

## Microlaryngoscopy

Shweta Salgaonkar<sup>1</sup>, Yogesh Rathod<sup>2</sup>, Pratiksha Sagare<sup>2</sup>, Priti Devalkar<sup>3</sup>

<sup>1</sup>Professor, Department of Anaesthesiology and Critical Care, Seth G S Medical College & KEM Hospital, Mumbai, India.

<sup>2</sup> Student, MD Anaesthesia 3<sup>rd</sup> year, Department of Anaesthesiology and Critical Care, Seth G S Medical College & KEM Hospital, Mumbai, India.

<sup>3</sup> Assistant Professor, Department of Anaesthesiology and Critical Care, Seth G S Medical College & KEM Hospital, Mumbai, India.

---

**Abstract :** We have described what appears to us a most satisfactory anaesthetic technique for microlaryngoscopy and definitive surgery of the larynx. The method of ventilation employed was basically an extension of Sanders' injector technique, using the Venturi principle. Blood gas determinations in a series of 60 patients showed oxygenation and ventilation to be satisfactory. From the endoscopist's point of view, this technique offered several advantages like the endoscopic procedure need not be interrupted to ventilate the patient. Since the patient is adequately oxygenated and ventilated the time for the procedure is not limited. There is no endotracheal tube to interfere with the free access and visualisation of the larynx. This is a refinement of direct laryngoscopy where a precise procedure on the larynx is performed under operating microscope for sufficient length of time. Laryngoscope is inserted from right side of angle of mouth, gets fixed by chest piece, it is self retaining & larynx is visualized through binocular operating microscope. Thus both hands of surgeon are free.

**Keywords:** stridor; microlaryngoscopy; bronchoscopy; propofol; tubeless anaesthesia.

---

### Introduction

Appropriate airway management is an essential part of the anaesthetist's role in ENT endoscopic surgery. Sharing of the airway with surgeons, as in ENT microlaryngoscopy, makes the tasks more challenging. The patient has to undergo a short procedure during which surgical stimulation is highly variable & at times quite intense. A strategy needs to be developed in order to anticipate and manage patients with difficult airways. This includes identifying the potential problem, considering different options, and selection of an appropriate plan in the particular scenario of the individual patient. So preoperative evaluation & regular and ongoing discussions with the surgeons regarding the plans of oxygenation & ventilation are also important. Finally, there should be alternative plans in case of failure of the initial plan.

Sixty children including neonates and infants, with stridor undergoing investigations under general anaesthesia, were studied retrospectively. General anaesthesia was induced using an inhalational technique with halothane and was maintained with propofol infusion without the use of tracheal intubation. The ages ranged from three days to two years and five months. In most of the cases after propofol infusion, there was a slight drop in blood pressure without change in heart rate. This modified technique was found to be satisfactory in most of the cases.

### Preoperative evaluation:

Meticulous preoperative physical examination & medical history with origin, duration & progression to cause airway problems must precede any decision regarding anesthetic plan. Patients may present with –

1. hoarseness of voice – rough & unpleasant voice results from VC lesions
  - hot potato voice – muffled voice due to laryngopharyngeal lesion
  - Breathy voice- poor volume voice due to VC paralysis.
2. Stridor- noisy breathing due to obstructed airflow. The age group of patient suggests likely cause such as laryngomalacia in neonate whereas laryngeal mass or cyst in adult patients. Positional variation making stridor better or worse should be noted. So placing the patient in that position, (most likely right or left lateral position), allow gravity to aid in reducing obstruction and will be beneficial during induction of anesthesia. Intermittent stridor is suggestive of intermittent obstruction due to pedunculated polyp.
3. **Dyspnoea** – difficulty in breathing. It is of two types:
  - **Inspiratory** – due to URT obstruction & associated with stridor
  - **Expiratory**- due to LRT obstruction & associated with wheezing.

4. **Cough**- with or without expectoration suggestive of infectious pathology.
5. **Neck pain** – ass with radiation to ear suggestive of trauma, infection or malignancy.
6. **Dysphagia**- difficulty in swallowing due to laryngopharyngeal & oesopharyngeal diseases.
7. Asymptomatic- airway problem gets diagnosed while undergoing anaesthesia for non ENT, non endoscopic surgery. This situation is very dangerous, challenging but can be catastrophic.

Progress of the symptoms, whether rapid or slow may help in diagnosis. After discussing chief complains suggestive of airway problems other significant medical & surgical history should be evaluated. Patient with long standing airway obstruction may develop cor pulmonale due to hypoxemia & hypercarbia. Notes of previous trauma to airway, presence of any postsurgical or irradiation scarring as well as information from previous anesthesia records will help in deciding whether a difficult airway can be expected. So detailed history will give some clues about probable diagnosis.

Age of the patient also narrows down our differential diagnosis. If elderly patient presenting with hoarseness, stridor & hemoptysis, more likely cause is malignancy but young children coming with airway obstruction then r/o congenital abnormalities & infections. Acute onset suggests infection & malignancy whereas chronic onset suggests TB, benign lesion or chronic infection.

Conditions	Symptoms
1. congenital laryngeal web	Hoarseness, inspiratory stridor
2. laryngomalacia	inspiratory stridor increases on crying
3. VC nodule	Hoarseness in morning, vocal fatigue, hawking cough
4. laryngeal stenosis	Hoarseness, inspiratory stridor
5. laryngeal papilloma	Hoarseness, inspiratory stridor
6. Carcinoma of Vocal Cord	Hoarseness, dry cough, blood stained sputum, stridor, dysphagia.

