

# Airway emergencies in cancer

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## Abstract

Management of airway obstruction is always challenging but more so in cancer setting, as obstruction can lie at any level right from pyriform fossa to low down in mediastinum. Morbidity is significant but if not managed properly leads to frightful death by suffocation. These cases need to be evaluated, diagnosed and managed with care, skill, speed and appropriate intervention. With the advent of technology, it has become much easier to manage such situations with a team of specialists involving anesthetist, thoracic surgeon and intensivist.

**Key words:** Airway obstruction, airway stenting, laryngeal papillomatosis, mediastinal mass, rigid bronchoscopy

## Introduction

Cancer is one of the frequent causes of death in India amounting to almost 6-6.5% of total deaths.<sup>[1]</sup> Head and neck cancer including malignant tumors of the larynx, pharynx and oral cavity continue to be the dominant cancer in males and third in overall incidence in females, behind cervical and breast cancer. Primary or metastatic tumors in the region of head neck, lung or mediastinum may cause airway obstruction at the level of larynx, trachea or bronchi. Clinical symptoms depend on the level of obstruction and degree of obstruction and may range from minimal stridor to almost complete airway obstruction. Rapid and accurate diagnosis with proper management can be life-saving. The goal of management is to provide prompt relief of airway obstruction with low morbidity and mortality; at the same time it should not interfere with future definitive therapy. In patients with terminal malignancy, it should be economical and minimize hospitalization.

## Causes and Pathophysiology

Airway obstruction may be divided into: (1) proximal or large airway obstruction and (2) distal airway obstruction. The proximal large airways include the hypopharynx, larynx and trachea up to the carina. This may be divided into the upper airway, which includes the part above the mid-trachea and the lower airway, which is distal to the mid trachea. This has implications for management, as proximal upper airway obstruction can be bypassed by tracheostomy, while the lower airway obstruction may not be. The distal airway includes the mainstem and lobar bronchi and their more distal radicals. Clinical differentiation between upper and lower airway obstructions may not be always possible. Consequences of such obstructive lesions can range from cough, dyspnea, wheezing, infection, atelectasis, to respiratory failure and death.

## Proximal airway obstruction

Upper airway obstruction is the primary mechanical emergency of the respiratory system in patients with cancer. It is a complication of tumors involving the base of the tongue, hypopharynx, larynx, thyroid or mediastinum or may result from benign causes, including aspiration of food or other foreign bodies, tracheal stenosis, tracheomalacia and laryngeal edema. Primary tumors

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of the trachea are less common causes. Lung cancer is a common cause of central airway obstruction; 30% of lung cancers cause obstruction of trachea and main bronchi with consequent respiratory distress. Acquired immunodeficiency syndrome (AIDS) related Kaposi's sarcoma involving upper airways and presenting with obstructive symptoms have been reported.<sup>[2]</sup> Benign tumors of upper and lower airways like fibromas, angiofibromas, papillomas, hamartomas can also produce airway obstruction.<sup>[3]</sup>

Because of close anatomical proximity, patients with esophageal cancer have frequent malignant involvement of the major airways, leading to respiratory distress and life-threatening major airway obstruction. In addition, intraesophageal self-expandable metallic stents currently used for palliation in patients with unresectable malignant stricture of the esophagus, can lead to bronchial / supracarinal obstruction (depending on the level of stent placement) up to 24h after placement, as the stent expands fully.

Laryngeal papillomatosis is one of the commonest upper airway emergencies in pediatric patients. Respiratory papillomatosis is a disease of viral etiology that is characterized by recurrent proliferation of benign squamous papillomas within the respiratory tract. The most common site of involvement by respiratory papillomas is the true vocal cord. Although benign histologically, respiratory papillomas may behave very aggressively and can precipitate sudden airway obstruction. 60 to 80% of cases are thought to be of childhood onset, usually before the age of three years. Although they can be found anywhere in the aerodigestive tract, there appears to be a predilection for areas where there is a junction of squamous and ciliary epithelium. Tracheotomy should be avoided in these children as it can lead to lesions around the tracheotomy site inducing an iatrogenic squamociliary junction.

