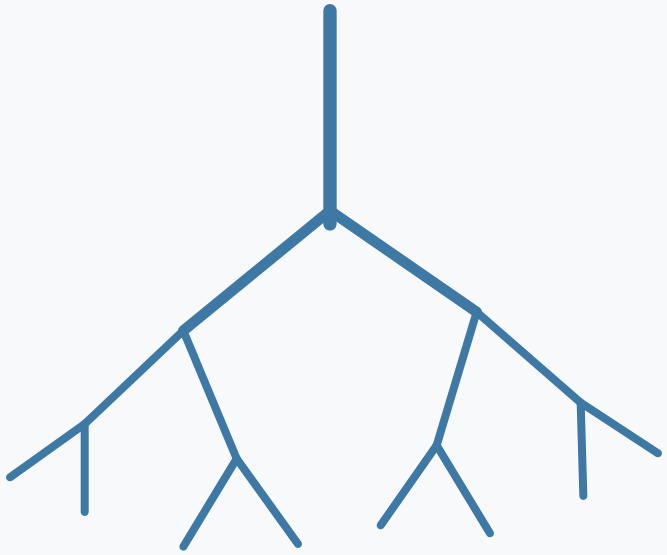
Flexible Bronchoscopy

SYNOPSES & TEACHING AIDS

Informed Consent / Procedural Safety / Moderate Sedation
Fluoroscopy / Step-by-Step Bronchoscopy Technique



HENRI G COLT, MD

Bronchoscopy International

bronchoscopy.org

Dedicated to bronchoscopy students and their teachers around the world

Contents

COMPETENCY TRAINING RESOURCES

Concise educational materials from the Bronchoscopy Education Project.
Local institutional policies and current clinical guidelines should also be followed.

Informed Consent

Synopsis

Description

- Informed Consent requires that medical doctors provide a patient with all relevant information about a proposed procedure or treatment prior to obtaining the consent of the patient to carry out that procedure or treatment.
- Informed consent protects patients by providing them with complete information on which to make an informed decision.
- Informed consent may also, at times, protect health care providers from liability (with exceptions) provided that the procedure is properly executed according to the prevailing standards of care in the community and without negligence.
- The informed consent process gives health care providers and patients an opportunity to consider and re-consider the diagnostic and therapeutic strategies being proposed, as well as the possible risks and benefits of such procedures and to prepare, as needed, for procedure-related adverse events.
- Inform consent assures that patients truly understand the elements of the procedure, as well as the consequences of undergoing or refusing to undergo the intervention. It follows that physicians must disclose any and all conflicts of interest or compensation gained from any treatments or research being proposed.
- Informed consent, therefore, is more than just informing patents about the risks and benefits of a proposed intervention or research project. It is a *process of communication* between a patient and a physician that results in the patient's authorization and agreement to undergo a specific medical intervention. During this dialogue, the physician who is performing the procedure; not a delegated representative, should disclose and discuss: (1 and 2) The patient's diagnosis and relevant clinical issues, (3 and 4) the purpose and nature of the procedure, (5 and 6) the risks and benefits of the procedure, (7 and 8) the risks and benefits of alternative procedures (including financial costs), (9) the risks of not performing the procedure or any of its alternatives, (10) the patient's understanding of the procedure in their own words*.

* Patients can be asked the following FIVE questions: (1) What is the medical problem? (2) What procedure or treatment has been recommended? (3 and 4) What will happen to you with and without the treatment? (5) What is the reason for the decision?

Consent should be Voluntary, Informed and Effective

- From a legal and ethical standpoint, consent for a medical procedure should be *voluntary*, *informed* and *effective*.
- For consent to be *voluntary*, the environment must be free of compelling forces that drive the decision in one direction and negate the patient's ability and freedom to choose. Doctors should always be aware they may intentionally or unintentionally coerce patients to make a particular decision.
- To be *informed,* a person must be given information about the procedure relevant to their individual situation.
- To be *effective,* the person undergoing the procedure should be able to demonstrate, in his or her own words, their understanding of the procedure. Merely asking a person if they understand and receiving a "yes" or a head nod in response is generally considered insufficient.
- Patients with decision making capacity demonstrate a correct understanding of the nature of the medical problem, its treatment and prognosis, and have a reason for their decision.
- In some countries, informed consent needs to be documented by signatures from patients, witnesses, and health care providers on a specially-designed document approved for use by the institution's medical and risk management committees. The validity in court of such documents is debated, however, and in some North American institutions, physicians are counseled to additionally describe the informed consent process in their dictated pre-procedure notes.

Competency and Capacity

- Another prerequisite to informed consent is having the mental capacity to make a reasoned choice. Sociologically, *competence* is defined as having sufficient ability to make choices such that personal autonomy remains intact. Legally, *competence* is a state in which an individual's decision-making ability is adequate to meet the demands of a clearly specified decision-making task. A person may therefore be competent in some endeavors but not in others.
- Legal standards of competence to consent to procedures include the ability to understand information that is provided, the ability to appreciate one's own situation in light of the information provided, the ability to reason with the information provided, and the ability to express a choice. Curiously, only the

abilities to understand information and to express a choice are universally held as legal standards upon which to base a determination of competence.

