

# Robotic Bronchoscopy and Ventilation Strategies for Navigation Biopsies

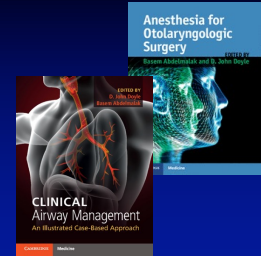
**Basem Abdelmalak, MD, FASA, SAMBA-F**  
 Professor of Anesthesiology  
 Director, Anesthesia for Bronchoscopic Surgery  
 Director, Center for Procedural Sedation  
 Anesthesiology Institute, Cleveland Clinic  
 Past President, Society For Ambulatory Anesthesia  
 Past president, Society For Head and Neck Anesthesia  
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@basemcc

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## Disclosures

- Speaker: Medtronic Inc. and Acacia Pharma
- Royalties; text books:
  - Anesthesia for Otolaryngology
  - Clinical Airway Management: an Illustrated Case Based Approach



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## Anesthetic Considerations And Techniques For Advanced Diagnostic And Therapeutic Bronchoscopy



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## Anesthesia: Intraoperative

- Topical anesthesia and sedation could be used for simple bronchoscopy

To Sleep or Not To Sleep  
That Is the Question

Joseph Cicenia, MD, FCCP,\* and Charanjit S. Bhatnagar, MD†

- GA is required for most of the advanced bronchoscopy

Abdelmalak B, Gidea T, Doyle J. Anesthesia For Bronchoscopy. Current Pharmaceutical Design. 2012; 18, 6314-6324.

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## Total Intravenous Anesthesia (TIVA)

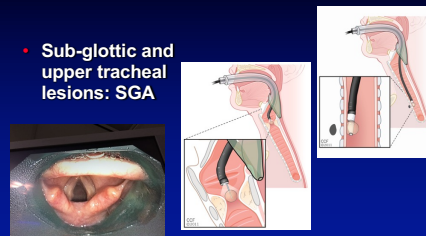
- Avoid polluting the room with inhaled anesthetic agents
- Ensures continuous delivery of anesthesia despite possible ventilation leaks
- Allows for utilization of intermittent apnea or jet ventilation techniques

Doyle J, Abdelmalak B, Mchuzak M, Gidea T. Anesthesia and Airway Management for Removing Primary Self-Expanding Metallic Stents. J Clin Anesth. 2010 Nov;22(7):528-30.

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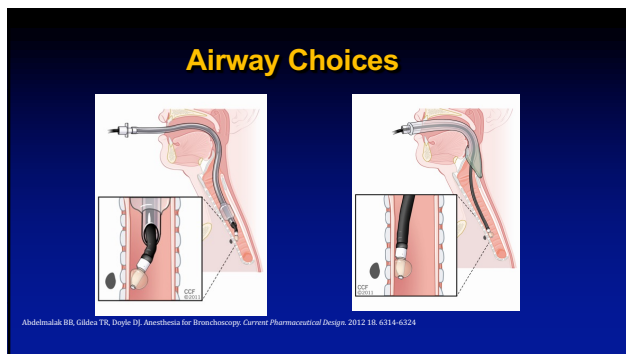
## Choice Of The Airway

