Anaesthetic considerations in Microlaryngeal surgery

Microlaryngeal surgery

Laryngeal surgery aided with a microscope

Anaesthesia for endoscopic procedures of the supraglottis, glottis and subglottis requires close cooperation between anaesthetist and surgeon

Indications

- Benign growth- nodules, polyps, cysts granulomas

Vocal cord dysfunction

Obstructed tumor

Recurrent respiratory papillomatosis

Foreign body

Patients for MLS

1)Patients vary from young , presenting with voice changes secondary to benign vocal cord lesions

2) Elderly, heavy smokers with chronic obstructive pulmonary disease presenting with voice changes, dysphagia and stridor caused by glottic carcinoma.

Preoperative Evaluation

- **Detailed history & examination-**

1)H/O hoarseness, voice change(low pitched , coarse fluttering – sub glottic/ high pitched ,cracking voice, aphonia or breathy –glottic)

2)Stridor- inspiratory or expiratory

3)Dysphagia, best breathing position, breathing pattern during sleep give an indication of severity of disease

4)Patients are likely to have CVS and respiratory dysfunction

5)History of previous endoscopic procedures & outcome

Preoperative Evaluation

1)Airway assessment

ease of ventilation, visualization of laryngeal inlet, tracheal intubation

2)Direct or indirect laryngoscopy:

assess the severity & size of lesion

3)Chest radiography, CT, MRI:

gives information about subglottic tracheal lesions

Before anaesthesia to patient identify

Size of the lesion	Mobility	Location
• Indication of potential airflow obstruction. • Stridor	• Mobile lesion cause airway obstruction post induction of anaesthesia	• Supraglottic • Subglottic

Preoperative preparation

- ✓ Cessation of smoking

- ✓ Continue bronchodilators
- ✓ If with tracheostomy: steam inhalation, nebulisation & suction

Premedication

- ✓ Routine premedication should be avoided
- ✓ Antisialagouge e.g. glycopyrrolate
- ✓ Titrated IV increments of midazolam with monitoring-preinduction area.

Monitoring

- ✓ Routine monitoring-
  - -ECG, HR
  - -NIBP
  - -Spo2, EtCO2
  - -temperature

- ✓ Additional –
  - -Airway pressures
  - - Invasive monitoring

Anaesthetic techniques for MLS.

INTUBATION TECHNIQUES

NON-INTUBATION TECHNIQUES

- Intermittent apnoea
- Insufflation technique
- Spontaneous Ventilation
- Jet Ventilation

CLOSED VENTILATION TECHNIQUES

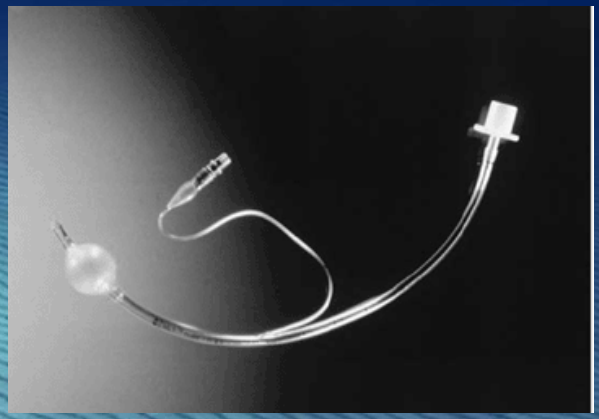
How to secure airway?

