BRONCHOSCOPY CURRICULUM
PULMONARY AND CRITICAL CARE FELLOWSHIP
AND CRITICAL CARE FELLOWSHIP
HENRY FORD HOSPTIAL

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Introduction

The purpose of this document is to provide a curriculum for bronchoscopy training within the Pulmonary and Critical Care Fellowship, Critical Care Fellowship, and Critical Care tracks at Henry Ford Hospital. Bronchoscopy is the technique most pulmonologists identify as their signature procedure. This document is designed to lay the framework for the educational goals to fulfill the Accreditation Council for Graduate Medical Education (ACGME) requirements for training as well as developing a complete competency in bronchoscopy. In addition, training in endobronchial ultrasound guided transbronchial needle aspiration (EBUS-TBNA), although not required, is becoming a more important skill that most graduates of pulmonary and critical care fellowships should have. Although, not inclusive in this edition, further training in pleural procedures is paramount to complete procedural training in pulmonary medicine.

Historically, teaching of procedural skills was left to the old adage: See one, Do one, Teach one. With the complexities of modern technologies, this concept is no longer a valid approach to education. Bronchoscopy education is not designed to only fulfill the requirements for training as established by the ACGME. Neither is it designed to allow you to pass the American Board of Internal Medicine (ABIM) examinations for board certification. The goal of your education in bronchoscopy, and related procedures, is to provide you with all of the skills necessary to be a proficient practitioner of bronchoscopy in the future. When referring to any medical procedures, the term ‘competency’ is often used. When getting privileges at new hospitals in the future, you will be required to demonstrate competency in these procedures. “Competency” is defined as: a. The state or quality of being adequately or well qualified; ability. b. A specific range of skill, knowledge, or ability. This program will identify all areas felt to be necessary for your education in bronchoscopy and assist you in gaining competency in these procedures.

In 2020, the ACGME fellowship requirements for bronchoscopy state: “fellows must be able to perform all medical, diagnostic, and surgical procedures considered essential for the area of practice”. Fellows must demonstrate competence in procedural and technical skills, including:”

ACGME Pulmonary Fellowship requirements 2020

IV.B.1.b).(2).(b).(iv)flexible fiber-optic bronchoscopy procedures, including those where endobronchial and transbronchial biopsies, and transbronchial needle aspiration are performed (Core).

IV.B.1.b).(2).(b).(vi).(a) diagnostic and therapeutic procedures, including thoracentesis, endotracheal intubation, and related procedures (Detail)

IV.B.1.b).(2).(b).(vii) use of chest tubes and drainage systems (Core);

IV.B.1.b).(2).(b).(xii) use of ultrasound techniques to perform thoracentesis and place intravascular and intracavitary tubes and catheters (Core);

https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/156_PCCM_2020.pdf?ver=2020-06-29-162350-787

ACGME Critical Care Fellowship requirements 2020

IV.B.1.b).(2).(b).(iv) therapeutic flexible fiber-optic bronchoscopy procedures limited to indications for therapeutic removal of airway secretions, diagnostic aspiration of airway secretions or lavaged fluid, or airway management (Core).

IV.B.1.b).(2).(b).(v) diagnostic and therapeutic procedures, including thoracentesis, endotracheal intubation, and related procedures (Core)

IV.B.1.b).(2).(b).(vi). use of chest tubes and drainage systems (Core)

https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/142_CriticalCareMedicine_2020_TCC.pdf?ver=2020-02-14-155703-173

Fellowship training in bronchoscopy will focus on each of the core competencies defined by the ACGME. These core competencies include:

1. Patient Care (PC)
2. Medical Knowledge (MK)
3. Systems Based Practice (SBP)
4. Professionalism
5. Practice Based learning and Improvement (PBLAI)
6. Communication and Interpersonal Skills (CAIP)

Please see Appendix A for further descriptions. These categories will be used by the instructors on the bronchoscopy rotation.

Responsibilities

Curriculum based learning will be divided into the year of fellowship training: first, second and third. Requirements will be outlined in each section. Some of these requirements will necessitate the signature of a staff physician, completion of an online supplement with printing of appropriate documentation, reading assignments, procedural competency evaluations, written assessment, and self-assessment. Please see the appropriate appendix for a checklist for each year of training: First year: Appendix B, Second year: Appendix C, Third year: Appendix D, Critical Care Track: Appendix E.

It is the responsibility of each fellow to complete all of these requirements in the time frame established. Any evaluations that were not completed during the respective year's bronchoscopy month must be scheduled with an interventional pulmonology staff for re-evaluation. If the fellow is felt to have deficiencies in their training, it is the fellow's responsibility to schedule a fifteen minute meeting with the Director of Bronchoscopy Education to discuss these issues, review their checklists, and evaluations. If there are any areas of concern identified, they will be discussed at this meeting. A plan of attainment will be established for the fellow with the Director of Bronchoscopy Education as to the remediation of this. The Director of Bronchoscopy Education will then be required to give a report to the Fellowship Director for the training records of each fellow.

It is an absolute requirement that fellows have completed all assignments identified on the checklists to be completed prior to beginning a rotation. This is mandatory and the fellow will not be allowed to begin the rotation without having done this. These pre-assignments have been developed to maximize each fellow's educational experience as well as ensure the safety of our patients.

In addition, it is the requirement of each fellow that they complete their requirements for each year. If all requirements, including: pre- and post-tests, virtual training sessions, checklists, and self-evaluations are not turned in to the Director of Bronchoscopy Education by the end of the academic year, they will not be permitted to move onto the next year's curriculum. They will instead be required to repeat the year missed and then complete the appropriate year's requirements.

As EBUS-TBNA and radial probe ultrasound are advanced technologies, it requires excellent procedural skills to perform these procedures safely and effectively. Training components and reading assignments pertaining to EBUS-TBNA and radial probe ultrasound have been incorporated into each of the first two year curriculums. Upon completion of the second year curriculum, fellows will be permitted to begin the EBUS-TBNA curriculum. To fulfill all of the requirements will necessitate fellows to come to the bronchoscopy suite on their own time to work on the simulator and to perform additional procedures to ensure your comfort and competency with these procedures.

Virtual reality training has grown significantly over the past decade. The importance of this training in improving many skills, including bronchoscopy is well documented in the literature and has growing importance in training in bronchoscopy. Each fellow will be assigned a username and password for the system in the Bronchoscopy Suite. All procedures will be recorded for completeness and skill set. It is expected that a >90% score be attained on the number of required procedures. These results will be reviewed by the Director of Bronchoscopy Education. Fellows or the Fellowship Director can request copies of these reports for their own review. There are four units on our current Simbionix simulator including: Skill Tasks, Diagnostic, Emergency, and EBUS. Each unit has six practice cases. As the requirement for each year is greater than the number in each unit, it will require repeating some cases to complete the requirement.

Part of our simulation training will also include the use of low-tech simulation to ensure that each trainee spends time using an actual bronchoscope on our models. The models include: the Zavala airway model and a sick-boy mannequin. As is indicated on the curriculums for each year, practice on these models will improve the skill set of each fellow.

PCCM Year 1 Bronchoscopy Curriculum (Refer to Checklist for Year 1, Appendix B)

To be completed prior to first day in the bronchoscopy suite:

1. Year 1 Pre-test
2. Read: Chapter 2, by Denis Cortese and Udaya Prakash, Anatomy for Airways, in "Bronchoscopy", by Prakash, 1994.
3. Have completed 30 virtual bronchoscopies on Simbionix trainer in the bronchoscopy suite after having completed reading the anatomy chapter (2a). It is recommended that most efforts be in mastering the Skill Tasks Module, repeating cases as necessary.
4. Review and be able to identify laryngeal anatomy. Refer to chapter 3: The Larynx, by Daniel Chelius and William Lunn, in: In "Introduction to Bronchoscopy" by Ernst 2009.
5. Perform 10 airway examinations on the Zavala or Sick-Boy models with an Olympus bronchoscope.

To be completed during the first month in the bronchoscopy suite:

1. Patient Care (PC)
    a. Present a case to the bronchoscopy staff, reviewing all pertinent history, physical exam findings, and radiologic findings to propose a plan for bronchoscopic assessment and appropriate tissue sampling.
    b. Review all cases the day prior to procedures, prior to scheduling, and develop a bronchoscopy plan to be discussed with the staff physician

2. Medical Knowledge (MK)
    a. 1st week: Understand right lung anatomy to segmental level. Understand airway anatomy by both the Boyden Surgical Classification as well as the Jackson-Huber classification. By the end of the first week perform right sided airway exam with 95% accuracy. (See Appendix G)
    b. 1st week: Demonstrate knowledge of laryngeal anatomy.
    c. 2nd week: Understand left lung anatomy to segmental level. Understand airway anatomy by both the Boyden Surgical Classification as well as the Jackson-Huber classification. By the end of the 2nd week be able to perform left sided airway exam with 95% accuracy. (See Appendix G)
    d. 3rd week: Learn lymph node stations using Mountain-Dressler classification (2R, 4R, 4L, 5, 7, 10R, 11R, 12R, 11L) When reviewing a CT scan be able to identify each of these nodes. (See Appendix H)
    e. Read Chapter 9: Bronchial Washing, Bronchoalveolar Lavage, Bronchial Brush, and Endobronchial Biopsy, by Carla Lamb, M.D. In "Introduction to Bronchoscopy" by Ernst 2009.
    f. Be able to perform a bronchoalveolar lavage (BAL).
    g. Understand the pharmacology of all medications routinely used in the bronchoscopy suite. Include: medical indications, onset of action, duration of effect, half-life of medication, maximal doses, medical contraindications to use (i.e. Meperidine use in renal failure patients), and methods of reversal. (Complete chart: Appendix I)
        i. Lidocaine
        ii. Meperidine (Demerol)
        iii. Fentanyl
        iv. Morphine
        v. Midazolam (Versed)
        vi. Diprivan (Propofol)
        vii. Diphenhydramine (Benedryl)
    e. 4th week: Be able to describe anatomic endobronchial location of:
        i. Lymph node stations:
            1. 2R
            2. 4R
            3. 4L
            4. 7
            5. 10R
            6. 11R
            7. 12R
            8. 11L
        ii. Main pulmonary artery
        iii. Left pulmonary artery
        iv. Esophagus
        v. Left Atrium
        vi. Right Ventricle
        vii. Superior Vena Cava
        viii. Aortic Arch

ix. Descending aorta

f. Understand the parts and operation of the bronchoscopy equipment including:
   i. Flexible bronchoscopes
   ii. Light source
   iii. Video processor
   iv. Cytology brush
   v. Biopsy forceps
   vi. Transbronchial biopsy needle
   vii. EBUS-TBNA needle system