- Technically, medical professionals lack the legal authority to determine competence, and instead are able to determine whether a patient has decision-making *capacity*. A patient may, for example, be capable of making the decision to refuse to undergo a procedure, yet be found legally incompetent to handle their personal finances. Often, a physician's assessment of decision-making capacity guides legal determinations of competence, and it is frequently the physician's finding of incapacity that causes alternative forms of consent to be sought.
- For patients who are obviously and permanently impaired who don't refuse treatment, physicians turn to family members to make the decision they believe the patient would have made or, if that's unknown, the decision that would be best for the patient. When patients, who have been functioning independently and making their own decisions, refuse treatment for a dangerous and serious condition, doctors and concerned family members understandably question the patient's ability and right to make what seems to them to be an irrational and self destructive decision. Before they can force an expressly unwanted medical intervention, physicians should attempt to understand the patient's reasons and *capacity* to make such decisions.
- It is reasonable to question whether decisional competence and capacity are truly preserved in a medical emergency. There are considerable conscious and unconscious barriers, as well as intellectual and emotional, to assimilating information during an acute illness, trauma, or life-threatening event.
- It is generally accepted that patients who received sedatives or narcotics as part of a treatment plan for respiratory insufficiency, intubation, pain, or high-grade anxiety should not be asked for permission to perform invasive procedures.
- Sometimes, even the stress of illness may suffice to alter the decision-making capacities of otherwise reasonable individuals. Studies of patients with acute myocardial infarctions, for example, suggest that psychological or physical stress alone may compromise understanding. Assessments of decisional abilities are also difficult in patients with suspected neurologic or cognitive impairment accompanied by communicative dysfunction (after a stroke, trauma, or burn injury for example), especially when there is limited time in which to institute a treatment plan. Other settings are emergency procedures required for survival.

Surrogates and Emergency situations

- In children (when a patient is under 18 years of age in the Unite States, unless married or otherwise considered to be an "emancipated minor") or if an adult

patient is mentally or physically incompetent, incapacitated, or if no Health Care Directive exists, a parent or other guardian can usually give surrogate consent or "permission", assuming that the surrogate has decisional capacity and legal empowerment to give such consent for medical care.

- The surrogate should act with the patient's best interest in mind and according to what the patient would have wanted had the patient been able to participate in the decision-making process.
- In the United States, when there is no guardian, the provisions of Section 59 of the Guardianship and Administration Act of 1993 apply: Consent must be obtained from a spouse, including a legal de-facto spouse, a parent, a sibling over 18 years of age, a son or daughter over 18 years of age, or a person (not being the guardian) who acts *in loco parentis*.
- In emergency situations, physicians can proceed without obtaining consent when treatment is needed urgently to save a person's life or to prevent serious damage to a person's health and (i) the treating health care provider does not have any knowledge of a prior refusal by the person to the treatment, (ii) the patient has not appointed a Medical Agent, (iii) the patient has not appointed an Enduring Guardian, and (iv) there is no Guardianship Order with a guardian appointed by a Guardianship Board.
- When patients are temporarily mentally impaired or even unconscious, and medical decisions must be made quickly, physicians often proceed despite their patient's impaired or absent decision making capacity. Such action may be justified by the concept of *implied consen*t (acting with the patient's best interest in mind and according to what the patient would have wanted had the patient been able to participate in the decision-making process).

History of Informed consent

- *Informed Consent* is the legal embodiment of the concept that each individual has the right to make decisions affecting his or her well-being. The "Doctrine of Informed Consent" may have been originally derived from the 1947 Nuremberg Code which required that doctors obtain the voluntary informed consent of a subject prior to conducting medical experimentation.
- During the Nuremberg trials, it was discovered that Nazi doctors had performed medical experiments on prisoners and work camp detainees. As a result, Human Subjects Institutional Review Boards and ethics committees were created in order to to protect the rights of both patients and research subjects.

- Institutional Review Boards also help assure compliance with the 1964 World Medical Association's Declaration of Helsinki formulation of an international code of ethics to address concerns about the preservation of autonomy, beneficence, non-maleficence, and justice for all human research subjects.

Procedure-related anxiety and the informed consent process*

- A patient's emotions and psychology have considerable impact on the informed consent process.
- Patients are significantly more likely to report procedure satisfaction if they see a familiar face, such as one of their health care providers, prior to the procedure and if they receive detailed information about their procedure from that same individual.
- Race, ethnicity, gender, socio-economic status, education, a patient's previous experiences with physicians, and health care system culture, also impact a patient's emotional and psychological well-being
- Regardless of medical environment and practice setting, the potentially coercive powers of family members, friends, other physicians, and ancillary health care providers capable of influencing a patient's decisions cannot be denied.
- Procedure-related anxiety is a complex, subjective response thought to be influenced most importantly by a patient's temperament and understanding, or lack of understanding, of their illness and the proposed intervention.
- Educating patients about the procedure may be the single most important and most easily manageable pre-procedure factor in lowering emotional concerns and procedure-related discomfort. Such educational interventions might be ideally delivered during inpatient or outpatient consultation, rather than at the time of the procedure itself.
- Obtaining proper informed consent and lowering a patient's procedure-related anxiety are not easily combined. It is well recognized that illness changes a person's perception of oneself and of others, often also altering a person's traditional value system. This places patients in a position of weakness as compared to their empowered health care providers, family members, and previously empowered selves.
- Too much information, or information provided in an inappropriate fashion, potentially increases procedure-related anxiety. Procedure-related emotional distress is frequently based on a patient's belief that medical procedures will cause pain, disability, or even death. Feelings of anxiety and fear are often accompanied by a sensation of helplessness and loss of control, sometimes

exacerbated by memories of emotional suffering, physical pain and even grief prompted by previous medical encounters.

- The person with disease, is after all, very different from the same healthy person living prior to disease. In the unfamiliar and often intimidating surroundings of a sterile procedure room, surrounded by strangers busily going about their business, many patients might even begin to think of themselves as victims rather than participants in their medical care.

* Excellent examples of informed consent issue are found in the following feature films: *The Death of Mr. Lazarescu, Extreme Measures* and *A Beautiful Mind* (Colt et al., *The Picture of Health: Medical Ethics and the Movies*, Oxford University Press, 2012).

