension and oral cefuroxime axetil for 3 days before surgery, continued until 2 hours preoperatively. Overall airway assessment suggested grade 2 difficulty for tracheal intubation (Mallampati class II), because passage of the endotracheal tube across the glottis was expected to be moderately difficult and potentially hazardous owing to the pedunculated subglottic mass. Because supraglottic airway devices were unlikely to bypass the lesion, an emergency front-of-neck airway strategy (cricothyrotomy or tracheostomy) was prepared as a contingency. Standard preparations included local anesthetics, sedative and anesthetic agents, a flexible bronchoscope, reinforced endotracheal tubes of different sizes, an ultrasound system, and an emergency tracheostomy kit.

After arrival in the operating room, the patient received supplemental oxygen in the lateral decubitus position, and intravenous hydrocortisone 100 mg was administered to reduce the risk of airway edema. Sedation was initiated with dexmedetomidine 40 μg and sufentanil 5 μg and titrated to a clinical target equivalent to a Ramsay Sedation Score of 2–3 (calm, cooperative, and responsive to verbal command). Ultrasound-guided airway block was then performed using a GE 12L-*RS* linear-array transducer (8–12 MHz). For bilateral SLNB, the probe was placed transversely at the hyoid level and moved caudally to identify the thyrohyoid membrane and the target plane containing the internal branch of the superior laryngeal nerve (Figure 2A). Using an in-plane approach (Figure 2B), 4 mL of 0.5% lidocaine was injected after real-time confirmation of needle-tip position and local anesthetic spread around the target plane.

For cricothyroid membrane puncture, the same transducer was used. On transverse scanning, the cricothyroid membrane was identified between the thyroid and cricoid cartilages as a thin linear hyperechoic structure (Figure 3A) and then confirmed on longitudinal view (Figure 3B). The needle was advanced in plane, and successful aspiration of air confirmed intraluminal placement. Topical anesthesia of the epiglottis and periglottic region was achieved with 2% lidocaine via a laryngeal spray catheter, and awake tracheal intubation was completed under flexible bronchoscopy guidance. No procedure-interrupting cough or defensive movement was documented, and intubation was successful on the first attempt. After correct tube placement was confirmed, general anesthesia was induced with sufentanil 20 μg, ciprofol 30 mg, and vecuronium 8 mg and maintained with

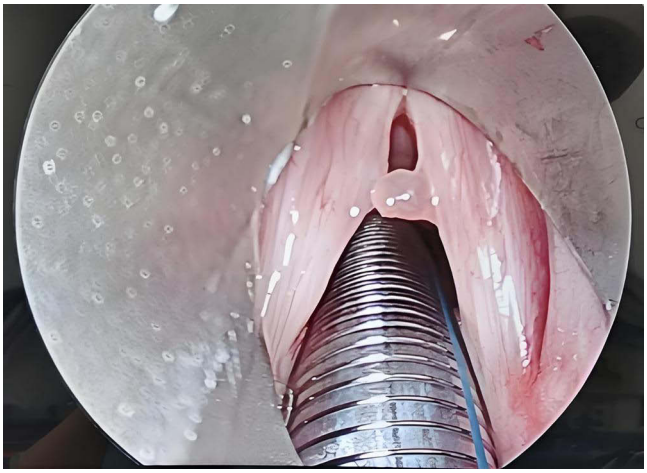

Figure 1 Preoperative flexible nasopharyngolaryngoscopic view showing a pedunculated subglottic neoplasm adjacent to the right vocal cord.

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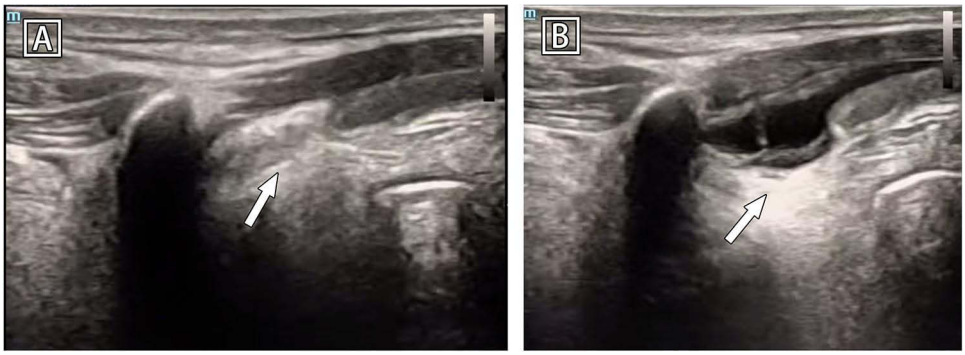

Figure 2 (**A**) Transverse view at the thyrohyoid membrane level. The white arrow indicates the internal branch of the superior laryngeal nerve. (**B**) The white arrow indicates the direction of the in-plane needle.