3. Systems Based Practice (SBP)
   a. Tumor Board is at 7:00 am every Wednesday. It is expected that you will have 100% attendance at Tumor Board to see how complex cases are discussed and evaluated by a group of subspecialists.
   b. Complete the Radiation Safety Module on HFHS University.
   c. Demonstrate understanding of medical indications for procedures as well as appropriateness of procedures, in particular with co-morbidities and/or on medications (asprin, heprin, clopidogrel, etc.). Know appropriate planning for these patients (pre-operative treatment, holding medications, etc.)
   d. Demonstrate knowledge of management of chronic medications when scheduling patients for procedures, i.e. antihypertensives, insulin, beta-blockers, anticoagulants (warfarin, clopidogrel, etc.)
   e. Be familiar with and correctly use the ASA physical status classification system (Appendix J).
   f. Be familiar with and correctly use the Mallampati Airway Classification. (Appendix K)
   g. Demonstrate clear understanding of pre-operative, operative, and post-operative positioning and monitoring of patient.
   h. Learn to use the video system used in the bronchoscopy suite (Olympus Exera II CLV-190 and CV-190). By the end of the month it is expected each fellow can:
      i. Turn on light source and processor
      ii. Install working channel and suction caps to a bronchoscope
      iii. Connect the suction to the system
      iv. Install a sputum trap into the system.
      v. Connect the bronchoscope to the system
      vi. Turn light source on and off.
      vii. White balance system
   i. Be able to explain the size and channel specifications, and advantages of use of all currently used bronchoscopes models: P, Q, IT, XT, and Pediatric. (Appendix L)

j. Understand and demonstrate the use of forceps. Describe the various types of forceps used in the bronchoscopy suite. Include: specific uses/advantages and bronchoscope requirements for each tool.
k. Demonstrate clear understanding of proper processing of pathologic, cytologic, and microbiologic specimens. (Appendix M)

4. Professionalism:
   By ACGME guidelines (see attachment)

5. Practice Based learning and Improvement (PBLAI)
   a. Perform practice airway examinations on the Zavala or Sick-Boy models in the bronchoscopy suite. It is strongly suggested that 25 airway exams per week for the 1st month.
   b. Complete the Moderate Sedation / Analgesia (Conscious Sedation) Module on HFHS University.

6. Communication and Interpersonal Skills (CAIP)
   a. It is highly recommended that you present at least one case to the Tumor Board during your month rotation.

PCCM Year 2 Bronchoscopy Curriculum (Refer to Checklist for Year 2, Appendix C)

To be completed prior to first day in the bronchoscopy suite:

1. Complete the pre-test.
2. Review appropriate materials from first year. It is expected that you can use all knowledge gained.
3. Virtual trainer: Repeat Skill Tasks Module. Complete Diagnostic Module. The Fellow may want to begin the Emergency Module. A total of 20 virtual procedures must be completed with a score of >90%.
4. Have completed 5 TBNA procedures on the virtual bronchoscopy trainer. This must be completed prior to beginning the month of bronchoscopy.

To be completed during the month rotation in the bronchoscopy suite:

1. Patient Care (PC)
   a. Present a case to the bronchoscopy staff, reviewing all pertinent history, physical exam findings, and radiologic findings to propose a plan for bronchoscopic assessment and appropriate tissue sampling.

2. Medical Knowledge (MK)
   a. Read Chapter 10: Transbronchial Lung Biopsy, by Scott Shofer, M.D. and Momen Wahidi, M.D., In "Introduction to Bronchoscopy" by Ernst 2009.

b. Read Chapter 11: Transbronchial Needle Aspiration, by William Fischer, M.D. and David Feller-Kopman, M.D., In "Introduction to Bronchoscopy" by Ernst 2009.
c. Read: Feller-Kopman D. Physics and Principles of Ultrasound Imaging. In: Endobronchial Ultrasound (Ernst A, Herth F, editors). Springer Science, 2009
d. Read: Yasufuku K. EBUS-TBNA Bronchoscopy. In: Endobronchial Ultrasound (Ernst A, Herth F, editors). Springer Science, 2009
e. Read materials provided Chapter 15, Lymph Nodes, in "A Textbook of Histology", by Fawcett, Bloom, and Raviola. (Appendix N)
f. Review and be able to use the 7th edition of the International Association for the Study of Lung Cancer TNM definitions and Staging. (Refer to Appendices O and P)
g. Be prepared to discuss the definitions of, indications for biopsy of, and techniques to biopsy:
    i. Solitary pulmonary nodules
    ii. Lung mass
    iii. Lung infiltrate
h. Explain the benefits, indications, and risks of EBUS-TBNA vs. traditional TBNA

3. Systems Based Practice (SBP)
    a. Tumor Board is at 7:00 am every Wednesday. It is expected that you will have 100% attendance at Tumor Board to see how abnormalities are evaluated by a group of subspecialists.
    b. Complete the Radiation Safety Module on HFHS University. Please turn in a copy of your certificate of completion with the end of the month materials.
    c. Understand and demonstrate the use of traditional transbronchial and EBUS-TBNA needles. Describe various types of needles used in the bronchoscopy suite. Include: specific uses/advantages and bronchoscope requirements for each tool.

4. Professionalism: By ACGME Guidelines (See attachment)

5. Practice Based learning and Improvement (PBLAI)
    a. Perform an airway examination with 95% accuracy to the segmental level during the first week of the rotation. Have staff initial completion.
    b. Perform practice TBNA procedures on the Zavala model in the bronchoscopy suite. It is strongly suggested that 10 of these procedures be performed per week.
    c. Describe and demonstrate on the Zavala model TBNA techniques. Have staff initial completion.
    d. Demonstrate the technique of wedging a bronchoscope
    e. Perform transbronchial biopsies – both driving bronchoscope and managing the forceps.

f. Perform TBNA.
g. Review sequence of lymph node biopsies and understand importance of such (i.e. N1 vs. N2 vs. N3).
h. Assist in a minimum of 20 EBUS-TBNA procedures to gain understanding of this procedure.
i. Demonstrate understanding of management of complications of transbronchial biopsies and transbronchial needle aspirations (bleeding, pneumothorax, etc.).
j. It is expected that all fellows completing their second year participate in the Henry Ford EBUS-TBNA and Advanced Diagnostic Bronchoscopy Course held in the spring of each year.

6. Communication and Interpersonal Skills (CAIP)
    a. It is highly recommended that you present at least one case to the Tumor Board during your month rotation.

PCCM Year 3 Bronchoscopy Curriculum (Refer to Checklist for Year 3, Appendix D)

To be completed prior to first day in the bronchoscopy suite:

1. Complete the pre-test.
2. Review appropriate materials from first and second year. It is expected that you can use all knowledge gained.
3. Virtual trainer: Repeat Skill Tasks and Diagnostic Modules. Complete the Emergency Module. An additional 20 virtual procedures must be completed with a score of >90%.

To be completed during the month rotation in the bronchoscopy suite:

1. Patient Care (PC)
    a. Present a case to the bronchoscopy staff, reviewing all pertinent history, physical exam findings, and radiologic findings to propose a plan for bronchoscopic assessment and appropriate tissue sampling.

4. Medical Knowledge (MK)
    a. Read Chapter 12: Bronchoscopy in the Intensive Care Unit, by Jed Gorden, M.D., in "Introduction to Bronchoscopy" by Ernst 2009.
    b. Read Chapter 13: Bronchoscopy in the Lung Transplant Patient, by Anne Fuhlbrigge, M.D., In "Introduction to Bronchoscopy" by Ernst 2009.
    c. Read Chapter 14: Advanced Diagnostic Bronchoscopy, by Ross Morgan, M.D. and Armin Ernst, M.D., In "Introduction to Bronchoscopy" by Ernst 2009.
    d. Read Chapter 15: Basic Therapeutic Techniques, by Luis Angel, M.D. and Deborah Levine, M.D., In "Introduction to Bronchoscopy" by Ernst 2009.

e. Read, Chapter 1, Ultrasound Basics – Getting Started, by William E Brant, in "Ultrasound", by Brant 2001.
f. Read, Chapter 3, Ultrasound-Guided Thoracentesis, by David Feller-Kopman, in "Ultrasound-Guided Procedures and Investigations", by Ernst and Feller-Kopman 2006.
g. Discuss management of massive hemoptysis, clinical definitions and therapeutic options.
h. Be prepared to discuss the bronchoscopic management of foreign bodies.

i. Be prepared to discuss:
    i. The indications and use of Autofluorescence and Narrow-Band Imaging
    ii. The indications and use of peripheral EBUS.
    iii. The indications and use of electromagnetic navigation techniques.

5. Systems Based Practice (SBP)
    a. Tumor Board is at 7:00 am every Wednesday. It is expected that you will have 100% attendance at Tumor Board to see how abnormalities are evaluated by a group of subspecialists.
    b. Complete the Radiation Safety Module on HFHS University. Please turn in a copy of your certificate of completion with the end of the month materials.
    c. Use and interpret peripheral ultrasound
    d. Set up for a bronchoscopy, including, the bronchoscope, sampling equipment, appropriate sampling medias, etc.
    e. It is highly recommended that you spend one day in the operating room with the Interventional Pulmonology Services.
    f. Complete at a minimum five billing sheets for the performance of bronchoscopy. (Refer to Appendix Q for worksheet)
    g. Complete five reports in Bronchosoft to have an understanding of the needed elements in the writing of a bronchoscopy report.

