

# **ANAESTHESIA FOR TRACHEAL RESECTION**

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# ANAESTHESIA FOR TRACHEAL RESECTION

## INTRODUCTION

Tracheal surgery was first performed in the 1950's. At the time, 2cm were believed to be the maximum length that could be resected. However, over the years through the advancement in apparatus as well as a better understanding of physiology and airway management an improved technique was developed, thus rendering tracheal surgery relatively safe despite its complexity. Progress in surgical and anaesthetic techniques now permits more than half of the trachea to be safely excised in selected cases.<sup>4</sup>

Tracheal resection and reconstruction is a relatively rare procedure, but when called upon poses many challenges to both the surgeon and the anaesthesiologist. One needs to have a good idea of the entire process of the operation together with an anticipatory mindset with regards to the course of the surgery. Subsequently, to design a successful anaesthetic plan, one needs to understand the cause and characteristics of the tracheal lesion, and thus a thorough preoperative evaluation is key. Patients usually presenting for airway surgery frequently have co-existing medical problems, and may require optimisation before the actual surgery.<sup>6,7</sup> It is also necessary to understand the relevant diagnostic procedures, the influence that the lesion has on the airway, as well as the selection of surgical site/incision. The choice of anaesthetic technique chosen with regards to intubation and intra-op ventilation will be dictated by the experience of the anaesthetist.<sup>1,8</sup>

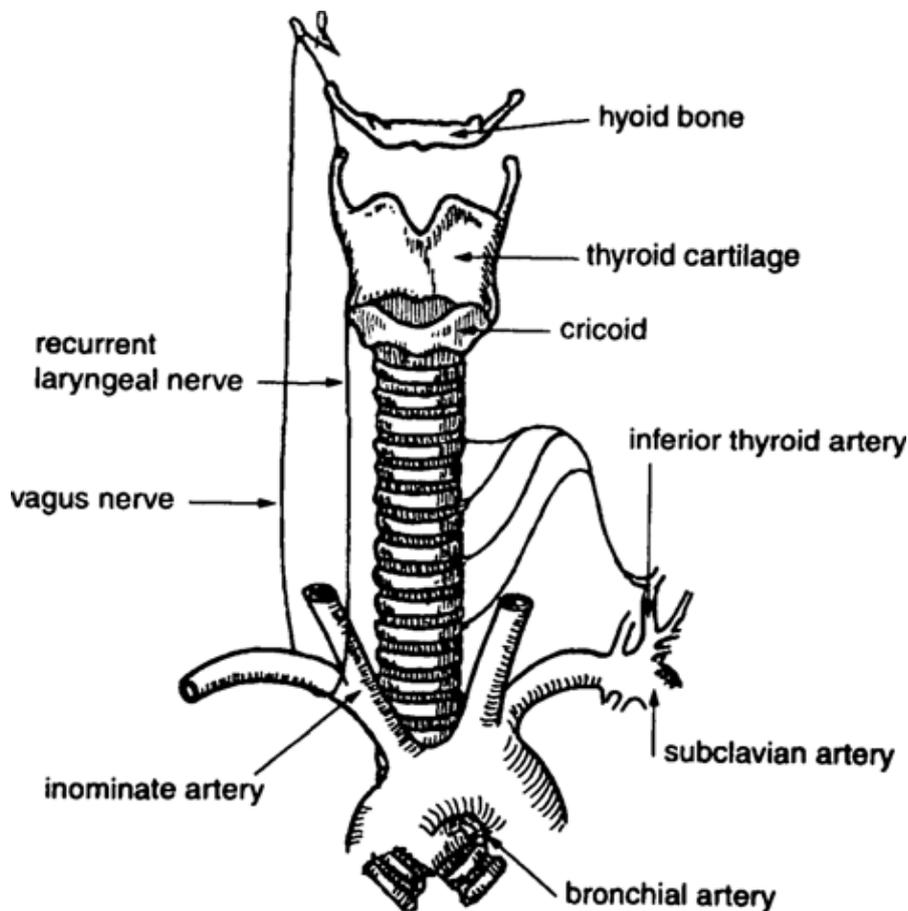
Multidisciplinary teams are mentioned in many operations, but none more important in this case, as the process requires both the surgeon and anaesthesiologist to share the airway. One must not forget that the airway itself is abnormal, and often tenuous, thus the anaesthesiologist must be adequately prepared and able to rapidly employ any variety of techniques to secure and maintain the airway throughout the procedure.<sup>8</sup>

## ANATOMY OF THE TRACHEA <sup>2,3,4</sup>

The trachea extends from the lower border of the cricoid to the top of the carina spur. It is reported that the average tracheal length is approximately 11cm with a range of 10-13cm. There are approximately two cartilaginous rings per cm for a total of 18-22 rings. These C-shaped rings form the anterior and lateral walls of the trachea. The posterior wall is membranous. The internal diameter of the trachea measures about 2.3cm laterally, and about 1.8cm antero-posteriorly. The proximal trachea is cervical and becomes mediastinal at the sternal notch. When the head is flexed, the trachea can become completely mediastinal. Conversely, head extension results in a longer portion of the trachea becoming cervical. These observations are especially important when related to tracheal resection.

The blood supply is segmental and approaches the trachea laterally with the upper trachea perfused by the inferior thyroid artery, and the lower trachea by the bronchial arteries with contributions by the sub-clavian, internal-mammary, innominate, internal thoracic, and the supreme intercostal arteries.

The recurrent laryngeal nerves course postern-laterally to the trachea in the groove between the trachea and oesophagus, and enter the larynx between the cricoid and thyroid cartilages immediately anterior to the inferior cornua of the thyroid cartilage.