In the paediatric population another common cause of airway obstruction is mediastinal tumors. In adults, the trachea and the right mainstem bronchus are relatively rigid structures compared with the superior vena cava (SVC), but in children these structures are more susceptible to compression. In addition, the relatively smaller intraluminal diameters of a child's trachea and bronchus can tolerate little edema or obstruction

before respiratory symptoms occur. Because of this accompanying respiratory component, children with mediastinal tumors frequently present with airway obstruction and constitute a serious medical emergency. 12% of pediatric patients with malignant mediastinal tumors present with superior mediastinum syndrome (SMS) that include SVC obstruction and airway obstruction. Jeffery *et al* in their case series have reported 2.4% incidence of severe airway obstruction in cases of Hodgkins lymphoma as presenting feature.<sup>[4]</sup>

### **Lower and distal airway obstruction**

Bronchial or lower airway obstruction is rarely life-threatening but can result in significant morbidity. The most common intrinsic cause of bronchial obstruction is primary carcinoma of the lung. Uncommonly, endobronchial metastases from carcinomas of the breast, colon or kidney and melanoma can produce bronchial obstruction. AIDS-related Kaposi's sarcoma is an increasing cause of lower airway obstruction, as is aspergillosis-causing obstruction of distal airway especially in immunocompromised and neutropenic patients.

Mediastinal masses can also give rise to extrinsic bronchial compression. These include patients with non Hodgkin's lymphoma, acute lymphatic leukemia, germ cell tumors, Hodgkin's disease, neuroblastoma and sarcomas of the mediastinum.

### **Clinical Manifestations**

The clinical manifestation of airway obstruction will not only depend on the underlying disease, but also on the site, severity and rate of progression in airway obstruction as well as the patients underlying health status and symptoms associated with postobstructive sequelae. There may be additional accompanying pathology such as the Superior vena cava syndrome, recurrent laryngeal nerve palsy etc. The airway obstruction can be due to endoluminal pathology or due to external compression. Patients are often misdiagnosed as asthma before the correct diagnosis is made.

Most patients who develop upper airway obstruction have a known diagnosis of cancer, but at times it may be the first presentation of a small, critically placed lesion that is curable. In the pediatric age group, many children with Hodgkins lymphoma present directly in respiratory

obstruction caused by a mediastinal mass as the first symptom.

On presentation patients may exhibit tachypnea and various degree of respiratory distress. Signs and symptoms develop when the airway obstruction impairs airflow to the point of increasing the work of breathing or altering cardiopulmonary interactions. Barach, in 1935, postulated that the primary sensation of air hunger in patients with central airway obstruction was not related to hypoxia or hypercapnia, but rather to “the increased effort required to obtain the normal velocity of air delivered to and from the lungs”.<sup>[5]</sup> Stridor is a sign of severe laryngeal or tracheal obstruction. If the obstruction is severe, the patient will be restless, diaphoretic, tachycardic, unable to lie down, using accessory muscles and many times cyanotic. Paradoxical breathing may be seen, with the abdomen coming up and chest moving inwards due to retraction of the intercostal muscles with each inspiration. On auscultation one might encounter silent chest due to total upper airway obstruction or prolonged inspiratory and expiratory phase along with inspiratory and expiratory wheeze.

As the asphyxiation becomes worse, at times in a matter of seconds, patients appear cyanotic and obtunded and develop bradycardia. Patients with mediastinal tumors and associated airway obstruction are typically unable to tolerate supine position and more comfortable in sitting or leaning forward position. Unilateral wheezing, often suggests airway obstruction distal to the carina. The presence of persistent unilateral wheezing should always prompt the investigation of focal airway obstruction.

Patients may also present with other nonspecific symptoms like positional wheezing. With an anatomically fixed obstruction, shortness of breath and wheezing are typically unresponsive to bronchodilators and failure of a patient to improve with these measures should prompt the physician to consider the presence of an obstructed airway.

