

# Bronchoscopy

**Chrispian O. Mamudi**

*Respirology and Critical Illness OMNI Hospital, Jakarta, Indonesia*

## DEFINITION

Bronchoscopy, fiberoptic or rigid, is an invasive procedure for visualization of the upper and lower respiratory tract for the diagnosis and management of a spectrum of inflammatory, infectious, and malignant diseases of the airway and lungs. Bronchoscopy may include retrieval of tissue specimens (bronchial brush, forceps, and needle), cell washings, bronchoalveolar lavage, coagulation, or removal of abnormal tissue by laser. Bronchoscopy is widely used as a diagnostic and therapeutic tool for management of the airway. Bronchoscopy is performed by a specially trained physician bronchoscopist and is assisted by a specially trained healthcare professional (HCP).

## SETTINGS

The preferred location for bronchoscopy is determined by the available equipment, the medical condition and age of the patient, and the specific procedures to be performed. A designated bronchoscopy room or suite is the preferred location for outpatients or inpatients who are not critically ill. The procedure may be safely performed at the bedside in the intensive care unit, the operating room, an appropriately equipped outpatient facility, or other suitably equipped clinical area.

## INDICATIONS

Indications include but are not limited to the presence of lesions of unknown etiology on the chest radiograph film or the need to evaluate recurrent pneumonia, persistent atelectasis or pulmonary infiltrates, the need to assess patency or mechanical properties of the upper airway, the need to investigate hemoptysis, persistent unexplained cough, dyspnea, localized wheeze, or stridor, suspicious or positive sputum cytology results, the need to obtain lower respiratory tract secretions, cell washings, and biopsies for cytologic, histologic, and microbiologic evaluation, the need to determine the location and extent of injury from toxic inhalation or aspiration, the need to evaluate problems associated with endotracheal or tracheostomy tubes (tracheal damage, airway obstruction, or tubeplacement), the need for aid in performing difficult intubations or percutaneous tracheostomies, the suspicion that secretions or mucus plugs are responsible for lobar or segmental atelectasis, the need to remove abnormal endobronchial tissue or foreign material by forceps, basket, or laser, the need to retrieve a foreign body (although under most circumstances, rigid bronchoscopy is preferred), therapeutic management of endobronchial toilet in ventilator associated pneumonia, achieving selective intubation of a main stem bronchus, the need to place and/or assess airway stent function, and the need for airway balloon dilatation in treatment of tracheobronchial stenosis.

## CONTRAINDICATIONS

Flexible bronchoscopy should be performed only when the relative benefits outweigh the risks. Absolute contraindications include absence of consent from the patient or his/her representative unless a medical emergency exists and patient is not competent to give permission, absence of an experienced bronchoscopist to perform or closely and directly supervise the procedure, lack of adequate facilities and personnel to care for such emergencies such as cardiopulmonary arrest, pneumothorax, or bleeding, and inability to adequately oxygenate the patient during the procedure. The danger of a serious complication from bronchoscopy is especially high in patients with the disorders listed, and these conditions are usually considered absolute contraindications unless the risk-benefit assessment warrants the procedure, coagulopathy or bleeding diathesis that cannot be corrected, severe refractory hypoxemia, and unstable hemodynamic status including dysrhythmias.

Relative contraindications (or conditions involving increased risk), according to the American Thoracic Society Guidelines for Fiberoptic Bronchoscopy in adults, include, lack of patient cooperation, recent (within 6 weeks) myocardial infarction or unstable angina, partial tracheal obstruction, moderate-to-severe hypoxemia or any degree of

hypercarbia, uremia and pulmonary hypertension (possible serious hemorrhage after biopsy), lung abscess (danger of flooding the airway with purulent material), obstruction of the superior vena cava (possibility of bleeding and laryngeal edema), debility and malnutrition, disorders requiring laser therapy, biopsy of lesions obstructing large airways, or multiple transbronchial lung biopsies and known or suspected pregnancy (safety concern of possible radiation exposure). The safety of bronchoscopic procedures in asthmatic patients is a concern, but the presence of asthma does not preclude the use of these procedures. Recent head injury patients susceptible to increased intracranial pressures. Inability to sedate (including time constraints of oral ingestion of solids or liquids).