**Figure 1: Taken from *Pinsonneault et al.***

## TRACHEAL LESIONS REQUIRING RESECTION AND RECONSTRUCTION <sup>4,6,7,8</sup>

The end goal of resection and reconstruction is ultimately to render the individual's airway patent. Below is a list of possible conditions that cause tracheal obstruction. Note that NOT all of these conditions are amenable to repair, and that in fact, tracheal obstruction may very well be a single feature of a much larger problem ie. tracheal obstruction due to aortic dissection.<sup>4,6,7,8</sup>

Benign strictures are the most common lesions and usually due injury and subsequent scarring from an endotracheal tube(ETT), despite the advent of *high volume low pressure ETTs*. Tracheostomy tube cuffs, or a tracheostomy stoma may also account for tracheal strictures but are much more rare in occurrence. Less common causes of benign strictures include acute airway trauma(such as striking a steering wheel in an MVA), or inhalation injury. Tracheal tumours are the other major type of obstructing lesion, and may either be primary or secondary.

Despite use of modern ETTs, the reported incidence of post-intubation tracheal strictures is estimated to be up to 11% in critically-ill ventilated patients. Associated risk factors include systemic hypotension, prolonged duration of ventilation and tracheostomy. It has also been suggested that tracheal stenosis following percutaneous tracheostomy occurs earlier than with surgical tracheostomy.<sup>7,8,29</sup>

## ETIOLOGY OF TRACHEAL PATHOLOGY

**TABLE: 1 Etiology of tracheal pathology** <sup>4</sup>

### TUMOURS:

Primary tumours

*Malignant*

adenoid cystic carcinoma(cylindroma), squamous cell carcinoma, others

*Benign*

neurofibroma, chondroma, chondroblastoma, hemangioma, pleomorphic adenoma

Secondary tumours

*Direct extension*

thyroid, larynx, lung, oesophagus

*Metastasis*

lung, breast, lymphoma

### INFLAMMATORY LESIONS:

Post-intubation lesion

stricture, granuloma, malacia, tracheo-oesophageal fistula

Post-traumatic stenosis

blunt trauma, penetrating injury, emergency tracheostomy

Post-infectious strictures

tuberculosis, diphtheria, histoplasmosis, rhinoscleroma

Burns

Connective tissue disease

SLE, Wegener's granulomatosis, amyloidosis

### COMPRESSIVE LESIONS:

Goitre

Vascular compression

thoracic aneurysm, congenital vascular rings, innominate artery aneurysm, anomalous right innominate artery, double aortic arch, complete tracheal rings and associated aberrant origin of left pulmonary origin

### MISCELLANEOUS:

sarcoidosis, relapsing polychondritis, osteoplastica tracheopathy, idiopathic

## FACTORS ASSOCIATED WITH POST-INTUBATION STENOSIS

- Overinflation of the tracheal cuff
- Large-bore ETTs
- Tube movement secondary to
  - spontaneous/assisted ventilation
  - heavy circuit tubing creating excessive traction
- Prolonged intubation
- Steroids
- Hypotension
- Diabetes
- Infection
- Nasogastric tub

## EVALUATION OF THE PATIENT AND ASSOCIATED WORK-UP

### Clinical presentation

Signs and symptoms may appear acutely or insidiously, and is largely dependant on the cause and/or underlying pathology. The majority of patients present with signs of upper airway obstruction, such as dyspnoea on exertion with diminishing effort tolerance, with associated wheezing and/or stridor. Obstructive signs are usually only noted when the airway is narrowed to 5-6mm in diameter. With tracheal tumours, a cough and often haemoptysis may accompany dyspnoea. Cyanosis should alert the physician to the potential for sudden and total occlusion of the airway. Tracheal stenosis can be noted in all ages ranging from patients with no co-morbidities to those with a multitude of other medical problems. Also a recent history of shortness of breath following endotracheal intubation is a clear indicator as to the possibility of a post-intubation stricture.

The progression of symptoms of stridor in patients of the sort maybe variable, and often leads to misdiagnosis as asthma until the stridor is evidently not responsive to bronchodilator therapy and the tracheal lumen significantly reduced to approximately 30% of the normal diameter.<sup>4,5,29</sup>