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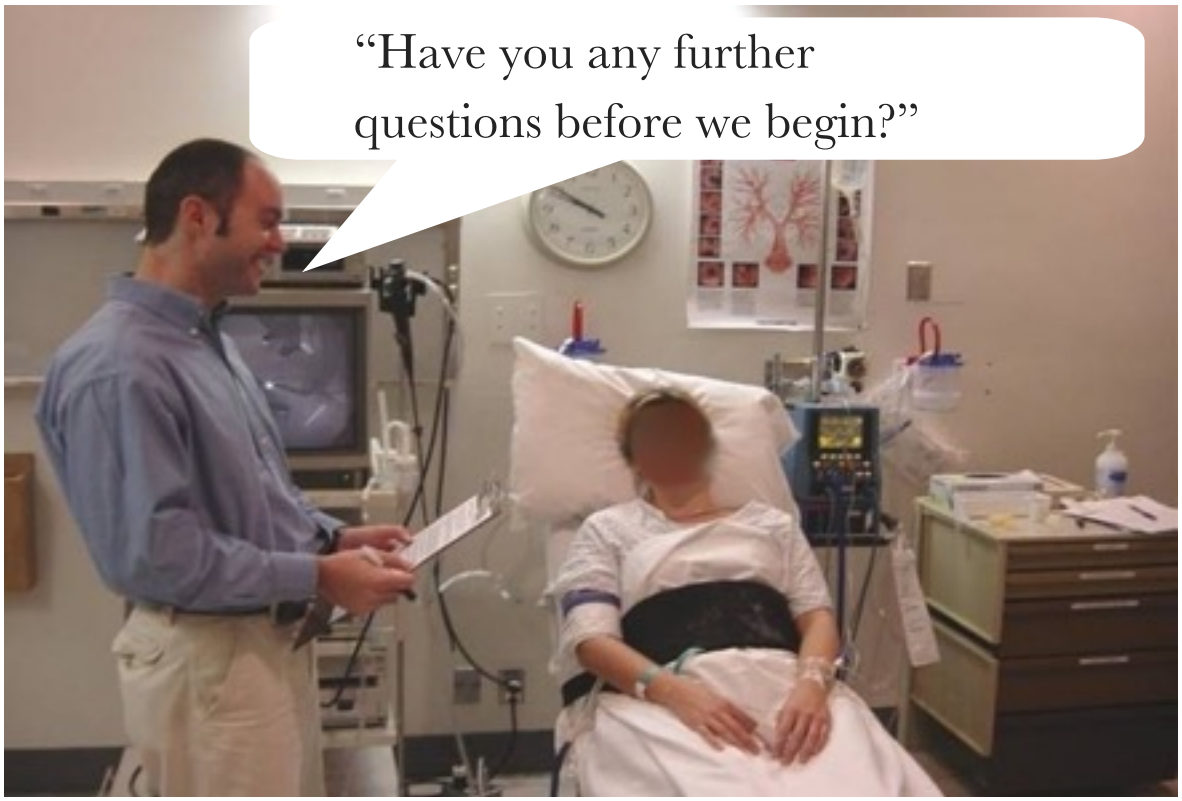
Note: This synopsis is authored by Henri Colt MD, with help from Jay Jacobson MD, Alan Goldman MD, John Knippa PhD, and Eric Edell MD.

Informed Consent

10 ways to ensure a patient's well-being



1. Explain the diagnosis.
2. Explain pertinent clinical issues.
3. Describe the purpose of the procedure.
4. Describe the nature of the procedure.
5. Describe procedure-related risks.
6. Describe procedure-related benefits. (Disclose conflicts of interest).
7. Describe alternative procedures regardless of cost or health care coverage.
8. Describe the risks and benefits of each and every alternative.
9. Describe the risks and benefits of not performing the procedure or any of its alternatives.
10. Ask patients to explain their understanding of the procedure in their own words.
    (Patients should be able to answer FIVE questions: What is the medical problem; what procedure has been recommended; what will happen with and without the procedure; what is the reason for the decision).

Procedural Pause (also known as 'Time Out)*

Abstracted from Institute for Clinical Systems Improvement Guidelines: safe site invasive procedures non-operating room. Downloaded ICSI.org, from http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=13702

Active oral Time Out process

The **Time Out** is to be performed immediately prior to the start of the procedure and is the final safety stop before the procedure is begun. The purpose of the Time Out is to ensure that the correct patient, site, side, positioning and procedure to be performed are all correctly verified. In addition, it is an opportunity to validate that any related images, equipment or implants are available.

The Time Out is initiated by the provider and includes active verbal acknowledgment by all members of the team. The scalpel, needle or other cutting/incising device is not to be handed to the provider until the Time Out has been completed. While it is desirable to actively include the patient in the Time Out, it is not always possible, particularly if the patient is under the influence of sedating medications or is otherwise unable to participate.

A visual memory aid can be used to trigger the initiation of the the Time Out. For example, a "Time Out" sign or towel can be used to cover the scalpel, needle or cutting/ incising device as a reminder to conduct the Time Out. When one of these aids is used, it is important to remove it from the sterile field at the conclusion of the Time Out so there is no potential for it to become retained in the patient or otherwise contaminate the field.

Every **Time Out** should include the following standard elements:

- Patient identity, using a minimum of two identifiers
- Procedure(s) to be performed (including internal and/or external laterality, multiples and/or level)
- Patient positioning if not already verified
- Procedure side, site and/or level including visualization of the provider's initials if applicable
- As appropriate, imaging, equipment, implants or special requirements (e.g., pre-procedure antibiotic administration)

The provider may delegate the Time Out elements to the nurse or other member of the team, but the initiation of the Time Out should be the responsibility of the provider. The

nurse or other team member may refer to the patient consent for the Time Out elements. However, prior to its use, the consent must have been validated against other documents, such as history and physical, radiology or pathology reports, progress notes, etc.

During the **Time Out**, each person in the procedure room must stop what he or she is doing and actively participate in the process. Involved staff may include the provider, resident, student, anesthesia, scrub, nurse and/or vendors whenever present. No individual is exempt from the process. Active participation requires each individual to state clearly and loudly that they agree with the elements of the Time Out. The scalpel, needle or other cutting/incising device is not to be handed to the provider until the Time Out has been completed. If a member of the team refuses to actively participate in the Time Out, the scalpel, needle or cutting/incising device is not handed to the provider until that individual is replaced and the Time Out completed.

Environmental distractions are to be eliminated as much as possible during the Time Out. For example, music is turned off, pagers are set on vibrate, talking other than participation in Time Out ceases and no staff are permitted to enter or exit the room. If during the Time Out an interruption or distraction occurs (pager goes off or an individual enters the room), the Time Out must be restarted.

