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CHEST Commentary

An Approach to Interventional Pulmonary Fellowship Training

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Interventional pulmonology continues to be a specialty that is experiencing an evolution of new technologies, with an emphasis on multidisciplinary care. The diversity and application of these procedures in patients with more complex conditions is leading to the need for more specific recommendations in training within this area. As patient safety and outcomes-based measures of clinical practice and procedures are in the forefront, the need for standardization in procedural training in high-volume centers of excellence beyond pulmonary and critical care fellowships must be considered. Other procedure-based specialties have developed such training programs, with structured curricula to enhance patient safety and outcomes, develop validated metrics for competency assessment of trainees, improve trainee education, and further advance the field by fostering research. ***CHEST 2010; 137(1):195–199***

Abbreviations: ACGME = American Council for Graduate Medical Education; ATS = American Thoracic Society; ERS = European Respiratory Society; IP = interventional pulmonology; TBNA = transbronchial needle aspiration.

Interventional pulmonology (IP) has been an evolving specialty for over 20 years. It has experienced an evolution of new technologies and an emphasis on multidisciplinary care. Guidelines have been published to better establish the procedures included in this arena as well as to suggest a minimum threshold number of procedures performed to demonstrate a level of competence, as outlined in Table 1.[1,2] The purpose of this paper is to establish the basis for structured training in the field of IP. Proposing specific recommendations for developing uniform IP fellowship programs includes clarifying the expectations of the necessary skills and knowledge base that a trainee should accomplish during the training period. These dedicated IP programs would involve 1 year of additional training, either distinct from standard pulmonary and critical care training or within a structure that would allow successful acquisition of the content set forth in this commentary. We do not intend to exclude select procedures from being performed by other properly trained pulmonologists or specialists from other disciplines.

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There remains a wide variation in the procedural skill sets currently offered during fellowships in pulmonary and critical care medicine, with only 30% of pulmonary programs meeting the proposed number-based requirements for "interventional" thoracic procedures.[1-3] Though competency is not solely defined by the number of procedures performed,

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Table 1—*Procedure-Specific Threshold Numbers for Initial Competency*

Procedures	ACCP	ERS/ATS[a]
Advanced bronchoscopy (diagnostic and therapeutic)		
Rigid bronchoscopy	20	. . .
Autofluorescence bronchoscopy	20	10
Endobronchial ultrasound-guided TBNA (radial and convex probe)[b]	50	40
Endoluminal therapies		
Laser	15	20
Electrocautery	15	10
Argon plasma coagulation	15	10
Cryotherapy	10	. . .
Brachytherapy	5	. . .
Photodynamic therapy	10	. . .
Airway stents silicone, (silastic/metallic/dynamic Y/hybrid)	20	10
Balloon tracheobronchoplasty	5	. . .
Procedures for pleural disease		
Thoracic ultrasound	10	. . .
Thoracentesis	10	. . .
Thoracic percutaneous needle/core biopsy	10 each	. . .
Tube thoracoscopy/pleural catheter, nontunneled	10	. . .
Tunneled pleural catheter	15	. . .
Percutaneous pleural biopsy	5	. . .
Medical thoracoscopy with or without pleural biopsy	20	. . .
Other		
Percutaneous dilational tracheotomy	20	5-10
Transtracheal oxygen catheter	10	5

Number achievement alone does not establish competency. Endoluminal therapies may be combined to achieve the recommended number. The list is representative and not all-inclusive. Programs may offer additional procedures. ACCP = American College of Chest Physicians; ATS = American Thoracic Society; ERS = European Respiratory Society; TBNA = transbronchial needle aspiration.

[a]Numbers are listed if they are different from the ACCP guidelines.

[b]ACCP recommendation for radial endobronchial ultrasound (EBUS); ERS/ATS recommendation for combined radial/linear EBUS.[1-2]

there are data from other specialties that directly relate outcome with procedural volume.[4-7]

The disciplines of interventional cardiology and electrophysiology are examples in which the American Board of Internal Medicine has acknowledged that special skill sets exist and demand a full year of formal subspecialized training.[8] During this year, a minimum number of therapeutic interventional procedures must be performed. As "performance of the required minimum number of procedures is not a guarantee of proficiency," the standard requirements of achieving competence in patient care, medical knowledge, interpersonal skills, communication skills, professionalism, and practice-based/systems-based learning are also required.[8] The Society of American Gastrointestinal and Endoscopic Surgeons has also developed guidelines for training in diagnostic and therapeutic endoscopic retrograde cholangiopancreatography.[9] These guidelines state that "short courses . . . do not constitute sufficient training" as they do not fully encompass the procedural volume and the range of cognitive clinical skills required to achieve competence.[10] The American Society for Gastrointestinal Endoscopy acknowledges that "more complex diagnostic and therapeutic procedures are used less frequently than standardized procedures . . . [and] their successful performance requires fewer endoscopists with more skill and experience gathered during a longer training period . . . often for one year after a standard fellowship."[11,12] They also state that "not all trainees should pursue such advanced training nor should all programs offer advanced training . . . such training should be concentrated in those programs that have a combination of both patient volume and faculty expertise."[11]

The recommendations by the above societies serve to elevate their respective disciplines by increasing the standard of care provided to patients, improving patient outcomes, advancing the field by fostering research, and improving trainee education. Training in IP should also provide sufficient experience in the evaluation and treatment of patients with complex airway disease and thoracic and pleural disease. Mastery of psychomotor and cognitive skills is fundamental in procedural training. The ability to anticipate, avoid, and manage associated complications is also necessary. It is optimal to obtain dedicated and formal training over the course of a year at a high-volume, comprehensive interventional pulmonary program offering didactic and hands-on training with ongoing research in the field.