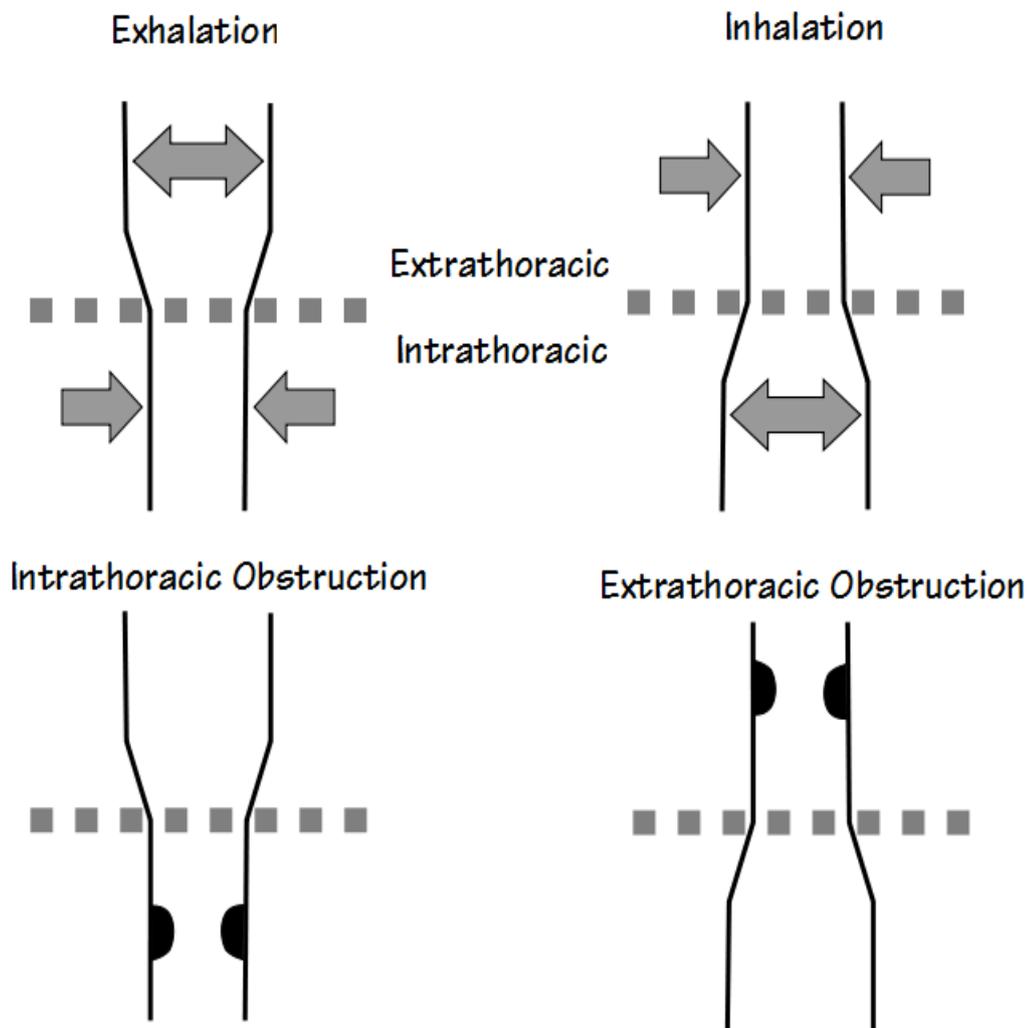
*“Any patient who has received ventilatory support in the recent past or even not so recent past, who develops signs and symptoms of upper airway obstruction, has an organic lesion until proven otherwise.”*  
**Dr Hermes C Grillo**

### Pre-anaesthetic evaluation

This should include a thorough history and physical evaluation. The underlying pathology of the lesion together with its anatomic characteristics and severity of obstruction need to also be known. Special attention needs to be payed to both the airway and pulmonary systems with physical examination and diagnostic studies critically evaluated. Effort/exercise tolerance, stridor, pattern of breathing and the possibility of a recent respiratory infection need to be noted. An increase in the amount pulmonary secretions coupled with aspiration when swallowing suggests a concurrent trachea-oesophageal fistula. Also the ability to lie supine needs to be evaluated.<sup>4,5,7</sup>

Regarding airway assessment, in addition to the actual lesion, patients may also present with factors that may complicate laryngoscopy, bag-mask ventilation or even intra-operative airway management, rendering airway management even more difficult.<sup>5</sup> Thus a detailed airway examination is imperative, which will include palpation of the trachea, neck mobility in extreme positions of flexion and extension assessed, and the lung field and trachea itself auscultated. The glottis must also be functional in order to protect the airway from aspiration.<sup>8</sup>

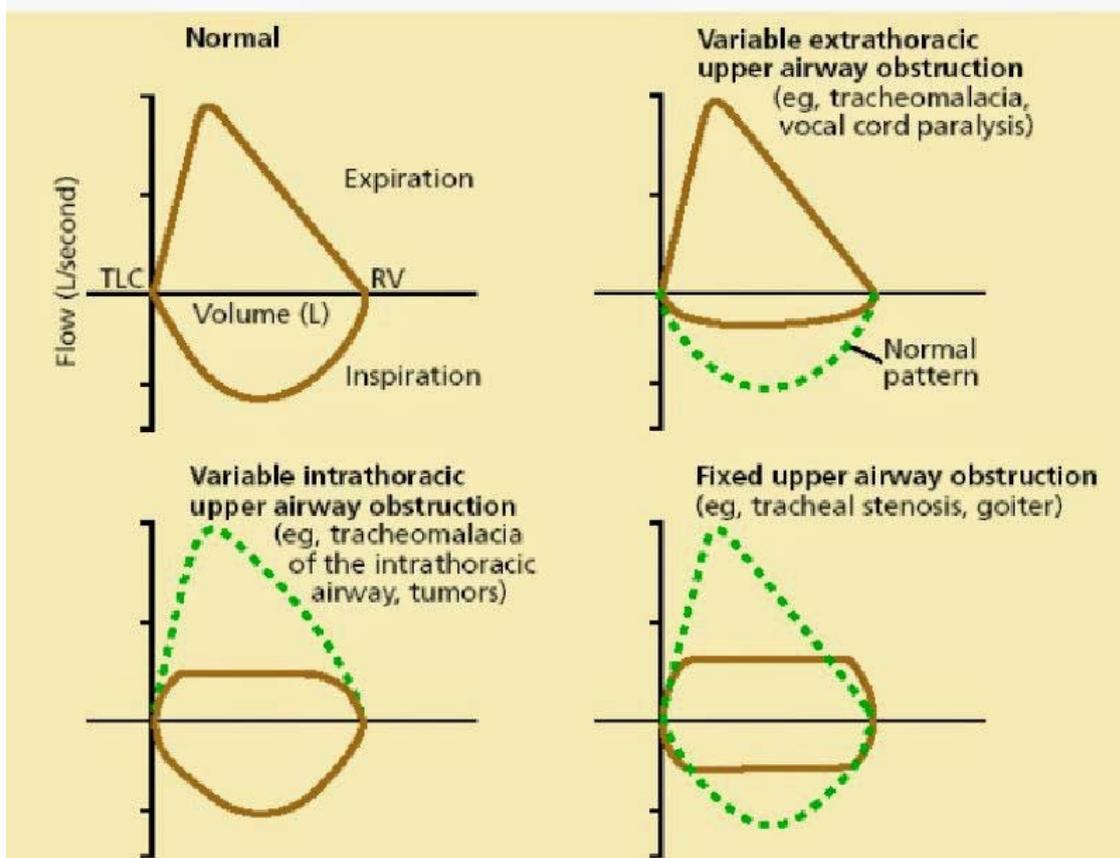
Forced inspiratory and expiratory manoeuvres need to be assessed. Airway obstruction may worsen with forced respiratory efforts, and is also largely dependant on the location of the lesion. Commonly in the above cases, lesions may either be extra-thoracic (high tracheal), or intra-thoracic. Extra-thoracic lesions exhibit worsening on forced inspiration as the large negative pressures within the trachea accentuates airway narrowing. Conversely, variable intra-thoracic lesions may worsen with forced expiration due to generation of relatively positive intra-thoracic pressures which favour airway closure.<sup>4,9,10</sup>



