Anesthesia for Bronchoscopic Procedures: Clinical and Technical Perspectives

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Conflict of Interest Disclosure
• No active industry grants.
• No paid advisory positions.
• Have been provided with equipment for clinical evaluation by a number of manufacturers.
• Co-editor, textbook on Anesthesia for Otolaryngology
• Will discuss off label use of meds.

Objectives
At the end of this presentation the participant will be able to discuss:
• Hybrid ORs and modern bronchoscopy suites
• Therapeutic bronchoscopic procedures
• Advanced diagnostic bronchoscopic procedures, Endobronchial Ultrasound (EBUS), Electromagnetic Navigational Bronchoscopy (ENB)
• Anesthetic considerations for advanced diagnostic bronchoscopy
• Anesthetic management for therapeutic bronchoscopy

Old Anesthesia Service at Bronchoscopy Suite
• Monitor
• Tram
• Battery
• Set of cables
• Portable NIBP
• 2 Propofol infusion pumps
• Oral and nasal airways
• O2 cannula
• Emergency drugs
• GA induction drugs
• Laryngoscope with MAC 4
• Two different sizes ET tubes
• Clip board, Anesthesia record
• #2 of different sizes syringes
• Topicalization equipment
• LMA

The New Bronchoscopic Surgery Center
STENTS

- Prosthesis supporting a hollow tubular structure
- Charles R. Stent, DDS (19th century, England)
- Stent ~ Prosthesis (Artificial) Coronary, Esophageal, Vascular Biliary, Endobronchial etc.
- Self expanding metallic stents (SEMS)

When Stents Go Bad!

- Retained stent pieces
- Mucosal tears with or without bleeding
- Re-obstruction requiring new stent placement
- Pneumothorax
- Damage to the pulmonary artery, and death
- Unwanted permanent incorporation of retained fragments in the tissue
- CPB may need to be instituted urgently in complicated cases

Stent Removal Products
**Bilateral Bronchial Stents**

**Before & After 1 year**

**SEMS: Future**
- Newer designs
- Radiation emitting stents
- Bio-absorbable stents
- Custom home-made stents

**Silicon Stents**
- Nd:YAG Laser
  - Could be delivered via flexible bronchoscope
  - High energy, deep penetration
  - Delayed complications
  - Laser fire
  - Avoid N₂O
  - Keep FiO₂ < 0.4
  - Saline filled ETT cuff

**Laser Delayed Complications**

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**Balloon Dilation**

- An effective palliative procedure for airway narrowing
- Under direct vision using FOB or rigid bronchoscope
- Physical dilation can be very stimulating
- GA is recommended

**New Procedures**

- **EndoBronchial UltraSound (EBUS)** needle aspiration
- Complete EBUS mediastinal staging
- Electromagnetic Navigational Bronchoscopy (ENB)

**EBUS Mediastinal Staging**

- Requires fluoroscopy
- Endobronchial US
- Transtracheal aspirational biopsy

**Electromagnetic Navigational Bronchoscopy (ENB)**

**Configuration for Electromagnetic Navigation**

- Bronchoscopy
- SuperDimension
- EBUS
- Fluoroscopy
Special Considerations for ENB

- Avoid ferromagnetic objects
- Special OR table

Bronchoscopic Lung Volume Reduction

- Alternative to open lung volume reduction surgery
- Intrabronchial one way valve, allows for one way exit of air and mucus.

Spiration® IBV System

- 4, 5, 6, 7 mm IBV Placement

Anesthetic Considerations and Techniques For Advanced Diagnostic and Therapeutic Bronchoscopy

- Airway evaluation, symptoms of compromise
- Size of the lesion or tumor, its location and extent
- Prior chemotherapy and its effects on vital organs (especially heart and lungs)
Pre-operative Evaluation Contd.

- Commonly associated conditions:
  - Heavy tobacco smoking
  - Alcohol use

- Common co-morbidities:
  - CAD
  - Chronic obstructive/restrictive pulmonary disease
  - Malnutrition
  - Aspiration pneumonitis

Anesthesia: Premedication

- Should only be considered for a very anxious patient
- Patients should never be medicated and left alone
- Judicious use of sedatives is warranted with small titrated doses

Anesthesia: Intraoperative

- Topical anesthesia and sedation could be used for some of these procedures
- GA is required for most of these surgeries
- TIVA might be a better technique
- Muscle relaxation is recommended

Options for Anesthetics and Adjuvants

- Inhalation anesthetics
- Propofol infusion
- Propofol + remifentanil or alfentanil
- Midazolam and Fentanyl
- Ketamine
- Dexmedetomidine
- Fospropofol

Total Intravenous Anesthesia (TIVA)

- Avoid polluting the room with inhaled anesthetic agents
- Ensures continuous delivery of anesthesia despite possible ventilation leaks
- Allows for utilization of intermittent apnea or jet ventilation techniques

Choice of The Airway

- Lower tracheal and bronchial lesions and/or defects:
  - Use as large of a tube as possible to allow room for the bronchoscope and ventilation
Choice of The Airway

- Sub-glottic and upper tracheal lesions: SGA


Simultaneous Ventilation

- Use a fiberoptic swivel connector to allow Continuous ventilation to avoid circuit disconnect during bronchoscopy


I-Gel


Ventilating Rigid Bronchoscope


Intermittent Apnea
Jet Ventilation

Jet Ventilation Equipment

The Use of Muscle Relaxation

- Facilitates LMA/ETT insertion
- Makes insertion of the rigid laryngoscope for suspension laryngoscopy, and of the rigid bronchoscope much easier and safer
- Improves overall lung compliance by eliminating the chest wall component
- Provides a motionless patient
  - Advantageous when unexpected patient movement can result in grave consequences

Abdelmalak B, Anesthesia Care for Interventional Pulmonology, in “The textbook of clinical anesthesia procedures outside the operating room” editors: Richard Urman, Beverly Philip, and Wendy Gross, Oxford University Press

Fluid Management in Bronchoscopic Surgery

- It is wise to restrict all administered fluids to the minimum needed for these patients
- Many present with a very limited lung reserve; and pulmonary congestion may aggravate their condition
- Concerns over concomitant cardiac disease, such as left-sided or right-sided heart failure, which may have been a complication of their long standing lung pathophysiology (cor pulmonale).


Management of the FiO₂

- Administering 100 % fraction of inspired oxygen (FiO₂) is very common
- It is usually necessary to maintain it at the lowest tolerable level, that is, below 40%, during treatment with Nd:YAG lasers or EBES
- If patients cannot tolerate lower oxygen levels, or suboptimal ventilation, it may become necessary to defer treatment temporarily, and ventilate with higher oxygen concentrations

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The Use of Steroids in Bronchoscopic Surgery

- Airway edema
  - Cases where the flexible fiberoptic bronchoscope (alone or through an LMA and in the absence of ETT), has been inserted into and removed from the airway several times, rubbing against the vocal cords
  - A rigid bronchoscope has been used for a prolonged duration to avoid residual vocal cords’ swelling post-operatively
  - Extensive tracheo-bronchial tissue trauma is caused by a prolonged procedure
- However, evidence of its real advantage is controversial at best

Anterior Mediastinal Mass


Summary

• Bronchoscopic surgery is evolving
• Anesthesiologists need to stay up-to-date with the new procedures as we share the airway with the Pulmonologists
• Flexibility is needed to tailor and modify old anesthetic techniques and develop new ones to meet the new needs
• Effective communications and team work are essential for successful management of these challenging cases

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Thank you for your attention
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