

# Tracheal Injury during Endoscopic Transoral Vestibular Approach Thyroidectomy: A Case Report

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## ABSTRACT

This report describes the intraoperative course of endoscopic thyroidectomy by oral vestibular approach in a female patient. This operation is new, and its perioperative management is not yet mature. In this case, the surgery resulted in trachea injury that could not be detected easily. As a result, the patient suddenly developed acute dyspnea and circulatory disorder. This procedure requires caution in surgical execution and anesthesia management.

## INTRODUCTION

Endoscopic thyroidectomy using the oral vestibular approach (ETOVA) is popular with patients for its good appearance, lacking an incision in the neck. However, this type of surgery is still in the early stages of application, the operation is not fully developed, and it requires continuous injection of CO<sub>2</sub>. These factors prompt new requirements for anesthesia management. Our hospital handled a patient with tracheal injury during surgery, as reported below.

## CASE REPORT

A female patient, age 55 years, weight 52 kg, American Society of Anesthesiologists (ASA) level II, was admitted for "right thyroid lump for a month." A lump ~2 × 1 cm in size was palpable in the thyroid region of the right neck on physical examination. It was tough, involved no tenderness, had a clear boundary, and moved up and down with swallowing. Other examination results were unremarkable. The diagnosis was right thyroid lump. The planned surgery was ETOVA.

The patient entered the operating room after sufficient preoperative preparation. Heart rate (HR) was 87 bpm,

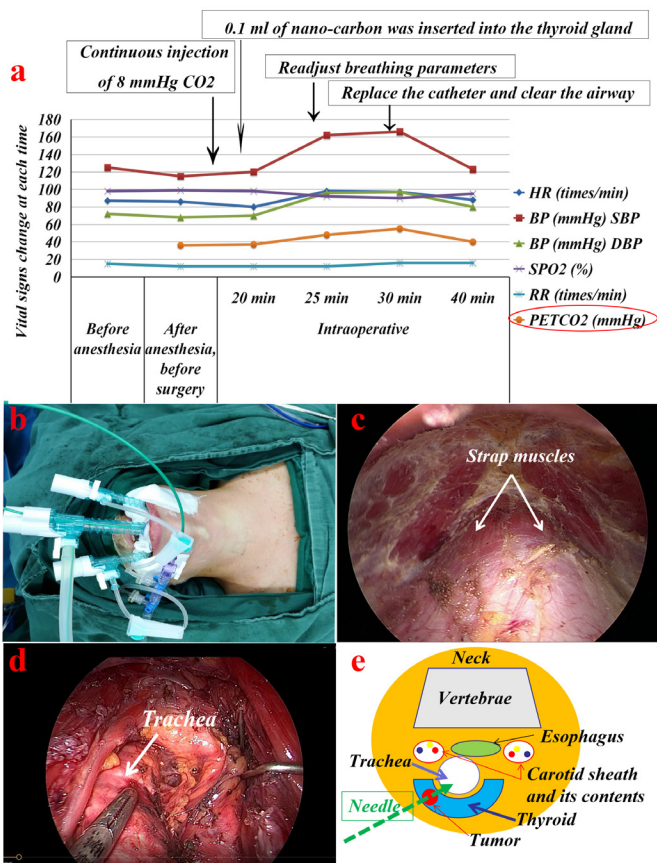


Figure 1. Description of perioperative events. (a) Vital signs change at each time point. (b), (c) and (d) Visual field during operation. (e) Simple illustration of the path of possible airway damage.

blood pressure (BP) was 125/72 mmHg, oxygen saturation (SPO<sub>2</sub>) was 98%, and respiratory rate was 15/min (Figure 1a). The right upper limb had an open venous channel, and oxygen was given at a flow rate of 2 L/min through the mask. After anesthesia induction, using the visual laryngoscope, a 6.5-internal-diameter recurrent laryngeal nerve endotracheal catheter was adjusted to place at the left corner of the mouth. Vital signs and end-tidal carbon dioxide partial pressure (EtCO<sub>2</sub>) were continuously monitored during the operation. Mechanical ventilation parameters were tidal volume, 6 mL/kg; respiratory frequency, 12/min; and suction/respiration

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ratio, 1:2. Anesthesia was maintained with conventional static inhalation combination. The operation was performed on the supine shoulder pad and the neck slightly overstretched after conventional disinfection towel placement. The operating space was maintained with continuous injection of 8 mmHg CO<sub>2</sub> (Figure 1b, c, and d).

After 20 minutes from the start of the operation, using a 4.5G needle, the surgeon injected the upper, middle, and lower part of the thyroid with 0.1 mL nanocarbon each. After withdrawal of the needle, gauze was compressed. The operation continued after the thyroid and surrounding lymph nodes were stained. Meanwhile, after 5 minutes, EtCO<sub>2</sub> gradually increased from 36 to 48 mmHg, HR increased to 98 bpm, and BP increased to 162/96 mmHg. Emergency examination showed that the bellows of the anesthesia machine had slightly collapsed, but it returned to normal after rapid oxygenation.