6. Professionalism: by ACGME Guidelines (see attachment)

7. Practice Based learning and Improvement (PBLAI)
    a. Perform an airway examination with 100% accuracy to the segmental level during the first week of the rotation. Have staff initial completion.
    b. Perform a bronchoscopy moving from above the main carina into any and all segments requested by the staff with 100% accuracy. Have staff initial completion.
    c. Perform transbronchial biopsies – both driving bronchoscope and managing the forceps.
    d. Perform traditional TBNA
    e. Demonstrate proficient use of fluoroscopy doing procedures including: guidance of instruments, choice of anterior-posterior and lateral views, and how to limit exposure.

f. Demonstrate appropriate screening for a pneumothorax using fluoroscopy after a transbronchial biopsy.
g. Perform five oral intubations.
h. Demonstrate understanding of the use of a laryngeal mask airway (LMA).
i. Be prepared to discuss the technique of intubating with an endotracheal tube using bronchoscopic guidance.
j. Demonstrate proficiency in the performance of transthoracic ultrasound for a pleural effusion.

8. Communication and Interpersonal Skills (CAIP)
    a. It is highly recommended that you present at least one case to the Tumor Board during your month rotation.
    b. Complete at least five bronchoscopy reports using the Bronchosoft reporting software. Bring copies of them to your meeting with the Director of Bronchoscopy meeting.

Critical Care Medicine Fellows (Refer to Checklist for Critical Care, Appendix E)

To be completed prior to first day in the bronchoscopy suite:

1. Complete the Year 1 Pre-test
2. Read: Chapter 2, by Denis Cortese and Udaya Prakash, Anatomy for Airways, in "Bronchoscopy", by Prakash, 1994.
3. Have completed 40 virtual bronchoscopies on Simbionix trainer in the bronchoscopy suite after having completed reading the anatomy chapter (2a). It is recommended that most efforts be in mastering the Skill Tasks Module, repeating cases as necessary. It is also recommended that additional time be dedicated to the Emergency Module.
4. Review and be able to identify laryngeal anatomy. Refer to chapter 3: The Larynx, by Daniel Chelius and William Lunn, in: In "Introduction to Bronchoscopy" by Ernst 2009.
5. Perform 10 airway examinations on the Zavala or Sick-Boy models with an Olympus bronchoscope.

To be completed during the first month in the bronchoscopy suite:

1. Patient Care (PC)
    a. Present a case to the bronchoscopy staff, reviewing all pertinent history, physical exam findings, and radiologic findings to propose a plan for bronchoscopic assessment and appropriate tissue sampling.
    b. Review all cases the day prior to procedures, prior to scheduling, and develop a bronchoscopy plan to be discussed with the staff physician

2. Medical Knowledge (MK)
    a. 1st week: Understand right lung anatomy to segmental level. Understand airway anatomy by both the Boyden Surgical Classification as well as the Jackson-Huber classification. By the end of the first week perform right sided airway exam with 95% accuracy. (See Appendix G)
    b. 1st week: Demonstrate knowledge of laryngeal anatomy.
    c. 2nd week: Understand left lung anatomy to segmental level. Understand airway anatomy by both the Boyden Surgical Classification as well as the Jackson-Huber classification. By the end of the 2nd week be able to perform left sided airway exam with 95% accuracy. (See Appendix G)
    d. 3rd week: Learn lymph node stations using Mountain-Dressler classification (2R, 4R, 4L, 5, 7, 10R, 11R, 12R, 11L) When reviewing a CT scan be able to identify each of these nodes. (See Appendix H)
    e. Read Chapter 9: Bronchial Washing, Bronchoalveolar Lavage, Bronchial Brush, and Endobronchial Biopsy, by Carla Lamb, M.D. In "Introduction to Bronchoscopy" by Ernst 2009.
    f. Be able to perform a bronchoalveolar lavage (BAL).
    g. Understand the pharmacology of all medications routinely used in the bronchoscopy suite. Include: medical indications, onset of action, duration of effect, half-life of medication, maximal doses, medical contraindications to use (i.e. Meperidine use in renal failure patients), and methods of reversal. (Complete chart: Appendix I)
        i. Lidocaine
        ii. Meperidine (Demerol)
        iii. Fentanyl
        iv. Morphine
        v. Midazolam (Versed)
        vi. Diprivan (Propofol)
        vii. Diphenhydramine (Benedryl)
    e. 4th week: Be able to describe anatomic endobronchial location of:
        i. Lymph node stations:
            1. 2R
            2. 4R
            3. 4L
            4. 7
            5. 10R
            6. 11R
            7. 12R
            8. 11L
        x. Main pulmonary artery
        xi. Left pulmonary artery
        xii. Esophagus
        xiii. Left Atrium
        xiv. Right Ventricle
        xv. Superior Vena Cava
        xvi. Aortic Arch

xvii. Descending aorta

f. Understand the parts and operation of the bronchoscopy equipment including:
   i. Flexible bronchoscopes
   ii. Light source
   iii. Video processor
   iv. Cytology brush
   v. Biopsy forceps
   vi. Transbronchial biopsy needle
   vii. EBUS-TBNA needle system

3. Systems Based Practice (SBP)
   a. Tumor Board is at 7:00 am every Wednesday. It is expected that you will have 100% attendance at Tumor Board to see how complex cases are discussed and evaluated by a group of subspecialists.
   b. Complete the Radiation Safety Module on HFHS University.
   c. Demonstrate understanding of medical indications for procedures as well as appropriateness of procedures, in particular with co-morbidities and/or on medications (asprin, heprin, clopidogrel, etc.). Know appropriate planning for these patients (pre-operative treatment, holding medications, etc.)
   d. Demonstrate knowledge of management of chronic medications when scheduling patients for procedures, i.e. antihypertensives, insulin, beta-blockers, anticoagulants (warfarin, clopidogrel, etc.)
   e. Be familiar with and correctly use the ASA physical status classification system (Appendix J).
   f. Be familiar with and correctly use the Mallampati Airway Classification. (Appendix K)
   g. Demonstrate clear understanding of pre-operative, operative, and post-operative positioning and monitoring of patient.
   h. Learn to use the video system used in the bronchoscopy suite (Olympus Exera II CLV-190 and CV-190). By the end of the month it is expected each fellow can:
      i. Turn on light source and processor
      ii. Install working channel and suction caps to a bronchoscope
      iii. Connect the suction to the system
      iv. Install a sputum trap into the system.
      v. Connect the bronchoscope to the system
      vi. Turn light source on and off.
      vii. White balance system
   i. Be able to explain the size and channel specifications, and advantages of use of all currently used bronchoscopes models: P, Q, IT, XT, and Pediatric. (Appendix L)

j. Understand and demonstrate the use of forceps. Describe the various types of forceps used in the bronchoscopy suite. Include: specific uses/advantages and bronchoscope requirements for each tool.
k. Demonstrate clear understanding of proper processing of pathologic, cytologic, and microbiologic specimens. (Appendix M)

4. Professionalism: By ACGME Guidelines (see attachment)

5. Practice Based learning and Improvement (PBLAI)

c. Perform practice airway examinations on the Zavala or Sick-Boy low-tech models in the bronchoscopy suite. It is strongly suggested that 25 airway exams per week for the 1st month.
d. Complete the Moderate Sedation / Analgesia (Conscious Sedation) Module on HFHS University.
e. Be prepared to discuss the technique of intubating with an endotracheal tube using bronchoscopic guidance.
f. Perform 5 oral intubations.

6. Communication and Interpersonal Skills (CAIP)
a. It is highly recommended that you present at least one case to the Tumor Board during your month rotation.

EBUS-TBNA Curriculum (Refer to Checklist for EBUS-TBNA, Appendix F)

The purpose of this section is to provide a curriculum for training in Endobronchial Ultrasound (EBUS) bronchoscopy for the Pulmonary and Critical Care Medicine fellows at Henry Ford Hospital.

This curriculum responds to the rapidly growing EBUS bronchoscopic techniques use in the pulmonary community; and intends to provide a foundation of the basic and advanced practice of EBUS to our fellows in order to make them skilled and competent by completion of their fellowship.

There are still no clear guidelines on how to achieve competency in EBUS bronchoscopy. The American College of Chest Physicians (ACCP) recommended in 2003 that 50 EBUS should be performed to achieve competency in fellowship, however this referred only to radial EBUS, not linear EBUS.[1]

A recent European study has shown that the diagnostic accuracy of using EBUS-TBNA is variable during the first 100 procedures in previously experienced bronchoscopist, with a yield ranging between 60 and 80%.[2] An Australian study showed that during the learning curve for EBUS-TBNA, the diagnostic accuracy did not peak until after 50 procedures.[3]

It is evident that beyond bronchoscopy skills and a good fund of knowledge of the airway and mediastinal anatomy, the person working with an EBUS-TBNA bronchoscope needs to acquire specific skills, including driving the scope with reduced optics and an oblique angle of view, acquiring and interpreting the ultrasound images, understanding how to operate the equipment and the needle, and performing the TBNA.

This curriculum is directed to those fellows who have completed their second year curriculum who have shown interest in learning about EBUS bronchoscopy. This training must begin by the beginning of the third year of fellowship.

<u>To be completed prior to beginning to perform EBUS procedures</u>:

1. To have completed the first and second year bronchoscopy curriculum requirements.
2. Virtual trainer: Repeat Skill Tasks and Diagnostic Modules. Complete the Emergency Module. In addition, the fellow must perform 30 virtual EBUS-TBNA procedures with a completed score of >90%.
3. To have completed the following reading:
    a. Feller-Kopman D. Physics and Principles of Ultrasound Imaging. In: Endobronchial Ultrasound (Ernst A, Herth F, editors). Springer Science, 2009
    b. Yasufuku K. EBUS-TBNA Bronchoscopy. In: Endobronchial Ultrasound (Ernst A, Herth F, editors). Springer Science, 2009
    c. Unroe M, Shofer S, Wahidi M. Training for endobronchial ultrasound: methods for proper training in new bronchoscopic techniques. Curr Opin Pulm Med 2010;16:295-300
4. Be prepared to discuss anatomy of the thorax with identification of every normal structure in a computed tomography of the chest, with special attention to the relationship between vessels, airways, lymph nodes, heart, lungs and esophagus (Appendix T).