- Sub-glottic and upper tracheal lesions: SGA



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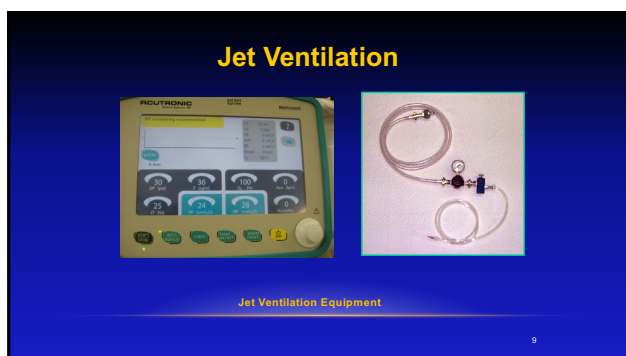
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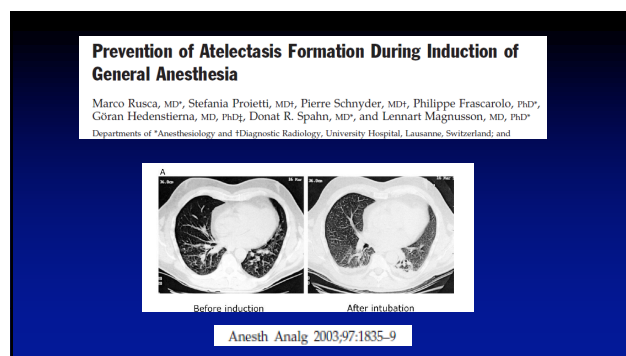
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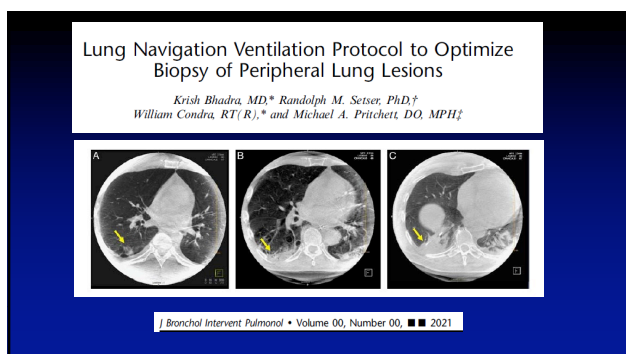
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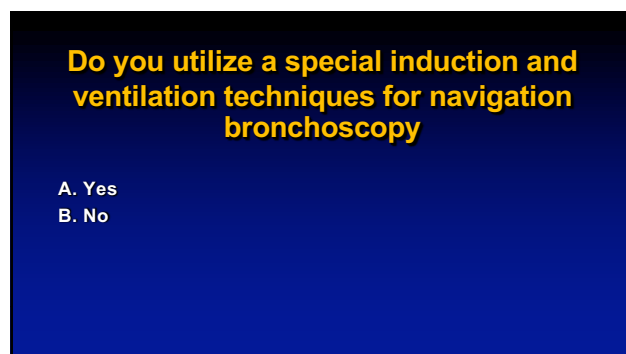
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Anesthesiology 2003; 98:28-33  
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## Optimal Oxygen Concentration during Induction of General Anesthesia

Lennart Edmark, M.D., D.E.A.A.,\* Kamelia Kostova-Aherdan, M.D.,† Mats Enlund, M.D., Ph.D.,‡  
Göran Hedenstierna, M.D., Ph.D.§

Table 2. Oxygenation and Apnea Times, End-tidal Oxygen Concentration, and Atelectasis in Patients Given 100%, 80%, or 60% Oxygen

|   | FIO <sub>2</sub> (%) |           |           |
|---|----------------------|-----------|-----------|
|   | 100                  | 80        | 60        |
| Oxygenation (s)*                                    | 328 ± 42             | 323 ± 30  | 324 ± 42  |
| ETO <sub>2</sub> just before apnea (%)              | 93 ± 1.4             | 75 ± 1.9  | 53 ± 1.3  |
| Apnea time, time to reach 90% saturation (s)        | 411 ± 84†            | 303 ± 59  | 213 ± 89  |
| Range   | 239-528              | 171-380   | 128-360   |
| n   | 11†                  | 12        | 12        |
| Atelectasis, cm <sup>2</sup> basal scan after apnea | 9.8 ± 5.2†           | 1.3 ± 1.2 | 0.3 ± 0.3 |
| Range   | 0.8-19.3             | 0.1-3.2   | 0.0-0.9   |

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Lung Navigation Ventilation Protocol to Optimize Biopsy of Peripheral Lung Lesions

Krish Bhadra, MD,\* Randolph M. Setzer, PhD,†  
William Condra, RT, R,\* and Michael A. Pritchett, DO, MPH‡

**Conventional Ventilation**

Spontaneous Intermittent or Continuous Mechanical Ventilation  
Tidal Volume, PEEP, Fractional inspiration of oxygen, respiratory rate, tidal volume, and airway pressure values were not subjected to any particular requirements.

