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Case Report

One Lung Ventilation in a Patient with Central Airway Obstruction: Fluoroscopic Guided Bronchial Blocker Placement

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Abstract

Thyroidectomy is the most common endocrine surgical treatment performed worldwide. Medullary thyroid carcinoma which accounts for less than 1.5 percent of these cases is different from other types of thyroid cancers in a way that it is a neuroendocrine malignancy which originates from the parafollicular C cells of the thyroid gland secreting calcitonin and it frequently spreads to lymph nodes and other organs. Anesthetic management in a case of a large thyroid mass with central airway obstruction is a task cut out for an anesthesiologist and the need to provide one lung ventilation in these patients for thoracoscopic dissection of mediastinal lymph nodes adds to the challenges. In this case report, we describe fluoroscopic guided bronchial blocker placement as a novel technique for delivering one-lung ventilation in such patients, when the traditional approach of bronchial blocker placement with concomitant use of a fibre optic bronchoscope was not practicable due to the small size of the endotracheal tube in the presence of a central airway obstruction.

Keywords: Thyroid; Mediastinal nodes; Airway obstruction; One lung ventilation; Bronchial blocker; Thoracoscopic surgery.

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Highlights

- Thyroid enlargement with tracheal compression is a risk factor for both laryngoscopy and intubation.

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- Patient considerations, anesthetic variables, and organizational considerations all influence the strategies used to provide one-lung ventilation.
- The anesthesiologist should always have a backup plan in place for both airway control and one-lung ventilation in patient with central airway obstruction.

Introduction

Thyroidectomy is the most common endocrine surgical treatment performed worldwide, with a preponderance of these patients having abnormal thyroid functions, and in some, malignant alterations in the thyroid gland [1]. Medullary thyroid carcinoma (MTC) accounts for 0.1 to 1.4 percent of these thyroid nodules and frequently present with regional lymphatic metastasis, including central, lateral, and mediastinal lymph nodes [2]. As a result, the surgical intervention might range from a simple thyroid nodule removal to a large gland removal with mediastinal lymph-node dissection requiring thoracic surgery.

Modern thoracic surgery, with its growing emphasis on minimally invasive procedure, necessitates intraoperative one lung ventilation (OLV). For decades, the double lumen tube (DLT) was regarded as the gold standard; nevertheless, evolving indications and medical procedures in thoracic surgery, as well as incorporation of traditionally inoperable patients, have made DLT usage unfeasible in certain situations and unfavorable in several [3].

Controlling a potentially difficult airway, especially in situations of large thyroid glands with danger of postoperative tracheomalacia owing to pressure effects on the trachea, is one of the most often recognized concern of thyroidectomy for an anesthesiologist and the intricacy of surgical intervention adds to the already challenging situation.

We hereby report a case of successful anesthetic management of a patient with large thyroid mass and significant tracheal compression posted for total thyroidectomy along with dissection of metastatic mediastinal lymph node by video assisted thoracoscopic surgery (VATS), which required OLV.

Case

A 40-year-old patient with a BMI of 22.8kg/m^2 presented with complaints of bilateral neck swelling for nine years. After a biopsy and PET CT scan of the swelling, diagnosis of MTC with metastasis to bilateral cervical, supraclavicular and right sided mediastinal lymph nodes was confirmed. In view of locally advanced MTC surgery was planned as soon as practicable. Patient was scheduled for a total thyroidectomy with bilateral neck dissection and VATS-guided lymph node dissection in the right mediastinum.

CT scan performed prior to surgery revealed significant thyroid mass compressing the trachea without retrosternal extension. The narrowest segment of trachea was located

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approximately 6cm above the carina as seen on Chest Xray (Figure 1) and the cross-sectional diameter of the trachea at this level was 0.45cm (Figure 2).

Figure 1: Chest X-ray PA view showing the narrowest point of trachea.