**Examination :**

- **General appearance of patient** – obesity, gross deformities, clubbing, cyanosis (pointing towards severity and duration of airway obstruction), lymphadenopathy & vitals
- Airway examination (11 points examination)
  1. Inspection of mouth & chin- shape of chin, mouth opening, loose teeth, caps & dentures, size of tonsils & tongue & MPC score
  2. **Inspection of Neck & Larynx** – presence of neck swelling, short neck, position of trachea, mobility of Cx spine, Thyromental distance & neck extension
- **Respiratory system examination** –
  1. listen & observe patient's breathing – stridor, wheezing, mouth breathing
  2. Use of accessory muscles of respiration
  3. Auscultation for adventitious sounds
- Indirect Laryngoscopy – OPD procedure, requires no preparation but can be informative about Cormack Lehane grading. Inverted image of larynx reflected in IDL mirror is seen. From above downwards following structures are seen
  1. post 1/3 tongue
  2. Valleculae, epiglottis & inlet of larynx
  3. Interior of larynx
  4. Pyriform fossa, post pharyngeal wall

**70 degree scopy** – It is a OPD procedure. It is done under local anaesthesia spray or nebulisation and patient in sitting position. It is useful when IDL is not informative in cases such as overhanging epiglottis, anterior larynx, lesion at anterior commissure and patient with restricted mouth opening. When connected to a monitor it gives a clear view of not only supraglottic and glottis lesions but also shows airway diameter actually available for ventilation and intubation,

**Investigations :**

1. X ray neck AP & Lateral view – It indicates tracheal deviation & compression
2. CT scan – It is noninvasive & accurate method of imaging of site, size & degree of airway compromise, involvement of surrounding structures (2mm size lesion). It generates cross sectional view of larynx & more informative than X ray. It is more useful for bony tissue scanning.

3. MRI scan – It is recent development of soft tissue scanning. It gives precise details regarding tumour location, no radiation exposure but costly. Repeat scan is advisable if not done in last three months.
4. Virtual Bronchoscopy – computer generated, three dimensional reconstruction technique that simulates bronchoscopist intraluminal & extraluminal view of airways suggesting dynamic obstruction. It helps to assess the craniocaudal extent of airway abnormality, subtle areas of stenosis & complex anatomical relationship prior to invasive procedure.

Pre-op optimization of patient before procedure is very important.

1. Steroids – to reduce laryngeal edema
2. Bronchodilator – to reduce chances of intraop bronchospasm
3. Anticholinergic – antisialagogue & vagolytic
4. Nebulisation of racemic epinephrine & lignocaine – soothing effect on vocal cord, reduces congestion & edema
5. Antibiotics - to control infection
6. Antihistaminics – If there is presence of irritating cough

Preop preparations for difficult airway in ENT surgery:

- Informed consent for anticipated difficult airway, explain the need for patient's cooperation if awake intubation is planned.
- Adequate preinduction fasting for stable patient and for elective procedure
- Avoid sedation or give in titration so as to get maximum patient cooperation but understanding the fact patient with chronic airway obstruction are sensitive to sedation.
- Premedication
  - IV anticholinergic (antisialagogue & vagolytic),
  - -IV steroid & racemic epinephrine nebulisation (airway edema),
  - -bronchodilator IV & nebulisation
- Difficult airway cart ready
- FOB, resuscitative equipment, O<sub>2</sub> source with anesthesia machine, wide bore suction & emergency drugs ready
- Experienced ENT surgeon gowned & ready for emergency tracheostomy

### **Microlaryngoscopy**

This is a refinement of direct laryngoscopy where a precise procedure on the larynx is performed under operating microscope for sufficient length of time. Laryngoscope is inserted from right side of angle of mouth, gets fixed by chest piece, it is self retaining & larynx is visualized through binocular operating microscope. Thus both hands of surgeon are free.

The patient is under general anaesthesia in supine position, head extension & neck flexion (Boyce position)

### **Indications**

- a) diagnostic – biopsy of laryngeal lesion
  - b) therapeutic – removal of vocal cord polyp, cyst and benign lesions, vocal cord nodules
- Dilatation of subglottic stenosis, Laser surgery

Excision of leucoplakia, Endoscopic arytenoidectomy

### **Anaesthesiologists concerns:**

- If history suggestive of pedunculated lesion, then keep patient's respiratory drive intact till definite airway is secured while planning for anaesthesia.
- Gentle laryngoscopy and intubation to avoid any trauma to lesion that could have worsened the airway obstruction.
- Excessive manipulation of larynx causes vagal stimulation
- ML scopy tube (available sizes 4, 5, 6mm internal diameter) causes CO<sub>2</sub> retention, airway resistance & hypoxia
- Chest piece prevents full expansion of lungs & resistance to ventilation
- Airway fire during laser surgery. For Laser surgery – avoid N<sub>2</sub>O, Keep Fio<sub>2</sub> < 30%, use of laser resistant or AL foil wrapped ETT with saline filled cuff, minimum intensity & duration of laser, saline soaked pledgets in airway & eyepads & source of water.
- The risk of total obstruction of compromised airway with sedatives, opioids or any induction agents.
- If no relaxants are used then chances of stimulation of airway reflexes are likely to happen.

- Pathological conditions above the glottis prevent a clear view of glottic opening, whereas subglottic lesions permit a good view of vocal cords but require careful placement of small ETT.

Surgical requirements for MLscopy are to provide surgeon with a clear view, an immobile field & room to work. The objectives are to protect the trachea, ensure good ventilation & oxygenation, minimize secretions & reflexes & finally to promote rapid awakening & return of protective airway reflexes.