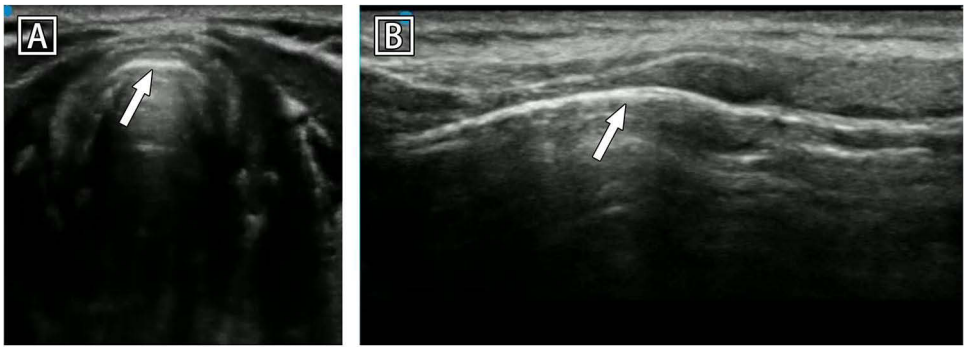

Figure 3 (**A**) Transverse view of the cricothyroid membrane. The white arrow indicates the cricothyroid membrane between the thyroid cartilage and the cricoid cartilage. (**B**) Longitudinal view of the cricothyroid membrane. The white arrow indicates the cricothyroid membrane.

continuous infusions of propofol and remifentanil. Deep tracheal suctioning was performed under deep anesthesia 30 minutes before the end of surgery.

To provide an objective peri-intubation description, key physiologic variables were reviewed at predefined time points: T0, pre-sedation baseline (13:50); T1, after sedation and completion of airway blocks, immediately before bronchoscopy-guided intubation (14:20); T2, immediately after tracheal intubation (14:25); T3, surgical start (14:35); T4, surgical end (14:50); T5, immediately before extubation (15:20); and T6, early post-extubation recovery (15:30). Hemodynamic instability was predefined as systolic blood pressure <90 mmHg, mean arterial pressure <65 mmHg, or heart rate <50 or >100 beats/min. Respiratory compromise was predefined as SpO_2 <90% or respiratory rate <10 breaths/min. Across these time points, systolic/diastolic blood pressure ranged from 131–183/68–102 mmHg, heart rate from 44 to 78 beats/min, respiratory rate from 14 to 22 breaths/min, and SpO_2 from 96% to 100% (Table 1). No hypoxemia occurred; a transient bradycardic nadir of 44 beats/min was recorded during recovery.

Postoperatively, the tracheal tube was removed after the patient met standard extubation criteria. Early post-extubation monitoring showed blood pressure 143/70 mmHg, heart rate 75 beats/min, respiratory rate 20 breaths/min, and SpO_2 99%. He was transferred to the post-anesthesia care unit for 30 minutes of observation, no immediate complication was noted, and he was then discharged to the regular ward in stable condition.

Discussion

This case illustrates that ultrasound-guided SLNB combined with cricothyroid membrane puncture can facilitate awake tracheal intubation in a patient with a pedunculated subglottic tumor while avoiding prophylactic surgical airway creation. The central clinical problem was not severe limitation of glottic exposure itself, but the risk that passage of the endotracheal tube or stimulation of the lesion could provoke cough, bleeding, tumor displacement, or complete airway obstruction.

Table 1 Objective Peri-Intubation Monitoring Data at Predefined Time Points

Time Point	Clinical Event	SBP/DBP (mmHg)	HR (Beats/Min)	RR (Breaths/Min)	SpO_2 (%)
T0 (13:50)	Pre-sedation baseline	183/102	78	17	98.3
T1 (14:20)	After sedation and airway blocks, before intubation	156/97	75	15	96
T2 (14:25)	Immediately after intubation	131/72	74	21	99
T3 (14:35)	Surgical start	134/73	73	22	99
T4 (14:50)	Surgical end	145/88	62	14	100
T5 (15:20)	Immediately before extubation	153/70	44	14	100
T6 (15:30)	Early post-extubation recovery	143/70	75	20	99

Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; RR, respiratory rate. Sedation was titrated to a clinical target equivalent to a Ramsay Sedation Score of 2–3.

