Microscopic Laser Laryngoscopy (CO2)

Redirecting to: https://medicine.uiowa.edu/iowaprotocols/microscopic-laser-laryngoscopy-co2

Microscopic Laser Laryngoscopy Surgery (CO2)

return to: Laser Surgery Protocols
see also: Adult Airway in the Operating Room

1. GENERAL CONSIDERATIONS

   a. The addition of a laser component to a procedure automatically increases the complexity of the process. Resources are expended for additional instrumentation, added safety measures, and an extra "laser nurse" in the operating room. As a result, the choice to use laser surgery should be based on a clearly identified advantage over alternative procedures that do not employ the laser.
      i. Note that endoscopic laryngeal hemostasis is readily effected without a laser employing
         1. Application of topical epinephrine
         2. Monopolar cautery
            a. Small vessels: Freche monopolar insulated microcautery
            b. Larger vessels: unipolar cautery applied to suction (preferably insulated)
            c. Largest vessels: unipolar cautery applied to grasping forceps (preferably insulated)
   b. Indications for Microscopic Laser Laryngoscopy
      i. Advantages to CO2 laser
         1. Capacity to make accurate incisions with improved hemostasis in an region with limited exposure (endoscopically)
         2. Capacity to vaporize tissue
      ii. Useful in the management of non-neoplastic laryngeal disease
         1. Bilateral vocal cord paralysis
         2. Glottic stenosis
         3. Subglottic stenosis
         4. Vascular laryngeal lesions (hemangioma)
         5. Removal of Teflon granuloma
         6. Endoscopic excision of supraglottic benign lesions (ie, saccular cyst)
      iii. Useful for in the management of neoplastic laryngeal disease
         1. Recurrent respiratory papillomatosis (see Pharmacotherapy for Recurrent Respiratory Papillomatosis (RRP))
         2. Endoscopic "laser partial laryngectomy"
            a. Glottic cancer (Tis, T1, selected T2)
            b. Supraglottic cancer (Tis, T1, T2, selected T3)
         3. Debubling obstructing laryngeal cancers to avoid tracheotomy
   c. Contraindications
      i. Disadvantages to CO2 laser
         1. Concern for thermal injury with scarring of adjacent normal tissue
         2. Added cost, time, use of personnel
         3. Exposure of patient and operating personnel to dangers of laser
         4. This laser is not compatible with a fiberoption scope, so it cannot be used in the distal airway.
      ii. Although the CO2 laser has been commonly used to surgically treat the following disease processes, alternative less-expensive and less-dangerous approaches have directed our practice to nonlaser technology for treatment.
         1. Vocal fold polyps, nodules, cysts
         2. Vocal process granuloma
         3. Polypoid corditis
d. Historical
i. The laser was first used in on the human larynx in 1971 after previous tests in the canine larynx just several years earlier.
e. The CO2 laser
i. This laser has a wavelength of 10,400 nm and is strongly absorbed by water.

2. PREOPERATIVE CONSIDERATIONS

1. a. Consent
i. Describe the procedure, including potential complications (see Microdirect Laryngoscopy (Suspension Microlaryngoscopy or Direct Laryngoscopy) protocol and Panendoscopy protocol).
ii. Describe use of laser energy to cut and vaporize.
iii. Describe potential for laser fire and the precautions taken to avoid it.
iv. Describe potential for burns of the surrounding skin, mucosa, or spot stains of the teeth.
b. Appropriately identify patient as a “laser case” to all those who may require a laser, allowing operating room preparations.
   i. An extra nurse is needed and is dedicated to control of the laser and laser safety considerations.
   ii. An extra 20 minutes is needed for room setup.
c. Prior to patient entry into the room
   i. Laser, microscope, and endoscopes needed in the room are assembled and functional. (Microslab on the microscope if microscope is to be used, bronchoscopic coupler set up or handpiece assembled).
   ii. Laser tech is in the room, alerting signs are posted, and protective eye wear is available.
   iii. Have laser tech power up the laser and alert all personnel in the room to don protective glasses.
   iv. Test fire the laser, through the operative system with the beam maximally focused, onto a wooden tongue blade at 5 to 10 watts to check that the He-Ne beam is well aligned with the CO2 beam.

2. RISING CONSIDERATIONS

1. a. Room Setup
   i. See Endoscopy Room Setup
   ii. CO2 laser
   iii. Microscope with 400 mm lens
   iv. Acuspot or microslab
   v. Laser-appropriate goggles for CO2 laser and singage
   vi. Buffalo Smoke Evacuator
b. Instrumentation and Equipment
   i. Standard
      1. Direct Laryngoscope Tray,
      2. Lewy Laryngoscope Holder Tray
      3. Bronchoscopy Tray, Adult
      4. Laser bronchoscopes and bronchoscope couplers (available only)
      5. Laryngoscope Instrument Tray, Microscopic Direct
      6. Ossoff-Karlan Laryngoscope Instrument Tray (available only)
      7. Adult laser instruments
      8. Telescope, Storz Hopkins, straight-forward, 0°, 4 x 30 cm and 5 x 20 cm, wide-angle (30° and 70° telescope should also be available)
   ii. Special
      1. Tracheotomy Tray
      2. Healy-Jako subglottoscope
      3. Neurosurgical cottonoids 1/2 in x 1/2 in
      4. Eye pads x 4
      5. 60 cc syringe with Frazier tip suction
      6. Cloth tape
      7. Storz light cable
c. Medications (specific to nursing)
   i. 1% lidocaine, preservative-free
   ii. 24% lidocaine solution topical (Draw up in Luer Lock syringe to secure abbocath)
   iii. Oxymetazoline HCL nasal spray, 0.05%
iv. FRED (fog reduction elimination device)

