

Supraglottic airway device and venoarterial extracorporeal membrane oxygenation support for curative surgery in a patient with huge thyroid mass: A case report

ABSTRACT

In the case of complete surgical resection of locally aggressive thyroid mass with severely compromised airways, airway management is difficult and can be considerably risky. We report a case of airway management using i-gel™ and cardiopulmonary bypass (CPB) with venoarterial extracorporeal membrane oxygenation (ECMO), which is a safe and feasible method of airway management for providing general anesthesia in a patient with a large thyroid mass.

Key words: Extracorporeal membrane oxygenation, supraglottic airway device, thyroidectomy

Introduction

The locally aggressive thyroid mass with severely compromised airways is a clinically important problem. Along with the degree of involvement of the laryngotracheal airway, various symptoms include dyspnea, stridor, aspiration, and airway obstruction. For complete surgical resection of the mass, airway management is difficult and can be considerably risky.

Here, we report a safe and alternative method of airway management using i-gel™ and cardiopulmonary bypass (CPB) with venoarterial extracorporeal membrane oxygenation (ECMO) in a patient with a huge thyroid mass.

Case Report

An 18-year-old woman (157 cm, 55 kg) was scheduled for elective thyroid gland surgery. She was diagnosed with Wilms' tumor at the age of 3 years and underwent a left nephrectomy.


She experienced neck swelling when she was 10 years old, and the swelling gradually increased in size. When she was 18 years old, she underwent an examination due to a huge goiter. The thyroid function tests were normal; however, the chest radiography showed right side displacement of the trachea at the T1-2 level due to the mass. On neck computed tomography (CT), the transverse and A-P diameters of the tracheal lumen were 3 and 12 mm, respectively [Figure. 1].

As the airway was severely narrowed and deviated, tracheal intubation was expected to be difficult. There was a possibility that ventilation might not be achieved when injecting a neuromuscular blocker, which should be avoided. After consultation with a multidisciplinary team, we established the safest surgical and anesthetic plan.

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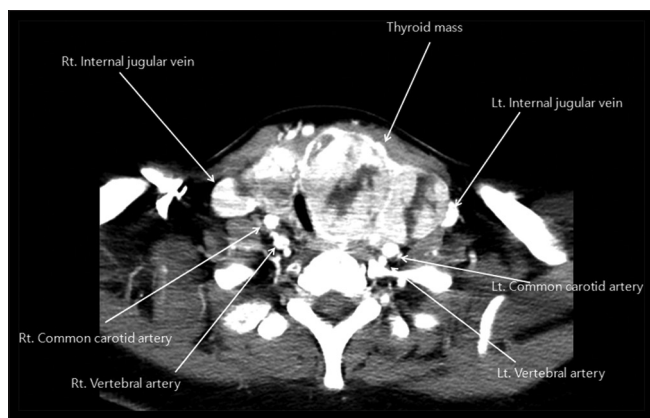


Figure 1: Chest computed tomography (CT) showed a huge mass on the right side of the trachea, and the trachea is deviated with compromising the airway tract

Plan: (1) Conscious sedation for femoral arterial and venous catheterization to standby CPB with ECMO. (2) After induction of general anesthesia, a supraglottic airway device (i-gel™ or laryngeal mask airway) would be inserted, and ventilation will be started. The surgery will be performed if the airway is well maintained. (3) If oxygenation maintenance is difficult, ECMO would be performed for conventional or mediastinal tracheostomy.

In the operating room, noninvasive blood pressure measurement, electrocardiogram, pulse oximeter, bispectral index (BIS), and cerebral oximeter were used. Sedation was induced with a target controlled infusion pump of continuous infusion of propofol (1.0 µg/ml) and remifentanyl (1.0–1.5 ng/ml). Sedation was maintained with an oxygen mask (5 L). The amount of propofol and remifentanyl were controlled as long as the patient's spontaneous breathing was maintained within the BIS range of 70–80. Sedation was performed. Foley catheter, rectal temperature tube, and left femoral vein catheters were inserted. The femoral vein catheters were inserted. Then, the arterial and venous catheters for bypass were inserted into the right femoral artery and vein. Five thousand units of heparin were administered to maintain the activated clotting time at 150–200.

After general anesthesia was initiated with continuous infusion propofol (3.0–4.0 µg/ml) and remifentanyl (2.0–3.0 ng/ml), a 4 size i-gel™ was placed atraumatically. We confirmed that ventilation was well maintained via capnography tracing and tidal volume, and bronchoscopy was used to check tracheal stenosis via the insertion of the i-gel™. Continuous rocuronium infusion was initiated to prevent unexpected movement during surgery.