## **COMPLICATIONS**

Adverse effects of medication used before and during the bronchoscopic procedure, hypoxemia, hypercarbia, bronchospasm, hypotension, laryngospasm, bradycardia, or other vagally mediated phenomena, mechanical complications such as epistaxis, pneumothorax, and hemoptysis, increased airway resistance, death, infection hazard for health-care workers or other patients, cross-contamination of specimens or bronchoscopes, nausea, vomiting, fever and chills, and cardiac dysrhythmias.

## **VALIDATION OF RESULTS**

Bronchoscopy should not be performed in patients who have a contraindication, unless the potential benefit outweighs the risk, as determined by the physician bronchoscopist. Poor or inadequate training of the bronchoscopy assistant or bronchoscopist, the techniques of premedication for bronchoscopic examination, function and preparation of bronchoscope and related equipment, physical and physiologic monitoring during the procedure, specimen retrieval (biopsies and washings), preparation of specimens, and site documentation, and post-procedure care of the patient.

## **ASSESSMENT OF NEED**

Need is determined by bronchoscopist assessment of the patient and treatment plan in addition to the presence of clinical indicators, and by the absence of contraindications.

## **ASSESSMENT OF OUTCOME**

Patient outcome is determined by clinical, physiologic, and pathologic assessment. Procedural outcome is determined by the accomplishment of the procedural goals, and by quality assessment indicators.

## **RESOURCES**

The appropriate bronchoscope size is determined by the bronchoscopist, based on the patient age; this includes selecting appropriate suction and biopsy valves, bronchoscopic light source, and any related video or photographic equipment, if applicable, cytology brushes, flexible forceps, transbronchial aspiration needles, retrieval baskets (Compatibility of the external diameter of all scope accessories with the internal diameter of the bronchoscope should be verified before the procedure.) Specimen-collection devices, fixatives, and as determined by institutional policies, syringes for medication delivery, normal saline lavage, and needle aspiration, bite block, laryngoscope, endotracheal tubes in various sizes, thoracostomy set/tray, venous access equipment (I.V. supplies), laryngeal mask airway, adaptor with ability to connect mechanical ventilator and bronchoscope simultaneously, sterile gauze for intermittently clearing tip of bronchoscope during procedure, appropriate procedure documentation paperwork, including laboratory requisitions, water-soluble lubricant or lubricating jelly, monitoring devices, pulse oximeter, electrocardiographic monitoring equipment, sphygmomanometer, whole-body radiation badge for personnel if fluoroscopy is used, capnograph, procedure room equipment, oxygen and related delivery equipment, resuscitation equipment, medical vacuum systems (wall or portable) and related suction supplies for scope or mouth, infection control devices, fluoroscopy equipment including personal protection devices if warranted, laser equipment if applicable, adequate ventilation and other measures to prevent transmission of tuberculosis, decontamination area equipment, protease enzymatic agent (eg, Protozyme) for cleaning and removal of blood and protein before disinfection or sterilization, or other detergent capable of removing these substances, high-level disinfection or sterilization agent: 2% alkaline glutaraldehyde (eg, Cidex, Metracide, Sonacide, Glutarex), ethylene oxide, or peracetic acid, and sterile water is preferred, if feasible, for rinsing bronchoscopes. Following this rinsing with isopropyl alcohol.

Medications: Institutional policies and personal preferences of the bronchoscopist vary greatly regarding the type and method of premeditation or bronchoscopic examination. Administration of these medications by intravenous or intramuscular routes is limited to nurses, physicians, or other trained personnel. (The training and certification of "other personnel" is institution specific, should be consistent with institutional policies, and may include the respiratory therapist.) Aerosolized or atomized drugs, or drugs instilled through the bronchoscope, may be delivered by the respiratory therapist or other trained assistants. Topical anesthetic (lidocaine 1%, 2%, 4%, benzocaine 14%), anticholinergic agent to reduce secretions and minimize vaso-vagal reflexes (atropine, glycopyrrolate), sedative agent 30-45 min prior to the procedure (eg, codeine, midazolam, morphine, hydroxyzine), intravenous sedative immediately prior to and/or during the procedure (midazolam, propofol, diazepam, fentanyl), benzodiazepine antagonist (flumazenil), narcotic antagonist (Narcan), sterile nonbacteriostatic 0.9% NaCl solution for bronchial washings or lavage, vasoconstrictor for bleeding control (dilute epinephrine, usually 1:10,000), inhaled  $\beta$  agonist (albuterol, metaproterenol, levalbuterol), water-soluble lubricant, or combined lubricant/anesthetic (viscous lidocaine), nasal decongestants (pseudoephedrine), mucolytics or mucokinetics (10% or 20% acetylcysteine, 7.5% sodium bicarbonate, rhDNAse), and emergency and resuscitation drugs as deemed appropriate by institutional policies