Airway cart with a variety of intubation aids should contain

- Rigid laryngoscope blades of alternate design & size
- ETT of different sizes, supraglottic devices – LMA, combitube
- MLscopy tubes, Laser tubes
- ETT guides: gum elastic bougie, ventilating bougie, semirigid stylet, light wand, Magill's forceps
- Jet ventilation equipment, retrograde & Fiberoptic intubation equipment
- Emergency surgical airway – cricothyrotomy
- ETCO<sub>2</sub>

**Monitoring:** The choice of monitoring will depend upon the physiological status of patient & extent of surgery. All patients should be monitored with standard monitors such as Pulseoximeter, NIBP, ECG, EtCO<sub>2</sub> & Precordial stethoscope.

**Airway management:** The majority of vocal cord lesions are located in anterior commissure area. Thus in most of cases special MLscopy tubes are used to provide positive pressure ventilation. MLscopy tubes are small diameter, long as adult size ETT with high volume low pressure cuff. Cuff size of these tubes is equivalent to 8mm PVC ETT, thereby forming a good seal in the trachea, allowing IPPV, protecting trachea from surgical debris and monitoring of ETCO<sub>2</sub>. They can be used without obscuring surgical view. Posterior commissure of larynx can be inspected at extubation or by moving tube aside.

- The other alternatives are – Different techniques of ventilation

1. Elective Tracheostomy local anesthesia
2. Apnoeic oxygenation (intermittent mask ventilation)
3. Positive pressure ventilation MLscopy tubes
4. Jet ventilation with - venturi (30-50psi, 6-7/min) - High frequency

- Manual jet ventilator which is connected to laryngoscope through side port. Inspiration is active & expiration is passive. I : E ratio is 1: 4. A hand is placed on chest for tactile monitoring of chest wall. Jet ventilation can only be used when vocal cords are visible through laryngoscope.

**Disadvantages** – vibration of VC, force blood or tumour tissue in lungs.

- High frequency ventilation uses a small catheter placed in trachea. This catheter injects O<sub>2</sub> 2- 3 ml/ kg at 400 breaths/ min in subglottic region.

**Advantages** – Blood, debris are not blown into trachea, minimal movement of VC & less concern of alignment of laryngoscope

**Disadvantages – Barotrauma**

- Apneic technique – It is used for short endoscopic procedures. Patient is ventilated by mask to maintain saturation 100%. MLscopy tube is passed. MicroLaryngoscope is positioned and fixed. MLscopy tube is then removed & surgery is performed during period of apnoea. Surgeon is allowed to operate till saturation starts falling, ventilation is started again by mask or by reinsertion of MLscopy tube.
- **Insufflation anaesthesia** – Place a small catheter in the trachea beyond vocal cord for insufflation of anaesthetic gases at high flow rates. High concentration of inhalational anaesthetic agent must be used to overcome atmospheric dilution & exhaled gases are blown back at the surgeon & operative room. It may cause vocal cord movement.
- In case of severe upper airway obstruction, tracheostomy under local anaesthesia is better choice. It requires patient cooperation, B/L superficial cervical plexus block, local infiltration & verbal reassurance. During the procedure give 100% O<sub>2</sub> & monitor cardiorespiratory parameters

A compromised airway implies partial obstruction to airflow & the risk of total obstruction if further airway narrowing occurs. Pathologic conditions above the glottis prevent a clear view of glottic opening, whereas subglottic lesions permit a good view of VC but require a careful placement of small ETT.

Patient with compromised airway present with clinical signs & symptoms such as stridor , tachypnoea , cyanosis, anxiety, sternal retraction, diaphoresis , tachycardia. Patient with chronic obstruction of airway learn to adapt their breathing & vocalization to limited airflow. Before attempting any method of intubating a compromised airway , proper evaluation of X ray , CT, old records, history & physical examination should be done. These patients should not be given general anaesthesia with or without muscle relaxants unless control of airway is ensured. Awake fibreoptic intubation should be performed under direct vision in patients with uncertain pathologic process.

- Anaesthetic technique: Short acting anaesthetics that allow smooth recovery with quick return of airway reflexes are drugs of choice. Only light premedication is required. Antisialagogue Inj. Glyco 0.2 mg im half an hour before procedure.
- For small, cystic & benign lesion – IV induction is safe method. Induction with Propofol 2 mg/ kg iv & Fentanyl 1-2 mcg/kg & Midazolam 0.03mg/kg in titrated manner such as half dose before induction & half dose after induction. Patient with compromised airway are more prone for hypoventilation, hypoxia. If patient is getting mask ventilated then short acting muscle relaxant Scoline 1-1.5mg/ kg can be given . Muscle relaxant is necessary for introduction of endoscopic instrument. Intermittent Succinyl choline is used for procedure lasting 10-15 mins & for longer procedures intermediate acting non depolarizing muscle relaxant , Inj. Atracurium 0.5 mg/ kg is used.
- To blunt sympathetic responses short acting beta blocker or Lidocaine either topically or IV 1-1.5 mg/kg can be used.
- If spontaneous ventilation is needed or preferred during the procedure , muscle relaxant is avoided. Patient is induced with inhalation agent by mask ventilation or with Propofol IV . After topical application of Lignocaine, endoscopic instrument can be introduced. Anaesthesia is maintained by insufflation of volatile agent in 100% O<sub>2</sub> via side port of laryngoscope or bronchoscope or by propofol infusion.
- Awake fibreoptic / direct laryngoscopic intubation with ML scopy tubes should be performed under direct vision in patients with compromised airway suggested by 70 degree scopy.(large size malignant lesion, pedunculated polyp).
- Ventilatory settings to be changed to low TV & increased RR

### **Extubation**

Before extubation check laryngoscopy should be done to check bleeding, all Adrenaline & Mitomycin patties removed & vocal cord edema due to instrumentation of airway. Smooth Extubation of the trachea is performed after muscle relaxant have been fully reversed & patient is maintaining an acceptable respiratory rate & tidal volume.