Comparison with Published Literature

Published evidence on airway management in patients with laryngeal tumors consistently shows that mobile or bulky lesions pose substantial risk during induction of general anesthesia because loss of muscle tone and positive-pressure ventilation may worsen dynamic obstruction or promote tumor displacement. In the most closely analogous report, Pandey et al described a pedunculated subglottic polyp that prolapsed through the glottis during expiration; the authors therefore selected awake fiberoptic intubation with preserved spontaneous breathing to minimize the risk of pedicle rupture, tumor dislodgement, and catastrophic obstruction[5] Similar principles have been reported in other laryngeal masses. Lee and Lim used awake videolaryngoscopy for a huge dangling vocal papilloma and emphasized that blind advancement of the tracheal tube may be hazardous when a highly mobile lesion occupies the glottic inlet.[6] Choi et al further showed that awake videolaryngoscopy, combined with flexible bronchoscopy when necessary, can be effective even in the presence of a huge fixed supraglottic mass[7] More recently, Barbaro et al reported a case series of awake videolaryngoscopy in patients with laryngeal cancer, again highlighting the value of maintaining spontaneous ventilation until the airway is definitively secured[8] The most relevant published reports are summarized in Table 2.

Table 2 Published Reports Relevant to Awake Airway Management in Laryngeal or Subglottic Tumors

Author (Year)	Clinical Scenario	Airway Management Strategy	Main Outcomes	Implications for the Present Case
Pandey et al (2009)	Pedunculated subglottic laryngeal polyp with dynamic movement; the lesion prolapsed through the glottis during expiration, creating a risk of sudden obstruction during airway instrumentation	Awake fiberoptic intubation with preserved spontaneous breathing; tube advancement was timed to the respiratory cycle to minimize contact with the mobile lesion.	The airway was secured successfully without tumor dislodgement or complete obstruction. The report emphasized that induction with neuromuscular blockade could have precipitated airway catastrophe.	This is the closest analogue to the present case and directly supports an awake, low-stimulation strategy for mobile subglottic tumors.[5]
Lee and Lim (2019)	Huge dangling vocal papilloma occupying the glottic inlet and posing a high risk of collision or bleeding during intubation.	Awake videolaryngoscopic intubation after meticulous airway anesthesia.	Intubation was completed safely without injury to the lesion. The authors argued that blind tube advancement during fiberoptic intubation may be unsafe in highly mobile laryngeal masses.	Supports the principle that adequate airway anesthesia and continuous visual control are crucial when the lesion is mobile and vulnerable to displacement.[6]

(*Continued*)

Table 2 (Continued).

Author (Year)	Clinical Scenario	Airway Management Strategy	Main Outcomes	Implications for the Present Case
Choi et al (2010)	Huge fixed supraglottic mass with markedly restricted access to the glottis	Awake intubation using GlideScope videolaryngoscopy with fiberoptic assistance after topical anesthesia and remifentanil sedation.	The airway was ultimately secured without loss of ventilation, showing that combined awake techniques can overcome severe tumor-related distortion.	Demonstrates that awake airway management should be individualized according to tumor location and mobility, and that combined strategies may be required.[7]
Krause et al (2016)	Anticipated difficult airways with altered neck anatomy, including patients in whom precise airway blocks were desirable	Real-time ultrasound-guided superior laryngeal nerve block combined with translaryngeal block before awake fiberoptic intubation.	All reported patients achieved effective airway anesthesia and successful awake intubation, with the authors highlighting the practical value of ultrasound guidance in distorted anatomy.	Provides direct technical support for using ultrasound-guided combined airway blocks rather than landmark-based techniques in anatomically challenging settings.[9]
Alessandri et al (2020)	Patients undergoing upper-airway oncologic surgery with airway stenosis who required awake fiberoptic intubation	Prospective comparison of topical anesthesia plus intercricoid block with or without superior laryngeal nerve block.	Addition of SLNB improved procedural comfort and shortened intubation time, indicating better suppression of airway reflexes.	Supports the view that SLNB adds clinically meaningful benefit beyond topicalization alone during awake intubation for upper-airway tumors.[10]
Mohanta et al (2021)	Anticipated difficult airway requiring awake fiberoptic intubation	Randomized comparison of ultrasound-guided airway nerve blocks (including SLNB and transtracheal block) versus ultrasonic nebulization with lidocaine.	Ultrasound-guided blocks were associated with shorter intubation time and superior intubating conditions, while hemodynamics remained acceptable in both groups.	Strengthens the rationale for a combined ultrasound-guided regional anesthetic approach when optimal intubating conditions are required.[11]
Barbaro et al (2024)	Case series of patients with laryngeal cancer and supraglottic tumor masses at high risk of bleeding and obstruction during induction	Awake videolaryngoscopic orotracheal intubation performed during spontaneous breathing and without sedative drugs.	All patients were intubated successfully without emergency surgical airway, underscoring the safety of an awake strategy in carefully selected tumor patients.	Reinforces the concept that awake intubation may serve as a less invasive alternative to prophylactic tracheostomy in selected laryngeal tumor cases.[8]