d. Prep and Drape
i. No prep
ii. Drape
   1. Head drape
   2. Cover eyes with moist pads and cloth tape
   3. Wet towels covering
   4. Split sheet

e. Drains and Dressings
i. None

f. Special Considerations
i. Instrumentation should be set up prior to induction and should remain assembled until patient is safely extubated and has a patent airway.
ii. Tracheotomy Tray and supplies ready for emergency tracheotomy.
iii. Separate laser operator following ANCI standards.
iv. Keep small amount of clean saline set aside to place biopsies in and to clean off biopsy forceps; will avoid cross-contamination between specimens.
v. Open 18-gauge needle when taking biopsies to remove tissue from forceps.
vi. Have oxymetazoline and neurosurgical cottonoids (1/4 x 1/4) available to open if biopsies or other manipulation of vocal cords occurs.
vii. Patient protection
   1. Use endotracheal tube precautions.
   2. Surround the operative field with wet towels, leaving the least possible area of the patient exposed.
   3. Apply head drape, then cover eyes with moist gauze or eye pads fastening them with cloth tape. Finally, apply moist towels to cover area surrounding laryngoscope.
   4. Periodically refresh the towels with water or saline.
   5. Cover the exposed endotracheal tube with saturated gauze or cottonoids. Refresh these with saline during the case.
viii. Personnel all need protective eye wear; the operator need not use eye wear if he/she is using a binocular microscope.
ix. Cuff on endotracheal tube may be filled with normal saline and methylene blue.

2. ANESTHESIA CONSIDERATIONS

1. a. 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.
      2. The vagolytic effect is beneficial.
   ii. Consider Decadron 8 to 10 mg IV when IV started to diminish edema
      1. Contraindications (diabetes, ulcer disease, other)
      2. 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 protocol).

b. Discuss Airway Management Preoperatively
   i. General oral endotracheal intubation
      1. Laser safe tube; discuss tube size and type
         a. There is no completely "laser-proof tube."
         b. Metal tubes with a double cuff are the safest; note the inflatable cuff of a metal tube is flammable.
      2. The endotracheal tube should not be rigidly secured to the patient with tape. The tube must be readily removed in the case of an airway fire.
      3. Avoid use of plastic tape. It melts onto the skin if hit with a stray beam.
   ii. Jet (Venturi) Ventilation
      1. Most commonly employed:
         a. To deal with the small airway of children
         b. To laser the subglottic/upper tracheal region of adults
      2. May supplement with intermittent intubation with either endotracheal tube or bronchoscope to permit more controlled ventilation

c. Anesthetic
   i. Paralysis is preferred to avoid movement during lasing.
Avoid spontaneous ventilation. Movement during respiration impairs accuracy with laser.

Apnea. Repeated removal and replacement of laryngoscope and equipment in between episodes of mask ventilation precludes careful use of laser.

Case to be run on as low an oxygen concentration (preferably <30%) as safely tolerated. Nitrous oxide should be avoided in that it also supports combustion.

d. Positioning
   i. Head of table turned 90° from anesthesia
   ii. Arms tucked for placement of suspension laryngoscopy support
   iii. Neck extended with a shoulder roll
   iv. Head of bed elevated 15 to 30°
   v. No plastic tape (only cloth tape) to be used near the operative field

2. OPERATIVE CONSIDERATIONS

1. a. Laser Manipulation: The emphasis is on safety.
   i. Laser settings
      1. Complete laser settings are given to the laser nurse, who should repeat them to the surgeon.
      2. Order laser to standby whenever it is intermittently discontinued such as when:
         a. Adjusting position (surgeon's, the patient's, or that of the laryngoscope)
         b. Exchanging instruments
         c. Changing operators
   ii. The foot pedal controlling laser firing should be manipulated only by the operating surgeon.
   iii. It is the surgeon's responsibility with support from nursing and anesthesia to ensure the patient and the endotracheal tube are adequately protected from the laser.

b. Surgical Principles
   i. Optimal exposure
      1. Employ the largest laryngoscope available.
      2. Employ an effective smoke evacuation system.
         a. Best: laryngoscope with plume evacuator built in
         b. Next best: suction platform
         c. Consider using multiple plume evacuation systems simultaneously.
         d. Evacuation of the plume before it leaves the endoscope is a safety measure to prevent exposure to the operating personnel, as well as to ensure exposure of the operative field.
   ii. Ensure hemostasis with the laser and adjust beam size with microspot manipulator
      1. Precise cutting, poor hemostasis: focused beam
      2. Less precise cutting, better hemostasis: slightly defocused beam
      3. Tissue vaporization: defocused beam
      4. Supplement with nonlaser techniques when needed (monopolar cautery)
   iii. Employ traction with countertraction when cutting tissue with the laser
      1. Biopsy forceps or suction may be used to put tissue on stretch.
      2. An assistant may be used to provide a third instrument in the wound endoscopically to permit simultaneous control of the laser control, the suction, and a grasping forceps.

2. POSTOPERATIVE CARE
   a. Please see Airway Monitoring protocol

2. SUGGESTED READING