Anesthesia for interventional pulmonology

An Essay

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In anesthesia

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بسم الله الرحمن الرحيم

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Abbreviations

Abbrev	Meaning
ABG	Arterial blood gas
ACCP	American collage of chest physicians
A-V	Atrio-ventricular
BAL	Bronchoalveolar lavage
CT	Computed tomography
EBUS	Endobronchial ultrasound
ECG	Electrocardiography
ET	End tidal
FDA	Food and drug administration
FB	Flexible bronchoscope
I.V	Intravenous
LMA	Laryngeal mask airway
MRI	Magnetic resonance image
Nd: YAG laser	Neodymium:Yttrium-Aluminum-Garnet.laser
PEEP	Positive end expiratory pressure
PPCs	Postoperative pulmonary complications
PSB	Protected specimen brush
ROSE	Rapid on – site evaluation
TBLB	Transbronchial lung biopsy
TBNA	Transbronchial needle aspiration
VATS	Video assisted thoracic surgery

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Introduction

Interventional pulmonology is a new field within pulmonary medicine focused on the use of advanced bronchoscopic and pleuroscopic techniques for the treatment of a spectrum of thoracic disorders ranging from tracheobronchial stenosis to pleural effusions associated with malignant tumors ***(Luis et al., 2001).***

It is a rapidly expanding field offering less invasive therapeutic procedures for significant pulmonary problems. Many of therapies may be new for the anesthiologist. Although less invasive than surgery, some of these procedures will carry significant risks and complications. The team approach by anesthiologist and pulmonologist is a key to the success of these procedures.

Many modalities for the treatment of central airway obstruction have emerged, including the expanding application of airway stenting procedures. There are many advances in anesthetic agents and techniques for interventional pulmonology procedures ***(Ross et al., 2009).***

Bronchoscopy is a visual examination of the air way of the lungs that are called bronchi. In which the physician can inspect the bronchi for range of therapeutic or diagnostic purposes. Depending on the medical reason for the bronchoscopy, the physician may use

either a rigid or flexible fiberoptic bronchoscope ***(Ernst et al., 2003).***

The flexible bronchoscope is made up primarily of fiberoptic bundles that carry illuminating light into the bronchus and reflected light back to the lens, which allows direct visualization of the airways.

The rigid bronchoscope is a long, straight metal tube with a light at the tip. The rigid bronchoscope can be used to manipulate the wall of the trachea and bronchi; the large lumen allows suctioning of large particles, but vision is limited ***(Jeffrey et al., 2007).***

Common reasons to do bronchoscope include unexplained symptoms related to the chest, such as persistent cough, hemoptysis, wheezing, hoarseness, noisy breathing or an abnormal chest x-ray may suggest problems that require closer inspection with bronchoscope ***(Mehta et al., 2008)***

Bronchoscope is a safe procedure. Complications are infrequent and usually minor complication may be related to the procedure itself, or to adverse reactions caused by sedatives or numbing medicines. Major complications have been reported in 0.08-5% of procedure, with a mortality of 0.01-5%. The major risks of this procedure are those associated with general anesthesia and in those with active ischemic heart disease, and advanced pulmonary

disease. Major complications include pneumothorax, pulmonary hemorrhage and respiratory failure. Other complications include hypoventilation, hypoxemia, cardiac dysrhythmias, cardiac ischemia, bronchospasm, fever, and rarely bacteremia ***(Hanibuchi et al., 2007).***

Depending on the procedures involved, anesthesia may range from slight topical sedation to deep narcosis and muscle relaxation with controlled ventilation ***(Lorx et al., 2010).***

Anatomy of bronchial tree

Trachea

The trachea is a tubular structure lying opposite the sixth cervical vertebra at the level of the cricoid cartilage. It is flattened posteriorly and supported along its 10 to 15cm length by 16 to 20 horseshoe shaped cartilages until bifurcating into right and left main bronchi at the level of the 5th thoracic vertebra. It contains a number of receptors that are sensitive to mechanical and chemical stimuli. The posterior tracheal wall muscles contain slowly adapting stretch receptors that are involved in the regulation of the rate and depth of breathing. Other rapidly adapting irritant receptors are found all around the tracheal circumference. They are usually considered to be cough receptors, although the other reflex action consists of bronchoconstriction ***(Miller, 2005).***

Bronchi

Nomenclature (Fig1, 2):

*** System of Jackson and Huber (1943):**

- Describes segmental lung anatomy.