Principles and Objectives of Training in IP

Training in IP builds on the fundamentals mastered during standard training in a pulmonary and critical care fellowship program. It is necessary for trainees beginning an IP fellowship to have met the prerequisite threshold numbers required by the American Council for Graduate Medical Education (ACGME) for the standard pulmonary and critical care fellow in the following procedures: thoracentesis, chest tube placement, intubation with laryngoscopy, flexible bronchoscopy with bronchoalveolar lavage, bronchial brushing, endobronchial and transbronchial biopsy, and transbronchial needle aspiration.

With completion of training in IP, the trainee should be able to:

1. Evaluate and manage patients with complex airways and thoracic and pleural disease.
2. Recommend the most appropriate diagnostic and/or therapeutic procedure based on an

understanding of accepted indications, contraindications, and additional diagnostic and therapeutic alternatives in the context of safety and timeliness.
3. Demonstrate the ability to obtain an accurate and thorough preprocedure patient assessment, including the identification of specific risk factors for each procedure.
4. Demonstrate the ability to minimize and manage anticipated and unanticipated complications.
5. Accurately identify, describe, and communicate pertinent procedural findings.
6. Recognize one's own limitations and the limitations of a particular specialty or institution, and appropriately refer patients to providers who have the required equipment and skill set.
7. Demonstrate personal skills in obtaining informed consent, advanced directives, medical ethics, and communication to patients, families, and referring physicians.
8. Develop an understanding of the required equipment, including maintenance and technical troubleshooting.
9. Continue to contribute to and critically evaluate the scientific literature, specifically participating in research regarding new technologies or techniques specific to IP.
10. Demonstrate the responsible use of resources for diagnostic testing and therapeutic interventions.
11. Obtain the necessary skills to develop and direct a sustainable interventional pulmonary program.
12. Maintain and review outcomes and compare them with benchmarks to maintain the highest possible quality of care.
13. Complete training in two primary advanced diagnostic techniques, to include endobronchial ultrasound, and reach threshold numbers with appropriate supervision.
14. Complete training in a minimum of two ablative techniques for therapeutic management of the airway.
15. Complete comprehensive training in the use of both silicone and metallic airway stents, including stent placement, removal, and management of complications.

Structure of IP Training Programs

Training in IP should occur within the context of a defined training program. This can occur in conjunction with an existing ACGME-accredited pulmonary and critical care program or in an independent program directed by those who have formal IP training. Given the multidisciplinary nature of IP, it is essential that the institutions have departments of internal medicine (and its specialties), radiology/interventional radiology, pathology, thoracic surgery, otolaryngology, radiation oncology, and medical oncology.

Responsibilities of the Interventional Pulmonary Training Program Director and Educators

Each training program should have an expert interventional pulmonologist who is designated as the training program director, with the following responsibilities:

1. Provide a structured, multidisciplinary didactic curriculum;
2. Provide hands-on teaching, including simulation training when applicable, with appropriate mentoring and supervision;
3. Monitor and record, on a regular schedule, the trainee's acquisition of appropriate technical and cognitive skills;
4. Review the trainee's procedural log documenting all procedures, including indications, complications, and outcomes of intervention, according to established performance standards;
5. Periodically review and update the program's training methodology and quality of training based upon peer-reviewed/medical society guidelines;
6. Conduct semiannual reviews in a 360° fashion, with both the trainee and the program faculty giving and receiving formal feedback; and
7. Document active research and demonstrate continuing medical education in IP.

Curriculum and Advanced Procedures

The suggested IP curriculum (Table 2) and the advanced procedures in which competency should be achieved during a fellowship in IP include, but are not limited to, those procedures listed in Table 3. A dedicated year of additional fellowship training is recommended. Alternatively, another training option in which these competencies in IP curriculum are achieved within the standard timeline and curricular framework of a pulmonary and critical care fellowship is feasible. Mastery of these skill sets is an ongoing process in practice, extending beyond the IP fellowship.

