

Anesthetic management for bronchoscopy and debulking of obstructing intratracheal tumor

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ABSTRACT

Primary tracheal tumors comprise a rare group of benign and malignant tumors. Bronchoscopy is required for diagnosis and staging of tracheal neoplasms as well as debulking of the tumor. The management of anesthesia for rigid bronchoscopy in a patient with tracheal neoplasm presents with many challenges to the anesthetist. We present anesthetic management of an 18-year-old female who presented with orthopnea. Computed tomography scan of the thorax revealed a polypoidal lesion in the trachea proximal to carina and consolidation in the right middle lobe. The patient was scheduled for rigid bronchoscopy and debulking of the tumor. Case was successfully managed by providing positive pressure ventilation and oxygenation during rigid bronchoscopy using manual ventilation through the side port of the rigid bronchoscope. The procedure was uneventful, and patient improved symptomatically in the immediate postoperative period. The successful management of this case demonstrates the airway management in a patient with tracheal tumor for rigid bronchoscopy.

Key words: *Bronchoscopy, high frequency jet ventilation, intratracheal tumor, positive pressure ventilation, rigid bronchoscope*

INTRODUCTION

The management of anesthesia for rigid bronchoscopy in a patient with obstructing intratracheal tumor presents many challenges to the anesthetist, such as difficulty in ventilation, securing of the airway, sharing of airway with the surgeon^[1] and need to control the seepage of blood and small chunks of tumor tissue distally into the tracheobronchial tree while resection.^[2] Meticulous planning and communication between the anesthetist and the surgeon is mandatory for the safe and successful outcome of the patient. We describe anesthetic management of a patient planned for bronchoscopy and debulking of obstructing intratracheal tumor.

CASE REPORT

An 18-year-old female weighing 40 kg presented with complaints of difficulty in breathing for past 2 years that

was insidious in onset, gradually progressive, aggravated on lying down position and relieved upon sitting. There were associated cough and chest pain. She was hospitalized on two occasions, once with respiratory difficulty and was found to be IgE positive for *Aspergillus fumigatus* and was treated with bronchodilators and steroids. There was recurrent hospitalization later again as her symptoms did not improve. This time she was taken up for rigid bronchoscopy which revealed mass lesion in the trachea obstructing both major bronchi. The biopsy taken at this time was inconclusive.

General physical examinations revealed a well-looking lady with shortness of breath. There was no clubbing or lymphadenopathy. Vital signs were otherwise normal except for the increased respiratory rate. Chest examination revealed bilaterally equal air entry with associated wheeze

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on the right side. ENT, systemic and indirect laryngoscopy examination were all normal.

Laboratory data included hemoglobin of 11.8 g/dl, white blood cell count of 12,300 mm³ and platelet count 1.9×10^6 . Arterial blood gas (ABG) analysis showed pH 7.478, pCO₂ 39, pO₂ 71.9, HCO₃ 29 mEq/L and O₂ saturation of 95% on FiO₂ of 0.4. Chest X-ray was suggestive of bronchopneumonia of the right middle lobe. Computed tomography (CT) scan of the thorax revealed a polypoidal lesion in the upper part of the trachea proximal to the carina. Pulmonary function test could not be done as a patient was having severe symptoms.

For a definitive diagnosis as well as symptomatic relief, patient was scheduled for rigid bronchoscopy and debulking of the tumor.

After informed high-risk consent, patient was accepted for surgery under American Society of Anesthesiologists III. In the operating room, equipment for jet ventilation with a small bore catheter was kept ready if ventilation failed at any point during the procedure. Small sized endotracheal tubes and fiberoptic bronchoscope were also available. Cardiorespiratory monitoring was instituted. Intravenous line was established and lactated Ringer's solution was on flow. Prior to induction of anesthesia, the patient's room air saturation was 95%. After adequate preoxygenation, anesthesia was induced with intravenous fentanyl 50 micrograms and titrated dose of propofol. After the confirmation of ease of ventilation with face mask, injection suxamethonium 40 mg was given to produce neuromuscular blockade. A rigid bronchoscope (Karl Storz size 6) was then introduced, and ventilation continued via the side port of the bronchoscope by connecting the anesthesia breathing circuit to it and providing manual ventilation. Massive tracheal tumor arising from the lateral wall of the trachea was visualized [Figure 1]. The bronchoscope could be negotiated beyond the growth [Figure 2], and it was possible to ventilate the lungs. Intermittent acting muscle relaxant (injection vecuronium 4 mg) was then given. Anesthesia was maintained with a supplemental dose of injection fentanyl 20 µg, injection vecuronium and propofol infusion at 100-120 mg/h (4.5 mg/kg/h). Resection of the tumor was done using punch forceps through the bronchoscope using multiple attempts and hemostasis was secured. At the end, adequate patency of the trachea was achieved, and only a small mass was left along the lateral wall [Figure 3]. The whole procedure took 75 min to complete. All vital parameters were well maintained during this period. Patient had no episodes of desaturation. ABG done did not reveal any hypoxia or hypercarbia.