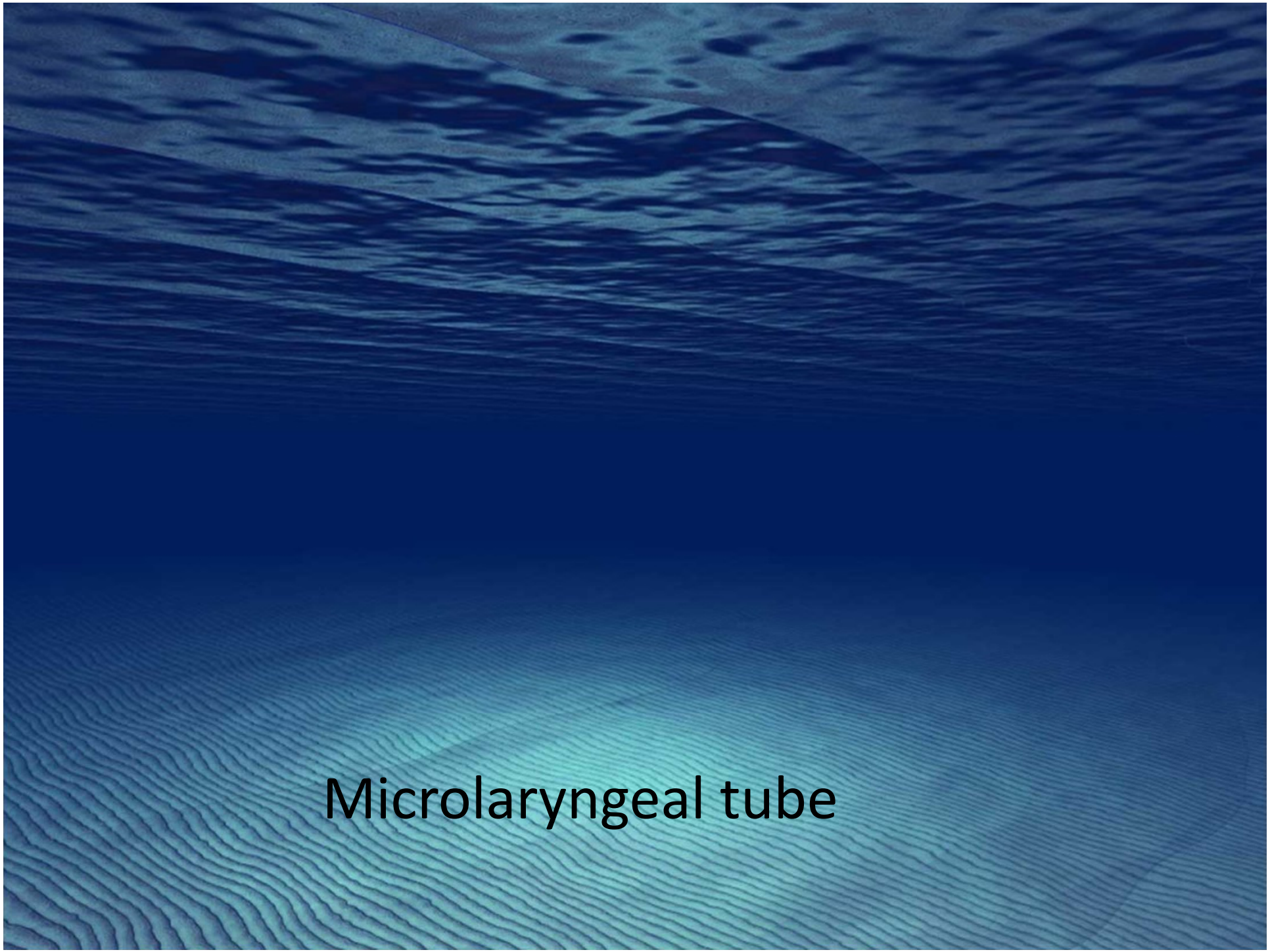
Depends on size of growth

- ✓ Small - routine tracheal intubation
- ✓ Mod. Large - awake intubation / tracheostomy ↓ LA as airway obstruction may worsen after anaesthesia. Limited pre-medication
- ✓ Large, impinging on upper airway , stridor at rest- preoperative tracheostomy, no pre-medication

Microlaryngoscopy tubes

- ✓ Small internal and external diameter
- ✓ **4-6mm ID,30cm long with standard cuff**
- ✓ low pressure high volume cuff
- ✓ Lies between arytenoid cartilages, leaving atleast anterior 2/3 of glottis unobscured.




Microlaryngeal tube

Advantages of intubation technique

- ✓ Routine technique for all anesthesiologist
- ✓ Protection of lower airway
- ✓ Control of ventilation
- ✓ Control of airway
- ✓ Minimal pollution by volatile agents
- ✓ Monitor $eTCO_2$

Disadvantages of intubation technique

- ✓ Surgical access and visibility of lesion may be limited.
- ✓ High inflation pressure may be required through small tube
- ✓ Higher resistance, difficulty in suctioning, increased chances of occlusion and kinking
- ✓ Tube related damage to vocal cords during intubation.
- ✓ Risk of LASER airway fire

Open system/non intubation techniques.

Open system/Non-intubation techniques

1. Spontaneous ventilation technique
2. Insufflation technique
3. Intermittent apnoea technique
4. Jet ventilation
   - Supraglottic jet ventilation
   - Subglottic jet ventilation
   - Transtracheal jet ventilation

1. Spontaneous Ventilation

- Inhalation induction with sevoflurane or halothane in oxygen
- Laryngoscopy done & topical LA : on and above vocal cords
- 100 % O_2 by face mask (spont. ventilation)
- Suitable depth : rigid laryngoscopy or bronchoscopy done

Advantages

- ✓ Excellent visualization of surgical field
- ✓ Evaluate vocal cord function
- ✓ Good for otherwise stable patients with compromised airway

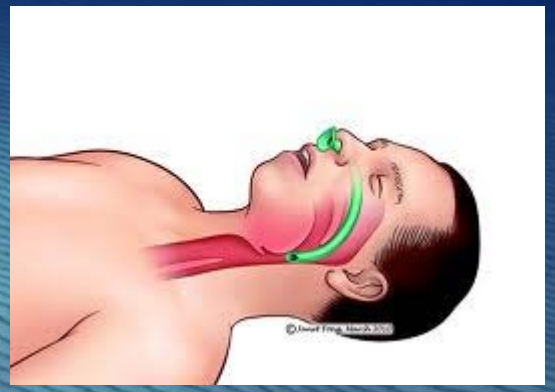
Disadvantages

- ✓ Oxygenation/ventilation more difficult to assess
- ✓ Surgical field not still
- ✓ Risk of aspiration
- ✓ Depth of anesthesia not consistent

2. Insufflation technique

ROUTES

- A small catheter in the nasopharynx ,placed above the laryngeal opening
- A tracheal tube cut short and placed through the nasopharynx emerging just beyond the soft palate
- A nasopharyngeal airway
- the side-arm or channel of a laryngoscope



Disadvantages

- ✓ No control over ventilation
- ✓ Loss of protective airway reflexes and the potential for the airway soiling
- ✓ Gastric distension
- ✓ Theatre pollution
- ✓ Not suitable for soft floppy lesions

3. Intermittent Apnoea technique

- ✓ Standard anaesthesia. Use of awake fibroptic (opportunity to look for subglottic lesion)

- ✓ Hyperventilated with a anaesthetic agent in oxygen
- ✓ Tracheal tube is then removed

- ✓ After 2–3 minutes, surgery is stopped,

the tracheal tube is reinserted and the patient hyperventilated

Apnoea tech contd...

Advantages

- ✓ Excellent visibility of surgical field
- ✓ Safety in the use of a LASER

Disadvantages

- ✓ Surgical time limit
- ✓ Inadequate ventilation
- ✓ Aspiration risk
- ✓ Variable levels of anaesthesia
- ✓ Potential trauma through multiple reintubation