Complications :

1. Smaller size ETT leads to hypoxia , hypercarbia & resp acidosis
2. Chest piece prevents chest expansion
3. Vagal stimulation of larynx
4. Avulsion of polyp during intubation
5. Trauma & Vocal cord edema
6. CO<sub>2</sub> retention, barotraumas
7. Airway fire due to laser

### **Postoperative considerations –**

1. Head up positioning to decrease airway edema.
2. Humidified O<sub>2</sub>
3. Nebulisation of racemic epinephrine 0.25 ml
4. IV Dexamethasone 0.5 mg/ kg.

### **Our experience with ML scopy.**

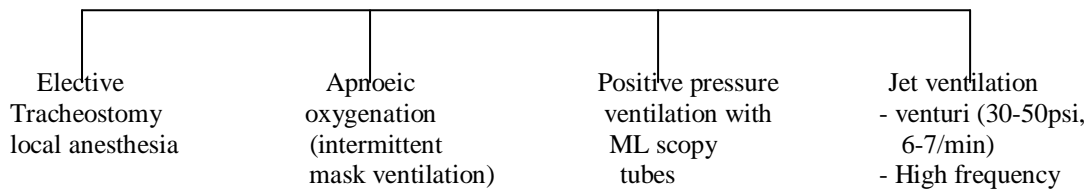
During last three months we managed 25 cases posted for ML scopy either therapeutic or diagnostic purposes. We came across patients of different age groups from paediatric (laryngeal papillomatosis), adult (vocal cord polyp, nodule, cyst) to elderly (malignant lesion of vocal cord, pyriform sinus, post cricoid region). Most of them presented with hoarseness of voice, dysphagia, dyspnoea, strider with history of smoking.

While inducing these patients we advised nebulization in the ward and then gave the premedications of IV steroid, bronchodilator, glycopyrrolate and titrated dosages of IV Injection midazolam and Fentanyl (half dosages). In these patients IDL or 70 degree scopy were showing bilateral vocal cord movement, good chink or involvement of one of the two vocal cord. Then we started with IV induction , Injection Propofol

(titrated manner). If patient could be ventilated, then muscle relaxant injection Scoline or vecuronium was given. In some patients where chink was inadequate on IDL or 70 degree scopy or growth extending into supra or infra glotic lesion then we induced with inhalation agent such as sevoflurane 8% & confirmed ventilation . Then Injection Propofol was given in titrated doses to allow intubation with ML scopy tube depending on size of chink. Then muscle relaxant & sedation was given. But in two patients where chink was not seen due to growth of pyriform sinus, larynx & covering laryngeal inlet we planned awake fiberoptic intubation after topical preparation of airway. In our case series we came across complications twice. Four year child with laryngeal papillomatosis developed masseter spasm on IV Scoline but relieved on injection Atracurium. 52 year old patient with vocal cord polyp developed post extubation bronchospasm and desaturated up to 90% responded to 100% oxygen by mask and asthalin lignocaine + adrenaline nebulization.

**Airway management:**

- For small, cystic & benign lesion – IV induction is safe method.
- Awake fibreoptic / direct laryngoscopic intubation with ML scopy tubes should be performed under direct vision in patients with compromised airway suggested by 70 degree scopy.(large size malignant lesion, pedunculated polyp). Ventilatory settings to be changed to low TV & increased RR
- In case of severe airway obstruction, tracheostomy under local anesthesia is better choice.
- Different techniques of ventilation



- Before extubation check laryngoscopy should be done – r/o bleeding, vocal cord edema and all adrenaline and mitomycin patties removed.
- For Laser surgery – avoid N2O , Keep Fio2 < 30 % ,use of laser resistant or AL foil wrapped ETT with saline filled cuff, minimum intensity & duration of laser, saline soaked pledgets in airway & eyepads & source of water.

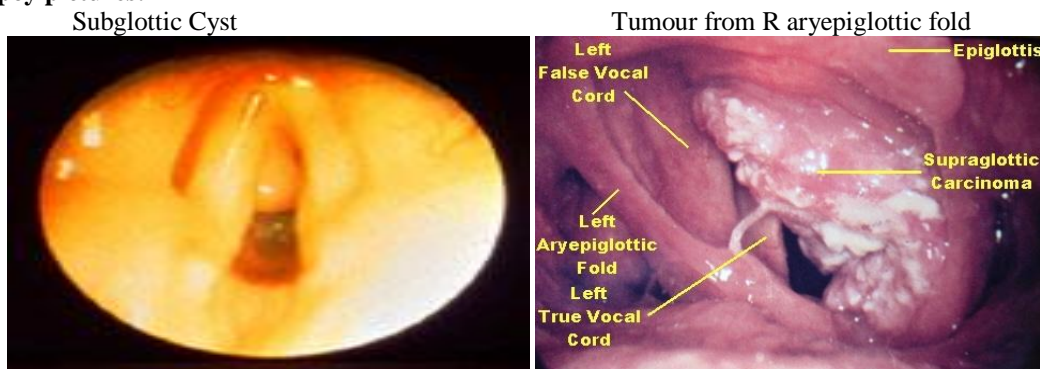
**Complications**

- Avulsion of polyp during intubation
- Trauma
- CO2 retention, barotraumas
- Airway fire due to laser
- Vocal cord edema

**Airway tumours**

Tumours are the commonest cause of upper airway obstruction in adults. Tumours can be benign or malignant. Types of tumour – solid ( Ca tongue , lingual tonsil , lingual thyroid etc.) -cystic ( laryngeal cyst , epiglottic cyst etc.)