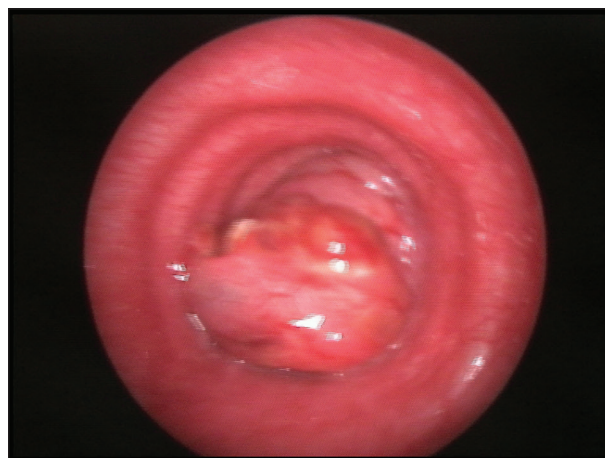


Figure 1: Massive tracheal tumor arising from lateral wall of trachea

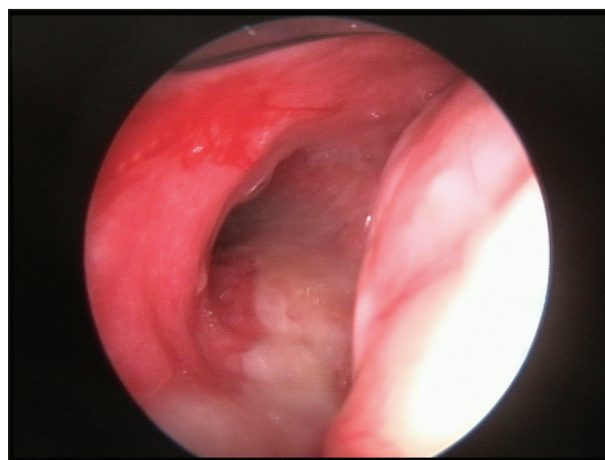


Figure 2: Bronchoscope negotiated beyond the growth to visualize the tracheal lumen

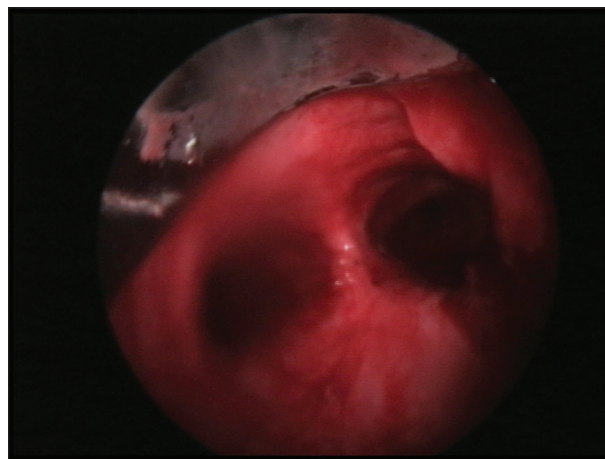


Figure 3: Tracheal lumen postresection of tumor

Bronchoscope was then taken out after thorough suctioning and airway secured using cuffed endotracheal tube number 6.5 mm ID. Gentle suctioning was done. Neuromuscular blockade was reversed with injection neostigmine/glycopyrrolate and patient's trachea extubated. Patient was

stable maintaining oxygen saturation on face mask with FiO_2 of 0.4.

The patient was transferred to the main Intensive Care Unit (ICU) for further observation. The patient improved symptomatically and had no dyspnea on lying down. Lung consolidation was managed with O_2 (FiO_2 0.4), antibiotics, chest physiotherapy and nebulization. The patient made an uneventful recovery and was shifted out of the ICU on postoperative day 2. She eventually became completely asymptomatic and was discharged after 10 days after being advised regular follow-up in the outpatient department. Her biopsy report revealed an adenoid cystic carcinoma.

DISCUSSION

Primary tracheal tumors comprise a rare group of benign and malignant tumors of the trachea. In the adult population, primary neoplasm are usually malignant with an annual incidence of 2.6 new cases/million/year.^[3-5] Benign tumors of the trachea are more common occurrence in the pediatric age group and are mostly papilloma, fibromas and hemangiomas.^[6]

The infrequency of cases creates a low level of suspicion among physicians. The patients present with common and nonspecific symptoms such as dyspnea, cough, wheeze, etc., which further leads to delay in diagnosis and treatment. Patients may also present with signs and symptoms of upper airway obstruction.^[7] The tumor must generally advance to a size which obstructs more than 75% of the tracheal lumen before dyspnea is experienced.^[8] The occurrence of hemoptysis secondary to mucosal ulceration generally prompts more aggressive diagnostic measures. Similarly, new onset hoarseness or dysphagia is a more ominous presentation of tracheal tumors. Among the signs and symptoms which should alert the anesthetist to an increased perioperative risk are increased dyspnea (orthopnea) or cough when supine (increased risk of airway complications).^[9]