## Evaluation and Diagnosis

In acute life-threatening upper airway obstruction, a rapid evaluation must be performed to ensure that a foreign body or blood clot is not the cause. Arterial blood gases are not useful in the evaluation of upper airway obstruction and the decision for emergency intervention

is based solely on the clinical condition of the patient. Spirometry, especially flow volume loops although possibly helpful, is relatively insensitive and too slow and has no role in emergency situations. Conventional chest radiographs are rarely diagnostic and not of any use in upper airway obstruction. Computed tomography (CT) scan is diagnostic tool of choice in cases with mediastinal masses and airway compromise. Standard CT scans provide much more information, including the ability to document dynamic airway collapse. Advances in airway imaging, now allow multiplanar and three-dimensional reconstruction with internal (virtual bronchoscopy) and external images. These new imaging protocols give better characterization as to whether the lesion is intraluminal, extrinsic to the airway or has features of both types of lesions and whether the airway distal to the obstruction is patent. In addition, the length and diameter of the lesions and the relationship to other structures such as vessels, are assessed to a much higher degree of accuracy. All these features help the physician determine the appropriate therapy.

Bronchoscopy (either rigid or flexible) is always necessary in assessing airway obstructions, and the rigid bronchoscope is very helpful tool in an emergency situation. Direct visualization provides useful information such as the level and degree of obstruction and extent of obstruction. Most importantly, bronchoscopy allows a tissue diagnosis to be made in cases of intraluminal neoplasm. However performing bronchoscopy in patients with moderate to severe airway obstruction can act as a double-edged sword. Endoscopy may further precipitate the obstruction, making the patient hypoxic. Agitated patients may not cooperate for the procedure necessitating use of sedation. The use of conscious sedation may depress ventilation and relax the respiratory muscles enough so that a relatively stable airway becomes unstable. Rigid bronchoscopy helps in getting airway control as in the cases, where obstruction is external or dynamic, the rigid bronchoscope acts like a stent and helps in getting airway control or even relieves intraluminal obstruction by debulking the lesion. Flexible bronchoscopy may be difficult and potentially dangerous, when obstruction is severe, as the instrument will further obstruct the remaining lumen and does not allow for ventilatory support. Access to a team equipped for advanced airway management along with equipments for emergency airway control is essential when undertaking

bronchoscopy in these patients.

## Management

### *Treatment strategies to secure the airway*

#### **Proximal upper airway obstruction**

The evaluation and management of patients with symptomatic airway obstruction require a thorough knowledge of the etiology, physiology, diagnostic and treatment options, as well as a multidisciplinary team approach including chest radiologists, anesthesiologists, medical oncologists, head and neck and thoracic surgeons and the intensivist.

Establishment of airway in an efficient manner in acute airway obstruction is the immediate goal. Many situations may warrant action under controlled environment like Operation Theatre. Several patients have increased distress in supine position with a number of patients even refusing to lie down. Allow the patient to assume the position of comfort and give supplemental oxygen. At all the times keep patient breathing spontaneously and avoid any procedure that will precipitate total airway obstruction.

Malignancies in upper airway that include base tongue, nasopharynx, pyriform fossa, epiglottis or vocal cords will usually require a surgical airway such as tracheotomy or cricothyrotomy. Attempting intubation in these cases can prove to be disastrous and should be attempted only in presence of a surgeon competent at establishing surgical airway. If a decision to secure airway with endotracheal tube is taken, tubes of smaller sizes should be kept ready. Also it should be kept in mind that these tumors being fragile can bleed uncontrollably, making the situation worse and hence one should be very gentle. Long acting sedatives, respiratory depressants and muscle relaxants should be avoided. The use of a fiberoptic bronchoscope for intubation is very limited specially if tumor is bleeding. The distorted anatomy in cases of hypopharyngeal tumors may make identification and visualization of glottic aperture difficult. If the patient is uncooperative or in severe respiratory distress, it is better to avoid fiberoptic intubation and go for surgical airway. From recent studies it is shown that there is no role of emergency laryngectomy for patients of carcinoma larynx presenting with airway obstruction as there is no survival benefit. These patients should undergo tracheostomy and have elective surgery at a later date.<sup>[6,7]</sup> For very

combative patients in severe distress, when patient can not even lie still for tracheostomy, stab cricothyrotomy can be life-saving, which can be later converted to tracheotomy.