Additional Time Outs are to be performed when there are two or more different procedures performed on the same patient during the same procedure period, whether or not the procedures involve a new procedure team. The process and elements of the Time Out as described above must occur prior to the start of the next procedure.

If the patient needs to be repositioned during the procedure and this repositioning affects the patient's presentation (i.e., the patient is turned prone), an abbreviated Time Out including the site, side, level and/or visualization of the provider's initials will be conducted. The Time Out process will be the same as described above (e.g., elimination of distractions, active participation).

Universal Precautions

Excerpt from the Fact Sheet Center for Disease Control : Provided for informational and educational use only

Downloaded from
http://www.cdc.gov/ncidod/dhqp/bp_universal_precautions.html#

"Universal precautions," as defined by CDC, are a set of precautions designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other bloodborne pathogens when providing first aid or health care. Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other bloodborne pathogens.

Universal precautions took the place of and eliminated the need for the isolation category "Blood and Body Fluid Precautions" in the 1983 CDC Guidelines for Isolation Precautions in Hospitals. However, implementing universal precautions does not eliminate the need for other isolation precautions, such as droplet precautions for influenza, airborne isolation for pulmonary tuberculosis, or contact isolation for methicillin-resistant *Staphylococcus aureus*.

Universal precautions apply to blood, other body fluids containing visible blood, semen, and vaginal secretions. Universal precautions also apply to tissues and to the following fluids: cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids. Universal precautions do not apply to feces, nasal secretions, sputum, sweat, tears, urine, and vomitus unless they contain visible blood. Universal precautions do not apply to saliva except when visibly contaminated with blood or in the dental setting where blood contamination of saliva is predictable.

Universal precautions involve the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of exposure of the health care worker's skin or mucous membranes to potentially infective materials. In addition, under universal precautions, it is recommended that all health care workers take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices.

Pregnant health care workers are not known to be at greater risk of contracting HIV infection than are health care workers who are not pregnant; however, if a health care worker develops HIV infection during pregnancy, the infant is at risk of infection resulting from perinatal transmission. Because of this risk, pregnant health care workers should be especially familiar with, and strictly adhere to, precautions to minimize the risk of HIV transmission.

GLOVING, GOWNING, MASKING, AND OTHER PROTECTIVE BARRIERS

All health care workers should routinely use appropriate barrier precautions to prevent skin and mucous membrane exposure during contact with any patient's blood or body fluids that require universal precautions.

Recommendations for the use of gloves are presented in detail in the Morbidity and Mortality Weekly Report dated June 24, 1988, which is available by calling the National AIDS Information Hotline at 1-800-342-2437 or the National AIDS Information Clearinghouse at 1-800-458-5231.

Gloves should be worn:

- for touching blood and body fluids requiring universal precautions, mucous membranes, or nonintact skin of all patients, and
- for handling items or surfaces soiled with blood or body fluids to which universal precautions apply.

Gloves should be changed after contact with each patient. Hands and other skin surfaces should be washed immediately or as soon as patient safety permits if contaminated with blood or body fluids requiring **universal precautions**. Hands should be washed immediately after gloves are removed. Gloves should reduce the incidence of blood contamination of hands during phlebotomy, but they cannot prevent penetrating injuries caused by needles or other sharp instruments. Institutions that judge routine gloving for all phlebotomies is not necessary should periodically reevaluate their policy. Gloves should always be available to health care workers who wish to use them for phlebotomy. In addition, the following general guidelines apply:

1. Use gloves for performing phlebotomy when the health care worker has cuts, scratches, or other breaks in his/her skin.
2. Use gloves in situations where the health care worker judges that hand contamination with blood may occur, e.g., when performing phlebotomy on an uncooperative patient.
3. Use gloves for performing finger and/or heel sticks on infants and children.
4. Use gloves when persons are receiving training in phlebotomy.

Masks and protective eyewear or face shields should be worn by health care workers to prevent exposure of mucous membranes of the mouth, nose, and eyes during procedures that are likely to generate droplets of blood or body fluids requiring universal precautions. Gowns or aprons should be worn during procedures that are likely to generate splashes of blood or body fluids requiring universal precautions.

All health care workers should take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices during procedures; when cleaning used instruments; during disposal of used needles; and when handling sharp instruments after procedures. To prevent needlestick injuries, needles should not be recapped by hand, purposely bent or broken by hand, removed from disposable syringes, or otherwise manipulated by hand. After they are used, disposable syringes and needles, scalpel blades, and other sharp items should be placed in puncture-resistant containers for disposal. The puncture-resistant containers should be located as close as practical to the use area. All reusable needles should be placed in a puncture-resistant container for transport to the reprocessing area.

General infection control practices should further minimize the already minute risk for salivary transmission of HIV. These infection control practices include the use of gloves for digital examination of mucous membranes and endotracheal suctioning, handwashing after exposure to saliva, and minimizing the need for emergency mouth-to-mouth resuscitation by making mouthpieces and other ventilation devices available for use in areas where the need for resuscitation is predictable.

MODERATE SEDATION SYNOPSIS

A Learning guide

The purpose of this synopsis is to provide learners with principles pertaining to the use of moderate sedation during flexible bronchoscopy. While many institutions have regulations and protocols, others are without a formal progam of instruction in these area.

Inappropriate use of medications severely affects patient safety. Many bronchoscopy-related complications are caused by sedation errors , including respiratory failure and even death. In addition to using the Moderate Sedation checklist (available in the Checklists Module on www.Bronchoscopy.org) the information in this synopsis should be mastered by all those using sedating agents in their practice.

We recommend at least ONE formal session during which an interactive, didactic lecture on Moderate Sedation be provided after learners review the content of this synopsis and other reading material. The checklist can be reviewed during separate sessions and during the course of day-to-day procedural training.

MODERATE SEDATION

SYNOPSIS

The purpose of this synopsis is to provide the reader with a brief overview of moderate sedation as it might apply to flexible bronchoscopy. It is assumed that institutions and practitioners have different biases and regulations. Herein a short summary is provided so that beginner bronchoscopists might acquire at least some of the elements necessary for a safe procedure. Readers are encouraged to follow guidelines and protocols established in their own institutions.