Jet ventilation

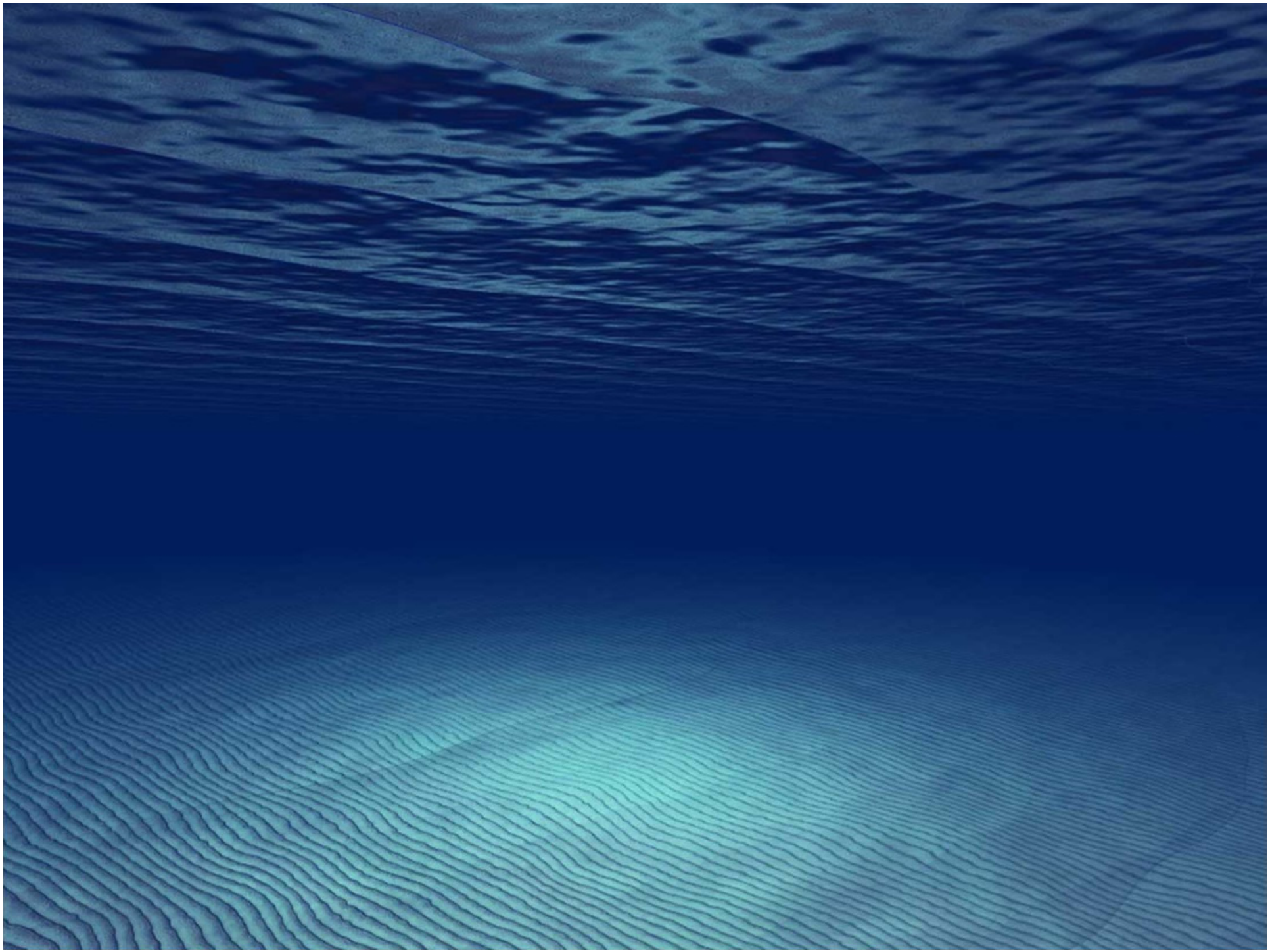
- Pulsed application of gas (mostly O_2) **jet** into the airway without airtight connection of the patient to the ventilator
- Sanders , 1967
- 16 G jet placed down the side arm of a rigid bronchoscope
- Modifications-

site at which jet emerges- supraglottic
-subglottic
-transtracheal

frequency normal , high

TECHNIQUE

- ✓ Preoxygenation
- ✓ IV Induction maintenance with propofol
- ✓ Supplemented with opioid (alfentanil /remifentanil)
- ✓ confirmation of mask ventilation , give muscle relaxant
- ✓ Laryngoscopy with topical LA administered
- ✓ Ventilation via facemask/ LMA with 100% o_2 till primed laryngoscope is not placed
- ✓ Perfect alignment of jet laryngoscope & trachea . Ventilatory rate – 6-7 bpm at 30-50 psi(adults), 5-10 psi(infant and children), I/E ratio 1.5:6 sec
- ✓ Monitor chest wall motion and Spo2

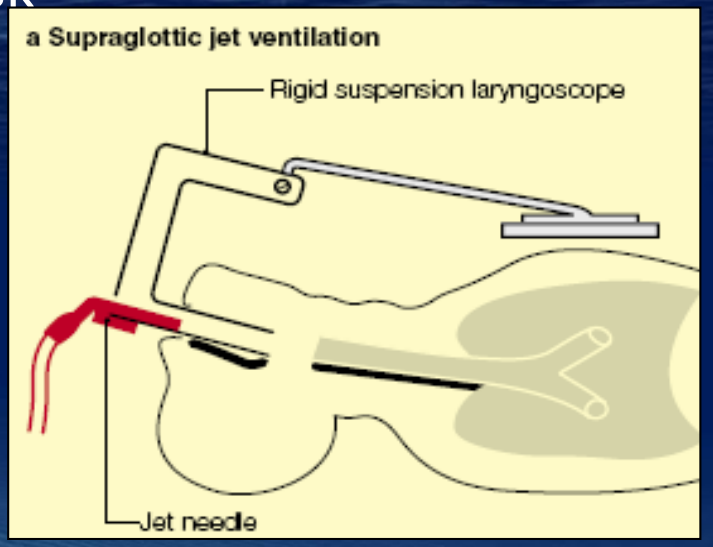


CONTRAINDICATIONS FOR JET VENTILATION

- ✓ Obesity(reduced chest compliance not allowing complete exhalation)
- ✓ COPD
- ✓ Bullous emphysema
- ✓ Retrognathia (overbite, challenging oropharyngotracheal alignment)
- ✓ glottic lesion, scarring , laryngospasm

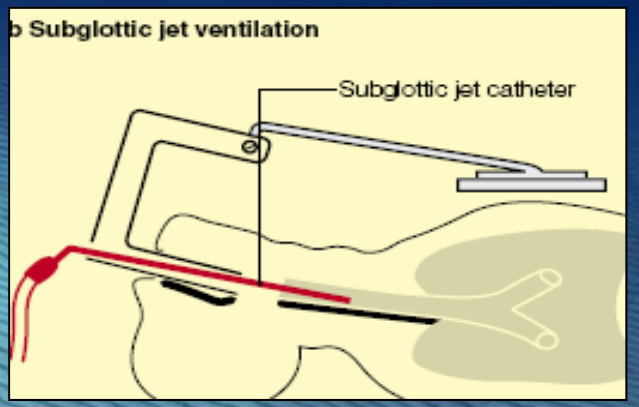
Supraglottic jet ventilation

- Commonly used in endoscopy procedures
- Allows a clear view for surgeon with no risk of LASER-induced airway fires
- Problems
  - risk of barotrauma
  - Gastric distension with entrained air
  - Malalignment of the rigid suspension laryngoscope or jetting needle
  - Blood, debris or fragments being blown into the distal trachea
  - movement of the vocal cords
  - Inability to monitor end-tidal carbon dioxide