Supervising doctors suspected that insufficient ventilation was caused by subcutaneous CO<sub>2</sub> insufflation and airway compression, so the respiratory parameters were readjusted. After 5 minutes of observation, the patient's EtCO<sub>2</sub> continued to increase to 55 mmHg, and the bellows obviously collapsed as before. To prevent further crisis and deterioration, manual respiration was begun, and airway resistance was found to decrease; thus air leakage in the breathing circuit was suspected. After careful examination, the cuff of the endotracheal catheter was found to be flat; it returned to shape after inflation with 5 mL air by syringe. Air leakage from the endotracheal catheter was confirmed.

The surgeons suspended surgery and proceeded to clean the airway. Approximately 5 mL of mild bloody sputum was sucked from the endotracheal catheter, and the catheter was replaced after consultation with the surgeons. After the endotracheal tube was replaced and the airway was cleared, the original mechanical ventilation scheme continued, and EtCO<sub>2</sub> gradually decreased to normal after 10 minutes.

The anesthesia team held an emergency consultation, determining that the damage was caused by puncture of the nanocarbon injection into the cuff during the operation (Figure 1e), and the analysis results were reported to the surgeon. The surgeon immediately carried out field exploration, and the trachea wall was found to have a 0.3-cm hole in the right cricoid cartilage, with a little bleeding. After the local myofascial suture was strengthened, surgery continued. The total duration of the operation was 3 hours and 25 minutes.

After the patient fully recovered, the endotracheal catheter was removed. The lower lip was slightly swollen. No obvious subcutaneous emphysema was found in the head or neck, and no complications such as hoarseness, cough, or hemorrhage were found. After 30 minutes of observation, the patient was safely returned to the ward and discharged successfully 3 days later.

## ETHICS

Informed consent was obtained from the patient, and the disclosure of this clinical case was approved by the Ethics Committee of Zunyi Medical University. This case strictly

adheres to the ethical standards of the Declaration of Helsinki and the International Ethical Guidelines for Human Biomedical Research.

## DISCUSSION

This case reports a sudden airway crisis during endoscopic thyroidectomy. Intraoperative exploration revealed that it was likely caused by damage of endotracheal tube and gas tube wall caused by overly deep puncture of the surgical needle. This injury quickly caused a severe ventilation crisis. If this kind of injury were ignored, it would put the patient in jeopardy. This case report provides a warning for clinical surgery, experience for anesthesia management, and ideas for crisis management.

ETOVA has the advantages of maintaining preoperative appearance, with no scar on the body surface, and quick healing. Therefore, this minimally invasive procedure may become a mainstream thyroidectomy in the future [Ngo 2020; Camenzuli 2018]. However, the operation space of this surgery is narrow, and the anatomic position of thyroid gland is close to the trachea, carotid sheath, and other vital structures. What is more, this kind of operation—performed on the neck of the patient with the oral vestibule approach—uses the same approach as conventional anesthesia airway management. Thus, overly deep puncture with the needle during the operation may cause an airway wall injury, leading to a severe respiratory crisis during the perioperative period (Figure 1e).

It is worth noting that the perioperative distance between the upper edge of the endotracheal tube cuff and the lower edge of the glottis is 1.9 to 4.1 cm [Chen 2018]. In other words, the endotracheal tube cuff and thyroid gland are located in a similar horizontal plane of the spine. Therefore, this kind of surgery may cause not only damage of the endotracheal tube cuff, but also of the airway. Compared with open surgery, the airway injury caused by needle puncture is concealed in endoscopic surgery, which is not conducive to timely detection and rescue treatment. In this case, the size of the wound was found to be 0.3 cm, larger than the diameter of the needle itself. If not found and handled in time, a series of serious complications would have occurred. All the above considerations prompt strict requirements for the endoscope operator's technique and anesthesiology management.

In addition, compared with open surgery, endoscope surgery often requires constant infusion of CO<sub>2</sub> at a certain pressure to maintain the operating space. Many studies have shown that CO<sub>2</sub> during minimally invasive surgery can enter blood vessels and other tissues, leading to severe complications such as hypercapnia [Wang 2019], vasospasm [Rubino 2000], and embolization [Hou 2020; Li 2020]. These complications can lead to serious hemodynamic changes, greatly reducing the perioperative rescue time window and increasing the risk of serious adverse perioperative events. When increased EtCO<sub>2</sub> occurs during ETOVA surgery, it is necessary to find the cause quickly.

In summary, strict surgical procedures and anesthesia management are critical for perioperative airway management,

especially for endoscopic neck surgery. This case shows that the poor operation of a surgical puncture needle during ETOVA may result in damage to the endotracheal catheter and the trachea. It is suggested that clinicians pay attention to the challenges inherent in the development of new techniques, such as minimally invasive surgery, to ensure the safety of patients during surgery.

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