Innovation and Mechanistic Rationale

The distinctive feature of the present strategy was not simply the use of SLNB, but the integration of ultrasound guidance with both superior and inferior airway anesthesia. Landmark-based SLNB may be less reliable in patients with altered neck anatomy and may be associated with incomplete block or inadvertent vascular puncture. In contrast, real-time ultrasound enables direct identification of the thyrohyoid membrane and more accurate deposition of local anesthetic around the internal branch of the superior laryngeal nerve. Krause et al reported successful ultrasound-guided superior laryngeal nerve and translaryngeal blocks in anticipated difficult airways with altered anatomy, supporting the feasibility of this approach[9] Alessandri et al showed that adding SLNB to topical anesthesia and intercricoid block improved patient comfort and shortened awake fiberoptic intubation time in patients undergoing upper-airway oncologic surgery[10] Mohanta et al further demonstrated that ultrasound-guided airway nerve blocks produced shorter intubation times and better intubating conditions than nebulized lidocaine alone during awake fiberoptic intubation[11] Collectively, these data support the concept that precise regional airway anesthesia can improve both technical conditions and patient tolerance.

Potential risks of this approach should nevertheless be acknowledged, particularly inadvertent vascular puncture during ultrasound-guided puncture and local anesthetic systemic toxicity. In the present case, these risks were mitigated by real-time ultrasound guidance, in-plane needle advancement, repeated aspiration, incremental injection, dose limitation, and continuous monitoring, with compression prepared for suspected vascular injury and lipid emulsion-based resuscitation available for suspected toxicity.

From a mechanistic standpoint, SLNB alone primarily attenuates supraglottic and glottic sensory input and may therefore be insufficient for subglottic pedunculated lesions in which tube passage or airflow-induced tumor motion can provoke coughing. The addition of cricothyroid membrane puncture extends anesthesia to the infraglottic mucosa and provides a more comprehensive sensory block. In the present patient, this combined approach was particularly relevant because subglottic stimulation could theoretically have caused forceful coughing, tumor displacement, bleeding, or complete airway compromise. The current technique may therefore be interpreted as a targeted form of total airway anesthesia tailored to the pathophysiology of a mobile subglottic mass.

Clinical Significance

The present case offers a pragmatic middle-ground strategy between two unsatisfactory extremes: conventional induction and intubation, which may be dangerous in the presence of a mobile laryngeal lesion, and prophylactic tracheostomy, which secures the airway at the cost of surgical morbidity. The patient also had hypertension, diabetes mellitus, and coronary artery stenosis, making avoidance of marked sympathetic responses particularly desirable. At predefined peri-procedural time points, SpO_2 remained between 96% and 100%, while systolic/diastolic blood pressure and heart rate ranged from 131–183/68–102 mmHg and 44–78 beats/min, respectively. These objective findings support the feasibility of this regional airway anesthesia strategy in a patient with substantial cardiovascular comorbidity, although the transient recovery-phase bradycardia underscores the need for continued close monitoring.

Limitations

Several limitations should be acknowledged. First, this is a single-case report, so the generalizability of the technique to other laryngeal pathologies, particularly fixed infiltrative lesions or patients with critical baseline obstruction, remains uncertain. Second, although predefined monitoring time points and objective hemodynamic and respiratory data were added, validated sedation and analgesia scales were not prospectively recorded in real time; therefore, patient comfort and intubation tolerance could only be described qualitatively from the anesthetic record. Third, mid- and long-term postoperative follow-up was not designed to assess subtle changes in laryngeal sensation, phonatory function, or aspiration risk after combined airway blocks. Finally, because no complication occurred in this single case, only a structured qualitative appraisal of procedural risk could be provided rather than a formal quantitative risk analysis. Prospective studies with larger cohorts are needed to better define the indications, reproducibility, and safety profile of this approach.

Conclusion

In selected patients with high-risk laryngeal tumors, ultrasound-guided SLNB combined with cricothyroid membrane puncture may provide a reliable and minimally invasive means of achieving awake tracheal intubation. By bridging the gap between hazardous conventional induction and prophylactic surgical airway creation, this strategy may improve airway safety while limiting procedural invasiveness.

Abbreviations

ATI, awake tracheal intubation; DBP, diastolic blood pressure; HR, heart rate; PACU, post-anesthesia care unit; RR, respiratory rate; SBP, systolic blood pressure; SLNB, superior laryngeal nerve block; SpO_2, peripheral oxygen saturation.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Tianyou Hospital Affiliated to Wuhan University of Science and Technology (Approval No. TY-IEC2026-012).

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and the accompanying images.

Author Contributions

All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all of these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article will be submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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