Definitions

- Moderate sedation may be produced by the use of intravenous, oral, transmucosal or intramuscular narcotics, sedatives or anxiolytic medications
- Moderate sedation is a medically controlled state of depressed consciousness that allows protective reflexes to be maintained, while retaining the patient's ability to maintain a patent airway independently and continuously. This implies that the patient is mildly drowsy but arouses to voice easily. This is to be distinguished from
- Deep sedation, where the patient is arousable only by vigorous stimulation and may lose the ability to maintain airway patency and protection.

ASA Classification

- ASA 1: normal and healthy patient
- ASA 2: Mild controlled systemic disease and no functional limitation
- ASA 3: Moderate to severe systemic disease that limits activity.
- ASA 4: severe systemic disease that is a constant threat to life or is functionally incapacitating.
- ASA 5: Moribund and not expected to survive without surgery

Equipment

- Informed consent for sedation should be obtained in addition to consent for the procedure.
- Oximetry
- Ability to monitor the patient for vital signs, airway patency, degree of wakefulness.
- Electrocardiogram
- Intravenous access
- Rescue equipment for any patient moving into deep sedation, including crash cart and defibrillator
- Appropriate size endotracheal tubes and ability to ventilate patient (including self-inflating Ambu-bag and mask system) should be available.
- Reversal agents for narcotics and benzodiazepines
- Charting should include baseline ventilatory, hemodynamic, neurologic status, time of administration of medication, dose administered, type of medication used, physical examination, informed consent, allergies, nothing to eat 8 hours prior to the procedure (except for clear liquids and medications, up to four hours prior to procedure).
- Ability to monitor patient status at least every 15 minutes during the procedure and for a minimum of thirty (30) minutes after the procedure and/or until patient returns to baseline status, including pulse oximetry equal or greater than 92% on room air, or assured with supplemental oxygen if patient on oxygen.

- Following administration of reversal agents such as naloxone, patient should not be discharged for a minimum of one (1) hour, and flumazenil two (2) hours.

Potential contrandications

- Uncooperative patients
- Mentally ill patients
- Severe cardiac, pulmonary, hepatic, renal or central nervous disease
- Pregnancy
- Morbid obesity
- Alcohol or drug abuse
- History of sleep apnea

High risk patients

- Previous problems with anesthesia or sedation
- Previous surgery or radiation or injury to neck or face
- Stridor, snoring, or sleep apnea
- Dysmorphic facial features
- Advanced rheumatoid arthritis
- Significant obesity, protruding teeth
- Small mouth opening (<3cm in adults), macroglossia, non-visible uvula, tonsillar hypertrophy, short neck, limited neck extension, decreased hyoid-mental distance (<3cm in adult).

Response to complications

- Ability to rotate patient onto lateral decubitus position in case of vomiting.
- Ability to insert a nasal trumpet
- Ability to perform chin lift/neck extension in case of obstructed airway
- Oral suction should always be available
- Ability to establish a safe and patent airway, and provide hemodynamic and circulatory support in case of compromise.

Specific medications

- *Midazolam* (Versed) is currently the most widely used agent for moderate sedation and anxiolysis. It is a water-soluble benzodiazepine with rapid onset of action. It is four times more potent on a mg per mg basis than

    - When administered intravenously, sedation and anxiolysis usually occurs within 2 minutes. Complete recovery of motor performance and consciousness occurs within one hour in most individuals.
    - Combining Midazolam and opioides increases the incidence of apnea. Large doses can produce prolonged drowsiness and cardio-respiratory arrest. Central nervous system dysfunction, including confusion and seizures can be seen in patients with brain metastases and paraneoplastic syndromes.
    - Ventilation is depressed by 0.15 mg/kg, especially in patients with COPD. The peak effect of respiratory depression occurs at three minutes following injection and remains for approximately 15 minutes. It can be most pronounced in geriatric and COPD patients.
- *Fentanyl* is a synthetic opiate analog that is structurally different from morphine or meperidine. It is 100 times more potent than morphine. The usual adult dose is 50-100 micrograms. Given intravenously, its onset of action and maximum respiratory

depression effect occurs about 5-10 minutes after administration, and lasts 30-60 minutes.

- O Given intramuscularly, the onset of action is within 7-15 minutes with duration of action lasting up to two hours.
- O Fentanyl should never be used in patients receiving MAO inhibitors because of increased risk of respiratory depression and coma.

• *Combination drugs*. Sedative responses are increased in patients who have received opioides or other benzodiazepines. Level of sedation and risk for respiratory depression are increased in the elderly and in patients with pre-existing respiratory dysfunction.

• *Reversal agents*:

- O Naloxone is a pure opiate antagonist that reverses all effects and side effects of opiates.). The initial dose is 0.1-0.2 mg IV, SQ, IM or via endotracheal tube and can be repeated every 2 minutes. The onset of action is about 30 seconds. Actually, no more than 0.4 mg should be administered because this might lead to increased activity of the sympathetic nervous system from acute termination of analgesia. Consequently, patients may develop hypertension, dysrhythmias, and pulmonary edema.
- O Flumazenil is a benzodiazepine antagonist that should be administered (0.2 mg IV over 15 seconds, then repeated every minute up to a maximum of 1 mg). Low doses of Flumazenil will reliably reverse sedation within 2 minutes, but higher doses are needed to reverse benzodiazepine-related anxiolysis. Duration of action is about 60 minutes. Side effects include nausea, vomiting, tremors, seizures, tears and dizziness. Contrary to naloxone, it does not cause hemodynamic instability.