**ML Scpoy pictures:**



**Signs & symptoms:**

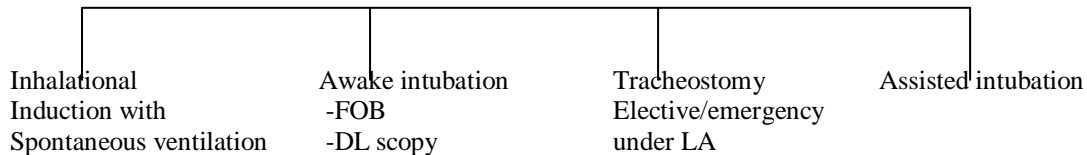
- snoring , positional airway obstruction , dyspnoea ,trismus
- dysphagia s/o oropharyngeal lesion
- stridor s/o laryngopharyngeal lesion
- bleeding from lesion,

**Airway problems:**

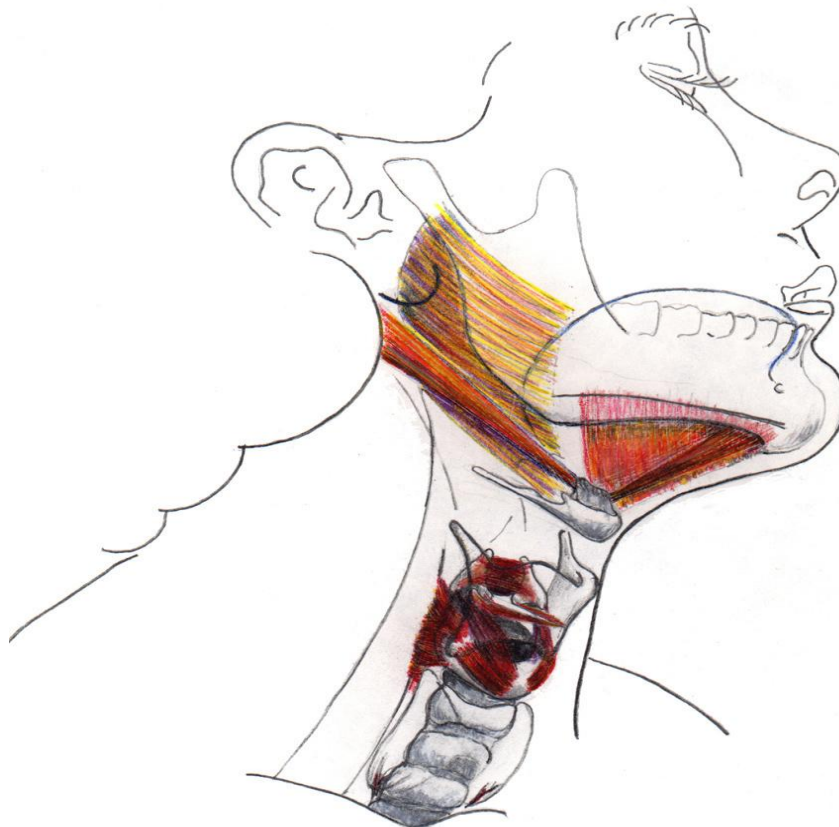
- Preexisting airway obstruction likely to be worsened by lying supine, by instrumenting larynx & under GA.
- Identifying laryngeal inlet may be difficult due to distorted anatomy
- Friable tumours bleed easily on attempted tracheal intubation
- Rupture of cystic lesion during instrumentation & risk of aspiration
- Prior radiation therapy causing extensive fibrosis,ankylosis of TMJ & preexisting submucosal fibrosis makes intubation difficult.
- Postop patient with flap reconstruction & recurrence of tumour presents with distorted anatomy & restricted neck movement.

**Airway management:**

- Nasotracheal intubation with preformed north pole tube is preferred for surgical convenience.
- For one sided intraoral tumour, laryngoscopy on opposite side is advisable.
- Different modes of airway management



Get Help!



**1. General Considerations**

a. Indications

**i. Suspected or known malignancy**

1. Laryngeal lesions that require precise staging and anatomic localization

- a. A large biopsy of a cancer to be treated with irradiation is more likely to result in greater dysphonia than a small biopsy.
- b. A small biopsy of a suspected cancer does not sample the lesion as well as an excisional biopsy
- c. Frozen section analysis is useful in many cases to confirm adequate tissue sampling
- d. Frozen section analysis may 'waste' tissue that would best be evaluated by processing with permanent section (discriminate dysplasia from cis from microinvasive CA)
- e. Smaller superficial lesions that can be sampled through excisional biopsy are often better assessed through permanent section histologic analysis

**i. see:Endoscopic Resection of Vocal Cord (Fold) Leukoplakia**

- 2. Treatment of cancer through endoscopic resection: laser/cold steel/microdebrider/Freche monopolar cautery
- 3. May be done in concert with rigid esophageal endoscopy, flexible fiberoptic bronchoscopy (see [Panendoscopy](#)).

**ii. Evaluation and treatment of hoarseness (see [Laryngeal Diagnostics protocol](#))**

- 1. Vocal nodules, polyps, cysts
- 2. Polypoid corditis, Reinke's space edema
- 3. Vocal process granulomata
- 4. Sulcus vocalis
- 5. Laryngeal web
- 6. Dysphonia without clear etiology
- 7. Use of videostroboscopic equipment with improved imaging of the larynx in the clinical setting has decreased the use of microlaryngoscopy for diagnostic purposes. The capacity to evaluate the undersurface of the vocal folds and to palpate, manipulate, and possibly offer a temporary (trial) injection maintains the value of microdirect laryngoscopy as a diagnostic tool.