**Figure 2: Taken from Pinsonneault et al.**

Diagnostic investigations should include spirometry, pulmonary function tests, arterial blood gases and radiological studies. Spirometry in the setting of a fixed lesion anywhere in the airway will show flow limitation during either inspiration or expiration. Variable extra-thoracic

lesions exhibit flow limitation during inspiration with normal expiration, while variable intrathoracic lesions exhibit expiratory flow limitation.<sup>9,10</sup>



**Figure: 3 Taken from *slideshare***

Pulmonary function testing will assist in predicting the of post-operative intubation in the setting of severe pulmonary dysfunction. ABGs also provides important information for post-operative management and may reveal pulmonary problems prior to surgery.

Radiological studies are imperative to assess the extent of the lesion, together with the exact length of trachea that may be stenotic. Specialised linear tomograms of the neck are particularly useful, and such information will dictate the possible surgical release manoeuvres required to achieve adequate anastomosis. Fluoroscopic studies may be undertaken to evaluate glottic function. CT scans provide detailed information about tracheal diameter and adjacent structure involvement. MRI may very well provide better soft tissue detail and allow better visualisation of the stenotic lesion by sagittal and coronal reconstructions.<sup>5,6,7</sup>

Bronchoscopy done under direct vision, with rigid bronchoscopy being the preferred method, allows for the defining of the length and diameter of the tracheal narrowing, as well as the character of the surrounding trachea. Consequently, bronchoscopy is usually undertaken just prior to resection. However, bronchoscopy can also be done days and weeks before the actual resection, in an attempt to relieve symptoms and 'buy time' for further imaging modalities, healing of associated injuries, and to assist with the planning of definitive surgery on an elective basis. This is done in patients with significant airflow obstruction due to

tracheal strictures, which are progressively dilated using a series of paediatric and adult rigid bronchoscopes

The importance of routine CT scans done together with bronchoscopy cannot be overstated. In a recent study by S Ramghulam and D Reddy at our institute IALCH, it was noted that prior to 2009 there was a significantly poor correlation between the findings at bronchoscopy and final stages of surgery. This may have been related to operator/observer variability, or the fact that strictures may evolve with repeated dilatation resulting in the external scarring noted at surgery being inconsistent with the length of the intraluminal lesion measured at bronchoscopy. In 2009, IALCH Cardiothoracic unit proceeded to routinely scan all patients with tracheal strictures/lesions necessitating surgical intervention. The combined use of CT and endoscopic evaluation has allowed for extremely accurate preoperative planning, including the surgical approach, the need for adjunctive release manoeuvres, and the prediction of post-operative complications.<sup>6,7,14,29</sup>

Essentially, patients selected for this rare procedure must have a lesion known to be resectable, as defined by the diagnostic procedures above. The glottis must be functional, and all co-morbidities assessed and evaluated. Patients not befitting this process are usually those that will require post-operative mechanical ventilation. Reason is that early extubation is the goal, so as to be prevent wound dehiscence.

### **Contraindications** <sup>4,15</sup>

Absolute:

- Severe pulmonary disease(likely to require post-op ventilation)
- Ventilator dependance
- Airway infection
- Inability to cooperate with post-op pulmonary toilet

Relative:

- Previous radiation therapy to neck or mediastinum
- Invasive tumours
- Steroid dependance
- Long, complex lesions

## **SURGICAL PROCEDURE:**

### **Brief overview**

Resection of stenotic segments of trachea followed by successful reconstruction requires the cut-ends of the remaining trachea to be re-approximated with minimal-to-no tension on the anastomotic suture line. Up to half the trachea may be removed with appropriate manoeuvres to mobilise the trachea. Most lesions are short enough that anterior dissection of the trachea and simple neck flexion brings the cervical trachea down into the chest, whilst longer lesions may require other release manoeuvres.<sup>7,11,15</sup>

**Anterior pre-tracheal digital dissection** is the freeing of the anterior trachea to allow greater mobility.<sup>4</sup>

**Suprahyoid release** involves the mylohyoid, geniohyoid, and genioglossus muscles and the lesser cornua of the hyoid bone to be transected and the body of the hyoid bone divided anteriorly so that the larynx drops 2-3cm. Post-op problems are less frequent using this release manoeuvre compared to the supra thyroid manoeuvre. Other release manoeuvres include the suprathyroid, and the intrapericardial right pulmonary hilar release.<sup>4</sup>

### **Dissection principles**

Dissection is performed down to the pre-tracheal plane. It is carried out below the lesion, and kept immediately on the tracheal wall, thus avoiding arterial trauma and lesions to the recurrent laryngeal nerves which course close to the trachea. If the lesion is benign, no effort is made to identify the nerves, as this may increase the risk of injury to them. Alternatively, if the lesion is malignant, the nerves are identified to see if they are involved by the tumour process and may have to be deliberately sacrificed. Great attention is paid to the blood supply that arrives laterally to the trachea. Circumferential dissection is done only at the margins of the transection and kept to a minimal. Transection is then below the lesion and dissection resumed until the diseased segment of the trachea can be excised.<sup>4</sup>