<u>To be completed while completing EBUS Curriculum:</u>

1. Patient Care (PC)
    a. Present the cases to the bronchoscopy staff, reviewing the pertinent history, physical exam findings, and radiological findings.
    b. Propose a plan for complete mediastinal staging of a case being evaluated for lung cancer.

2. Medical Knowledge (MK)
    a. It is highly recommended that the fellow participate in two open thoracotomies to gain an extra-bronchial understanding of lung anatomy.
    b. Read the following:

i. Gandagharan S. Staging principles in Lung Cancer. In: Endobronchial Ultrasound (Ernst A, Herth F, editors). Springer Science, 2009
ii. Gomez M, Silvestri GA. Endobronchial ultrasound for the diagnosis and staging of lung cancer. Proc Am Thorac Soc 2009; 6(2):180-6
iii. Herth F, Becker H. Endobronchial Ultrasound. In: Thoracic endoscopy, advances in Interventional Pulmonology (Simoff MJ, Sterman DH, Ernst A, editors). Blackwell Futura, 2006
iv. Alsharif M, Andrade R, Groth S, et al. Endobronchial Ultasound-Guided Transbronchial Fine-Needle Aspiration. Am J Clin Pathol 2008; 130:434-443

c. The fellow should be able to use the 7th edition of the International Association for the Study of Lung Cancer TNM definitions and staging.
d. Review of the following topics:
   i. Ultrasound: physics, knobology, terminology, artifacts
   ii. Thoracic anatomy: standard anatomy and ultrasound anatomy
   iii. EBUS: radial and linear (differences, indications, complications)
   iv. EBUS-TBNA bronchoscope: parts, functioning, needles
   v. Pathology: specimen adequacy, handling, microscopic examination

3. System Based Practice (SBP)
   a. It is expected that the fellow will have 100% attendance to the Lung Tumor Board while on rotation. EBUS-TBNA is tied into the evaluation, diagnosis, and staging of patients with cancer of the chest. It is important to understand how this technology is used within the context of patient management.
   b. Learn to operation of the endoscopic ultrasound generator.
   c. The fellow should be able to assemble the EBUS-TBNA bronchoscope on their own, prior to the beginning of a procedure.

4. Professionalism: By ACGME Guidelines (see attachment)

5. Practice Based Learning and Improvement (PBLI)

   Step wise education is implicit to the proper understanding and complete mastering of new technologies.
   a. The first five procedures will be focused on airway manipulation of the EBUS-TBNA bronchoscope. This is to understand the off-center visualization of the bronchoscopes imaging.
   b. The second five procedures should be directed towards identification of mediastinal structures with the EBUS-TBNA bronchoscope using ultrasound imaging. Structures include but are not limited to: Aortic arch, descending aorta, pulmonary artery, descending pulmonary artery on the left, azygos vein, superior vena cava, the right and left atria of the heart, and the esophagus.

c. The next five procedures will be focused on the technique of TBNA by sampling stations 4R and/or 7 nodes with the EBUS-TBNA bronchoscope.
d. Further procedures will be to develop knowledge of lymph node positions and sampling techniques to maximize yield.
e. Please note that intubation will be taught after mastery of endobronchial EBUS-TBNA bronchoscopy. Upon graduation, most EBUS-TBNA procedures performed in community hospitals are done with deep sedation and an LMA. For new practitioners, this procedure is recommended.
f. Records of all EBUS-TBNA procedures must be kept by the fellow. Nodal location sampled, size of nodes and yields should be recorded. Overall yield will be assessed after 10, 20, 25, and 40 procedures.

6. Communication and Interpersonal skills (CIS)
    a. The fellow will be presenting results of procedures performed at tumor board.

Evaluation:

Fellow evaluation will be performed throughout training as this will span most of the third year. The fellow will have with them a copy of the EBUS-TBNA Assessment Tool completed (Appendix U) every 10 EBUS-TBNA bronchoscopies performed (each assessment tool evaluation will be completed on a single case). A final score of 100 is required in order to successfully graduate from the training. The fellow will also need to complete the written evaluation as well as completing a self-evaluation prior to graduation (Appendix U).

References:

1. Ernst A, Silvestry GA, Johnstone D. Interventional Pulmonary Procedures: guidelines from the American College of Chest Physicians. Chest 2003;123:1693-1717.
2. Kemp SV, Batrawy SH, Harrison RN, et al. Learning curve for endobronchial ultrasound using custom analysis. Thorax 2010;65:534-538.
3. Steinfort DP, Hew MJ, Irving LB. Bronchoscopic examination of the mediastinum using endobronchial ultrasound: a description of the first 216 cases performed at an Australian tertiary hospital. Intern Med J 2009 DOI: 10.1111/j.1445-5994.2009.02142.x.

List of Appendices:

Appendix A: ACGME and ABIM Requirements for Bronchoscopy

Patient Care:

Overall patient care will be objectively evaluated by the instructor:

Medical Knowledge:

Medical knowledge will be evaluated by the instructor. Further assessment of medical knowledge will include completion of all sections of The Essential Bronchoscopist. Objective evidence of by the completion of the written examination at the end of each month of bronchoscopy during the fellowship.

Systems-based Practice:

Will be defined by the use of the following descriptors:

1. Fellows must demonstrate their knowledge of the environmental context and health care systems within which they function. The scope of systems-based practice includes

- familiarity with financing structures, the organization and capacities of provider entities and delivery systems;
- tools and techniques for controlling costs and allocating resources;
- systems for improving the quality of care; and
- the roles and contributions of other professionals in caring for individual patients and populations.

Fellows must use their knowledge of system resources to provide care that is of optimal value.

This often requires actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

This is further described by the ACGME:

IV.A.5.g) Systems-based Practice

Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Fellows are expected to:

IV.A.5.g).(1) work effectively in various health care delivery settings and systems relevant to their clinical specialty;

IV.A.5.g).(2) coordinate patient care within the health care system relevant to their clinical specialty;

IV.A.5.g).(3) incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population based care as appropriate;

IV.A.5.g).(4) advocate for quality patient care and optimal patient care systems;

IV.A.5.g).(5) work in interprofessional teams to enhance patient safety and improve patient care quality; and

IV.A.5.g).(6) participate in identifying system errors and implementing potential systems solutions.

Professionalism:

Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Fellows are expected to demonstrate:

IV.A.5.f).(1) compassion, integrity, and respect for others;

IV.A.5.f).(2) responsiveness to patient needs that supersedes self interest;

IV.A.5.f).(3) respect for patient privacy and autonomy;

IV.A.5.f).(4) accountability to patients, society and the profession;

IV.A.5.f).(5) sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation;

IV.A.5.f).(6) high standards of ethical behavior, including maintaining appropriate professional boundaries and relationships with other physicians, and avoiding conflicts of interest; and

IV.A.5.f).(7) a commitment to lifelong learning, and an attitude of caring derived from humanistic and professional values.

Practice-based Learning and Improvement:

1. Fellows must know and apply scientific methods and analytic tools to improve their patient care practices. They must be able to:

- locate and appraise scientific evidence and clinical studies related to their patients' health problems;
- apply information about the panels and populations from which their patients are drawn;
- use information technology including online resources; and
- analyze practice experience in order to perform systematic improvement activities.

Quality improvement, evidence-based medicine, and informatics are among the content areas that fall within this competency.

2. That involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care

3. Fellows must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Fellows are expected to:

a. Analyze practice experience and perform practice-based improvement activities using a systematic methodology.
b. Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems.
c. Obtain and use information about their own population of patients and the larger population from which their patients are drawn.
d. Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness.
e. Use information technology to manage information, access on-line medical information; and support their own education.
f. Facilitate the learning of students and other health care professionals.

This is further described by the ACGME:

IV.A.5.d) Practice-based Learning and Improvement

Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Fellows are expected to develop skills and habits to be able to meet the following goals:

IV.A.5.d).(1) identify strengths, deficiencies, and limits in one's knowledge and expertise;

IV.A.5.d).(2) set learning and improvement goals;

IV.A.5.d).(3) identify and perform appropriate learning activities;

IV.A.5.d).(4) systematically analyze practice, using quality improvement methods, and implement changes with the goal of practice improvement;

IV.A.5.d).(5) incorporate formative evaluation feedback into daily practice;

IV.A.5.d).(6) locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;

IV.A.5.d).(7) use information technology to optimize learning; and,

IV.A.5.d).(8) participate in the education of patients, families,students, fellows and other health professionals; and

IV.A.5.d).(9) apply new contributions to the management and care of their patients.

Communication and Interpersonal Skills

Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Fellows are expected to:

IV.A.5.e).(1) communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;

IV.A.5.e).(2) communicate effectively with physicians, other health professionals, and health related agencies;

IV.A.5.e).(3) work effectively as a member or leader of a health care team or other professional group;

IV.A.5.e).(4) act in a consultative role to other physicians and health professionals;

IV.A.5.e).(5) maintain comprehensive, timely, and legible medical records, if applicable;

IV.A.5.e).(6) demonstrate the ability to relate to patients and their families, as well as other members of the health care team, with compassion, respect, and professional integrity; and,

IV.A.5.e).(7) be effective teachers.

