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Case Report

Anaesthesia consideration for carinal resection and reconstruction - A case report

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ABSTRACT

A 25- year old male patient, with subcarinal mass projecting into carina and lower tracheal lumen underwent carinal resection and reconstruction surgery. This was done through the laryngeal drop and bilateral thoracotomy approach. Intraoperative course was complicated by persistent hypoxia and arrhythmias. This report explores the various anaesthetic issues involved which were effectively managed.

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1. Introduction

Carinal resection anastomosis is a relatively rare and challenging case for both Anaesthesiologist and Surgeon because of sharing of common area of intervention. The goal of Anaesthesia is to control the airways, maintaining satisfactory gas exchange and ensuring good surgical exposure to the trachea.¹ This can be achieved with various techniques. Cross field ventilation is commonly used technique in airway surgery especially if the defect involves the carina. We encountered hypoxia secondary to cross field ventilation and subsequent arrhythmias. This case report explores the successful management of these complications.

2. Case Report

A 25 year old male patient, presented with a history of cough with expectoration, dyspnea on exertion and hemoptysis. His routine blood investigations were normal. CT thorax was suggestive of subcarinal mass lesion

projecting into carina and lower tracheal lumen (Image I). Bronchoscopy confirmed the diagnosis which revealed mass in both bronchi and lower trachea (Image I). He had dyspnea on exertion and air entry was reduced on left side of chest. Pulmonary function tests (PFT) was of obstructive pattern. Electrocardiogram, 2D Echocardiography (2D ECHO), chest X- ray (CXR) and arterial blood gas (ABG) were normal. Preoperative optimization done with deep breathing exercises and antibiotic prophylaxis.

First, he was posted for rigid bronchoscopy for biopsy and debulking of tumour. After written informed consent, patient was taken in operation theatre (OT) and connected to cardiorespiratory monitor. He was induced with adequate dosage of intravenous Glycopyrrolate, Midazolam, Fentanyl, Propofol and Succinylcholine. Forcep biopsy was taken through the rigid bronchoscope. This was followed by coring of tumour mass on left side with single pass of diode LASER fiber. He was intermittently ventilated with Venturi device. Post procedure, air entry was improved on left side of the chest. Histopathology report was suggestive of benign peripheral nerve sheath tumour suggestive of schwannoma with acute inflammation. He was posted for laryngeal drop

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followed by carinal resection and reconstruction surgery through bilateral thoracotomy.

Thoracic epidural catheter was inserted at T 7- T 8 level under local Anaesthesia. He was premedicated and induced with adequate dosage of intravenous Glycopyrrolate, Midazolam, Fentanyl, Propofol and Vecuronium. Trachea was intubated with 8.5 single lumen cuffed Endotracheal (ET) tube. Tip of the ET was proximal to tumour mass which was confirmed clinically and with bronchoscopy. Anaesthesia was maintained with O₂ + Nitrous Oxide + Sevoflurane and Fentanyl, Midazolam and Vecuronium infusion. Apart from routine monitoring, invasive arterial blood pressure monitoring and intraoperative consciousness were monitored. Central venous pressure was monitored through right internal jugular vein cannulation which was done after the closure of neck incision.

In supine position laryngeal drop was done through collar incision. Around 1.5 cm of tracheal segment was mobilized down. Carinal resection along with tumour tissues with adequate margins and left bronchial sleeve resection was done through bilateral thoracotomy approach.

Left hilar dissection and left bronchus mobilization was done through left thoracotomy. It was followed by right thoracotomy to mobilize right bronchus. It was found to be around 3x2 cm tumor involving left postero-lateral wall of lower 2 cm of trachea. It was extending around 1 cm into left main bronchus. This was associated with enlarged subcarinal lymph nodes. Before opening of airway, patient was preoxygenated with 100% Oxygen. Total intravenous Anaesthesia (TIVA) was initiated with Propofol infusion. We preferred intermittent apnea ventilation technique (IAVT) during resection and anastomosis of airway. Patient was ventilated through cross field ventilation and not through orotracheal intubation during ventilatory phase of IAVT. This was achieved with 6.0 mm flexometallic tube (FMT) inserted by surgeon under vision whenever prompted by Anaesthesia team. During right side resection and anastomosis, left cross field endobronchial intubation was done and vice versa. While doing left side resection, he was ventilated with right endobronchial cross field intubation. He was not maintaining oxygen saturation (SpO₂) so left endobronchial intubation was done with other 6.0 mm FMT. This differential lung ventilation (DLV) was started by using Y connector connected to both endobronchial FMTs to a single Anaesthesia machine. There was no improvement in SpO₂ despite DLV. Ventilator was showing persistent high airway pressure so both bronchial suctioning was done to rule out tumor embolus or mucous plug. 100 % oxygenation started. Patient went into bradycardia which did not respond to IV Atropine 0.6 mg. Second dose of Atropine 0.6 mg corrected the bradycardia. Simultaneously surgical team re-positioned the right side FMT, which subsequently improved the SpO₂. Later the remaining posterior wall anastomosis was completed uneventfully.

