

Tracheal Perforation Caused by Too Deep Suture during Thyroidectomy: a Case Report and Literature Review

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Abstract: Tracheal perforation is a rare complication in thyroidectomy and intubation. The anesthesiologist needs more experience to make a timely diagnosis of tracheal perforation. However, there is little literature that discuss the intraoperative tracheal perforation. This article describes an unexpected tracheal perforation during thyroidectomy and reviews literature about risk factors, symptoms, and tracheal management. Case presentation — A 66-years-old female patient who was diagnosed with recurrent multinodular goiter, was planned to undergo subtotal thyroidectomy. When surgeon sutured the remain organ of thyroid, the anesthesiologist heard the air leakage near the trachea while the ventilator not showing insufficient ventilation. To find the damage position, appropriate saline that could cover the tracheal was injected into the surgical wound. Inflated the endotracheal tube cuff and some small bubbles emerged from a suture. The suspect that the damage was caused by over deep suture was confirmed, which tightly bonded the wall of the trachea with the cuff. Conclusions — In a word, for the surgery near-tracheal, the purpose of this case report was to recommend observe patient's condition more carefully, instead of simply relying on ventilator monitoring. In addition, if resistance is encountered during the extubation, the tube should not be blindly violently extubated.

Keywords: anesthesia, endotracheal intubation, tracheal perforation, thyroidectomy

1. Introduction

Thyroidectomy is a mature and low-risk surgical procedure. In order to prevent damage to the muscles and nerves in the laryngeal during the operation, the NIM standard reinforced EMG endotracheal tube (EMG ETT) is often used for anesthesia endotracheal. According to the literatures, tracheal perforation and rupture are rare complications (0.03%) in thyroidectomy and anesthesia endotracheal[1]. This also means that it is difficult for an anesthesiologist to accumulate experience through clinical practice. The case report describes an unexpected Intraoperative tracheal perforation and review related literatures, which is helpful for anesthesiologist to identify, diagnose and deal with this rare complication.

2. Case report

A 66-years-old female patient, weight 60 kg, height 160 cm, who was scheduled for a subtotal thyroidectomy because of a recurrent multinodular goiter. Her cervical chest radiography (CT) supported the diagnosis of multinodular goiter. (Figure 1)

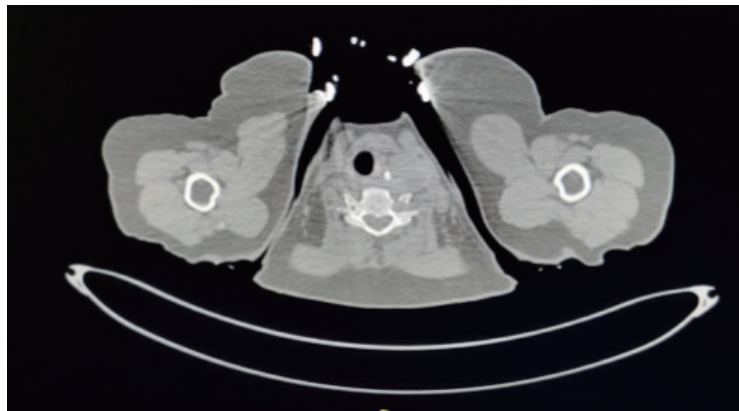


Figure 1. The patient's CT (1. The largest nodule is in the left lobe of the thyroid; the size of nodule is about 4.2*3.5cm. 2. The structure of the trachea and esophagus moves to the right under pressure)

The anesthesiologist asked her medical history and checked her electrocardiogram (ECG), laboratory examination and CT. There are no anesthesia contraindications.

In the operating room, the patient was monitored by non-invasive blood pressure monitor (NIBP), ECG and pulse oximetry (SpO₂). Before induction of anesthesia, the anesthesiologist checked the airtightness of the EMG ETT.

After adequate preoxygenation, anesthesia was induced by midazolam 2mg, etomidate 12mg, sufentanil 20ug, and rocuronium 60mg. The process of tracheal intubation went smoothly. The catheter was inserted through glottal. Then the cuff was injected with ~8ml gas and peak airway pressure (PIP) is 15cm H₂O. The proper placement of EMG ETT was confirmed by bilateral lung auscultation and end-tidal carbon dioxide curve. The EMG tube was fixed with adhesive tape on the mouth at the 22 cm mark. Volume-controlled mechanical ventilation was started with tidal volume of 450ml. During the operation, the tidal volume and respiratory rate were adjusted to maintain the end-tidal CO₂ between 35 and 40mm H₂O. The anesthesia was maintained by intravenous anesthesia and inhalation anesthesia. The patient's vital signs were stable.

About 2 hours later, part of the left thyroid lobe was removed, and the remaining organ was sutured. Both the surgeon and the anesthesiologist heard air leakage from EMG ETT. But the ventilator did not alarm for the ventilation circuit leak. At this time, the tidal volume was 400ml and the airway pressure was 15cm H₂O, which is no significant change from before. The anesthesiologist inspects EMG ETT for damage immediately, and he found that the cuff with inflation valve became semi-filled compared to the size of operation beginning. It did not make the cuff inflated by injecting 10ml gas with a syringe through inflation valve, which suggested that there was damage on the EMG ETT. In order to maintain the ventilation, the anesthesiologist immediately switched the ventilator to manual-controlled mode and increased the oxygen flow.