Subglottic jet ventilation

- Allows delivery of a jet of gas directly into the trachea
- More efficient than supraglottic jet ventilation
- Results in reduced peak airway pressures
- No vocal cord motion
- Good surgical field
- No time constraints for the surgeon
- **Disadvantages**
  - Risk of laser-induced airway fires

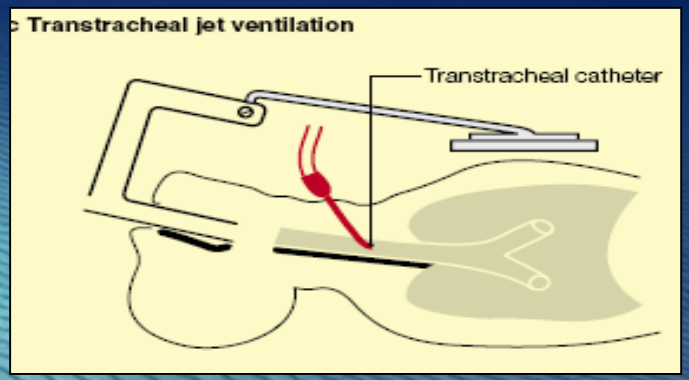


Transtracheal jet techniques

- Percutaneous transtracheal catheters through the cricothyroid memberane or trachea
- In individuals with significant airway pathology

Problems

- Greatest risks of barotrauma of all jet ventilation techniques
- Blockage & Kinking
- Infection
- Bleeding
- Failure to site the catheter



High frequency Jet Ventilation

- ✓ Ventilatory rates : about 100-150 b/minute used
- ✓ Tidal voume : <2 ml/kg
- ✓ Allows
  - A continuous expiratory flow of air, enhancing the removal of fragments of blood and debris from the airway
  - Reduced peak and mean airway pressures with improved cardiovascular stability
  - Enhanced diffusion and interregional mixing within the lungs resulting in more efficient ventilation
  - Particular importance in significant lung disease and obesity