### **Surgical approaches**

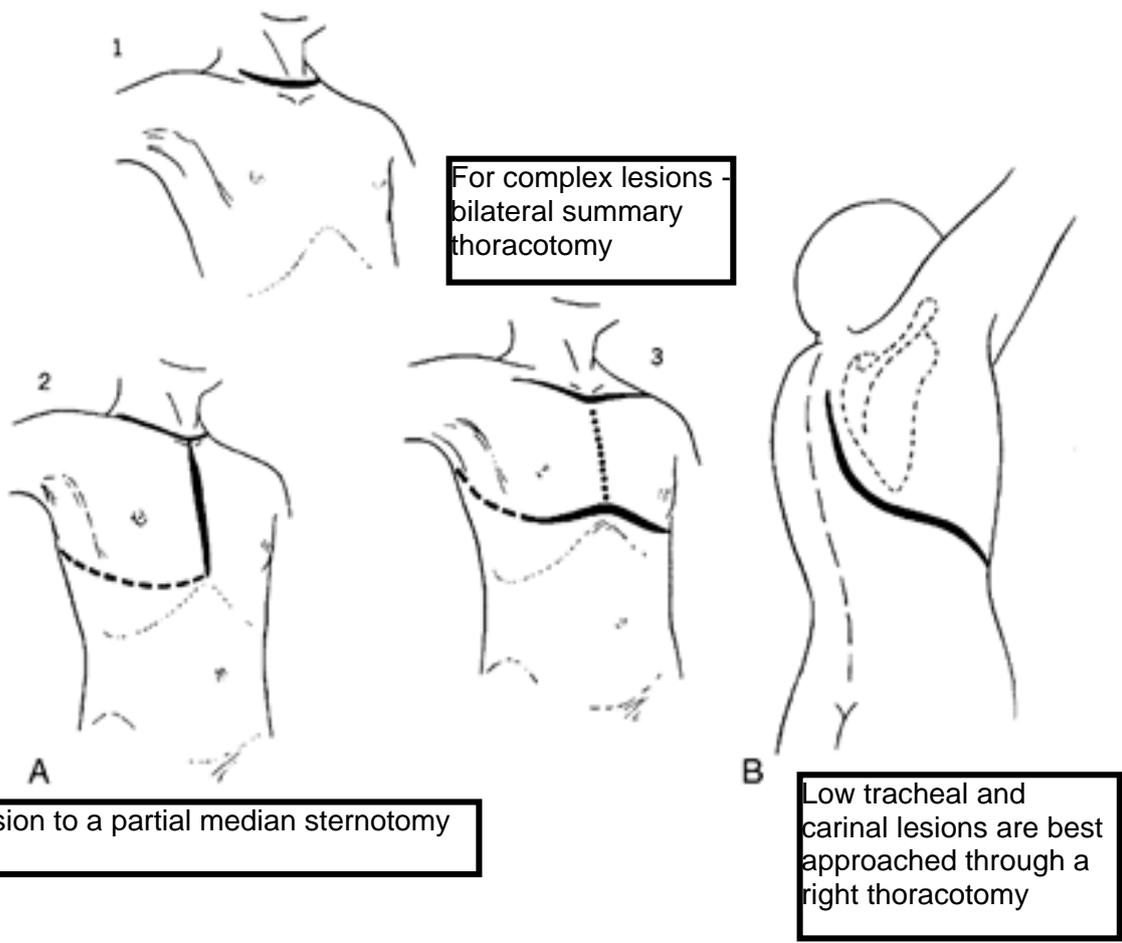
**HIGH AND MID-TRACHEAL LESIONS:** Patients are positioned in the supine with arms by the side and an inflatable bag (wrapped ringers!!!) between the scapulas so the neck is in full extension. Surgery proceeds through a collar incision with/without an upper sternotomy extension, depending on the extent of the lesion.<sup>4,5,6,7</sup>

**LOW TRACHEAL LESIONS:** Patients may be positioned as above if the head extension brings the diseased segment into the cervical region. Patient can also be in the left lateral decubitus position with the neck flexed. Surgery then proceeds through a right posterolateral thoracotomy in the 4th intercostal space.<sup>4,5,6,7</sup>

**CARINAL LESIONS:** A right postero-lateral thoracotomy is the most frequent approach, again with the patient's neck flexed. The surgical field includes the neck, anterior chest, and right arm. Median sternotomy may be adequate for limited carinal resections. For extensive involvement of the carina, distal trachea and right mainstem bronchus, a bilateral submammary trans-sternal thoracotomy may be needed. Only rarely is left thoracotomy done because exposure of the carina is poor due to the aortic arch overlying the left hilum.<sup>4,5,6,7</sup>

Before performing the anastomosis, traction sutures are placed and a tentative approximation done. If the approach used was the cervical, then the bag between the scapulae is deflated, so as to lift the head of the patient to 30degrees, which will result in the appropriate neck flexion. If excessive traction seems to be present then the above-mentioned release manoeuvres may be done.<sup>5,6</sup>

High tracheal lesions can be accessed through a cervical incision



**Figure: 4 - Taken from Grillo HC, surgical approaches to trachea**

Ultimately, the surgical approach to each patient is individualized based on the endoscopic data derived from rigid bronchoscopy and Computed Tomography(CT).