Because EMG ETT's cuff is close to the suture, it is considered that the damage may be related to the surgical operation. Under this suspicion, Anesthesiologist inspected that the endotracheal tube exposed to the mouth was not damaged. Then appropriate saline that could cover the trachea was injected into the surgical wound. Then 10ml gas was injected into the valve cuff again, it could be seen that some small bubbles emerged from a suture. It was confirmed that the damage was caused by over deep suture, which bonded the wall of the trachea with the cuff.

In order to avoid trachea tear caused by replacement of the EMG ETT, the surgeon was required to cut off all sutures. The anesthesiologist deflated the cuff fully before extubation, pulled out the EMG tube softly while observing the surgical wound. There was no traction on the surgical wound and no resistance during the extubation. Fortunately, reintubation was smoothly under direct laryngoscopy. For preventing the perforated portion of the trachea, the new endotracheal tube was positioned more deeply than before, with the depth marking on the surface of new tube is 23cm. The entire tube replacement process lasted for 2 minutes, with patient's NIBP, ECG and SpO₂ keeping stable. Half an hour later, the operation was completed successfully.

Two perforation splits about 1mm could be seen on the cuff of the replaced EMG ETT (Figure 2 & Figure 3).



Figure 2. There were two splits on the cuff of the replaced EMG ETT



Figure 3. Inflate the ENG ETT with 20ml air by a syringe, through the cuff inflation valve; continuous bubbles emerge from the two cuff splits

The surgeon did not do any special treatment for the perforation because the tracheal perforations were too tiny to suture and covered with muscle. The follow-up procedure went successfully. The patient was transferred to PACU under anesthesia, and the circumstances during the operation were explained and the patient's vital signs were asked to pay more attention especially for the extubation.

In PACU, the patient did not show the symptoms such as cough, chest pain, dysnea and subcutaneous emphysema after extubation. So, the patient was sent back to the ward safely.

Physical examination of the patient every day after thyroidectomy, and no tracheal-related complications were found. Unfortunately, the patient was discharged on the fourth day after the surgery with no other imaging tests performed.

3. Discussion

By reviewing the literature about tracheal injury caused by thyroidectomy, we found that tracheal injury is an extremely rare complication of this surgery, which incidence is less than 1%. J. E. Gosnell reported that Tracheal perforation often occurs in the posterolateral trachea, following the suture ligation of vessels near the ligament of Berry or use of diathermy adjacent besides the trachea. It is related to the characters of multinodular goitre, which are repeated hyperplasia, degeneration and fibrosis. Those dense hyperplastic thyroid tissue surrounding the tracheal makes recognition of anatomical planes is more difficult [2-4]. In addition to the above anatomical risk factors, some literatures suggest that some mechanical factors such as overinflation of the cuff, multiple intubation, inappropriate or oversized endotracheal tube, repositioning endotracheal tube with cuff inflated should be avoided[3].

Tracheal perforation or rupture associated with thyroidectomy could be divided into two types: The first case is that the tracheal injury is identified during the surgery. According to the size of the tracheal wound, this type of injury can be repaired by absorbed suture or conservative treatment. Another situation is that the injury occurs after the surgery, including delayed rupture. It usually induces subcutaneous emphyse, dyspnea, pneumothorax and other symptoms [5,6]. There are few literatures reports this situation [7,8]. Compared with the first type, the second injury needs more complicated treatment.

This case report belongs to the first type of the tracheal injury, either the reports of Hyung-Chul Lee and Minal Joshi [6,9]. What is remarkable in this report is that the tidal volume, PIP and SpO₂ had no significant change when the perforation occurred, which increased the difficulty of identify. We considered that the indicators did not change is associated with too small size of perforation points and tight sutured between trachea and cuff.

However, if the perforation cannot be recognized during the operation, the following extubation would make trachea torn. And the tracheal injury would change from the first type to the second. It is confirmed that the early diagnosis of trachea injury means better outcomes [9]. Therefore, it is crucial to be able to detect the tracheal injury and repair it during the operation.

4. Conclusions

Airway management is one of the most important tasks in the work of anesthesiologists. This case report reminds us that we cannot only rely on the monitoring of the ventilator, but also need to carefully observe the patient's respiratory conditions, especially for operations performed near the trachea. In addition, this also warns us that after the thyroidectomy,

if the extubation process is not smooth, we should not blindly and violently extubate the tube. All kinds of potential dangers should be eliminated before extubation to prevent iatrogenic injury.

4.1 What is known

- Airway management is one of the primary tasks of anesthesiologists during surgery. Tracheal injury, as a relatively rare complication of the thyroid, often occurs after surgery. Intraoperative tracheal injuries are even rarer.

- There are few literature reports on tracheal injuries, and anesthesiologists need to accumulate more experience in order to identify and diagnose tracheal injuries in time

4.2 What is new

- After the tracheal perforation, the anesthesiologist and the surgeon only heard the sound of air leakage, and there was no ventilation circuit leak. Therefore, the ventilator did not give a warning. This special situation reminds the anesthesiologists that we cannot only rely on the monitoring of the ventilator, but also need to observe the patient's respiratory conditions carefully.

- The tracheal injury in this case occurred during surgery. Appropriate saline that could cover the trachea was injected into the surgical wound. Then 10ml gas was injected into the valve cuff again, it could be seen that some small bubbles emerged from a suture. It was confirmed that the tracheal perforation was caused by over deep suture.

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Abbreviations: EMG TT: NIM standard reinforced EMG endotracheal tube; NIBP: non-invasive blood pressure monitor; SpO₂: PULSE oximetry saturation; PIP: Peak airway pressure; PACU: Post Anesthesia Care Unit

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