APPENDIX B: **Checklist for PCCM Year 1** **Name:** _____

To be completed prior to beginning bronchoscopy rotation

	Date completed	Signature
Year 1 Pre-test		
Read Chapter by Prakash: Airway Anatomy		
Completed 30 virtual bronchoscopies on the Simbionix Trainer: Skill Tasks Module		
Read Chapter by Chelius & Lunn: Laryngeal Anatomy		
Perform 10 exams on low-tech model(s)		

To be completed during bronchoscopy rotation

	Signature
Complete case presentation	
Right lung anatomy to segmental level (Boyden and Jackson-Huber Classifications	
Left lung anatomy to segmental level (Boyden and Jackson-Huber Classifications	
Demonstrate knowledge of laryngeal anatomy to staff	
Practice on Zavala airway model:	
Week 1: number of practice airway examinations ( )	
Week 2: number of practice airway examinations ( )	
Week 3: number of practice airway examinations ( )	
Week 4: number of practice airway examinations ( )	
Demonstrate knowledge of lymph node stations	
Demonstrate clinical use of Mountain-Dressler Staging system	
Read: Bronchial Washing, BAL, Brush, and EBBx Chapter	
Complete chart (Appendix H) regarding bronchoscopy pharmacology	
Complete Moderate Sedation Module on HFHS University	
Complete Radiation Safety Module on HFHS University	
Demonstrate practical knowledge of bronchoscope specifications	
Demonstrate understanding of management of chronic medications when scheduling patients	
Appropriately use the ASA Physical Classification System	
Appropriately use the Mallampati Airway Classification System	
Pre-operative, operative, and post-operative monitoring	
Tumor Board Week 1: Date ( )	
Week 2: Date ( )	
Week 3: Date ( )	
Week 4: Date ( )	

Case presented at Tumor Board: Date ( )	

Checklist for PCCM Year 1 cont. **Name:**

	Signature
Demonstrate understanding and operation of:	
a. Flexible Bronchoscope	
b. Light Source	
c. Video Processor	
d. Cytology Brush	
e. Biopsy Forceps	
f. Transbronchial biopsy needle	
g. EBUS-TBNA needle system	
Specimen handling and labeling	
Demonstrate understanding of endobronchial location of mediastinal anatomy	
Perform a BAL	
Completed airway exam testing Date ( ) Staff initial ( )	

To be completed upon conclusion of bronchoscopy rotation

	Signature
Complete Year 1 Post-test	
Complete self-assessment tool	

Upon completion of all requirements and this document please sign and return to the Director of Bronchoscopy Education. It is highly recommended that you retain a copy for your records. Please sign this document indicating that you have completed all requirements in good faith. Please turn in a copy of the airway exam testing and your self-assessment tool with this document.

Fellow Signature: _____ Date: _____

Director of Bronchoscopy Education: _____ Date: _____

APPENDIX C: **Checklist for PCCM Year 2** **Name:** _____

To be completed prior to beginning bronchoscopy rotation

	Date completed	Signature
Review appropriate material from first year	Not required	
Complete Year 2 Pre-test		
Virtual trainer: Perform 20 virtual bronchoscopies. Repeat Skill Tasks Module. Complete Diagnostic Module		
Complete 5 TBNA procedures on the virtual bronchoscopy trainer		

To be completed during bronchoscopy rotation

	Signature
Perform an airway examination with 95% accuracy in 1st week Date ( ) Staff initial ( )	
Read Chapter on Transbronchial biopsy	
Read Chapter on Transbronchial needle aspiration	
Read Chapter on Physics and Principles of Ultrasound Imaging	
Read EBUS-TBNA Bronchoscopy	
Read Lymph Node material provided in Appendix N	
Demonstrate knowledge of lymph node stations	
Demonstrate clinical use of Mountain-Dressler Staging system	
Demonstrate clinical definition of, indications of biopsy for, and techniques to be used for:	
a. Solitary pulmonary nodules	
b. Lung mass	
c. Lung infiltrate	
Discuss benefits, indications, and risks of EBUS-TBNA vs. Traditional TBNA	
Complete Radiation Safety Module on HFHS University	
Practice on Zavala airway model:	
Week 1: number of practice TBNAs ( )	
Week 2: number of practice TBNAs ( )	
Week 3: number of practice TBNAs ( )	
Week 4: number of practice TBNAs ( )	
Tumor Board Week 1: Date ( )	
Week 2: Date ( )	
Week 3: Date ( )	
Week 4: Date ( )	
Case presented at Tumor Board: Date ( )	
Demonstrate practical knowledge of bronchoscope specifications	

Demonstrate practical knowledge of brushes, forceps, and needles	

Checklist for PCCM Year 2 cont. **Name:**

_____

Demonstrate wedge technique	**Signature**
Transbronchial biopsies Number ( )	
Perform Traditional TBNA Number ( )	
Demonstration of TBNA technique to Senior Staff Date ( ) Staff initials ( )	
Discuss management of complications of TBBx and TBNA	
Assist in a minimum of 20 EBUS-TBNA	
Completed airway exam testing Date ( ) Staff initials ( )	

To be completed upon conclusion of bronchoscopy rotation

	Signature
Complete Year 2 Post-test	
Complete self-assessment tool	
Participation in Henry Ford Hospital EBUS-TBNA and Advanced Diagnostic Bronchoscopy Course	

Upon completion of all requirements and this document please sign and return to the Director of Bronchoscopy Education. It is highly recommended that you retain a copy for your records. Please sign this document indicating that you have completed all requirements in good faith. Please turn in a copy of the airway exam testing and your self-assessment tool with this document.

Fellow Signature: _____ Date: _____

Director of Bronchoscopy Education: _____ Date: _____

APPENDIX D: **Checklist for PCCM Year 3** **Name:** _____

To be completed prior to beginning bronchoscopy rotation

	Date completed	Signature
Review appropriate material from first and second year	Not required	
Complete Year 3 Pre-test		
Virtual trainer: Perform 20 virtual bronchoscopies. Repeat Skill Tasks and Diagnostic Modules. Complete the Emergency Module.		

To be completed during bronchoscopy rotation

	Signature
Perform an airway examination with 100% accuracy in 1st week Date ( ) Staff initial ( )	
Perform an directed airway examination with 100% accuracy in 1st week Date ( ) Staff initial ( )	
Read Bronchoscopy in the ICU	
Read Bronchoscopy in the lung transplant patient	
Read Advanced Diagnostic Bronchoscopy	
Read Basic Therapeutic Techniques	
Read Ultrasound Basics – Getting Started	
Read Ultrasound-Guided Thoracentesis	
Discuss massive hemoptysis management with IP staff	
Discuss foreign body management with IP staff	
Discuss AF and NBI indications and use with IP staff	
Discuss use of peripheral ultrasound	
Discuss use of EMN techniques	
Complete Radiation Safety Module on HFHS University	
Set up Bronchoscopy Suite for a procedure	
To OR with Interventional Pulmonology Services Date ( ) Staff ( )	
Complete 5 billing sheets one for each of following:	
a. Airway examination	
b. BAL and TBBx	
c. TBBx, brush, BAL using peripheral EBUS	
d. TBBx, brush, BAL using EMN & peripheral EBUS	
e. EBUS-TBNA for stations: 11R, 7, 4R, and 4L	
Complete 5 bronchoscopy reports in Bronchosoft	

Checklist for PCCM Year 3 cont.	**Name:** _____

Tumor Board Week 1: Date ( )	
Week 2: Date ( )	
Week 3: Date ( )	
Week 4: Date ( )	
Case presented at Tumor Board: Date ( )	
Transbronchial biopsies Number ( )	
Traditional TBNA Number ( )	
Use and interpret peripheral ultrasound Number ( )	
Demonstrate appropriate use of fluoroscopy during a procedure	
Demonstrate screening for PTX after TBBx	
Date ( ) Staff initial ( )	
Perform 5 oral intubations	
Discuss intubation with an ETT with IP or CCM staff	
Demonstrate understanding of use of LMA	
Transthoracic ultrasound for pleural effusion	
Completed airway exam testing Date ( ) Staff initials ( )	

To be completed upon conclusion of bronchoscopy rotation

	Signature
Complete Year 3 Post-test	
Complete self-assessment tool	

Upon completion of all requirements and this document please sign and return to the Director of Bronchoscopy Education. It is highly recommended that you retain a copy for your records. Please sign this document indicating that you have completed all requirements in good faith. Please turn in a copy of the airway exam testing and your self-assessment tool with this document.

Fellow Signature: _____ Date: _____

Director of Bronchoscopy Education: _____ Date: _____

APPENDIX E: **Checklist for CCM Fellow** **Name: _____**

To be completed prior to beginning bronchoscopy rotation

	Date completed	Signature
Year 1 Pre-test		
Read Chapter by Prakash: Airway Anatomy		
Completed 40 virtual bronchoscopies on the Simbionix Trainer: Skill Tasks and Emergency Modules		
Read Chapter by Chelius & Lunn: Laryngeal Anatomy		
Perform 10 exams on low-tech model(s)		

To be completed during bronchoscopy rotation

	Signature
Complete case presentation	
Right lung anatomy to segmental level (Boyden and Jackson-Huber Classifications	
Left lung anatomy to segmental level (Boyden and Jackson-Huber Classifications	
Demonstrate knowledge of laryngeal anatomy to staff	
Practice on Zavala airway model:	
Week 1: number of practice airway examinations ( )	
Week 2: number of practice airway examinations ( )	
Week 3: number of practice airway examinations ( )	
Week 4: number of practice airway examinations ( )	
Demonstrate knowledge of lymph node stations	
Demonstrate clinical use of Mountain-Dressler Staging system	
Read: Bronchial Washing, BAL, Brush, and EBBx Chapter	
Complete chart (Appendix H) regarding bronchoscopy pharmacology	
Complete Moderate Sedation Module on HFHS University	
Complete Radiation Safety Module on HFHS University	
Demonstrate practical knowledge of bronchoscope specifications	
Demonstrate understanding of management of chronic medications when scheduling patients	
Appropriately use the ASA Physical Classification System	
Appropriately use the Mallampati Airway Classification System	
Tumor Board Week 1: Date ( )	
Week 2: Date ( )	
Week 3: Date ( )	
Week 4: Date ( )	
Case presented at Tumor Board: Date ( )	

Checklist for Critical Care Fellow cont. **Name: _____**

	Signature
Pre-operative, operative, and post-operative monitoring	
Demonstrate understanding and operation of:	
f. Flexible Bronchoscope	
g. Light Source	
h. Video Processor	
i. Cytology Brush	
j. Biopsy Forceps	
k. Transbronchial biopsy needle	
l. EBUS-TBNA needle system	
Specimen handling and labeling	
Demonstrate understanding of endobronchial location of mediastinal anatomy	
Perform a BAL	
Perform 5 oral intubations	
Discuss intubation with an ETT with IP or CCM staff	
Completed airway exam testing Date ( ) Staff initial ( )	

To be completed upon conclusion of bronchoscopy rotation

	Signature
Complete Year 1 Post-test	
Complete self-assessment tool	

Upon completion of all requirements and this document please sign and return to the Director of Bronchoscopy Education. It is highly recommended that you retain a copy for your records. Please sign this document indicating that you have completed all requirements in good faith. Please turn in a copy of the airway exam testing and your self-assessment tool with this document.