**iii. Other**

- 1. Recurrent respiratory papillomatosis (RRP) (see [Pharmacotherapy for Recurrent Respiratory Papillomatosis \(RRP\)](#))
- 2. Other laryngeal lesions - either identified or suspected
  - b. Contraindications
    - i. Unstable cervical spine
    - ii. Unable to obtain exposure of the larynx (ie, retrognathic)
    - iii. Consider alternatives to direct laryngoscopy
      - 1. Exposure and instrumentations transorally employing indirect mirror
      - 2. Flexible fiberoptic laryngoscopy employing biopsy port
      - 3. External approach through laryngofissure

**2. Preoperative Preparation**

a. Evaluation

**i. Essential preoperative studies (benign lesions)**

- 1. Speech pathology assessment
- 2. Consider trial of nonsurgical therapy
- 3. Videolaryngoscopy - note: videostroboscopy as we perform it (by Speech Pathology - usually with a rigid scope through a transoral route) is a good way to evaluate the vocal folds and permits concurrent high-quality voice recording. Transnasal fiberoptic examination by an Otolaryngologist often provides a more comprehensive examination of the pharynx and, in selected cases, permits a better view of the vocal folds and subglottic area.
  - i. With history of neck arthritis or neck surgery/injury: Lateral neck radiographs in flexion and extension
  - ii. Optional studies: Acoustic and aerodynamic evaluation (see [The Voice Clinic protocol](#))
  - iii. Offer to most patients with dentition: Dental prosthetics evaluation preoperatively to fashion a tailored (custom-made) acrylic dental splint
- 4. To prevent dental injury more effectively than the standard plastic "gump"
- 5. To patients who will undergo multiple microscopic direct laryngoscopy procedures (hence greater possibility of dental exposure; ie, RRP) (see suggested reading "Dental Protection During Rigid Endoscopy")



6. To improve exposure of the larynx by permitting greater pressure to be distributed across the custom dental guard
7. Less expensive dental protectors may be purchased and prepared by the patient - see Custom Dental Guards for Micro Direct Laryngoscopy (Suspension Laryngoscopy)
- b. Consent for Surgery
  - i. Describe procedure and expected recovery: Placement of rigid tube through your mouth into your voice box to expose the vocal cords. With a bright light attached for illumination and a microscope in place for magnification, the vocal cords will then be . . . (depends on the procedure to be done)

**Potential complications (not inclusive)**

1. Bleeding, infection, reaction to the anesthesia
2. Damage to adjacent structures
  - a. Lips, teeth, tongue
  - b. Larynx, pharynx
  - c. "numb tongue, altered taste, TMJ syndrome, dental injury"
3. Potential hoarseness, breathing, or swallowing problems
4. "A surgical incision - whether it be on the vocal cords or elsewhere - always results in a scar. Our goal is to minimize the amount of scarring with an effort to make it imperceptible."
5. Mention prolonged intubation or temporary tracheotomy if it is more than an extremely remote possibility.
6. Mention possibility of developing a numb tongue or hypoglossal nerve paralysis from pressure of the laryngoscope (usually temporary).

**3. Nursing Considerations**

- a. Room Setup: See Panendoscopy Room Setup
- b. Instrumentation and Equipment
  - i. Standard
    1. Direct Laryngoscope Tray
    - a. included Dedo laryngoscope and Lindholm
    2. Bronchoscopy Tray, Adult
    3. Lewy Laryngoscope Holder Tray
    4. Laryngoscope Instrument Tray, Microscopic Direct
    5. Telescope, Storz, Hopkins straight 0° 5.5 mm x 20 cm
    6. Telescope, Storz, Hopkins straight 0° 4.0 mm x 30 cm
    7. Telescope, Storz, Hopkins 70°, 4 mm x 30 cm
    8. Storz fiberoptic light cable
    9. Stryker camera adapter (if flexible bronchoscope used)
    10. Microscope plus video unit
  - ii. Special
    1. Tracheotomy Tray (available only)
  - c. Medications (specific to nursing)
    - i. 4% lidocaine solution, topical: Draw up in Luer Lock syringe to secure 25-gauge needle (used to spray vocal cords) with 25 gm x 1.5 in nDL. Lidocaine should be preservative free.
    - ii. 1% Lidocaine with 1:100,000 epinephrine
    - iii. Oxymetazoline HCL nasal spray, 0.05% (for hemostasis on 1/2 in x 1/2 in neuropathies). 4% cocaine can also be used for topical hemostasis.
    - iv. FRED (fog reduction elimination device); used to defog the telescopes used in imaging the larynx; FRED is variable in effectiveness to prevent fogging; HH's preference: use hot water to warm the tip of the telescope to prevent fogging
    - v. Kenalog 40 mixed 1:3 with 1% Lidocaine with 1:100,000 epinephrine (final dilution: Kenalog 10) for granuloma injections.
- d. Prep and Drape
  - i. No prep
  - ii. Drape
    1. No need for shoulder roll if patient appropriately positioned on table:
      - a. Head of patient at end of bed with 'head extension' flexed down
      - b. Raise back of bed 30 degrees to elevate head above abdomen
    2. Two unfolded pillowcases with towel clamp for a head drape oriented to protect eyes
    3. Tape eyes (employ moistened eye pads and cloth tape if use of laser is possible)
    4. Cloth drape across chest