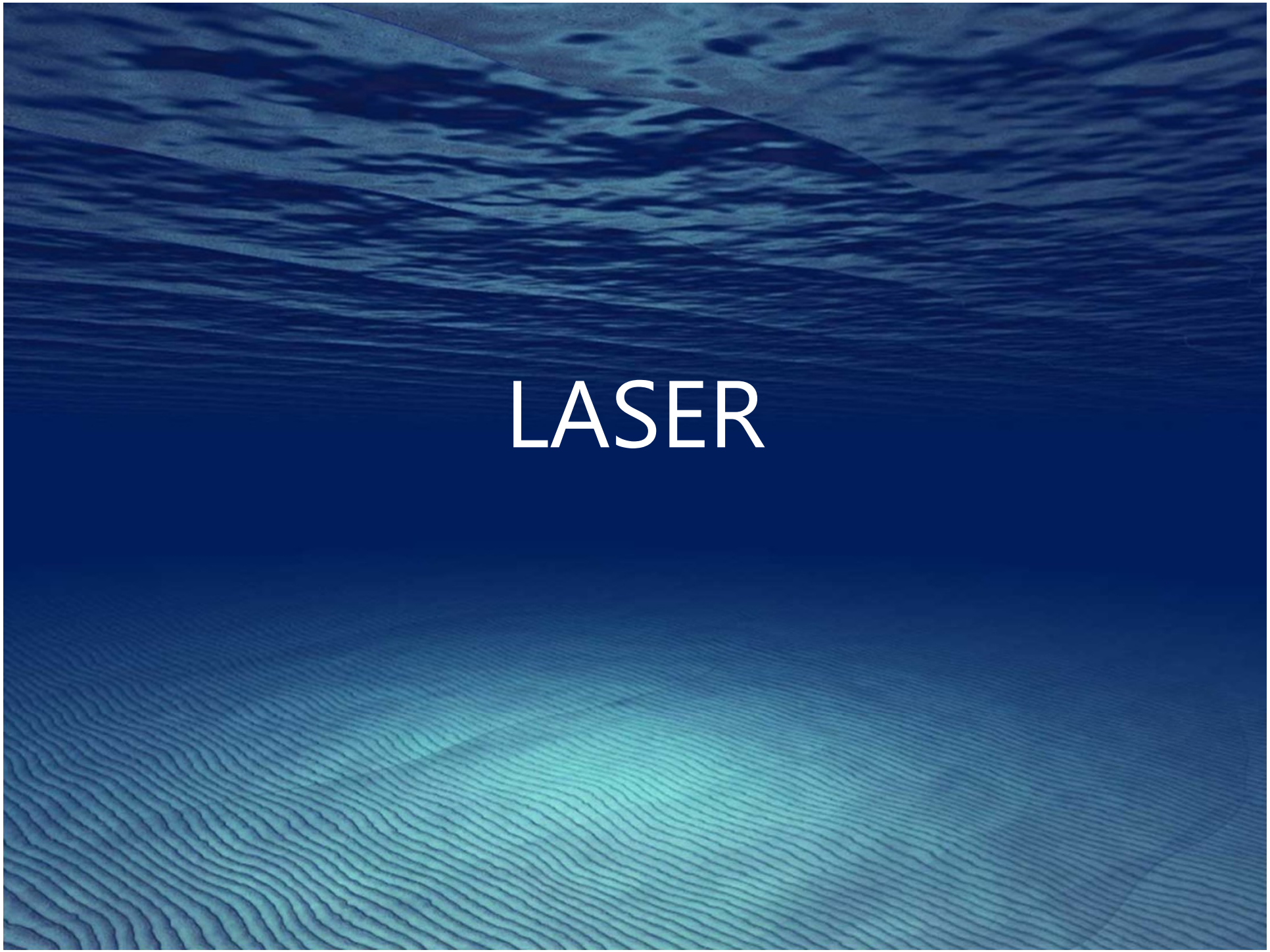
Complications

Intraoperative

- Arrthymias
- Aspiration / seeding of polyp into trachea
- Airway sharing

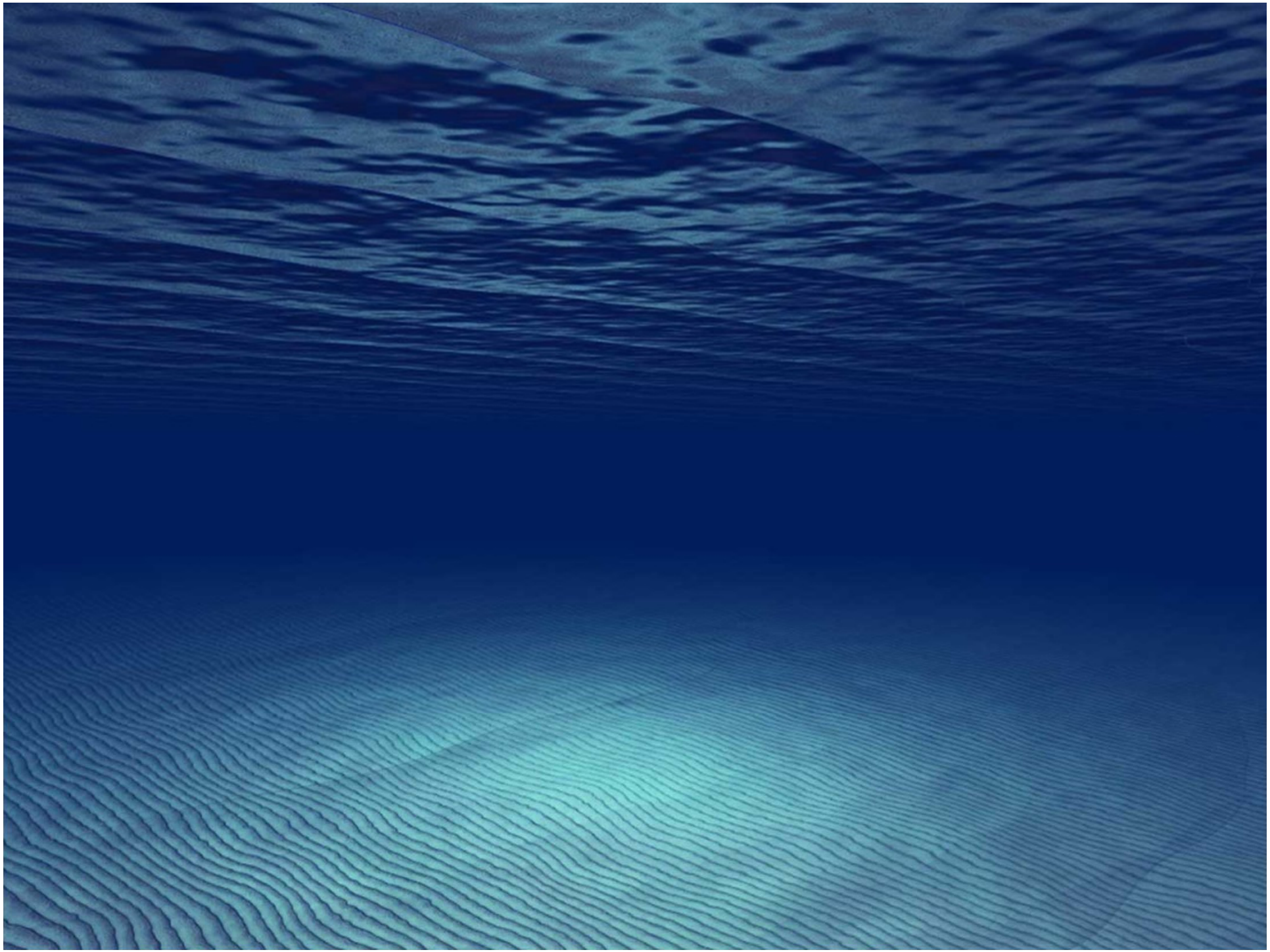
Postoperative

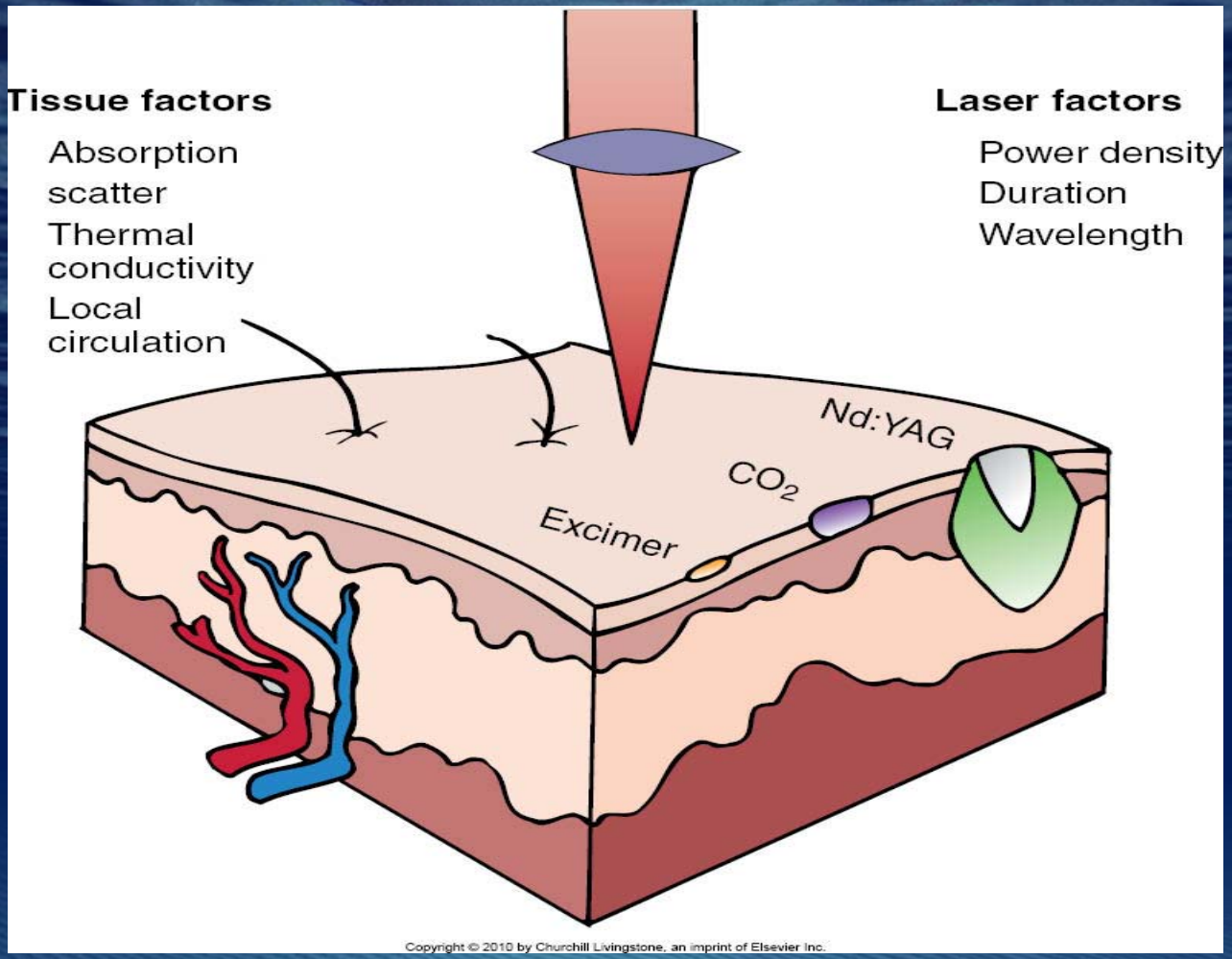
- Laryngospasm
- laryngeal edema
- Stridor
- Barotrauma and pneumothorax


LASER

LASER

- Light Amplification by Stimulated Emission of Radiation
- Characteristics:
  - Monochromatic
  - Coherent
  - Collimated
- ESSENTIAL COMPONENTS-
  - ✓ Laser medium- atoms whose electrons create laser light
  - ✓Energy source to excite atoms
  - ✓Resonating mirrors





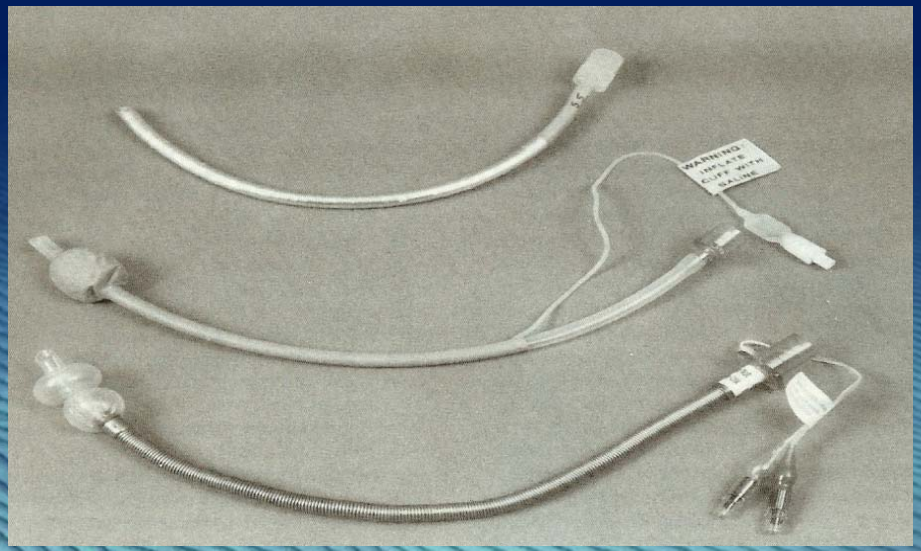
Different wavelengths of laser light cause different patterns of tissue destruction. The destructive effect of laser light on tissue depends on laser parameters and tissue factors.