Fellow Signature: _____ Date: _____

Director of Bronchoscopy Education: _____ Date: _____

APPENDIX F: **Checklist for EBUS-TBNA** **Name: _____**

To be completed prior to beginning bronchoscopy rotation

	Date completed	Signature
To have completed the first and second year bronchoscopy curriculum requirements.		
Complete EBUS-TBNA Pre-test		
Virtual trainer: Repeat Skill Tasks and Diagnostic Modules. Complete the Emergency Module. In addition, the fellow must perform 30 virtual EBUS-TBNA procedures with a completed score of >90%		
Read Physics and Principles of US Imaging		
Read EBUS-TBNA Bronchoscopy		
Read Training for endobronchial ultrasound		

To be completed during bronchoscopy rotation

	Signature
Present a case including node sampling plan	
It is highly recommended that the fellow participate in 2 open thoracotomies	
Read Staging Principles in Lung Cancer	
Read Endobronchial Ultrasound for the diagnosis and staging of lung cancer	
Read Endobronchial Ultrasound	
Read Endobronchial Ultrasound Guided Transbronchial Fine-Needle Aspiration	
Demonstrate clinical knowledge of lung cancer staging to IP staff	
Review and be prepared to discuss with IP staff:	
a. Ultrasound: physics, knobology, terminology, artifacts	
b. Thoracic anatomy: standard as it relates to ultrasound	
c. EBUS: linear vs. radial – differences, indications, complications	
d. Pathology specimen adequacy and handling	
Perform the set-up of and EBUS-TBNA bronchoscope without assistance	
Demonstrate knowledge of EBUS-TBNA bronchoscope characteristics to IP staff.	
Attendance at Lung Tumor Board the week prior to all cases being performed.	

Checklist for EBUS-TBNA cont. **Name: _____**

Performance of EBUS-TBNA Bronchoscopies

	Signature
5 Procedures: Manipulation of EBUS-TBNA bronchoscope	
5 Procedures: Successfully identify mediastinal structures	
5 Procedures: Sampling stations 4R and/or 7	
Intubation with EBUS-TBNA bronchoscope (optional)	
Yield at 10 procedures	
Yield at 20 procedures	
Yield at 25 procedures	
Yield at 40 procedures	

Sample record

Please use the following as a record for your EBUS-TBNA procedures. The procedure number should be indicated as 1, 2, 3, …40. The same procedure number can be used on multiple lines as in many cases multiple nodes will be sampled. Each line is to be used for a single lymph node. Under node, the actual nodal station should be indicated: 4R, 4L, etc. Pathology should indicate the findings of each nodal sampling: normal lymph node, adenocarcinoma, NSCLCA, etc.

Procedure number	**Node**	**Pathology**

After each of 10, 20, 25, and 40 procedures, you should calculate your yield. If your yield is below 80% it is important to review your results with an IP staff

Total nodes sampled _____ Total Positive _____ Overall Yield _____%

Checklist for EBUS-TBNA cont. **Name: _____**

To be completed upon conclusion of bronchoscopy rotation

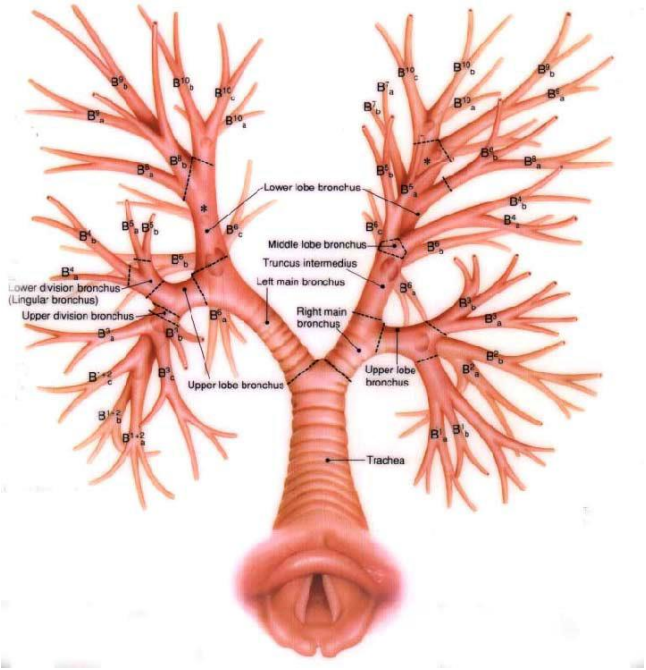
	Signature
Complete EBUS-TBNA Post-test	
Complete EBUS-TBNA self-assessment tool	

Upon completion of all requirements and this document please sign and return to the Director of Bronchoscopy Education. It is highly recommended that you retain a copy for your records. Please sign this document indicating that you have completed all requirements in good faith. Please turn in a copy of the airway exam testing and your self-assessment tool with this document.

Fellow Signature: _____ Date: _____

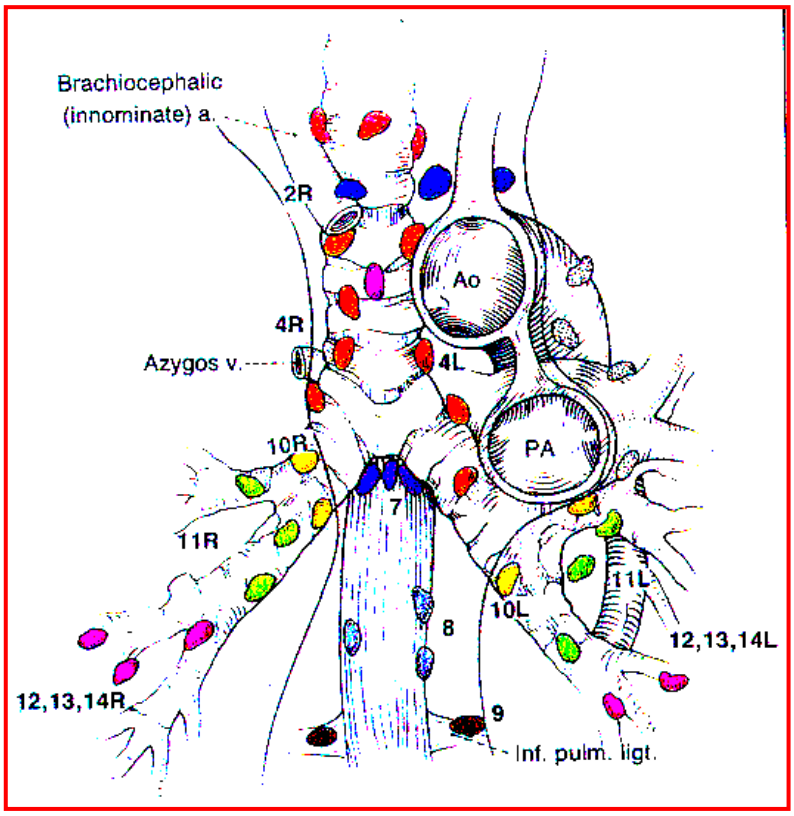
Director of Bronchoscopy Education: _____ Date: _____

APPENDIX G: **Airway Anatomy**



Right Lung			Left Lung	
Boyden	**Jackson-Huber**		**Boyden**	**Jackson-Huber**
Right Upper Lobe			LUL: Upper Division	
B1	Apical		B1/2	Apicoposterior
B2	Posterior		B3	Anterior
B3	Anterior			
Right Middle Lobe			LUL: Lingula	
B4	Lateral		B4	Superior
B5	Medial		B5	Inferior
Right Lower Lobe			Left Lower Lobe	
B6	Superior		B6	Superior
B7	Medial Basal		B7/8	Anteromedial
B8	Anterior Basal		B9	Lateral basal
B9	Lateral Basal		B10	Posterior basal
B10	Posterior Basal			

APPENDIX H: **Lymph Node Stations**



Mediastinal Lymph Nodes	1, 2, 4, 5, 7, 8, 9
Hilar Lymph Nodes	10, 11, 12

Note that Mediastinal Lymph Nodes are single digit and hilar nodes are double digit.

APPENDIX I: Bronchoscopy Pharmacology

Medication	Indication	Onset of Action	Duration of Effect	Half-life	Maximal Dosage	Medical Contraindications	Method of Reversal
Lidocaine							
Meperidine							
Fentanyl							
Morphine							
Midazolam							
Diprivan							
Diphenhydramine							

APPENDIX J: **ASA Physical Classification System**

Physical Status	Description
1	Normal, healthy patient
2	Mild systemic disease without functional limitation
3	Severe systemic disease with functional limitation
4	Life-threatening severe systemic disease
5	Moribund, not expected to survive operation
6	Brain-dead organ donor
E	Emergency operation (this designation is added to the appropriate physical status numerical score, i.e. 2, 3, etc.)