- e. Drains and Dressings
  - i. None
- f. Special Considerations
  - i. Keep small amount of clean saline set aside to place biopsies in and to clean off biopsy forceps to avoid cross-contamination between specimens.
  - ii. Open 18-gauge needle when taking biopsies to remove tissue from forceps. Place on Telfa for pathology.
  - iii. May use silver nitrate sticks to control extensive bleeding from the pharynx or supraglottic larynx (not recommended on the vocal folds). Alternatively, have the monopolar cautery available to touch to suction as it is applied to bleeding site through the laryngoscope with care to avoid contact with the laryngoscope; a safer monopolar cautery is the shielded Freche micro-cautery unit.
  - iv. Topical 1:100,000 epinephrine or oxymetazoline for application to vocal folds on 1/2 in x 1/2 in neurosurgical cottonoid for hemostasis. Topical cocaine can also be used.
  - v. Patients may have premade tooth guards.
  - vi. Instruments should be set up prior to induction and remain assembled until patient is extubated and patent airway is established.
  - vii. Tracheotomy Tray should be available for emergency tracheotomy.
  - viii. Second Mayo stand may be used for support for surgeon to rest hands during microlaryngeal surgery may be useful in selected cases.
  - ix. Rigid telescope with fiberoptics attached to camera and printer with Polaroid film for immediate still pictures to be entered into chart at time of laryngoscopy. Ideally, 0-degree and 70-degree telescopes will be available for imaging.
  - x. Laser is generally not used except for papillomata and occasionally for malignancy to improve the airway. Laser attachment to the microscope can be placed preoperatively if lateral cordotomy is to be made to "spot weld" the mucosa back together (rarely needed).
  - xi. Laryngoscopes
    - 1. Jackson laryngoscope: Rarely used, best to introduce rigid bronchoscope
    - 2. Hollinger anterior commissure laryngoscope: Poor monocular exposure; useful when exposure is impossible with other laryngoscopes
    - 3. Dedo laryngoscope: The "workhorse" provides adequate exposure of the glottis in most patients; limited for laser surgery by absence of smoke evacuation port
    - 4. Ossoff-Karlan laryngoscopes: Good exposure but cannot be used in all patients because of larger size; best for laser surgery because of smoke evacuation port
    - 5. Weerda laryngoscope: Expands both proximally and distally to provide excellent exposure for supraglottic surgery
    - 6. Lindholm scope: good for supraglottic exposure and glottic exposure, not useful for difficult airways requiring endolaryngeal exposure. May supplement with laryngeal spreader.
      - a. note - the Jackson and Lindholm scope have more acute angles at the corners allowing the surgeon to rest the laryngeal instrumentation with greater stability than other scopes, specifically the Kleinsasser.
  - xii. Concept of 'floating the lesion':

#### **4. Anesthesia Considerations**

- a. General Anesthesia
  - i. Communication with anesthesia staff is essential
    - 1. Oral endotracheal intubation with small (4.0 to 6.0) endotracheal tube (MLT tube = microlaryngeal/tracheal tube)
    - 2. Use laser-safe endotracheal tube if intraoperative laser use is planned
    - 3. Short-term paralysis (duration dependent on procedure; communicate with anesthesiologist)
    - 4. Consideration for alternative methods
      - a. Jet anesthesia
      - b. Apnea with intermittent mask
      - c. Spontaneous ventilation
      - d. Local anesthesia with sedation (see Local Anesthesia for Rigid Endoscopy protocol)
      - e. The surgeon should be in the operating room during induction if there is potential for airway compromise.
    - b. Preoperative Systemic Medications
      - i. Glycopyrrolate 0.1 to 0.2 mg IM on call to operating room
        - 1. The drying effect improves exposure; consider avoiding in patients with xerostomia, cardiac disease; contraindicated with glaucoma or urinary retention
        - 2. Vagolytic effect

3. IM administration has longer half-life than IV, but onset of action for IM is 15-30 minutes, versus 1 minute for IV
- ii. Consider Decadron 8 to 10 mg IV when IV started to diminish edema
1. Contraindications: diabetes, ulcer disease, other
- iii. Antibiotics administered only if biopsies or incisions are made in an infected or contaminated region (not usually employed for vocal fold surgery) (see [Antibiotic Prophylaxis in Head and Neck Surgery](#) protocol)
- c. Positioning
  - i. Head of table turned 90° from anesthesia
  - ii. Arms tucked for placement of suspension laryngoscopy support
  - iii. Head extended
  - iv. Head of bed elevated to 30°
  - v. Have ETT taped to right upper lip and affix to right upper corner of the table to aid surgical manipulation and avoid accidental extubation.

## **5. Operative Procedure**

**see: Adult Airway in the Operating Room**

### **1. Conditions**

- a. General Principles
  - i. Respect the integrity of the vocal fold and, in particular, the vocal ligament.
  - ii. Perform a systematic search (inspection/palpation) for synchronous laryngeal pathology not identified preoperatively (ie, sulcus vocalis, scarring, webs).
  - iii. Perform a conservative resection of diseased tissue.
  - iv. Avoid operative treatment of the anterior aspect of both vocal folds at the same time to avoid webbing.
  - v. Employ the largest laryngoscope possible to maximize exposure.
  - vi. Hemostasis
    1. Topical application of ephedrine or epinephrine
    2. Judicious use of needle tip Freche monopolar electrocautery
- ii. Avoid procedures that increase risk of vocal fold scarring
  1. Better to leave benign diseased tissue rather than excise too much normal tissue
  2. An irregular edge to the vocal fold with preservation of pliable mucosa is usually a better phonatory result than a scarred straight edge
- iii. Infusion of 1% lidocaine with 1:100,000 epinephrine into the superficial layer of the lamina propria may be of benefit in selected cases to define the vocal fold lesion and improve visualization during surgical intervention. This technique, known as "floating the lesion," may be performed using the [Xomed-Treace Injection Tray](#).
- iv. Although it is not clearly established to be of value, placement of Kenalog 10 into or onto the surgical bed may be beneficial in selected cases.
- v. Respect the principle of unilateral surgery in laryngology, with care to avoid creating opposed raw surfaces on both vocal folds. This leads to scarring and stenosis.
  - b. Nodules
    - i. Strict attention to the proper selection of patients in need of surgery to
      1. Remove nodules only after a long period of voice therapy
      2. Remove nodules only after behavior has been modified to diminish the risk of nodule recurrence after resection
    - ii. Nodules are superficial mucosal lesions
      1. Conservative removal of superficial abnormal mucosa
      2. Avoid use of laser
  - c. Polyps
    - i. Preoperatively, speech pathologists are generally involved in the evaluation; speech therapy usually employed postoperatively.
    - ii. Polyps are usually superficial lesions and often are associated with a "feeding blood vessel".
      1. Preservation of all of the abnormal epithelium overlying the polyp is usually not useful.
      2. Endoscopic suturing or use of fibrin glue to reapproximate epithelium after removal is of questionable benefit.
      3. Monopolar cautery (Freche) is done superficially and on a low setting to the feeding blood vessel.
  - d. Cysts
    - i. Preoperatively, speech pathologists are generally involved in the evaluation; speech therapy usually employed postoperatively.