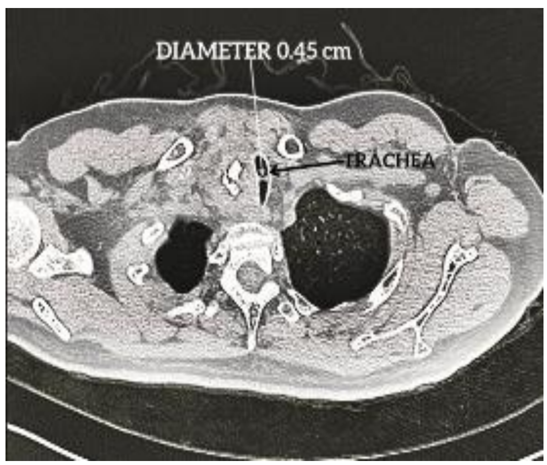

Figure 2: CT scan slice at the narrowest part of trachea.

Preoperative blood pressure was 130/80 mmHg, heart rate was 84 bpm, respiratory rate was 16 per minute and room air oxygen saturation was 99%. Intravenous access was secured and the patient received injection Glycopyrrolate 0.2mg intramuscularly approximately 20 minutes prior induction. Standard ASA monitors were attached in the operating room and oxygen was started through nasal prongs at 4 litre/min. Preoperative nebulization with 4 percent lignocaine was used, followed by pharyngeal spray with 10 percent lignocaine before starting bronchoscopy, and finally, spray-as-you-go (SAYGO) technique anesthetizing above and below vocal cords with 4 percent lignocaine, with the maximum dose of lignocaine limited to 9 mg/kg [4]. Patient received injection dexmedetomidine at loading dose of 1μg/kg over 10mins followed by infusion of 0.5μg/kg/hr for anterograde amnesia, anxiolysis and analgesia in addition to its primary sedative effect [5].

Our primary strategy was to conduct fibre-optic examination of the airway while the patient was conscious and breathing spontaneously, followed by tracheal intubation beyond the point of stenosis using the largest size endotracheal tube possible. Backup strategy called for intravenous induction of general anaesthesia along with rapid short acting neuromuscular blockade, followed by tracheal intubation using a smaller size endotracheal tube and in the event that the airway could not be secured we would expect swift recovery in spontaneous ventilation. We were able to secure the airway with our primary plan using a single lumen tube (SLT) with internal diameter (ID) of 7 mm via the left nostril.

The SLT was advanced further into the right main bronchus using fibre-optic bronchoscope (FOB). The depth of the right main bronchus where the balloon of bronchial blocker (BB) was needed to be positioned for optimal OLV was accurately marked on the fluoroscope after visualizing through FOB. The FOB was then removed and BB was threaded through the lumen of SLT. The balloon of BB was advanced slowly under fluoroscopy guidance till it reached the marked position for optimal oLV. Once the BB was in desired position, it was tightly held in place, and the SLT was retracted, again with continued fluoroscopy guidance, until the tip of the tube was sufficiently proximal to the carina (Figure 3). The BB balloon was inflated with 5ml of air, and adequate OLV was validated by auscultation, confirming the optimal position of the BB as well. After the patient was placed in lateral position for surgery, chest auscultation indicated adequate OLV once more. The entire procedure lasted 12 hrs, and OLV was appropriately provided during the VATS portion. Patient was transferred to the intensive care unit with continued mechanical ventilation after the procedure.

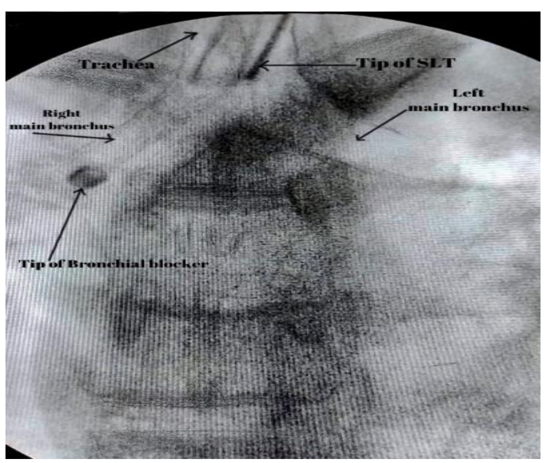

Figure 3: Intraoperative fluoroscopy image of balloon placement.