APPENDIX K: **Mallampati Airway Classification**

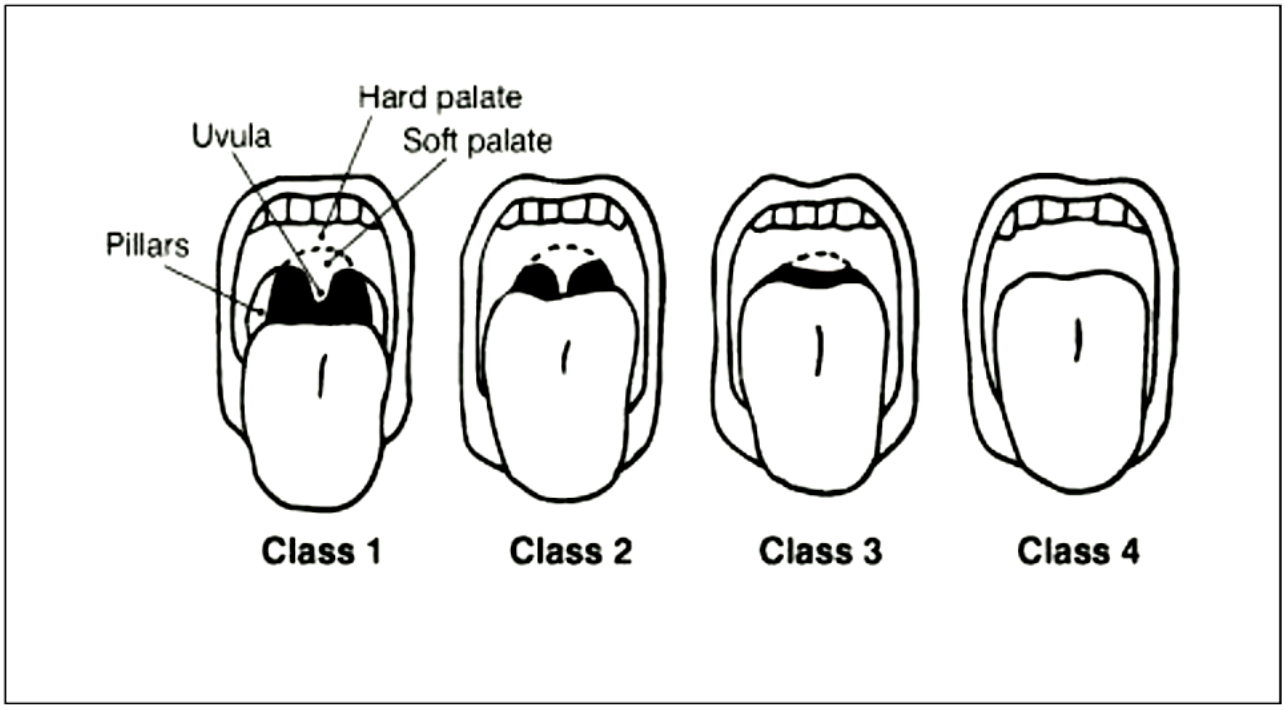


Figure 1. The Mallampati score:

Class 1. Complete visualization of the soft palate
Class 2. Complete visualization of the uvula
Class 3. Visualization of only the base of the uvula
Class 4. Soft palate is not visible at all

APPENDIX L: **Bronchoscope Specifications**

OLYMPUS BRONCHOSCOPES AND ULTRASOUND

(OD=outer diameter; ID=working channel diameter)

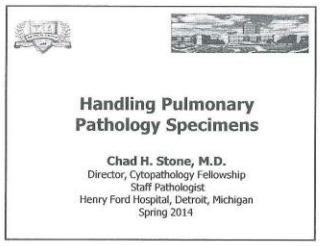
	Insertion tube OD (mm)	Distal end OD (mm)	Channel ID (mm)	Bending (up/down)	Comments
Mobile bronchoscopes					
MAF-TM	5.2	5.1	2.6	180°/130°	–
MAF-GM	4.1	3.9	1.5	120°/120°	–
Video bronchoscopes					
BF-Q180-AC	5.3	5.5	2.0	180°/130°	NBI with EXERA II
BF-Q180	5.1	5.5	2.0	180°/130°	NBI with EXERA II
BF-P180	4.9	4.9	2.0	180°/130°	NBI with EXERA II
BF-1T180	6.0	6.0	3.0	180°/130°	NBI with EXERA II
BF-1TQ180	6.3	6.2	2.8	180°/130°	NBI with EXERA II
BF-XT160	6.3	6.2	3.2	180°/130°	–
BF-3C160	3.8	3.8	1.2	180°/130°	–
BF-MP160F	4.4	4.0	2.0	180°/130°	–
BF-XP160F	2.8	2.8	1.2	180°/130°	–
BF-260	4.9	4.9	2.0	180°/130°	NBI with LUCERA SPECTRUM
BF-1T260	6.0	5.9	2.8	180°/130°	NBI with LUCERA SPECTRUM
BF-F260	5.4	5.5	2.0	180°/130°	AFI with LUCERA SPECTRUM
Video pleuroscope (medical thoracoscopy)					
LTF-160	7.0	7.0	2.8	160°/130°	–

	Insertion tube OD (mm)	Channel ID (mm)	Bending (up/down)	Bending (left/right)	Working length (mm)
Ultrasonic endoscopes for EBUS-TBNA					
BF-UC180F	6.3	2.2	120°/190°	–	600

	Frequency (MHz)	Working length (mm)	OD (mm)	Min. working channel Ø
Ultrasonic probes for EBUS				
UM-S20-17S	20	2150	max. 1.8	2.0
UM-S20-20R	20	2050	max. 2.0	2.2
UM-S30-20R	30	2050	max. 2.0	2.2
UM-BS20-26R	20	2025	max. 2.6	2.8

APPENDIX M: **Pathologic and Cytologic Specimen Handling**

Talk is from presentation of Dr. Stone to EBUS-TBNA and Advanced Diagnostic Bronchoscopy Course



Handling Pulmonary Pathology Specimens

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Spring 2014

Goals in Specimen Handling

- Maximize diagnostic yield
- Minimize "background noise"

Diagnostic Yield Determinants

- Patient characteristics
- Lesion characteristics
- **Sample type(s)**
- **Sample size**
- **Specimen handling/ processing**

Background Noise

- Lack of relevant clinical history/ clinical impression
- Poor specimen
- Poor specimen handling
- Poor specimen labeling

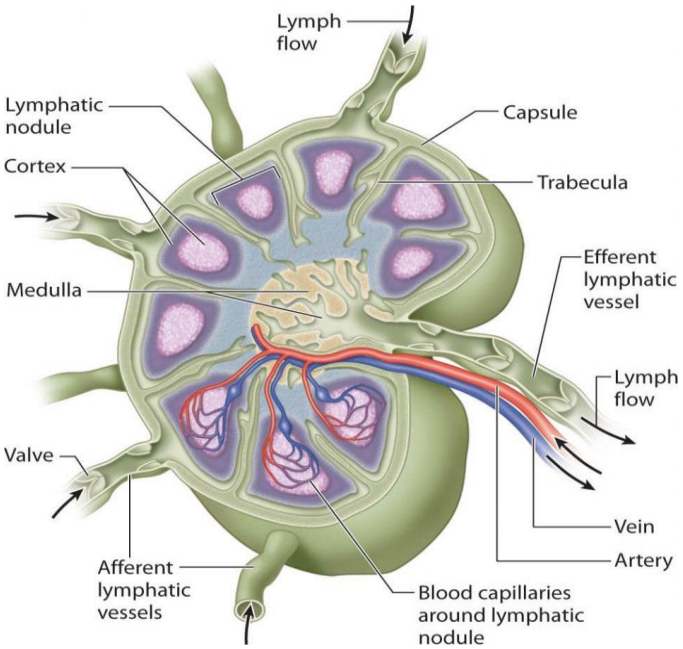
Specimen Handling

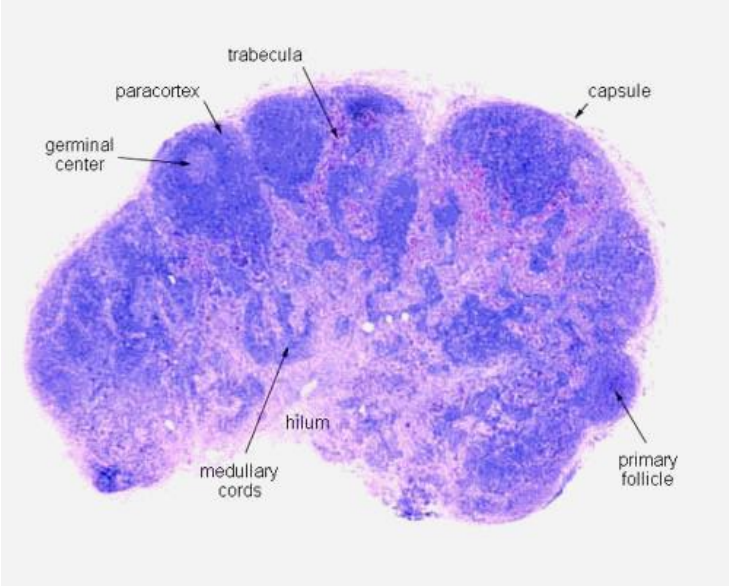
- Dependent upon
  - Clinical Question
  - Specimen Type

Specimen Handling

- Clinical Question
  - **Cancer?**
    - **If cancer, type?**
      - **Biomarker testing?**
  - **Infection?**
  - **Non-neoplastic "medical lung"?**
- Defines specimen type, specimen handling, etc...

APPENDIX N: **Lymph Nodes, in "A Textbook of Histology"**





https://link.springer.com/referenceworkentry/10.1007%2F978-3-319-95309-0_3860

APPENDIX O: **8th Edition Staging**

	N0	N1	N2	N3
T1	IA	IIB	IIIA	IIIB
T2a	IB	IIB	IIIA	IIIB
T2b	IIA	IIB	IIIA	IIIB
T3	IIB	IIIA	IIIB	IIIC
T4	IIIA	IIIA	IIIB	IIIC
M1a	IVA	IVA	IVA	IVA
M1b	IVA	IVA	IVA	IVA
M1c	IVB	IVB	IVB	IVB

APPENDIX P: **8th Edition TNM**

TNM 8th - Primary tumor characteristics	
T_x	Tumor in sputum/bronchial washings but not be assessed in imaging or bronchoscopy
T_0	No evidence of tumor
T_{is}	Carcinoma in situ
T_1	≤ 3 cm surrounded by lung/visceral pleura, not involving main bronchus
$T_{1a(mi)}$	Minimally invasive carcinoma
T_{1a}	≤ 1 cm
T_{1b}	> 1 to ≤ 2 cm
T_{1c}	> 2 to ≤ 3 cm
T_2	> 3 to ≤ 5 cm *or* involvement of main bronchus without carina, regardless of distance from carina or invasion visceral pleural *or* atelectasis or post obstructive pneumonitis extending to hilum
T_{2a}	>3 to ≤4cm
T_{2b}	>4 to ≤5cm
T_3	>5 to ≤7cm in greatest dimension *or* tumor of any size that involves chest wall, pericardium, phrenic nerve *or* satellite nodules in the same lobe
T_4	> 7cm in greatest dimension *or* any tumor with invasion of mediastinum, diaphragm, heart, great vessels, recurrent laryngeal nerve, carina, trachea, oesophagus, spine *or* separate tumor in different lobe of ipsilateral lung
N_1	Ipsilateral peribronchial and/or hilar nodes and intrapulmonary nodes
2	Ipsilateral mediastinal and/or subcarinal nodes
3	Contralateral mediastinal or hilar; ipsilateral/contralateral scalene/ supraclavicular
M_1	Distant metastasis
M_{1a}	Tumor in contralateral lung or pleural/pericardial nodule/malignant effusion
M_{1b}	Single extrathoracic metastasis, including single non-regional lymphnode
M_{1c}	Multiple extrathoracic metastases in one or more organs