## ANAESTHETIC MANAGEMENT

The essential goal for resection and reconstruction of the airway is the ability of the anaesthesiologist and surgeon to maintain control of the airway at all times. The goal needs to be a fine well sutured anastomosis with minimal traction and a patient that is awake and cooperative. The surgeon must have maximal free access to the airway and an unobstructed surgical field with no interference by an ETT. The anaesthesiologist must provide adequate ventilation and oxygenation to a patient with a pre-operative critical airway, followed by an intra-operative transected airway, and finally a precarious post-operative airway that may be swollen and oedematous due to multiple manipulations and also because of cervical flexion positioning.<sup>4,8</sup>

Sedation and anxiolysis need to be carefully managed, as to avoid any form of respiratory depression and subsequent total airway occlusion. Anxiety however can also worsen the respiratory pattern. Generally speaking though, a calm, measured and caring demeanour, together with a clear and confident sense of the anaesthetic and surgical plan relayed to the patient, are usually sufficient to allay any anxiety.<sup>12,13</sup>

Antisialagogues should also be used with great caution, as drying of secretions can cause a mucous plug that can obstruct an already tight lumen. It may be best to defer all medications until the patient is in supervised surroundings.<sup>12,13</sup>

Regarding monitoring and equipment, standard equipment such as ECG, pulse oximetry, capnography, NIBP, temperature monitors, gas analysers, and pressure alarms should be incorporated. An arterial line on the left arm may be placed, as compression or division of the innominate artery may render the blood pressure reading inaccurate if placed on the right arm. Additional equipment includes a warming blanket, nasogastric tube, and foley catheter. For such specialised surgery, it also makes sense to have special equipment on hand as part of the anaesthetic and surgical plan.<sup>12,13,14,16</sup> These include:

- A 2nd anaesthesia machine capable of delivering up 20L/min O<sub>2</sub>
- Long, flexible ETTs
- Dedicated O<sub>2</sub> supply for jet ventilator
- Jet ventilator catheters
- Fibre-optic bronchoscopes
- Rigid bronchoscopes
- Tracheostomy instruments
- Sterile airway hoses
- Sterile Y-pieces
- Sterile wire-bound/flexible ETTs

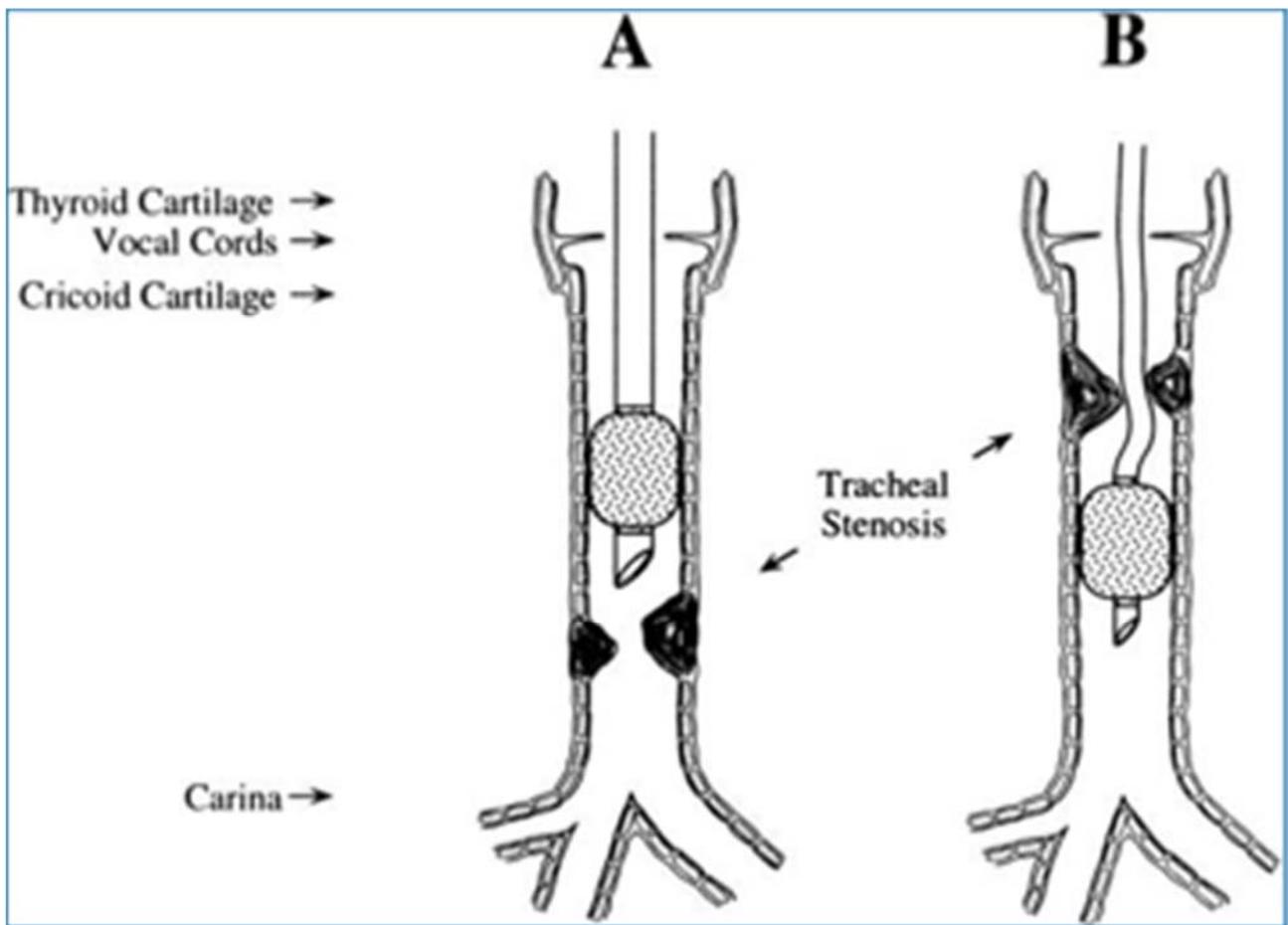
### **Induction:**<sup>8,12,13,14,16</sup>