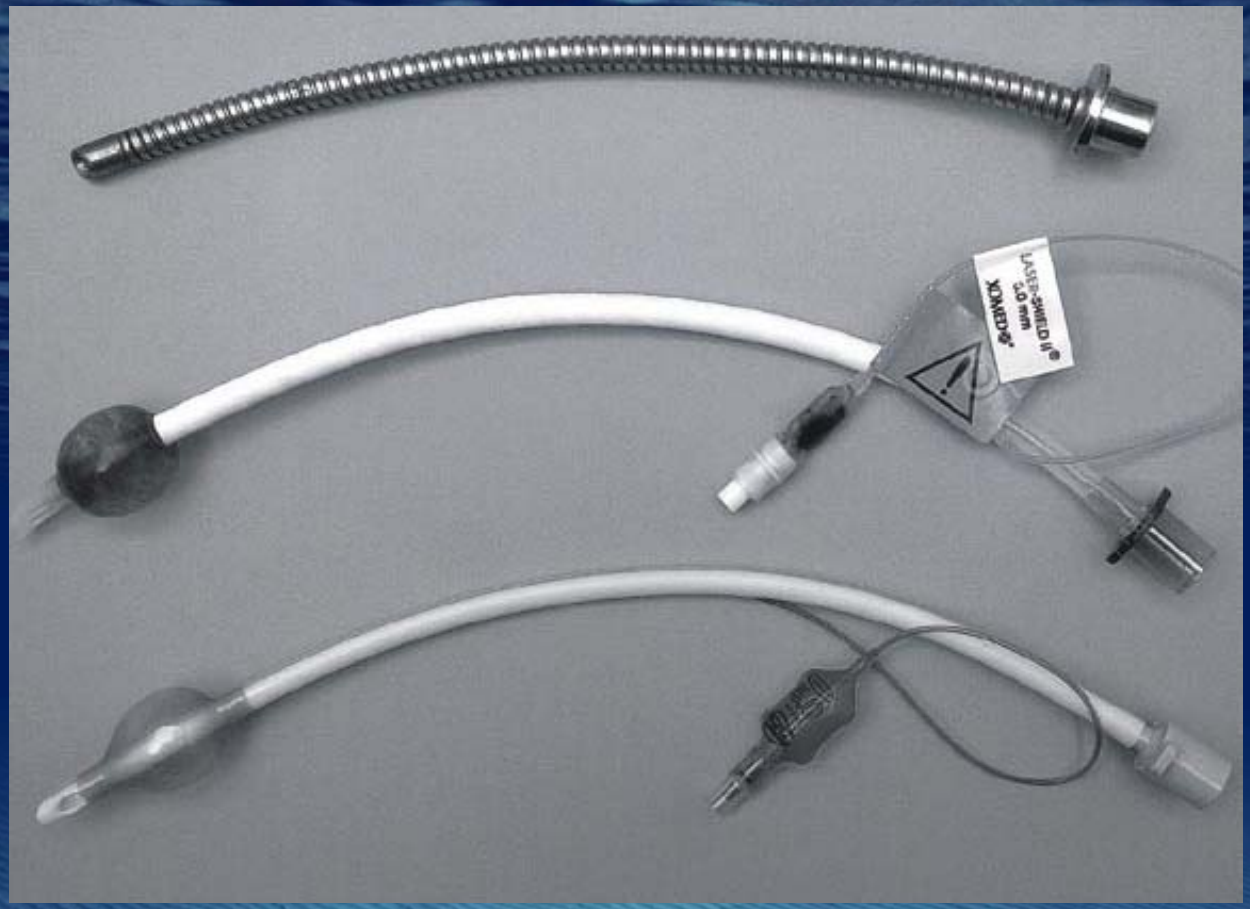
Advantages

- ✓ Good homeostasis
- ✓ Rapid healing & minimal scarring
- ✓ Surgical accuracy & preservation of normal tissue
- ✓ ↓ Postoperative edema & pain

Endotracheal tubes for Laser surgery

- **Metal endotracheal tube**
- **Norton's** stainless steel spiral coil without cuff (Walls not air tight)
- **Laser flex tube** air tight stainless steel spiral with two distal cuffs
- **Bivona foam cuff** aluminum spiral tube with outer silicone coat and self inflating foam sponge filled cuff

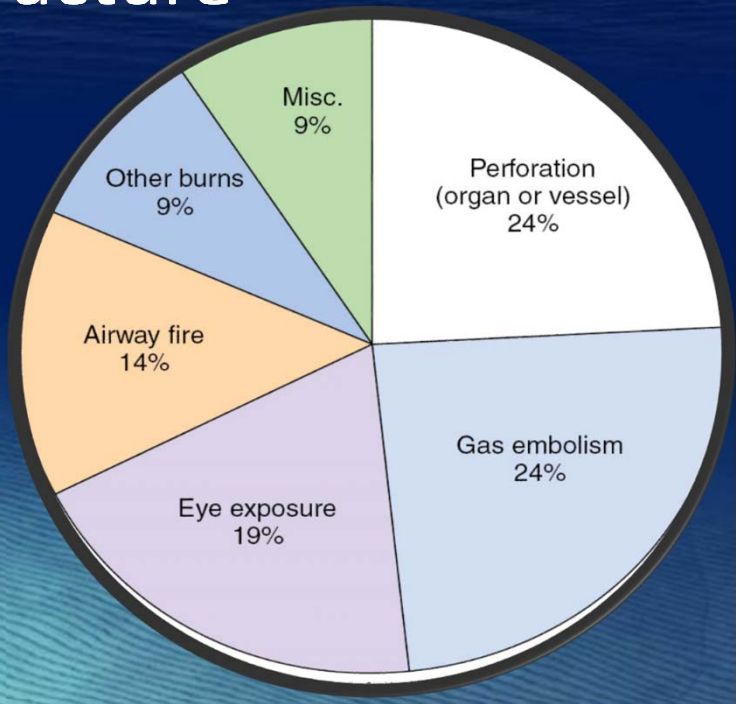




a : Metal Norton tube with no cuff
b: 5.0 mm internal diameter Xomed Laser Shield II
c : 5.0 mm internal diameter Portex microlaryngoscopy tube

LASER Hazards

- ✓ Atmospheric contamination
- ✓ Perforation of a vessels or structure
- ✓ Airway fire
- ✓ Venous air embolism
- ✓ Inappropriate energy transfer



LASER Hazards

Atmospheric contamination-

- Plume of smoke and fine particulates (mean size 0.31µm)
- Efficiently transported and deposited in the alveoli
- Sensitive individuals: headaches, tearing, and nausea after inhalation
- Animal study: interstitial pneumonia,bronchiolitis, reduced mucociliary clearance, inflammation, emphysema

Prevention

smoke evacuator

high-efficiency masks

Laser Hazards

Perforation

- ✓ Misdirected laser energy may perforate a viscous or a large blood vessel
- ✓ LASER-induced pneumothorax
- ✓ Perforation may occur several days later when edema and necrosis are maximal

Venous air embolism

- ✓ Associated with Nd-YAG LASER system
- ✓ Coolant gas

Precaution- use liquid coolant

LASER Hazards

Inappropriate energy transfer

- ✓ Incidentally pressing the LASER control trigger
- ✓ Tissue damage outside of surgical site
- ✓ E.g.-Drape fire
  - -Eye (patient or other medical staff)
  - -Endotracheal tube-damage, fires

Safety considerations

- ✓ OT warning signs for LASER use.
- ✓ Restrict entry into OT
- ✓ Wear protective eye glasses
- ✓ Avoid flammable materials (drapes, plastic tubes etc.).
- ✓ Patient's eyes – taped closed & cover with wet pads
- ✓ Wet towels to drape.
- ✓ Competent personnel for equipment use
- ✓ Avoid misdirection of beam

Safety considerations

- ✓ Avoid ETT in short procedures (use venturi)
- ✓ Ready bucket of clean water for dipping the tube
- ✓ Smoke evacuators at surgical site
- ✓ Reduce the flammability of the endotracheal tube
- ✓ Use Venturi ventilation/intermittent apnea technique
- ✓ Reduction of available oxygen content to minimum required for reasonable arterial saturation