*** System of Boyden (1961):**

- Designates segmental bronchi.

- Followed by a number (e.g., B1, B2, etc.).
- Numbered sequentially, progressing distally from trachea.

Bronchi:

- Right main bronchus.
- Left main bronchus.

Lobar and segmental bronchi:

- **Right upper lobe bronchus**
  - Apical segmental bronchus (B1).
  - Posterior segmental bronchus (B2).
  - Anterior segmental bronchus (B3).
- **Middle lobe bronchus**
  - Lateral segmental bronchus (B4).
  - Medial segmental bronchus (B5).
- **Right lower lobe bronchus**
  - Superior segmental bronchus (B6).
  - Basilar segmental bronchi:
    - Medial segmental bronchus (B7).
    - Anterior segmental bronchus (B8).
    - Lateral segmental bronchus (B9).
    - Posterior segmental bronchus (B10).
- **Left upper lobe bronchus**
  - Apical –posterior segmental bronchus (B1+2).
  - Anterior segmental bronchus (B3).

- Lingular bronchus:
  - Superior segmental bronchus (B4).
  - Inferior segmental bronchus (B5).

- **Left lower lobe bronchus**
  - Superior segmental bronchus (B6).
  - Basilar segmental bronchi:
    - Anteromedial segmental bronchus (B7+8).
    - Lateral segmental bronchus (B9).
    - Posterior segmental bronchus (B10).

Right bronchial anatomy

Right main bronchus

- Origin anterior to esophagus; courses inferolaterally posterior to right pulmonary artery
- Relatively short; more vertical than left main bronchus; more prone foreign body aspiration.
- Divides into Right upper lobe bronchus and bronchus intermedius.

Right upper lobe bronchus

- Origin from lateral aspect of right main bronchus at or just below carina; more cephalad than left upper lobe bronchus.
- Courses horizontally and laterally (1-2cm) before branching.

Right upper lobe bronchial segments

- Apical segmental bronchus: First branch of Right upper lobe bronchus.
- Posterior and anterior segmental bronchi: Typically horizontal, parallel to axial plane. Posterior segmental bronchus courses cephalad and posteriorly; anterior segmental bronchus courses anteriorly.

Bronchus intermedius

- Origin at level of Right upper lobe bronchus.
- Courses obliquely (3-4cm); directly posterior to right pulmonary artery.
- Branches into middle lobe and right lower lobe bronchi.

Middle lobe bronchus

- Origin anterolateral wall of bronchus intermedius; same level as origin of lower lobe bronchus; origins separated by a spur.
- Courses anterolaterally, caudally and obliquely.
- Branches into lateral and medial segmental bronchi.
- Lateral segmental bronchus more horizontal.

Right lower lobe bronchus

- Superior segmental bronchus originates posteriorly from short proximal portion of right lower lobe bronchus.

- Right lower lobe bronchus continues 5-10 mm as truncusbasalis; divides into four basilar segmental bronchi (medial, anterior, lateral and posterior basilar segmental bronchi. Identified by relative position to each other; course toward respective lung segments.

Left Bronchial anatomy

Left main Bronchus

- Origin anterior to esophagus; courses inferolaterally.
- Longer, more horizontal than right main bronchus; less prone to aspiration.
- Divides into left upper and left lower lobe bronchi.

Left upper lobe Bronchus

- Origin from left main Bronchus; bifurcates or trifurcates.
- Most commonly branches into superior and lingular divisions.

Left upper lobe Bronchial segments

- Superior portion divides into apicoposterior and anterior segmental bronchi.
- Inferior (lingular) portion courses obliquely, inferiorly and anterolaterally; analogous to middle lobe bronchus. Bifurcates into superior and inferior segmental bronchi.