Induction of anaesthesia in these patients with compromised airways requires patience, planning, and foresight. The surgeon needs to be present at induction, and a set of rigid bronchoscopes must be ready for use in the case of an obstruction. Adequate pre-oxygenation with 100% O<sub>2</sub> should ideally be followed by inhalation induction with gentle supported breaths if need be. Maintenance spontaneous breathing is widely considered the safest and most recommended method. Muscle relaxants are only given once the airway is secured and ventilation verified and shown to be possible. An awake intubation with the airway topicalised with local anaesthetic is another method if bronchoscopy is not to be done

first. Alternatively, if the patient is able to lie supine without any difficulty and the lesion is known to be fixed, then an intravenous induction can be pursued.<sup>8,12,13</sup>

The procedure usually starts with rigid bronchoscopy to define the lesion visually: exact location, extent, and the amount of healthy trachea proximal and distal to the lesion. Once bronchoscopy is done, a more secure airway must be obtained. If the airway is <5mm, dilatation may be performed first. This is serially done with dilators or paediatric bronchoscopes. The anaesthesiologist should also have a look, to help decide on the appropriate sized tube. Generally, the tip of the ETT is kept above the lesion, but sometimes it is passed through the lesion if the lesion is high enough that the ETT cannot be secured in the trachea if the tip is kept above the lesion (**figure 5 below**). Rarely a tracheostomy may be done to secure the airway.<sup>6,7,8,12</sup>

**Figure 5, taken from Sandberg et al.**



In practice, induction of anaesthesia for the vast majority of patients with tracheal lesions can be accomplished by inhalation or intravenous induction, with airway control by face mask, followed by bronchoscopy and intubation. Nonetheless, it is still important to consider

and promptly institute extracorporeal respiratory support, especially for distal lesions not amenable to tracheostomy, as a backup plan if the airway cannot be controlled.<sup>4,8</sup>

Following induction, anaesthesia is maintained with volatile agents in oxygen, supplemented with small doses of opioids. Opioids should be used sparingly, because extubation is the primary goal. Alternatively TIVA with propofol and remifentanyl can be used with satisfactory results. Generally a smaller dose of a long-acting opioid is given near the end of the procedure, and is usually more than adequate for post-operative analgesia.<sup>8,12,18</sup>

### ***Open airway & Cross-field ventilation:***

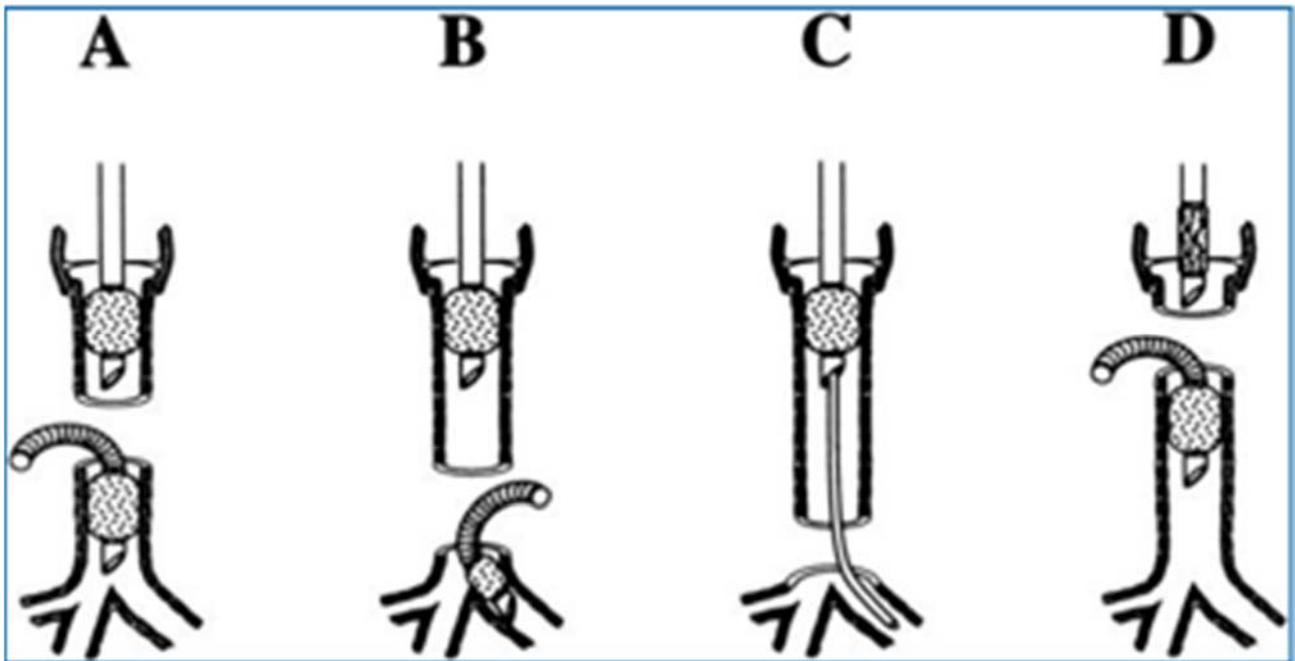
Once the airway is opened, ventilation is provided across the surgical field. For lesions in the proximal and mid-trachea, the oral-ETT is pulled back to expose the lesion, and the surgeon then places a flexible, spiral-wire, reinforced ETT into the distal airway. Hand ventilation is usually done, with the ETT frequently being repositioned or removed to allow surgical exposure, with ventilation being provided intermittently. With carinal resections, multiple anastomoses may be required. One or more endobronchial tubes may be placed for ventilation, again being frequently repositioned to facilitate surgery.

Once the anastomosis is ready to be closed, the trachea is again intubated from above. The original ETT may be advanced distal to the anastomotic line under direct vision by the surgeon, or a new ETT may be placed. Reintubation will be required if the original tube had to be removed from the trachea to afford for surgical access to high tracheal lesions (**figure 6, image D**)<sup>8</sup>. This is done by passing a sterile red rubber catheter retrograde into the pharynx from the field. The new ETT is sutured to the catheter and pulled into the airway by the surgeons.<sup>8,12,13,14,16</sup>

In **figure 6** below, ventilatory management of the open airway is shown after resection of the lesion.