**Lung Navigation Ventilation Protocol**

Rapid intubation (not rapid sequence intubation), 8.5 ETT or larger, paralyze with non-depolarizing muscle relaxants, Apply lowest tolerable FIO<sub>2</sub>

4 PEEP recruitment maneuvers

Pressure Control/Volume Guaranteed ventilation strategy  
Tidal Volume: 10-12 cc/kg ideal body weight  
Pressure Limit set at 45 cmH<sub>2</sub>O

**Upper and Middle Lobe lung lesions**  
PEEP and APL valve set at 10-15 cmH<sub>2</sub>O

**Lower Lobe lung lesions**  
PEEP and APL valve set at 15-20 cmH<sub>2</sub>O

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**Updates and controversies in anesthesia for advanced interventional pulmonology procedures**

Basem B. Abdelmalak\* and D. John Doyle\*

**Curr Opin Anesthesiol 2021; 34:455-463**  
DOI:10.1097/ACO.0000000000001029

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Cleveland Clinic Proposed protocol for induction and ventilation in navigation bronchoscopy

**Pre anesthesia:**

- 1) Incentive spirometry and nebulizer as per the pulmonologist's discretion

**Pre-induction:**

- 1) Optimize patient position on the table, as well as table height, and head position, oral airway, etc. before starting
- 2) Prepare you intubating device (DL/VL) and ETT (largest size possible, 8.5 or 9.0 mm ID) styletied or not, as needed.
- 3) Position the patient in head up position, or reverse Trendelenburg (especially in obese patients) as feasible and appropriate at the Anesthesiologist's discretion
- 4) Encourage deep breathing during pre-oxygenation with 100% FIO<sub>2</sub>
- 5) If the airway is not judged to be difficult to warrant awake intubation, Induce with propofol and other adjuvants, followed immediately by the muscle relaxant and flush the line.
- 6) Start mask ventilation immediately after induction using an oral airway, delivering TV of approximately 10-12 mL/Kg (avoid rapid small TV PPV)
- 7) Experienced intubator should intubate as fast as possible when patient is fully paralyzed (these are non-airway teaching cases)
- 8) Immediately start mechanical ventilation with PCV/SIMPCV mode (and not PCVVC), and PEEP of 8-12 mmHG. Adjust driving pressure to achieve a TV of around 10 mL/Kg

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**Maintenance:**

- 1) TIVA anesthesia
- 2) Maintain high fresh gas flow, > 12 L/min throughout regardless of the FIO<sub>2</sub> used
- 3) Lower the FIO<sub>2</sub> to approximately 50% as tolerated if feasible, while still maintaining high flow total FGF
- 4) Ventilation with PCV/SIMPCV mode (and not PCVVC), and PEEP of 8-12 mmHG. Adjust driving pressure to achieve a TV of around 10mL/ Kg
- 5) Use Portex swivel adapter with the least number and extent of diaphragm cuts to facilitate insertion of the bronchoscope and thus the least amount of leaks
- 6) Pulmonologist to minimize airway suctioning to minimal needed
- 7) If intubation takes longer than expected, and/or after excessive suctioning, may attempt re-inflate the lungs using recruitment maneuvers.

**Breath Holding:**

Should be done at peak inspiration, by flipping the ventilator switch, may adjust APL and/or hold the bag while maintaining high fresh gas flow. The goal is maintaining the lung appropriately inflated to facilitate proper imaging during the X-Ray sweep which lasts approximately 40 seconds

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## A Word About Robotic Bronchoscopy!



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## Planning Ahead



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## Anticipate Emergencies



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## Safe Execution



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## A Blue Print for Success: Bronchoscopy Suite



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Every life deserves world class care.

Thank you !  
Basem Abdelmalak, MD, FASA, SAMBA-F  
[abdelmb@ccf.org](mailto:abdelmb@ccf.org)  
[@basemcc](https://twitter.com/basemcc)

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