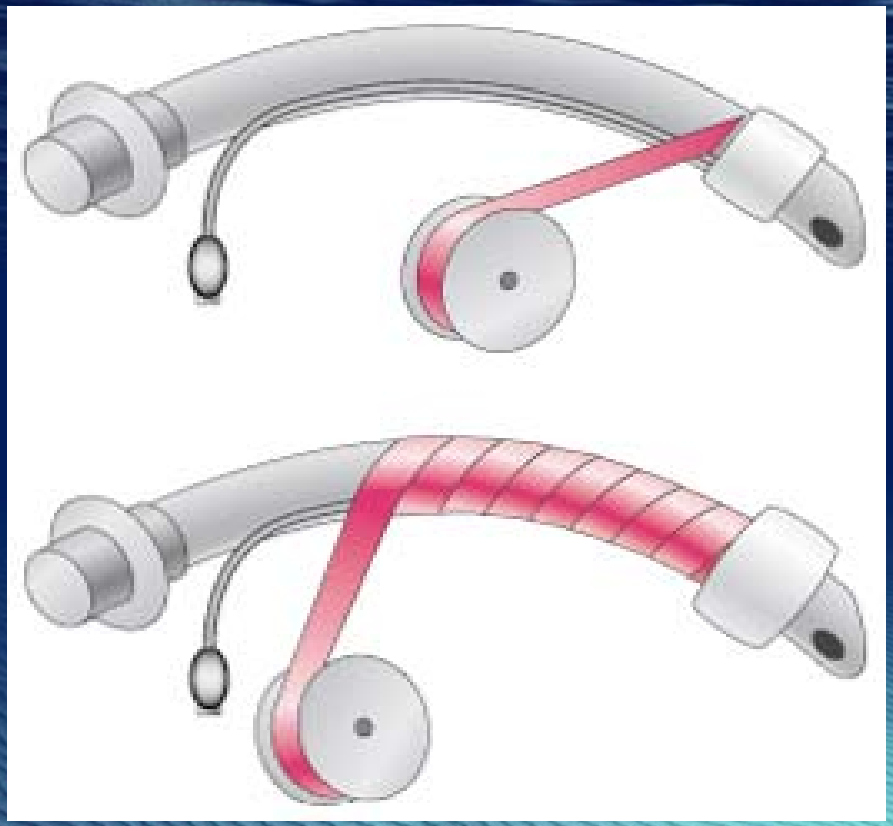
Protection of endotracheal tube

- ✓ wrapping with moistened muslin
- ✓ wrapping with metallized foil tape

  most popular approach

  - aluminum foil
  - copper foil
  - plastic tape thinly coated with metal

Technique of wrapping



- ✓ Distal end of tape cut at 60 degree angle
- ✓ Start at proximal end of cuff junction
- ✓ Overlap- 30%, no PVC exposed
- ✓ Cuff filled with methylene blue

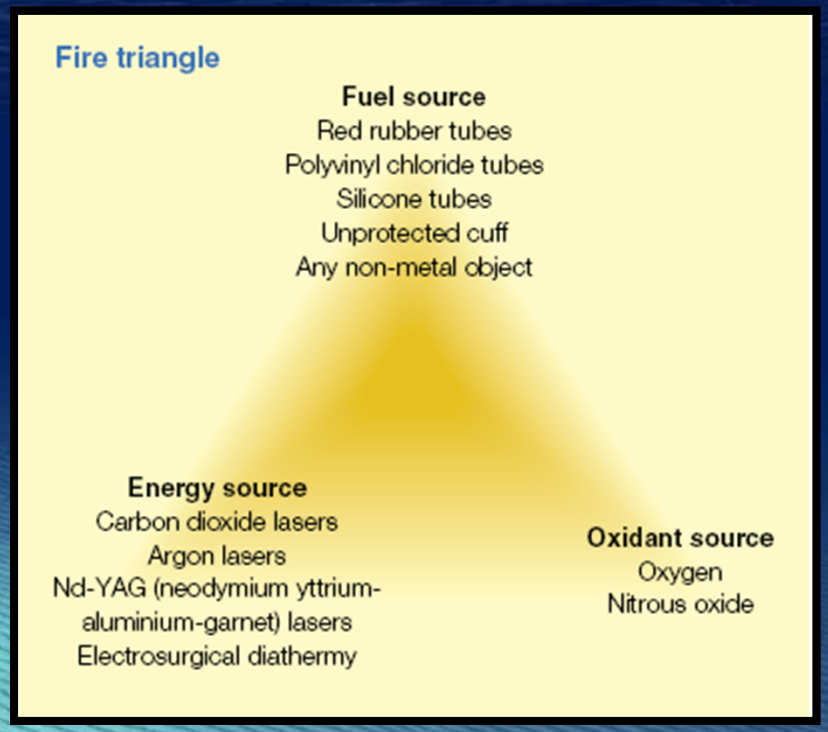
Disadvantages of wrapping

- ✓ No cuff protection
- ✓ Adds thickness to tube
- ✓ Not an FDA-approved device
- ✓ Protection varies with type of metal foil
- ✓ Adhesive backing may ignite
- ✓ May reflect laser onto non-targeted tissue
- ✓ Rough edges may damage mucosal surfaces

AIRWAY FIRES

- Only if three components of the fire triangle are present

- To minimize these risks:-
  - Use lowest FiO_2 to maintain SpO_2
  - Air should be preferred to N2O
  - Potential fuel source:
    - Laser resistant : Laser tubes



Airway fire drill

Extract / Eliminate/ Extinguish

- Put out fire – flood field with saline
- Remove energy source – stop LASER
- Remove oxidant source – disconnect circuit, stop ventilation & gases
- Remove fuel source (blowtorch effect)– extubate and remove burning fragments

Evaluate

- Review airway – ensure no burning fragments
- Oxygenate – 100% oxygen by bag and mask
- Review damage – flexible or rigid bronchoscopy
- Establish airway – re-intubate, laryngeal mask airway or jet ventilate
- No airway damage – may proceed with surgery
- Severe airway damage – tracheostomy or oral intubation, ICU admission and controlled ventilation


THANK
YOU !