In pediatric patients with laryngeal papillomas who present with acute airway obstruction, endotracheal intubation is the preferred option even in an emergency situation. It is advisable to intubate these children awake with spontaneous breathing maintained, as mask ventilation can be very difficult. Tracheostomy should be avoided as far as possible as it can lead to distal spread of papillomas. As these papillomas are pedunculated finger-like projections which can be easily separated out, most of the times intubation can be achieved, even though the view on direct laryngoscopy looks scary. In emergency situations or when intubation expertise is not available, however tracheostomy can be considered. At the present time, the control of respiratory papillomatosis is best achieved with periodic microsuspension laryngoscopy and carbon dioxide laser vaporization. The laser permits a more precise and complete removal of disease, while providing effective hemostasis. These factors help minimize the chance of acute postoperative airway obstruction.

#### ***Lower and distal airway obstruction***

For more distal airway lesions, intubation and tracheotomy may not be of much use to alleviate the symptoms. Rigid therapeutic bronchoscopic intervention is increasingly accepted to treat such patients with central airways obstruction. The rigid bronchoscope is of immense value especially when airway obstruction is due to a foreign body like part of fragile tumor or blood clot. It is not as invasive as tracheostomy or cardiopulmonary bypass and entails less risk of barotrauma than a jetting device. Low equipment demand and easy availability has made rigid bronchoscope very valuable tool. Successful bronchoscopic intervention restores central airway patency and provides symptomatic and functional improvement. The rigid bronchoscope acts as a stent holding airway open in cases of extrinsic compression and airway collapse. This is very important especially in cases of lower tracheal obstruction from an extrinsic mass.<sup>[8]</sup> In such cases, simple endotracheal intubation with direct laryngoscopy is generally possible but not of much use due to distal obstruction. The rigid bronchoscope has several other advantages. It provides a secure airway,



allowing excellent control of oxygenation and ventilation and also creates a channel through which number of instruments can be passed. An obstructing lesion can be "cored out" or a foreign body like tumor tissue or blood clot can be removed, a stenosis can be dilated with the barrel of the bronchoscope and therapeutic modalities such as laser, electrocautery and stent placement can be employed. Certain modalities, such as placement of most silicone stents, can be performed only through a rigid scope. In addition, the barrel of the bronchoscope can be used to tamponade a bleeding central lesion. A study by Colt and Harrell reviewed the records of 32 patients with central airway obstruction requiring admission to an intensive care unit before therapeutic intervention with a rigid scope. Twenty of these patients had an immediate reduction in the level of care following therapeutic rigid endoscopy. Of the 19 patients requiring mechanical ventilation, 10 (53%) had immediate discontinuation of mechanical ventilation. Rigid bronchoscopy was used to explore, ventilate and dilate airway obstruction for temporary control.<sup>[9]</sup>

In patients with critical upper airway obstruction, helium-oxygen combination (80-20%) has been used effectively by many authors to tide over the period of crisis till more effective modality can be applied. Curtis *et al* reported how, in a patient with respiratory failure due to inoperable extrinsic compression of the upper airway, the need for intubation and mechanical ventilation was avoided by using heliox for 48h while chemotherapy and radiation reduced tumor size and obstruction.<sup>[10]</sup> A similar case of NHL has been reported by Mizrahi *et al*.<sup>[11]</sup> Stephen *et al* reported successful management of airway obstruction due to laryngeal carcinoma by using heliox.<sup>[12]</sup> Grosz *et al* have reported successful management of 32 children with upper airway obstruction using heliox.<sup>[13]</sup>

The basic principle of this modality is that the manipulation of inspired gas density will decrease the work of breathing and energy expenditure. Also using helium as a carrier gas would increase intraalveolar oxygen delivery. Curtis *et al* have proposed three mechanisms by which helium helps patients with upper airway obstruction.-1. Reduction of resistance at stenotic orifice according to Grahams law, 2. Reduction and elimination of turbulence downstream by decreasing Reynolds number and 3. In case of intrathoracic narrowing, there is reduction of the tendency for the airway down stream from the stenosis

to collapse due to increased intraluminal pressure. Most of the authors have reported clinical improvement. The reduction in work of breathing by these mechanisms may be enough to allow for a more stable intubation, either with an endotracheal tube or the rigid bronchoscope or may totally alleviate the need for intubation.