APPENDIX Q: **Bronchoscopy Billing**

Go to CHEST Physician page for article “Bronchoscopy coding and billing tips”

Bronchoscopy coding and billing tips. HCV+ donors. Women and COPD. Treating penetrating trauma | CHEST Physician (mdedge.com)

APPENDIX R: **Bronchoscopy Skills and Task Assessment Tool**

Fellow: _____ PGY: 4 5 6

Faculty: _____ Date: _____

Educational Item* Items 1-10 each scored separately	**Satisfactory Yes/No**
1. Identification of Right sided anatomy (2 points each, target 20 points) □ RB1 apical □ RB2 posterior □ RB3 anterior □ RB4 medial □ RB5 lateral □ RB6 superior □ RB7 medial basal □ RB8 anterior basal □ RB9 lateral basal □ RB10 posterior basal	Yes / No Score ____/20
2. Identification of Left sided anatomy (2 points each, target 16 points) □ LB1+2 apical/posterior □ LB3 anterior □ LB4 superior □ LB5 inferior □ LB6 superior □ LB8 anterior basal □ LB9 lateral basal □ LB10 posterior basal	Yes / No Score ____/16
3. Identify and enter RB 4+5+6 on demand (All three segments must be entered to earn 5 points, no partial points given, target 5 points) □ RB 4+5+6	Yes / No Score ____/5
4. Identify and enter LB 8+9+10 on demand (All three segments must be entered to earn 5 points, no partial points given, target 5 points) □ LB 8+9+10	Yes / No Score ____/5
5. Posture/Hand positions/Equipment safety (3 points each, target 9 points) □ Body posture □ Hand positions □ Equipment handling	Yes / No Score ____/9
6. Scope centered and kept in midline (5 points, no partial points given) □ Scope centered in airway lumen	Yes / No Score ____/5
7. Airway wall trauma avoided (5 points, no partial points given) □ Airway wall trauma avoided	Yes / No Score ____/5
8. Procedures performed: □ Airway Examination □ BAL □ Brushing □ EBBX □ TBBx □ TBNA	
9. Overall performance of procedures performed. **Procedures fellow needs further instruction: □ Airway Examination □ BAL □ Brushing □ EBBX □ TBBx □ TBNA**	Yes / No Score ____/20
10. Demonstrate appropriate screening for a pneumothorax using fluoroscopy after a transbronchial biopsy.	Yes / No Score ____/5

Final Score: _____/90
Faculty Comments:

APPENDIX S: **Bronchoscopy Self Assessment Tool**

Please answer each question by writing the number that most closely represents your experience with your bronchoscopy education to date:

1	2	3	4	5
Not Comfortable		Comfortable		Very Comfortable

1. I am able to identify airway anatomy _____
2. I am able to identify airway mucosal abnormalities _____
3. I am able to describe secretions and other airway abnormalities _____
4. I am able to maneuver the flexible bronchoscope _____
5. I am able to do a BAL through the flexible bronchoscope _____
6. I am able to use a brush through the flexible bronchoscope _____
7. I am able to use biopsy forceps through the scope _____
8. I would now feel comfortable performing this case in a patient _____

I feel I would benefit from more instruction in:

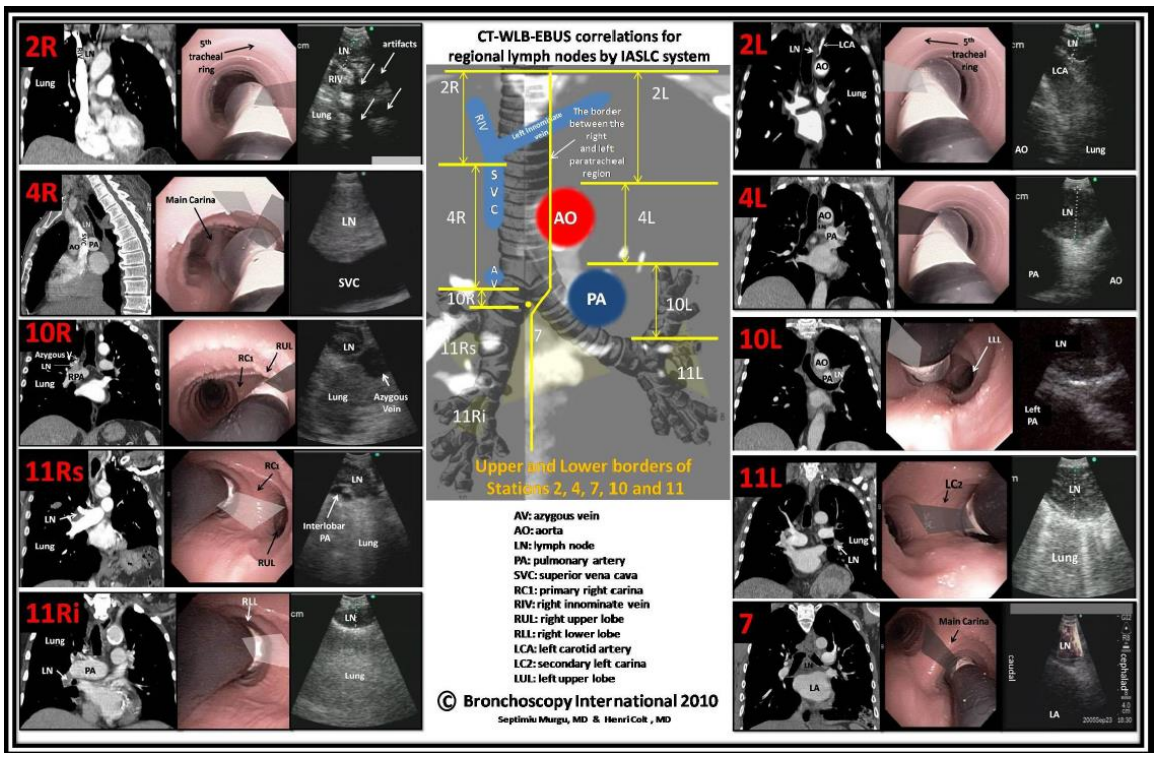
_____ Anatomy
_____ Airway abnormalities
_____ Technique
_____ Interpretation of findings

1	2	3	4	5
Poor	Below Average	Average	Good	Excellent

Using the above scale please rate the training received as it represents the requirements assigned. _____

Comments:

APPENDIX T: **EBUS Anatomy**



From:

Murgu S, Colt H. Computed Tomography-White Light Bronchoscopy-EBUS correlations for regional lymph nodes by IASLC system. In: Bronchoscopy International 2010. Accesed at: www. Bronchoscopy.org

APPENDIX U: EBUS-TBNA SKILLS AND ASSESSMENT TOOL

EBUS SKILLS AND TASKS 10 Point ASSESSMENT TOOL

Student: _____ PGY 4 PGY 5 PGY 6

Faculty _____ Date _____

Educational Item* Items 1-10 each scored separately	**Satisfactory Yes/No**
1. Able to maneuver the scope through upper airway into trachea, without trauma or difficulty (5 points for single item tested) ☐ Nares or mouth and Vocal cords ☐ ET Tube ☐ Laryngeal mask airway	Yes / No Score ____/5
2. Able to maneuver scope using white light bronchoscopy within tracheobronchial tree without trauma (4 points, no partial points) ☐ Scope centered in airway lumen avoiding airway wall trauma	Yes / No Score ____/4
3. Ultrasound image obtained without artifacts (5 points, no partial points) ☐ Absence of artifacts on image, any target	Yes / No Score ____/5
4. Identify major mediastinal vascular structures (4 points per item) ☐ Aorta ☐ Pulmonary artery ☐ Superior vena cava ☐ Azygos vein ☐ Left atrium	Yes / No Score ____/20
5. Identify lymph node station (Select 3 targets, 5 points each) ☐ 2R ☐ 2L ☐ 4R ☐ 4L ☐ 7 ☐ 10R ☐ 10L ☐ 11R ☐ 11L	Yes / No Score ____/15
6. Able to operate EBUS processor (2 points each item) ☐ Gain ☐ Depth ☐ Doppler	Yes / No Score ____/6
7. Performance of EBUS-TBNA (1 point each, target 15 points) ☐ Advance needle through working channel (neutral position) ☐ Secure needle housing by sliding the flange ☐ Release sheath screw ☐ Advance and lock sheath when it touches wall ☐ Release needle screw ☐ Advance needle using jab technique ☐ Visualize needle entering target node ☐ Move stylet in and out a few times ☐ Remove stylet ☐ Attach syringe ☐ Apply suction ☐ Pass needle in and out of node 10-15 times ☐ Release suction ☐ Retract needle into sheath ☐ Unlock and remove needle and sheath	Yes / No Score ____/15
8. Image analysis: CT scans (1 point each, target 10 points) ☐ Image 1 ☐ Image 2 ☐ Image 3 ☐ Image 4 ☐ Image 5 ☐ Image 6 ☐ Image 7 ☐ Image 8 ☐ Image 9 ☐ Image 10	Yes / No Score ____/10
9. Image analysis: EBUS views (1 point each, target 10 points) ☐ Image 1 ☐ Image 2 ☐ Image 3 ☐ Image 4 ☐ Image 5 ☐ Image 6 ☐ Image 7 ☐ Image 8 ☐ Image 9 ☐ Image 10	Yes / No Score ____/10
10. Decision-making tasks: (2 points each, target 10 points) ☐ Image 1 ☐ Image 2 ☐ Image 3 ☐ Image 4 ☐ Image 5	Yes / No Score ____/10

* The combined use of the 10 items pertains to technical skills needed to climb learning curve from novice to advanced beginner to intermediate to competent bronchoscopist able to perform EBUS-TBNA independently.

FINAL GRADE PASS FAIL **SCORE** _____/100