During anterior wall suturing patient had an episode of unstable supraventricular tachycardia (SVT). Normal sinus rhythm was established with internal cardioversion with 5 Joules. Hypotension was corrected with boluses of colloids. After hemodynamic stabilization rest of the surgery was carried out uneventfully. He was ventilated later with intact orotracheal ET after anterior wall suturing. Neck was placed in flexed position with the help of chin sutures.

Postoperative bronchoscopy was done for removal of secretions. It revealed normal anastomosis of newly constructed carina. In view of intraoperative cardiac events, he was ventilated overnight in ICU and extubated on next postoperative day (POD). His ICU stay was uneventful and shifted out of ICU on third POD and discharged after a week. Follow up bronchoscopy was done after one month which was showing normal anastomotic site of newly constructed carina (Figure 1).

3. Discussion

Indications for carinal resection include bronchogenic carcinoma, other airway neoplasm, benign or inflammatory strictures and congenital anomalies.² Management of carinal resection and reconstruction start preoperatively. For an Anaesthesiologist, it is must to discuss surgical plan with surgical team as the airway is shared with them. Careful patient selection and preoperative optimization is essential to the success of these technically demanding and high risk surgery. Resection of carina may be combined with right or left pneumonectomy or upper lobe bronchial sleeve resection.³

Preoperative optimization includes detailed history and examination. Associated comorbidities increase the likelihood of perioperative complications. Hemoptysis and stridor are the alarming symptoms. Malignant tumours may produce hemoptysis, while presence of stridor alters the anaesthesia induction plan. Complete PFT, ABG analysis, and quantitative ventilation and perfusion scans should be performed to assess preoperative status and to predict postoperative lung function.² At the same time debulking of the tumour should be done whenever indicated. The imaging like CT Scan neck and thorax or three dimensional helical CT is needful in defining the relationship of the lesion to the airway. Cardiac assessment is recommended in carinal resection especially when combined with pneumonectomy. Ventilation and perfusion scan may be warranted, when the resection of considerable lung parenchyma is anticipated. Smoking cessation and deep breathing exercises are recommended. Apart from routine monitoring special monitoring like arterial cannulation, central venous cannulation and intraoperative consciousness level monitoring should be used.

Ventilation and maintaining oxygenation during tracheobronchial resection surgery is the challenging moment for the anesthesiologists.⁴ It is well known that