Dosing guidelines

• *Midazolam* single dose 1 mg IV, onset of action 1-2.5 minutes, total dose 5 mg
• *Lorazapam* single dose 2 mg IV, onset of action 20-30 minutes, total dose 4 mg
• *Morphine* single dose 2-4 mg IV, onset of action 1-5 minutes, total dose 10 mg
• *Fentanyl* single dose 50 mcg IV, onset of action 1-5 min, total dose 100 mcg

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FLUOROSCOPY

SYNOPSIS

The purpose of this synopsis is to provide the reader with a brief overview of fluoroscopy as it might apply to flexible bronchoscopy. It is assumed that institutions and practitioners have different biases and regulations. Herein a short summary is provided so that beginner bronchoscopists might acquire at least some of the elements necessary for a safe procedure. Readers are encouraged to follow guidelines and protocols established in their own institutions. Students are urged to read the Syllabus on Fluoroscopy and Radiation Protection created by the California Department of Health Services, which is downloadable from http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/RHB-FluoroSyllabus.pdf

Definitions and consequences

- Refraction is the bending of light rays as they pass from a medium of one density to a medium of a different density. Brightness improves visual acuity
    - O If the fluoroscopic image is not bright enough to be of good quality, it cannot be improved by prolonged observation.
- Visual acuity is the ability of the eye to recognized differences between two sources of light stimulus, and thus to perceive fine detail.
    - O Night vision is best when the eye scans a scene (moving the fluoroscopic image).
- The eye retains any image it receives for a fraction of a second after the image is removed.
    - O Frame rates of 24 frames per second (still frames as for television), will thus appear continuous, as in a movie).
- Fluoroscopy images are electromagnetic radiation waves traveling at the speed of light (186,000 miles/second). Photons have energy that is directly proportional to the frequency or inversely proportional to the wavelength of the radiation.
    - O Increasing voltage increases energy and shortens the wavelength, making a more energetic and penetrating beam. The intensity of the radiation beam is influenced by current (milliAmperes mA).
- Radiation, like all energy, can be primary, scattered, or remnant. Interactions with tissues continue until all energies are spent.
    - O Primary is the radiation emitted directly towards the patient, scattered is what happens when the energy collides with matter (the patient), remnant is the energy that pass through the patient and strikes the image detector.
- Scatter increases if tissue density or thickness increases, or when voltage and milliAmperage increase.
    - O Compton scatter results from colliding electrons that lose their energy, as photons are scattered in all directions at low energies. Usually this is associated with increased voltage, and will diminish the quality of the fluoroscopic image. This causes quantum mottle (a grainy appearance in the image)

- Resolution, Distortion, and Lag time
    - O Definitions provided below. Move fluoroscope slowly while scanning. Keep image centered, and use highest lines/mm monitor (screen) possible.

Reducing patient exposure

- Collimate (focus) the radiation beam to the target of interest
- Use last image hold technique of fluoroscopy rather than continuous applications
- Keep patient to image intensifier (image to detector) distance as short as possible. Moving image intensifier away from the patient increases patient radiation dose.
- Use highest voltage and lowest milliAmperage as possible
- Use largest image intensifier mode (with non magnification) if possible
- Target to tabletop distance never less than 12 inches (30 cm), and should be at least 18 inches (45 cm) because patient dose decreases with increasing distance
- Use low absorption tabletops (made of aluminum, Bakelite, or carbon fiber) that do not attenuate the radiation beam.
- Use "dead-man" exposure switch (pedal) that terminates the radiation exposure when the foot is removed from the pedal. Do not provide continuous exposure.
- Doubling exposure time doubles radiation dose to both operator and patient.
- Do not use magnification mode unless absolutely necessary.

Improving visibility

- Adjust brightness and contrast settings on the screen
- Darken the procedure room lighting
- Avoid changing settings such as milliAmperage or voltage. It is better to adjust room lighting and screen properties.
- Changing the brightness setting on the screen will not improve quality of original image.
- Changing the contrast mode on the screen should be set so that bright objects of interest do not completely saturate (white out). It may be necessary to modify brightness after changing contrast modes.

Patient and operator shielding and monitoring

- Gonad shields, Thyroid shields
- Lead curtains, Body aprons
- Personal radiation film badges should be worn at collar height above the protective apron or on top of the protective apron itself.
- Badges should be checked periodically to record exposure and measure accumulated exposure over a specified period of time

Special precautions for pregnant patient and health care providers

- There is always a potential for adverse biological effects after exposure to radiation.
- Examinations should not be postponed if deemed clinically necessary, but appropriate shielding precautions should be followed.
- There is no "safe" period" for the real or potential embryo/fetus or future fertilized ovum
- Therapeutic abortion is never justified because of radiation dose to embryo/fetus during a diagnostic fluoroscopic examination
- Effects are proportional to absorbed radiation dose
- The first three months of pregnancy are when the embryo-fetus is most sensitive to radiation.
- Pregnant or potentially pregnant health care providers should not assist in fluoroscopic procedures.

Resolution, Distortion, Scattered radiation, and Lag

- Limited by screen capabilities (525 to 1000 lines/mm)
- Defined as the ability of the imaging system to differentiate small objects as separate images when they are close together.

- Distortion effects size and shape, and can be greatest at the periphery of the image.
- Lag time, and thus blurring of the image as the fluoroscope is moved, occurs because it takes a certain amount of time for the image to build on the screen.
- Scattered radiation is increased in case of high voltage, large field size and thick body parts (obesity.
- The fluoroscopist and assistants should stand as far away from the patient as possible.
- The dose of radiation received from scattered radiation by the fluoroscopist and assistants is directly proportional to the patient radiation dose.
- Preferably a 0.5 mm protective apron should be worn (transmitted exposure reduction is thus 99.9 percent, as compared to 97% reduction for a 0.25 mm apron). Aprons cover only 80% of active bone marrow of the body.

Basic operational procedures

- Use short looks rather than continuous observation. Because the recognition time of the human eye is 0.2 seconds, a short look will accomplish the same as continuous observation.
- Use a resettable timer that will alarm when a maximum of 5 minutes exposure time is reached.
- Use best contrast (lowest milliAmperage) and highest peak voltage possible.
- Keep target area small and focused, but without magnification mode.
- Maintain radiation dose as low as possible (should be less than 5 rads per minute)
- Use last frame hold strategy to keep an image on screen without additional radiation exposure.
- Place image intensifier as close to the patient as possible.
- Prevent patient motion by giving clear instructions.
- Reduce extraneous light in procedure room.
- Use gonad shields and protective aprons of at least 0.25 mm lead equivalent.
- Use audible indicator (beeper alert) when fluoroscopy is on.
- Use personal radiation dose monitoring devices (radiation badge) according to institutional guidelines.