Training in these advanced procedures should only be pursued if there is a realistic expectation that the trainee will achieve sufficient proficiency in the given procedures to perform them without supervision at the completion of training and maintain the skill set thereafter. Brief exposures to these advanced procedures during most standard pulmonary and critical care fellowship programs or training courses are not adequate to achieve competency. It is important that

Table 2—*Disease-Specific Knowledge Base Requirements*

Basic Principles
Physiology as applied to:
Large airway obstruction (malignant and benign, asthma, COPD)
Pleural disease
Jet ventilation
Anesthesia, sedation, and analgesia
Comprehensive evaluation and management of patients with:
Thoracic malignancies
Lung cancer (including early detection/screening and staging)
Other intrathoracic malignancies
Intrathoracic manifestations of malignancy
Pleural diseases
Parapneumonic effusion and empyema
Malignant pleural effusions
Malignant mesothelioma
Recurrent nonmalignant pleural effusions
Pneumothorax
Pleural fistulas
Complex airway disorders
Malignant central airway obstruction
Nonmalignant central airway obstruction due to:
Tracheal stenosis
Tracheobronchomalacia
Amyloidosis
Relapsing polychondritis
Sarcoidosis
Wegener's granulomatosis
Iatrogenic complications
Esophageal and airway fistulas
Surgical interventions
Mediastinoscopy
Thoracotomy and lung resection
Thoracoscopy and video-assisted thoracoscopy
Surgical management of empyema
Lung volume reduction surgery
Lung transplantation
Laryngeal/tracheal resection and reconstruction
Tracheoplasty
Suspension laryngoscopy
Open surgical tracheotomy
Other
Hemoptysis
Foreign body removal
Pulmonary alveolar proteinosis
Endoscopic therapeutic approaches to COPD and asthma
Image-guided or computer-guided diagnostic and therapeutic bronchoscopy

Requirements assume disease-specific knowledge of standard pulmonary and critical care training as a baseline to subsequent procedural components to this knowledge. The list is representative and not all-inclusive.

Table 3—*Advanced Procedures*

Procedures
Procedures for pleural disease
Thoracic ultrasound to assess and guide interventions in the pleural space
Medical thoracoscopy with parietal pleural biopsy and pleurodesis
Pleural catheter placement (chest tube, small bore catheter, and implantable tunneled catheters
Percutaneous pleural biopsy
Diagnostic bronchoscopy
Endobronchial ultrasound
Radial and convex probe (for evaluation of parenchymal opacities, of airway invasion vs compression, and to guide biopsy)
Electromagnetic navigational bronchoscopy
Autofluorescence bronchoscopy and narrow-band imaging
Therapeutic bronchoscopy
Foreign body retrieval with a variety of available tools
Rigid bronchoscopy
Endoluminal therapies
Thermal ablation techniques including:
Electrocautery
Argon plasma coagulation
Laser
Photodynamic therapy
Endobronchial brachytherapy
Cryotherapy
Balloon tracheoplasty/bronchoplasty
Tracheobronchial stenting
Silicone/silastic, metallic, hybrid, and dynamic Y stents
Other:
Transtracheal oxygen catheter placement and maintenance
Transthoracic needle aspiration/biopsy
Percutaneous dilational tracheotomy

designated training programs offer independently, or in collaboration with other disciplines in their respective institutions or with other interventional pulmonary training programs, the full complement of technologies and clinical applications. Such programs should have the flexibility and academic interest to integrate new technologies as they develop and become standards of care and to discard obsolescent technologies.

Ongoing Competence, Credentialing, and Certification

As the ACGME does not presently accredit or certify programs in IP, procedural competence and certification of completion of a dedicated IP fellowship will be provided by the training program director. Credentialing to perform procedures independently after training is determined by the respective institution's credentialing committee. Presently, there are no set standards for monitoring long-term procedural competency, although there are published guidelines recommended by experts regarding threshold numbers required to maintain specific skill sets.[1,2]

Conclusion

The increasing acuity of patients and complexity of procedures requires standardized training to achieve optimal outcomes. Establishing high-volume training programs at centers of excellence with recognized experts in the field and ongoing research will enhance patient safety and quality of care. Training standards will also establish accountability parameters for the individual physician.

It is now well established that other specialties requiring advanced technical expertise through additional training improve patient outcomes by reducing procedure-related complications.[4-7,9,10] Our primary goal is to provide a recommendation toward more standardized IP training. Performance and competence metrics along with procedures and standards need to be implemented. We have delineated a representative set of procedures, realizing that once trained, the trainee's practice will direct the specifics of the procedural complement after training. In order to provide the necessary range of patients, procedures, didactic teaching, and research, a dedicated formal year of training beyond the standard pulmonary and critical care fellowship is optimal. While it may be possible to accomplish training in select procedures during a 3-year standard pulmonary and critical care fellowship, the scope and depth of training in the full range of interventional procedures may be difficult. It is crucial that designated IP training programs provide the complete spectrum of recommended training independently or in close collaboration with other recognized national or international IP programs. We are not seeking to restrict those who have acquired training to perform specific pulmonary procedures, but to better define the procedures that should be provided by IP training programs. Future goals include the development of a standardized curriculum, the use of procedural simulation, the determination of validated assessment metrics, and defining a more specific path to certification in the field. Dedicated programs with structured training are essential as we continue to work toward improved patient safety, education of trainees, and further research and technology in the specialty now known as IP.[13]

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