The precise role of the bronchoscopy assistant varies among institutions; however, the prime responsibilities include preparation and monitoring of the patient, assisting with the procedure, handling specimens, post-procedure care of the patient, maintenance of the bronchoscopy equipment, and recordkeeping. Bronchoscopy assisting should occur only under the direction of a physician who has been trained in bronchoscopy. Bronchoscopy assisting should be limited to personnel who possess the skills necessary to determine adverse reactions and to undertake the appropriate remedial action. The bronchoscopy assistant must be trained in the setup, handling, cleaning, and care of bronchoscopy equipment and related supplies; specimen retrieval and preparation for commonly ordered laboratory studies on bronchoscopy specimens; biopsy labeling; delivery of aerosolized drugs; and mechanical ventilation. The assistant must also be trained in monitoring and evaluating the patient's clinical condition as reflected by pulse oximetry, capnography, electrocardiogram, and stability of or changes in mechanical ventilation parameters, and be capable of relating changes in clinical condition to disease state, procedure, or drugs administered for the procedure. Assistants should be versed in CDC ventilation requirements for control of tuberculosis transmission. Bronchoscopy assistants should hold one of the following credentials: Certified Respiratory Therapist (CRT), Registered Respiratory Therapist (RRT), Certified Pulmonary Function Technologist (CPFT), Registered Pulmonary Function Technologist (RPFT), Registered Nurse (RN), Licensed Practical Nurse (LPN), physician (MD or DO), or Certified Surgical Technologist (CST).

## **MONITORING**

Patient monitoring should be done before, at regular intervals during, and after bronchoscopy until the patient meets appropriate discharge criteria. For no or minimal sedation, less monitoring is necessary. For moderate and deep sedation, more monitoring should be done. The following should be monitored before, during, and/or after bronchoscopy, continuously, until the patient returns to his pre-sedation level of consciousness: level of consciousness, medications administered, dosage, route, and time of delivery, subjective response to procedure (eg, pain, discomfort, dyspnea), blood pressure, breath sounds, heart rate, rhythm, and changes in cardiac status, SpO<sub>2</sub>, FIO<sub>2</sub> and ETCO<sub>2</sub>, Tidal volume, peak inspiratory pressure, adequacy of inspiratory flow, and other ventilation parameters if subject is being mechanically ventilated, lavage volumes (delivered and retrieved), monitor and document site of biopsies and washings. Record which lab tests were requested on each sample. Periodic post-procedure follow-up monitoring of patient condition is advisable for 24-48 hours for inpatients. Outpatients should be instructed to contact the bronchoscopist regarding fever, chest pain or discomfort, dyspnea, wheezing, hemoptysis, or any new findings presenting after the procedure has been completed. Oral instructions should be reinforced by written instructions that include names and phone numbers of persons to be contacted in emergency. Chest radiograph one hour after transbronchial biopsy to exclude pneumothorax.

Bronchoscope integrity (fiberoptic or channel damage, passage of leak test) Strict adherence to the manufacturer's and institutional recommended procedures for cleaning, disinfection, and sterilization of the devices, and the integrity of disinfection or sterilization packaging. Smooth, unhampered operation of biopsy devices (forceps, needles, brushes)

Quality assessment indicators as determined appropriate by the institution's quality assessment committee, documentation of monitors indicated, identification of bronchoscope used for each patient, annual assessment of the institutional or departmental bronchoscopy procedure, including an evaluation of quality assurance issues, adequacy of bronchoscopic specimens (size or volume for accurate analysis, sample integrity), review of infection control procedures and compliance with the current guidelines for semicritical patient-care objects, synopsis of complications, control washings to assure that infection control and disinfection/sterilization procedures are adequate, and that cross-contamination of specimens does not occur, and annual review of the bronchoscopy service and all of the above listed records with the physician bronchoscopists.

## **FREQUENCY**

The frequency with which bronchoscopy is repeated on a given patient should be determined by the physician bronchoscopist based on indications.

## **INFECTION CONTROL**

Standard Precautions CDC Guideline for Handwashing and Hospital Environmental Control: Cleaning, disinfecting, and sterilizing patient care equipment, CDC Guideline for preventing tuberculosis transmission, Hepatitis B vaccination for personnel, establishment of and conformance to written protocol for infection control.