DESCRIPTION

Bronchoscopy Step-by-Step

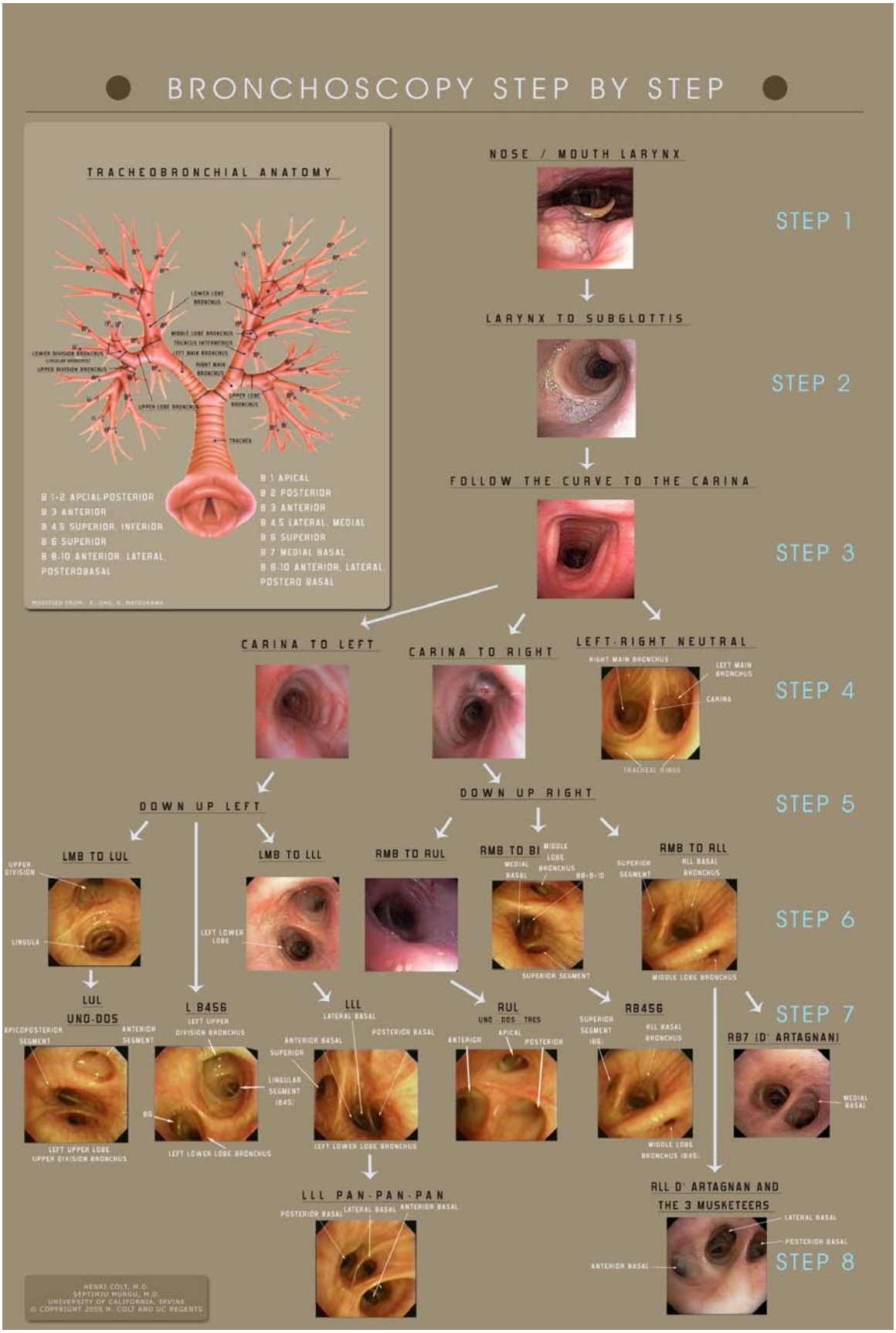
The Bronchoscopy Step-by-Step exercises were inspired by Arthur Murray's dance education principles. The most complex dance sequences, when broken down into numbered steps, can be learned step-by-step. Gradually, the steps are combined, and the moves finessed, until an elegant dance can be performed. Bach's Goldberg variations, all 30, are some of the most difficult to master pieces written for harpsichord and piano. No pianist learned them all together; but with patience, they can be mastered note by note by note. To become a good tennis player, one cannot master the forehand, backhand, serve, volley, smash and all other strokes at the same time; separately and repeatedly, the different strokes are practiced and then combined to play a beautiful game.

What these examples have in common is:

- *Systematic Approach:* Deconstructing complex tasks into constituent elements

- *Development of Muscle Memory:* Motor learning through the sub-conscious process of improving motor skills, smoothness and accuracy of movements, thus creating maximum efficiency and economy of movement. The major prerequisite for development of muscle memory is *repeated, deliberate practice.*

- *Development of Spatial Awareness:* To learn to flow in space, always occupying the desired position. In bronchoscopy, this additionally requires the accurate identification of airway anatomy.