- A: The technique employed for the majority of cases. The ETT is pulled back so that the lesion can easily be manipulated, but the cuff is left inflated to protect the airway from above. Intubation of the distal airway is accomplished across the field using sterile equipment.
- B: Endobronchial intubation used for low tracheal lesions and carinal resections.
- C: Endobronchial ventilation using a jet ventilation catheter placed through an ETT.
- D: A high tracheal lesion with an oral ETT cuff deflated and the tube pulled back into the larynx. If necessary, the oral ETT may be removed entirely and reintubated by a retrograde technique.

Figure 6, taken from *Sandberg et al.*



Even the most flexible of ETTs can interfere with surgical exposure, either due to their large diameter, or proximity of their cuffs to the developing suture lines. In such cases, it may be easier to use jet ventilators due to their smaller diameters and them having no cuff and associated cuff pressure.<sup>8,18,19</sup> The jet ventilator cannula is typically placed through the lumen of the ETT. If necessary, differential ventilation of separate lungs/lobes may be accomplished with 2 catheters. Adequacy of ventilation is noted with excursion of the chest wall and by monitoring of ABGs.<sup>18,19</sup> Close attention needs to be paid to jet ventilator catheters, to ensure that it does not become dislodged or impacted against the wall of the airway.<sup>8,12,13</sup>

Alternatively, a wire-wound flexible ETT passed into the airway and sealed with a cuff provides a reliable conduit for ventilation. The tube can be periodically removed to provide a clear and quiescent field for precise suture placement. This method of intermittent ventilation is coordinated by the surgeon and allows the surgery to proceed in a controlled and orderly fashion.<sup>8</sup>

### ***Extubation and emergence:***

This is potentially the most critical period of the entire process. Extubation is the primary goal, as post-operative mechanical ventilation is associated with anastomotic failure. Despite this, the reconstructed airway is still very precarious for the immediate post-surgery days, as it is tenuous, and will require constant attention and readiness to intervene with any variety of modalities.<sup>4,8,16</sup>

The process of extubation and emergence needs to be smooth and efficient. All neuromuscular blocking agents need to be reversed and out of the system, and confirmed with

a nerve stimulator. If TIVA is used, it can be stopped a few minutes prior to emergence and the be replaced with nitrous oxide to allow for a predictable, rapid, and controlled emergence at the appropriate time. The same goes if volatiles were used. Small doses of long-acting opioids may be given about 15 minutes before the end to optimise the analgesia and post-op pain, and anti-emetics administered to decrease the incidence of post-op nausea and vomiting.<sup>8,15,16</sup>

Immediately following extubation, phonation should be elicited to exclude a recurrent laryngeal nerve injury. Also nebuliser epinephrine should be administered to help with the airway swelling, and the patient propped up in a head-up position. The patient needs to be kept as comfortable as possible and his neck maintained in the fixed flexion position at all times. To assist with head flexion, a guardian/sentinel stitch is placed between the skin of the chin and the anterior chest to achieve head flexion at 35 degrees. This stitch which is kept in place for at least 6-10 days serves as a reminder to the patient not to extend the neck to avoid traction on the anastomosis. It is surprisingly well tolerated by patients. Alternatively, the sentinel stitch can be avoided using an orthopaedic corset custom made for cervical flexion.<sup>8,15,16</sup>



Re-intubation is rarely ever required, and if all of the anaesthetic goals for emergence have been met, it almost surely indicated a problem with the airway. Resecuring the airway is of primary importance and needs to be done promptly, and decisively, with all parties communicating and understanding of their roles. Special care needs to be taken so as not to put extra tension onto the tracheal anastomosis. Direct laryngoscopy may be possible, but immediate flexible bronchoscopic intubation may very well prove to be more useful. Bronchoscopic intubation will also allow examination of the reconstructed segment during spontaneous ventilation and may very well reveal the problem as the airway is reestablished.<sup>5,8,23,26</sup>

Orthopaedic corset to maintain cervical flexion

## **POST-OPERATIVE CONSIDERATIONS** <sup>23,26</sup>

Patients are admitted to an ICU/High care facility. Constant assessment of the pattern and effort of breathing are required to detect problems with the reconstructed airway. Clinical evaluation is supplemented with periodic supplemental ABGs. Also aggressive pulmonary toilet is instituted very early.

The patient needs to be comfortable and kept in the fixed flexion position. Pain management is imperative to keep levels of anxiety as low as possible. The development of stridor or any other evidence of airway obstruction may indicate a problem with the reconstructed segment. If structural problems with the airway anastomosis is found, then a reapposition is the only reliable way to address the problem. Frequently mucous plugs are found with resultant improvement in the patients condition.

Complications of tracheal surgery depend on the underlying pathology and on the degree of dissection and mobilisation of the trachea. The incidence of granulation tissue has decreased since surgeons started using absorbable sutures. Dehiscence of the anastomosis usually results from excess traction or from necrosis due to a compromised blood supply.

## **CONCLUSION**

Tracheal resection and reconstruction constitute a major and complex surgery performed only in specialised centres. It is a rare procedure, but when done, is usually a highly rewarding process for both the patient and team involved. Advances in techniques, both surgical and anaesthetic in recent years make this procedure relatively safe and worthwhile in carefully selected and appropriate patients. Team work amongst surgeons, anaesthetists and nursing staff is imperative, and a well structured, coordinated plan is key. Meticulous planning, and anticipation of possible problems can never be over-emphasised. There have been numerous techniques for airway management that have been reported (many of which not discussed here), and knowledge of these varied techniques is vitally important particularly in this type of surgery.

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