- 
- ii. A lateral cordotomy is generally the best approach to cyst removal with preservation of overlying epithelium and underlying vocal ligament.
    - 1. Ensure that epithelium overlying the cyst is normal before performing a lateral cordotomy.
    - 2. If the epithelium overlying the cyst is abnormal, access for removal of the cyst may be done through judicious resection of the abnormal epithelium.
  - e. Vocal Process Granuloma
    - i. Indications for removal
      - 1. Biopsy to rule out cancer
      - 2. Airway compromise
      - 3. Persistent symptoms despite adequate nonsurgical therapy
    - ii. Nonsurgical therapy
      - 1. Antireflux measures
      - 2. Consider Nissen fundoplication for refractory cases
      - 3. Consider voice therapy
      - 4. Consider a trial of antibiotics and steroids
    - iii. Operative approach
      - 1. Inject base with Kenalog before excision
      - 2. Grasp granuloma with forceps and resect with scissors
      - 3. Avoid use of laser if possible
      - 4. Employ perioperative antibiotics
  - f. Polypoid Corditis AKA Reinke's space edema
    - i. Indications for removal
      - 1. Symptomatic dysphonia refractory to nonsurgical management
      - 2. Airway obstruction due to advanced disease
      - 3. Concern for malignancy
    - ii. Nonsurgical therapy
      - 1. Voice therapy
      - 2. Antireflux medication
      - 3. Smoking cessation (smoking cessation halts disease progression)
    - iii. Operative approach
      - 2. POSTOPERATIVE CARE
        - a. Most procedures are done as outpatient; concern regarding adequacy of airway may warrant hospitalization.
        - b. Medications
          - i. Consider additional IV Decadron postoperatively if laryngeal manipulations cause edema.
          - ii. Consider antibiotics (Ancef/Keflex) if implants placed or if there is infection identified.
  - iii. Consider Zantac/Prilosec/omeprazole with antireflux instructions if findings suggestive of laryngopharyngeal reflux (LPR) (see [Antireflux](#) instructions).
  - iv. Humidification (bedside humidifier)
  - v. Hydration (drink noncaffeinated fluids "until your urine is pale")
    - c. Voice Rest
      - i. Usual: Absolute voice rest for 48 hours (provide writing pad and bell). "Arm's length rule" ensures voice conservation for two weeks postoperatively. Do not speak to anyone farther away than an arm's length away.
      - ii. Confer with speech pathologist regarding special cases. Voice professional may require longer period of voice rest.
    - iii. Usual follow-up
      - 1. Reevaluate two weeks postoperatively (earlier if cancer diagnosed).
      - 2. Videoendoscopy with speech pathology assessment at 6 weeks postoperatively.
      - 3. Further follow-up is individualized.
      - d. Please see [Airway Monitoring](#) protocol
  - 3. CPT CODING
    - a. 31526, Laryngoscopy, direct, with or without tracheoscopy; diagnostic, with operating microscope
    - b. 31531, Laryngoscopy, direct, operative, with foreign body removal; with operating microscope
    - c. 31536, Laryngoscopy, direct, operative, with biopsy; with operative microscope
    - d. 31541, Laryngoscopy, direct, operative, with excision of tumor and/or stripping of vocal cords or epiglottis; with operating microscope.

### References

- [1]. Hoffman H. Review of Woo et al. Aerodynamic and stroboscopic findings before and after microlaryngeal phonosurgery. *J Voice*. 1994;8:186-194. *Otolaryngol J Club*. 1995;2:143-147.
- [2]. Hoffman H, Karnell M. Hoarseness and laryngitis. In: Conn HF, Rakel RE, eds. *Conn's Current Therapy*, eds. Philadelphia, PA, WB Saunders. 1996:28-36
- [3]. Olsen GT, Moreano EH, Arcuri MR, Hoffman HT. Dental protection during rigid endoscopy. *Laryngoscope*. 1995;105:662-663.
- [4]. Pinkston DR, Gartlan MG, Hoffman HT. Pathology quiz case: ductal cysts of the larynx. *Arch Otolaryngol*. 1992;101:1266-1268.
- [5]. Verdolini-Marston K, Hoffman HT, McCoy S. Nonspecific laryngeal granuloma: a case study of a professional singer. *J Voice*. 1994;8:352-358.
- [6]. Poels PJ et al. Consistency of the preoperative and intraoperative diagnosis of benign vocal fold lesions. *J Voice*. 2003 Sep;17(3):425-33.
- [7]. El-Orbany M, Woehlck H, Salem MR Head and Neck Position for Direct Laryngoscopy. *Anesth Analg*. 2011 Jul;113(1):103-9. Epub 2011 May 19
- [8]. A modified technique of tubeless anaesthesia for microlaryngoscopy and bronchoscopy in young children with stridor M. K. THAUNG MBBS (RGN), FFARCSI<sup>1</sup>, A. BALAKRISHNAN MBBS (S'PORE), FRCS (ED), FAMS<sup>2</sup> 9 OCT 2008 DOI: 10.1046/j.1460-9592.1998.00732.1998 Blackwell Science Ltd. *Issue Pediatric Anesthesia Volume 8, Issue 3, pages 201–204, May 1998.*