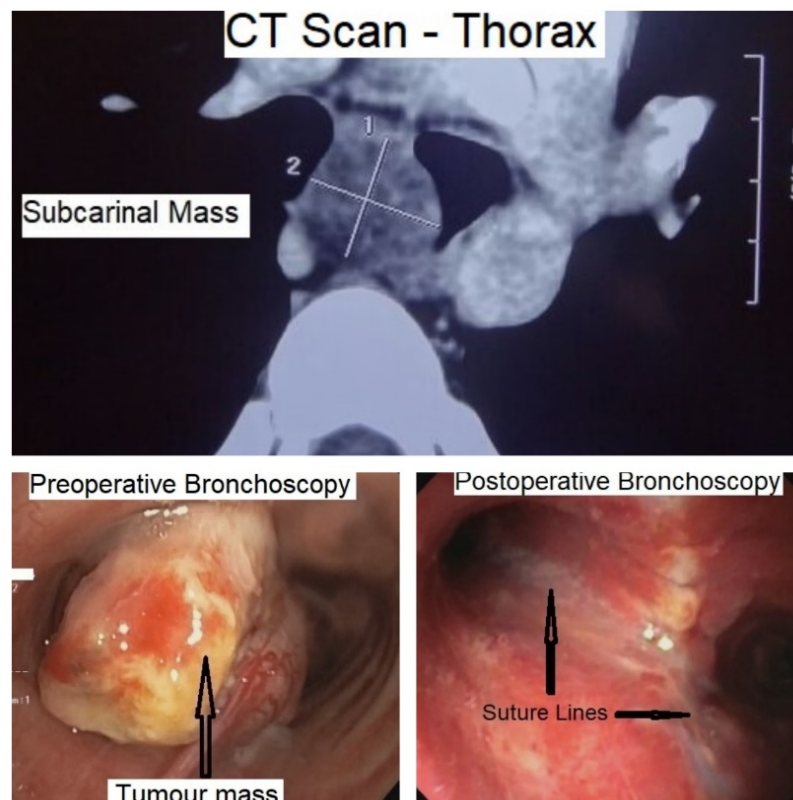


Fig. 1: CT scan thorax and bronchoscopy

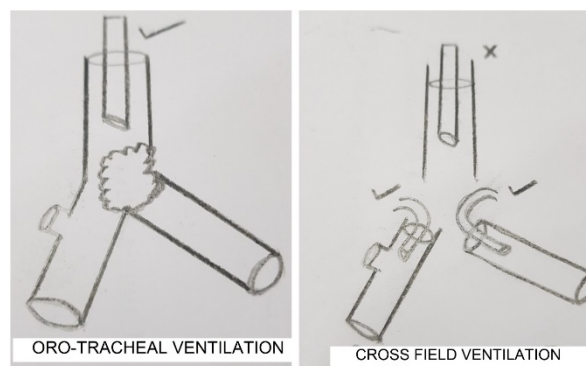


Fig. 2: Oro-tracheal and cross field ventilation

the ability to provide adequate ventilation throughout the perioperative period is a major predictor for better outcome during carinal resection surgery.⁵ A variety of methods for providing adequate oxygenation and carbon dioxide elimination have been used during tracheal resection. These include, standard orotracheal intubation, insertion of a tube into the opened trachea distal to the area of resection, high frequency jet ventilation (HFJV) through the stenotic area, low frequency jet ventilation for stent insertion, high frequency positive pressure ventilation

(HFPPV) and cardiopulmonary bypass specially when left thoracotomy approach is used.⁶ Fung et al. has reported a case of elective veno-venous Extra Corporeal Membrane Oxygenation (ECMO) and high flow nasal oxygen for subtotal resection of a distal malignant tumor.⁷ In present case, we used cross field ventilation (Image II) which is the most commonly used technique, but requires close anesthetic collaboration. When trachea is opened, the oral tube is pulled proximally but still in trachea. And usually, a sterile FMT is placed under vision across surgical

field by the surgeon to the distal airway for the period of segmental resection. This is followed by reintroduction of the native orotracheal ET ventilation after end-to-end anastomotic reconstruction.⁸ In our case, re-positioning of right FMT improved the SpO₂. Thus, meticulous attention of ET and its cuff is very important in preventing oxygen desaturation in cross field ventilation. Apneic oxygenation operates on the principle that with preoxygenation and hyperventilation, 10-12 min of total apnea can be safely tolerated.⁹ Here we have used the standard orotracheal ventilation method till the time of open airway. Thereafter, IAVT and endobronchial intubation distal to the area of resection. Post anastomosis he was again ventilated with standard orotracheal ET.

OT should be equipped with emergency cart, additional anaesthesia machine and trained Anaesthesia team. Anaesthesia strategy depends on the presence or absence of the airway obstruction. Resection and reconstruction of the airway is the most challenging phase of this surgery, where close communication with surgeon should be made. In present case, we preferred intermittent apnea technique as ventilatory strategy. Apart from I.A.V.T., which is one of the cause hypoxia, we ruled out other causes i.e. airway secretions, mucus plug or tumor embolization. In this case, right sided hypoventilation secondary to improper positioning of right endobronchial FMT could have caused hypoxia.

Pathogenesis of perioperative arrhythmias is multifactorial. The increased sympathetic outflow, related to hypovolemia, anemia, hypoxia or pain, can elicit new onset atrial fibrillation in surgical patients. Pericardial manipulation and local inflammation during thoracic and cardiac surgery may contribute, as does the surgery related systemic inflammatory response. Finally metabolic derangements such as perioperative hypothyroidism or hyperglycemia and electrolyte disturbances may also contribute to perioperative arrhythmias pathogenesis.¹⁰ The sympathetic and parasympathetic nervous systems contribute to the cardiac plexus located close to the aortic arch and tracheal bifurcation. Surgical dissection especially during exposure of the hilum and mediastinal lymph nodes can damage the plexus. Vagal stimulation can also precipitate arrhythmias.¹¹ In our case occurrence of arrhythmias could be because of hypoxia or surgical manipulation of cardiac plexus.

It is desirable to extubate patient immediately after the surgery. The positive pressure ventilation can apply stress on the freshly created airway anastomosis, increasing the post-operative morbidity.¹² Short acting or reversible agents facilitate this goal. But we ventilated him postoperatively in view of intraoperative cardiac events. In order to prevent anastomosis dehiscence, patient was ventilated with low acceptable tidal volume without PEEP and with adequate sedation.

We obtained the consent for publication from patient's relatives.

4. Conclusion

Carinal resection is a high risk procedure that offers acceptable clinical outcomes for patients who are appropriate candidates. Intraoperative hypoxia and arrhythmias is not uncommon in airway surgery. For successful outcome of this relatively rare surgery the anaesthetic management should be entwined with the surgical management.

5. Source of Funding

None.

6. Conflict of Interest

None.

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