### **Patients with mediastinal masses**

Stabilisation of the airway in patients with mediastinal mass and airway compromise can be a very challenging job. Patients suffer from airway obstruction in the lower part of trachea and main bronchi where endotracheal intubation or tracheostomy would be futile. Many times these patients are unable to tolerate the supine position due to weight of tumor compressing not only airway but also great vessels and heart including the right ventricular outflow tract. If lymphoma or other malignant disease is suspected, it is desirable to obtain a tissue sample for diagnosis before starting any treatment. If a pleural effusion is present, a cytologic diagnosis is frequently possible using thoracentesis. In those children who present with peripheral adenopathy, a lymph node biopsy under local anesthesia and in an upright position may be possible. In situations in which the above diagnostic procedures are not fruitful, consideration of a computed tomography-guided core needle biopsy should be contemplated. However, transporting these patients to radiology department to obtain the specimen may involve significant risk and may not be clinically feasible. Bedside FNAC can be done when patients are not in condition to be shifted to CT-scan and mass is situated in anterior mediastinum. Once the specimen is obtained for tissue diagnosis, patients can be immediately started on steroids and definite chemotherapy started after proper diagnosis is established.

Meanwhile patients can be managed in sitting or left lateral decubitus position, which helps by lifting off mass airway and right ventricular outflow tract along with face mask oxygen or non invasive PEEP. When noninvasive ventilation is being used for these patients one has to be extra cautious and ensure that lungs are emptying at the end of expiration and no air trapping is happening. Many times the situation may be a medical emergency with no opportunity to establish a tissue diagnosis. Sometimes sudden intratumor bleed can precipitate acute obstruction causing total obliteration of lumen. Large mediastinal masses that compress the trachea, bronchi

and pulmonary arteries cause unpredictable variations in pulmonary mechanics, difficulties in intubation because of anatomic distortion of the airway, airway edema due to SVC obstruction, ventilation difficulties because of high airway pressures from trapped lung and perfusion abnormalities because of compression of the pulmonary vasculature.

When the mass is in the anterior mediastinum, a trial can be given to ventilate the patient in prone position, which would decrease mechanical effects of tumor. A trial of change in position can be given keeping a continuous watch on airway pressures and gas exchange. In life-threatening obstruction in these cases, it may be appropriate to initiate empiric therapy prior to biopsy. The combination of radiation therapy and corticosteroids is standard therapy in an emergency situation awaiting definitive diagnosis, with the daily dose governed by the presumed radiosensitivity of the tumor (most lymphomas are radiosensitive), as radiation to mediastinum does not interfere with tissue diagnosis from other sites. For patients with severe respiratory distress requiring mechanical ventilation, radiotherapy is technically not feasible. In such situations high dose steroids help in opening the airway by decreasing edema as well as causing tumor lysis. Empiric chemotherapy can be started in certain cases using a combination of cyclophosphamide and anthracycline or vincristine.

Patients with extreme life-threatening airway obstruction not relieved by any means may be salvaged by institution of femoro-femoral cardiopulmonary bypass, followed by definitive therapy for the cancer.

Malignant airway obstruction often warrants multimodality treatment like endobronchial debulking of tumor, stenting and simultaneous chemotherapy.<sup>[14]</sup> Chao *et al* have reported successful management of a 21-year-old female with massive mediastinal tumor using veno-venous extracorporeal membrane oxygenation support for three days till concurrent chemotherapy allowed time for tumor shrinkage.<sup>[15]</sup> A search of MEDLINE revealed one other case in which chemotherapy was administered while the patient was on portable cardiopulmonary bypass support.<sup>[16]</sup>

From their retrospective review of eight patients with extrinsic airway obstruction due to mediastinal masses

Phua *et al* have come to the following recommendations:

- 1) Avoidance of airway manipulation, muscle paralysis and general anesthesia.
- 2) Immediate maneuvers include repositioning the patient in the lateral, prone or sitting position; application of positive pressure support via facemask; administration of intravenous steroids if appropriate.
- 3) Awake fibreoptic bronchoscopic intubation if endobronchial intubation necessary.
- 4) Rigid bronchoscopy for endobronchial stenting should be accessible for immediate application if airway patency is not restored.
- 5) Standby ECMO as a temporizing life-saving measure.
- 6) Diagnosis should be established urgently so that specific therapy can be instituted, which includes surgery, chemotherapy, radiotherapy and palliative endobronchial stenting.<sup>[17]</sup>

### **Definitive therapy**

Once the airway is stabilized more definitive treatment options can be considered for these patients. Detailed and careful bronchoscopy and imaging studies should be performed to plan additional measures. If a dedicated airway team is not available, patient transfer to a specialized center should be considered at that time. As the number and scope of therapeutic options have increased dramatically, the appropriate measures must be chosen carefully in the context of each patient's situation, disease prognosis and the expertise of the team. Expert opinion supports the use of multimodality and multidisciplinary approaches featuring a combination of several interventions to produce effective long-term success. In the palliative setting of alleviating central airway obstruction, laser resection, endoscopic resection by using mechanical debridement or electrocautery, argon plasma coagulation and stenting are techniques that can provide immediate relief, in contrast to cryotherapy, brachytherapy and photodynamic therapy with delayed effects. For patients with resectable cancers, radical surgical resection with systemic nodal dissection is the standard approach.

**Electrocautery:** Advances in flexible bronchoscopy have allowed for the development of techniques directed at alleviating airway obstruction, including cryotherapy, brachytherapy and photodynamic therapy. Although cost-effective, their effects are delayed and may require repeat treatments. Labeled as "the poor man's laser," electrosurgery has equivalent "laser-like" tissue effects at a fraction of the cost. Since the evolution of a new

generation of electrosurgical devices used in GI endoscopy electrocautery has become quite safe in application. Side effects of electrocautery include bleeding, airway perforation and endobronchial fire. In their prospective observational case series of 118 evaluations Coulter *et al* reported management of 47 evaluations using electrocautery of which 42 (89%) were successful in alleviating the obstruction, thus eliminating the need for Laser resection without major complications.<sup>[18]</sup> Sutedja *et al* have reported immediate reopening of the airway in 15 of the 17 patients, the two failures having extraluminal obstruction.<sup>[19]</sup> Similarly Petrou *et al* reported excellent cost-effective palliation following diathermy resection and stent insertion.<sup>[20]</sup> Boxem *et al* have shown bronchoscopic electrocautery is equally effective but is a less expensive and, can be used in institutes where Nd-YAG laser is not available.<sup>[21]</sup>

**Laser therapy:** Laser therapy using rigid or flexible bronchoscope in a controlled setting often helps in relieving upper airway obstruction due to endoluminal growth. Laser has drastically changed management of laryngeal papillomas. In cases of endobronchial obstructing lesions or intratracheal lesions that are low down and not amenable to CO<sub>2</sub> laser, tumor debulking can be achieved using Nd YAG laser, which can be used through fiberoptic scope. Dumon's group published the first large series using Nd:YAG laser photoresection for both benign and malignant airway disease in 111 patients and their best results were obtained in patients with malignant disease.<sup>[22]</sup> In their experience of 2008 patients with malignant airway obstruction Cavaliere *et al* obtained good results using Nd YAG laser for endoscopic resection when there was no extrinsic compression or extensive infiltration of airway. They got 100% success for tracheal tumors with less favorable results for peripherally situated tumors and low complication rates.<sup>[23]</sup> There are many case studies where laser has been used to relieve upper airway obstruction with success rate of 90-100%.<sup>[24,25]</sup>