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Discussion

The case we present here is unusual in a way that our patient with central airway compression along with significant risk of airway occlusion needed to undergo total thyroidectomy and required OLV in view of VATS for resection of right mediastinal lymph nodes. We'd want to use the aforementioned case report to demonstrate a unique strategy for accomplishing OLV in a patient with central airway obstruction. In patients, where preoperative imaging reveals significant compression of the airway by a large thyroid gland, the size of SLT that can be negotiated across the narrowest part is a source of consternation for anaesthetists. The decision regarding the appropriate size of SLT is often entirely driven by the radiological analysis, placing less emphasis on the location of the compression, the origin or the patient's symptoms. Radiological perusal of the cross-sectional area of trachea can be helpful in anticipating major anaesthetic complications which correlate more in patients with tracheal area less than 50% of the expected [6]. These challenges are difficult to predict entirely on the basis of symptoms as patients with tracheal area of less than 40% have been found to be asymptomatic [7]. The type of tumor compressing the trachea also plays a significant role in deciding the size of SLT as benign tumors may allow a larger size tube than the estimated size on imaging, while this may not hold true for a malignant tumor with fibrosis due to soft tissue involvement [6],[8]. Similarly retrosternal extension of thyroid gland leading to significant central airway compression may not allow a larger size tube in comparison to extrathoracic goiters with same degree of airway occlusion [9].

Determining the appropriate size of the SLT in such patients is an intricate task as it does not correlate accurately neither with symptoms nor with the radiological assessment. Here, a rational approach seems to be a FOB examination of the airway above and below the compression, followed by selection of the tube size that seems to be apt. The different methods described for placement of BB are intraluminal (through SLT lumen) and extra-luminal (outside SLT lumen). Intraluminal placement of BB is conventionally done using FOB and BB simultaneously through the same lumen and this requires a large size endotracheal tube with ID of more than 7.5 mm. Extra-luminal placement of BB can be done in two ways:

(i) The BB is placed inside the trachea by direct laryngoscopy prior to tracheal intubation by SLT. This BB is then directed to the optimal position under the guidance of intraluminally inserted FOB.

(ii) By using two SLTs, the first SLT is used to intubate the contralateral main stem bronchus and BB is inserted intraluminally via this SLT. Once BB is placed in the desired bronchus, the first SLT is removed and the second SLT is inserted into the trachea. Again, BB is then directed to the optimal position in the similar way using intraluminal FOB [10].

Apart from intraluminal and extraluminal BB placement technique, a third alternative is via Univent tube wherein the BB is passed through the tube lumen but not the airway

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lumen. Univent tubes are flexible silicon tubes with an oval airway lumen that results in narrow effective ID and a 2mm fixed channel for BB placement which expands the outer diameter as opposed to a same size SLT. Univent tubes have an added benefit of assisting intubation in difficult cases, especially in patients with large goiter and difficult laryngoscopy, where the blocker may be used as a bougie to aid intubation [11]. However, the limitation of using univent tube is that it has a smaller ID which causes high airflow resistance and might need to be changed at the end of surgery when postoperative ventilation is planned.

Conclusion

Fluoroscopy guided placement of BB can be advantageous, particularly in patients with significant central airway obstruction. In situations where the internal tracheal tube diameter forbids the simultaneous use of a FOB and BB, fluoroscopic guided BB placement is an alternative and an expedient approach to conventional FOB guided placement and by employing this approach we can avoid a large sized SLT, thus minimizing the risk of airway trauma.

Conflicts of interest

None

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