These patients are usually treated for bronchial asthma or chronic obstructive pulmonary disease with inhaled corticosteroids and beta 2 agonists for many years.^[10] The chest radiograph shows no abnormality in 30-75% of such patients. The pulmonary function testing may suggest the presence of upper airway obstruction. An obstructive flow pattern which does not respond to bronchodilator therapy should arouse suspicion of a fixed upper airway obstruction. Flow volume loops, with characteristic flattening of both inspiratory and expiratory phases, may provide further evidence of upper airway obstruction. A CT scan is advised to rule out any intratracheal mass when

symptoms do not improve with bronchodilator therapy. CT scan demonstrates the intraluminal and extraluminal extent of tumor and delineates the relationship of the tumor to the adjacent structures.^[11]

Bronchoscopy is the mainstay of diagnosis and staging of tracheal neoplasms.^[12] The rigid bronchoscope is preferred because it allows more accurate measurements and allows more secure control of the obstructed airway and control of any bleeding that may occur following biopsy. Rigid bronchoscopy allows “coring out” of an obstructing tumor to allow clearing of a postobstructive pneumonia or to allow weaning from corticosteroids prior to definitive treatment.

Endoscopic clearance of endotracheal tumor may be performed for palliation in otherwise inoperable patients or as a means of maintaining airway patency until subsequent definitive surgical resection can be performed. The tumor can be removed with biopsy forceps, laser therapy using neodymium-doped yttrium aluminum garnet laser or KTP laser, cryotherapy or electrocoagulation.^[13-16]

A variety of methods for providing adequate oxygenation and carbon dioxide elimination during bronchoscopic ablation of the tracheal tumor include:

- Local anesthesia.
- General anesthesia under spontaneous ventilation/controlled ventilation.
- Manual/high frequency jet ventilation (HFJV).
- Tracheostomy.

Each anesthetic approach has certain advantages as well as there are associated limitations and complications. The site and extent of the lesion, and the preferences of the anesthetist and the surgeon determine the technique used.

General anesthesia needs a step-by-step induction of anesthesia with continuous monitoring of gas exchange and hemodynamics. The airway is locally anesthetized, and the rigid bronchoscope passed beyond the tracheal obstruction while maintaining spontaneous ventilation until the airway is definitively secured. Topical anesthesia applied at this time helps in preventing adverse reflexes during the bronchoscopy. If muscle relaxants are required, assisted ventilation should first be gradually taken over manually to assure that positive-pressure ventilation is possible and only then can a short-acting muscle relaxant be administered. Spontaneous breathing can cause ineffective ventilation and a potential hindrance to surgery.

High-frequency jet ventilation should be available in the operating room to prevent any life threatening airway catastrophe. If the bronchoscopy reveals a tracheal tumor

which is completely obstructing the airway, then under these circumstances HFJV provides a viable option for airway management.^[17] It provides an unobstructed and quiet surgical field. However, when using HFJV in an obstructed tumor, there is the potential for barotrauma from built up of pressure due to impaired egress of expired gases. There can be a risk of distal dislodgement of any broken piece of mass or increase in airway obstruction by movement of the mass itself. There is a fair chance of compromising the oxygenation by collapse of the tracheal lumen distal to the mass during expiration or by development of pneumothorax. Another issue is the development of hypercarbia.

We used general anesthesia step by step and after confirmation of adequate face mask ventilation, a short-acting muscle relaxant was given for the introduction of a rigid bronchoscope. As we were able to negotiate rigid bronchoscope beyond the growth and were able to ventilate the lungs, an intermediate-acting muscle relaxant was then given. We chose this technique as spontaneous breathing provides ineffective ventilation. Anesthesia was maintained with propofol infusion as inhalation agents may cause airway irritation and also ventilation is interrupted several times during the procedure making it difficult to achieve a certain MAC.^[18]

Previous reports on anesthetic management of intra-tracheal mass show that it is possible to negotiate a rigid bronchoscope beyond the growth and ventilate the patient manually or with jet ventilation.^[19,20] However, we should always be prepared to deal with critical airway obstruction. Equipment for jet ventilation, emergency tracheostomy should be available.

In our case, we had manual jet ventilation available for an emergency oxygenation. This technique, however, has complications of its own. Pulmonary barotrauma is a real danger because of high oxygen pressure at the source. There are several reports of pneumopericardium, pneumothorax, and pneumomediastinum.^[21]

Tracheostomy is suitable mostly for pedunculated nonvascular intratracheal tumor situated in the cervical region.^[2] Tumors that are situated beyond the sternal notch would not allow successful tracheostomy or tracheal intubation as it increases the risk of disease spreading to the trachea and bronchi. Tracheostomy was not possible in our case due to site and size of the lesion.

CONCLUSION

It can be concluded that it is always prudent to go for endoscopic or radiological evaluation of airways in patients with long-standing or recurrent respiratory

symptoms. The management of this case demonstrates the tremendous usefulness of rigid bronchoscopy. It provided a conduit for biopsy and debulking of an obstructing tumor. Many previous technical limitations to the performance of bronchoscopic procedures can now be overcome by careful preoperative delineation of the site and degree of obstruction, close intraoperative communication between the surgeon and anesthetist, improved anesthetic management techniques and meticulous postoperative care.

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Conflicts of interest

There are no conflicts of interest.

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