**External beam radiation and brachytherapy:** Although external beam radiation to the chest is an established therapy for lung cancer and related complications, it is only variably effective for cancer-induced airway obstruction. Radiotherapy basically acts by inducing tumor lysis. Many times however radiotherapy may precipitate/exacerbate the obstruction by increasing peritumor edema or inducing intratumor hemorrhage. The

factor limiting most external beam radiation treatments is the unwanted exposure of normal tissue, primarily the normal lung parenchyma, as well as the heart, spine and esophagus. Brachytherapy allows radiation to be delivered endobronchially thus minimizing exposure to normal tissue. The most commonly used source of radiation is iridium-192 (192Ir), which is delivered endobronchially via a catheter. Brachytherapy may be delivered by either low-dose rate (LDR), intermediate-dose rate (IDR) or high-dose rate (HDR) methods. Many authors have shown good response to brachytherapy in patients with malignant airway obstruction.<sup>[26-28]</sup> However as response is not immediate this modality is not of much use in emergency management of airway obstruction. Radiotherapy also demands transfer of patient to radiotherapy suite, which may not be possible in cases of symptomatic airway obstruction. Also it is difficult to predict which patients will respond before starting treatment. Hence it is always advisable to use other modalities of treatment to open up the airway and then subject the patient to brachytherapy. A distinct advantage of brachytherapy is that the catheters can be placed in the upper lobe bronchi, as well as in segmental bronchi, areas typically inaccessible to laser therapy. Endobronchial radiotherapy has also been used successfully in patients with peribronchial disease.

**Airway Stents:** Airway stenting is the only endoluminal therapy available for the management of malignant obstruction from extrinsic disease and is also a useful adjunct to providing coverage of endoluminal tumor. This procedure being less invasive does not require long hospitalization and achieves good symptomatic relief as shown by deSouza *et al* in their case series.<sup>[29]</sup> Advances in airway prosthetics have provided a variety of silicone stents, expandable metal stents and pneumatic dilators, enabling the surgeon to manage life-threatening airway obstructions successfully. There are currently two main types of stents: metal and silicone. Metal stents are available in covered and uncovered varieties. For malignant airway obstruction, the only appropriate metal stents are covered models, which prevent tumor ingrowth. In their retrospective case series Anton Vonk Noordegraaf have shown excellent palliative effect of airway stenting in terminal cases with central airway obstruction.<sup>[30]</sup> Similarly Wassermann and colleagues reported successful emergency management of malignant upper airway obstruction using dilating bougie followed

**The Dos and Do nots of malignant airway obstruction<sup>[35]</sup>**

Do	Do Not
Allow position changes (sitting, decubitus, prone) if possible	Use respiratory depressing sedatives and muscle relaxants
Have multiple sized endotracheal tubes	Instrument the airway before having a controlled environment or adjunct personnel ready
Awake establishment of airway if possible	Induce general anesthesia
Have different size bronchoscope	Positive pressure ventilate until obstruction relieved
Proceed with further radiological examinations (CT, MRI)	
Consult thoracic, head and neck surgeons and anesthesiologists	

by silicon stent insertion.<sup>[31]</sup> Kenten *et al* have reported their experience with critically-ill patients with central airway obstruction and impending suffocation managed by various bronchoscopic techniques. Out of 97 patients, they had 49 patients with malignant airway obstruction. In these patients, authors first performed mechanical coring out, followed by laser ablation of residual tumor and stents were placed if further needed.<sup>[32]</sup>

**Surgical resection:** Surgical intervention for airway obstruction is usually reserved for benign and relatively short tracheal lesions. However with increasing frequency, malignant tracheal lesions without evidence of metastasis are being considered for surgical resection. Surgical resection is the preferred definitive therapy for primary airway tumors. A subset of lung or thyroid malignancies that invade the airway may also be amenable to primary surgical resection, as long as a complete resection of tumor can be obtained along with primary airway reconstruction. Commonly employed surgical techniques in the trachea are primary end-to-end anastomosis and tracheal sleeve resection. The majority of patients with malignant airway obstruction will be unresectable due to locally advanced disease, metastatic disease or contraindicating comorbidity and in them previously mentioned modalities like mechanical debridement PDT or stent insertion will be preferred.<sup>[33-34]</sup>

## Conclusion

Airway emergencies in cancer can be extrinsic, intrinsic or mixed and fixed or dynamic. In hypoxic patients establishment of airway and restoration of oxygenation and ventilation is most important. The team approach including anaesthetists, intensivist, surgeons, medical oncologists and radiation oncologists is essential in delivering most appropriate intervention and minimize

morbidity and hospital stay in these patients.

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