BRONCHOSCOPY STEP BY STEP
TRACHEOBRONCHIAL ANATOMY
B 1-2 APICAL-POSTERIOR
B 3 ANTERIOR
B 4-5 SUPERIOR, INFERIOR
B 6 SUPERIOR
B 8-10 ANTERIOR, LATERAL, POSTEROBASAL
B 1 APICAL
B 2 POSTERIOR
B 3 ANTERIOR
B 4-5 LATERAL, MEDIAL
B 6 SUPERIOR
B 7 MEDIAL BASAL
B 8-10 ANTERIOR, LATERAL POSTERO BASAL
NOSE / MOUTH LARYNX
STEP 1
LARYNX TO SUBGLOTTIS
STEP 2
FOLLOW THE CURVE TO THE CARINA
STEP 3
CARINA TO LEFT
CARINA TO RIGHT
LEFT-RIGHT NEUTRAL
RIGHT MAIN BRONCHUS
LEFT MAIN BRONCHUS
CARINA
TRACHEAL RINGS
STEP 4
DOWN UP LEFT
DOWN UP RIGHT
STEP 5
LMB TO LUL
UPPER DIVISION
LINGULA
LMB TO LLL
LEFT LOWER LOBE
RMB TO RUL
RMB TO BI
MIDDLE LOBE BRONCHUS
MEDIAL BASAL
B8-9-10
SUPERIOR SEGMENT
RMB TO RLL
SUPERIOR SEGMENT
RLL BASAL BRONCHUS
MIDDLE LOBE BRONCHUS
STEP 6
LUL
UNO-DOS
APICOPOSTERIOR SEGMENT
ANTERIOR SEGMENT
LEFT UPPER LOBE UPPER DIVISION BRONCHUS
L B456
LEFT UPPER DIVISION BRONCHUS
LINGULAR SEGMENT (B4S)
B6
LEFT LOWER LOBE BRONCHUS
LLL
LATERAL BASAL
ANTERIOR BASAL
SUPERIOR
POSTERIOR BASAL
LEFT LOWER LOBE BRONCHUS
RUL
UNO DOS TRES
ANTERIOR
APICAL
POSTERIOR
RB456
SUPERIOR SEGMENT (B6)
RLL BASAL BRONCHUS
MIDDLE LOBE BRONCHUS (B4S)
RB7 (D' ARTAGNAN)
MEDIAL BASAL
STEP 7
LLL PAN-PAN-PAN
POSTERIOR BASAL
LATERAL BASAL
ANTERIOR BASAL
RLL D' ARTAGNAN AND THE 3 MUSKETEERS
LATERAL BASAL
POSTERIOR BASAL
ANTERIOR BASAL
STEP 8
HENRI COLT, M.D.
SEPTIMIU MURGU, M.D.
UNIVERSITY OF CALIFORNIA, IRVINE
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The Bronchoscopy Step-by-Step Exercises

All exercises are done while observing basic principles. Optimum hand position and posture should be maintained at all times. The bronchoscope should be kept midline, minimizing white-out and red-out. The airway wall should be respected and trauma avoided. Steps should be practiced while standing both at the "patient's" head and side. It is best that practice be done initially on inanimate models and/or a virtual reality (VR) simulator.

Remember: Decision; Intent; Control; Confidence; Economy of Movement.

Step 1: Practice advancing from the nares or oral cavity (through a bite block) to the larynx. Identify structures as you proceed: nasal turbinates, hard and soft palate, uvula, posterior tongue, valecula, epiglottis and frenulum, ariepylglottic folds and arythenoid cartilages, false and true vocal cords separated by the vestibule. Assess the movement and symmetry of the vocal cords upon tidal and deep respiration and phonation.

Step 2: Practice delivery of topical anesthetic (lidocaine) in small 1-2 ml. aliquots until anesthesia has been achieved. Observing the timing of breathing, during maximum abduction of the vocal cords, proceed beyond the vocal cords into the subglottic space (the widest point is usually near the posterior commisure). Examine the subglottic space while passing through the subgottic funnel, beyond the thyroid and cricoids cartilages, and the first tracheal ring. Stopping in the subglottis is uncomfortable, and induces cough and should be avoided.

Step 3: Navigate from the subglottis, following the tracheal curve, to the carina. Repeat up and down many times.

Step 4: Turn from the neutral position at the carina to the left, then back to the neutral position. Repeat many times. Then, turn from the neutral position at the carina to the right, then back to the neutral position. Repeat many times. Then practice doing each exercise both possible ways ("forward" and backward"). Then do the two exercises intermittently, one to the left, then to the right, then to the left, and so on. Then shuffle the exercises randomly, left and right and forward and backward.

Step 5: Turn from the neutral position at the carina to the left, down to the end of the LMB, and back up to neutral position at the carina. Do this exercise both possible ways ("forward" and backward"). Repeat many times. Then, turn from the neutral position at the carina to the right, down to the end of the RMB, then down the BI, and back up to neutral position at the carina. Do this exercise both possible ways ("forward" and backward"). Repeat many times. Then do the two exercises intermittently, one to the left, then to the right, then to the left, and so on. Then shuffle the exercises randomly, left and right and forward and backward.

Step 6: From the carina, follow the LMB, entering the two lobar bronchi (LLL and LUL) and return back to the LMB and carina. Repeat several times. Then, from the carina, follow the RMB and BI, entering the three lobar bronchi (RML, RLL, and RUL) and return back to the RMB and carina. Repeat several times.

Steps 7 & 8: On the left, from the LMB, enter the LLL, first the Sup segment, then the basilar pyramid (Ant, Lat, Post). Then, from the LMB, enter the LUL, then each of the two divisions (Upper Div and Lingula), then each segment (Ant, Apic-Post, Sup-Ling, Inf-Ling). Then, perform the B-4-5-6 exercise, entering the Sup and Inf segments of the Lingula, followed by the Sup segment of the LLL. On the right, from the RMB, follow the BI to the RML, and enter both segments of the RML (Med, Lat). Then, enter the RLL, first the Sup segment, then the basilar pyramid (Med, Ant, Lat, Post). Then, perform the B-4-5-6 exercise, entering the Med and Lat segments of the RML, followed by the Sup segment of the RLL. Follow the BI up and enter the RUL, entering all three segments (Ant, Post, Apic). Shuffle left and right exercises.

You are now ready to perform a complete flexible bronchoscopy. Remember, there is usually no need to enter a segment more than once.

BRONCHOSCOPY EDUCATION PROJECT

A consolidated collection of concise synopses and teaching aids for flexible bronchoscopy education.

COMPETENCY TRAINING RESOURCES

Bronchoscopy International

bronchoscopy.org