After approximately 40 min of operation, the tidal volume suddenly decreased from 400 to 150 mL, the airway pressure

increased to 29 mmHg, and oxygen saturation decreased to 91%, which was caused by surgical manipulation of the thyroid gland. The oxygen saturation, tidal volume, and airway pressure did not return to the normal range for a long duration, and the ECMO was performed for 20 min. After repositioning the i-gel™ for thyroid manipulation, ventilation was well maintained, and the bypass was terminated.

At the end of the thyroid operation, a bronchoscopy was performed to determine whether the airway returned to its original state. After confirming that the trachea returned to its original state, the propofol was stopped, the remifentanyl was titrated, and the i-gel™ was removed after intravenous administration of sugammadex. The patient's spontaneous respiration was restored, and remifentanyl was maintained (0.5–0.8 ng/ml) and femoral catheters for CPB with venoarterial ECMO were removed. She was then moved to the intensive care unit (ICU). Two days after surgery, she was transferred from the ICU to the general ward and discharged 5 days after surgery.

Discussion

For airway securing during general anesthesia, oral intubation was initially considered, and if an event of expected and/or unexpected difficult intubation occurred, surgical airway, such as tracheostomy, have to be attempted.^[1] However, when the surgical airway approach is impossible or difficult because of the location and size of the mass and indistinct anatomical landmark, it could be life-threatening, and we have to seek a rescue option for airway management.

In this case, as there was a large thyroid mass with a severely narrowed and deviated trachea—tracheal intubation was considered technically impossible and clinically dangerous; the airway irritation may cause spasms. Preanesthetic tracheostomy was also considered difficult and risky because of the size and location of the mass. Therefore, we first planned bypass establishment under conscious sedation before anesthetic induction to prevent the potential risk of airway failure and/or cardiovascular collapse and then attempted laryngeal mask airway (LMA) insertion. If airway management through LMA would fail, the use of continuous bypass was planned until tracheostomy, in which case, conventional tracheostomy was difficult because of the huge mass over the trachea, and subsequently, general surgeons considered that tracheostomy was a comparable risk to thyroidectomy. Fortunately, oxygenation through LMA was maintained. However, ventilation became uncontrollable at approximately 30 min after surgery, which might have been caused by LMA dislodgement due to extensive intraoperative

surgical manipulation. At that time, CPB oxygenation was assisted for 20 min, and oxygenation through LMA was maintained through surgery. In a few case reports related to huge thyroid mass evacuation, CPB was used to support the airway during tracheostomy,^[2-4] and CPB was removed after securing the airway. However, in this case, mechanical ventilation was permitted through the LMA under preinduction access for CPB, and we used bypass oxygenation transiently during the surgery. To our knowledge, this is the first report of an airway rescue in a patient with a locally aggressive and large thyroid mass.

CPB has potential complications, but consideration of bypass is warranted in this case; extremely limited rescue options in the event of airway loss. The main concern regarding CPB was related to the increased bleeding tendency.^[5] Anticoagulation requiring mechanical extra circulation could interfere with the surgical field of thyroidectomy and damage the surrounding structures. Moreover, other risks, such as vascular injury, embolism, and neurological injury, should be considered during bypass.^[6] Of course, in this case, jet ventilation might be left as a rescue option; however, it could also be risky, and jet ventilation instruments were not available in our hospital. Jeon *et al.*^[7] reported the use of venovenous bypass ECMO to secure a compromised airway during locally aggressive thyroid cancer surgery. We first considered the venovenous bypass ECMO, but obtaining adequate vascular access for venovenous bypass ECMO was difficult. Due to the huge neck swelling and surgical manipulation, cannulation via the neck was ruled out. In addition, because there were large vascular structures around the thyroid mass, hemodynamic support might be needed during surgery. Therefore, venoarterial bypass was requested, although the risk of bleeding and air emboli was greater in the venoarterial bypass than in the venovenous bypass.^[8] However, the venoarterial bypass has advantages in circulatory support and more advanced oxygenation compared with venovenous bypass.^[5,8]

In conclusion, we believe that preinduction access to CPB with i-gel™ insertion is a safe and feasible method of airway

management for providing general anesthesia in patients with locally aggressive and large thyroid masses.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient's consent forms. In the form, the patient's parents have given their consent for the child images and other clinical information to be reported in the journal. The parents understand that their names (including child name) and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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