Pulmonary Medicine Institute Rotation
Rotation Goals and Objectives
Pulmonary/Critical Care Medicine Fellowship Program
University of Nebraska Medical Center
Revised: June 2012

I) Rotation Goals

A) To evaluate, diagnose and manage patients with a variety of pulmonary illnesses.
B) To assume direct patient care responsibilities for patients with severe pulmonary diseases.
C) To acquire procedural skills required by a Pulmonary Disease specialist.
D) To develop facility with selecting appropriate billing codes used by the Pulmonary Disease specialist.
E) To begin to acquire skill in management of an office practice.

II) Core Competencies for this rotation

A) Patient Care

1) Demonstrate an ability to obtain a comprehensive and accurate history of present illness for a variety of pulmonary disease presentations.
2) Identify common historical elements for all patients presenting with pulmonary disease including smoking history, occupational history, sleep history, environmental triggers for respiratory symptoms and family history.
3) Demonstrate physical examination skills, specific to the respiratory system including examination of the upper airway, neck, chest, abdomen and extremities.
4) Demonstrate the ability to interpret complete pulmonary function testing including spirometry before and after bronchodilator therapy, lung volumes, diffusing capacity and exercise oximetry.
5) Order and interpret radiographic tests related to pulmonary diseases including chest roentgenograms, computed axial tomography scans, ventilation/perfusion studies and pulmonary angiograms to provide a therapeutic plan for the patient.
6) Apply the skills listed above to provide a clear, concise and legible consultation note and/or dictation, which directly answers the question asked by the primary care provider.
7) Demonstrate an ability to perform bronchoscopy, bronchoalveolar lavage and various bronchoscopic biopsy techniques.
8) Demonstrate an ability to interpret cardiopulmonary exercise tests, indirect calorimetry studies, six-minute walk distance and methacholine challenge tests in addition to other specialized tests, which may be performed in the pulmonary function laboratory.
9) Learn the indications and contraindications for insertion of various chest tubes for removal of fluid and/or air.
10) Demonstrate effective communication through the informed consent process for minor procedures.
11) Demonstrate caring and respectful behaviors when interacting with patients.
12) Gather essential and accurate information from patients.
13) Make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence and clinical judgment.
14) Develop and carry out patient management plans in association with the supervising physician.
15) Counsel and educate patients and their families.
16) Use information technology to support patient care decisions and patient education.
17) Demonstrate competency in all medical and invasive procedures performed on this rotation
18) Demonstrate an ability to work with a variety of health care professionals to provide patient-focused care
19) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Optional Mini-CEX (to be arranged with attending)

B) Medical Knowledge

1) Demonstrate an ability to interject a discussion of recent readings relevant to patients seen in clinic or during rounds.
2) Develop familiarity with seminal literature covering topics in pulmonary medicine, especially those extant in patients on the PMI service.
3) Read appropriate chapters in a Pulmonary Medicine text or electronic resource
4) Read the suggested material listed at the end of this document.
5) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Chart-stimulated recall sessions

C) Practice-based Learning and Improvement

1) Select appropriate billing codes for all evaluation and management or procedures.
2) Explain the process by which a new referral is scheduled, a new record is generated, the tracing of patient flow from check-in to check-out and how bills are generated and submitted to insurance.
3) Demonstrate an ability to locate and apply scientific evidence to the care of patients including the use of the Cochrane Database and other online sources.
4) Demonstrate an ability to read and critically appraise at least one clinical study applicable to a patient seen on the service. This will be judged by informal interaction with the attending therefore the fellow must mention this reading to the attending.
5) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Chart-stimulated recall sessions

D) Interpersonal & Communication Skills

1) Demonstrate an ability to develop a therapeutic and ethically sound relationship with patients and their families.
2) Demonstrate an ability to use verbal and non-verbal skills to communicate effectively with patients.
3) Demonstrate effective listening skills
4) Elicit and provide information using effective nonverbal, explanatory, questioning and writing skills
5) Demonstrate an ability to work effectively as a team member and team leader within the clinic.
6) Demonstrate an ability to develop professional relationships with residents and other members of the health care team
7) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Evaluations from key consultants
   (c) Evaluations from PMI clinic nurses and the PFT Lab staff
E) Professionalism

1) Demonstrate compassion, respect, integrity and honesty.
2) Accept responsibility for direct patient care activities.
3) Always act in the best interest of the patient.
4) Demonstrate a responsiveness to the needs of patients and society that supercedes self-interest
5) Demonstrate accountability to patients, society and the profession
6) Demonstrates a commitment to excellence and on-going professional development
7) Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent and business practices
8) Demonstrate sensitivity to patient’s culture, ethnicity, age gender and disability.
9) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Evaluations from key consultants
   (c) Evaluations from PMI clinic nurses and the PFT Lab staff

F) System-based Practice

1) The fellow should understand how their patient care and other professional practices affect other health care professionals, the health care organization, and the larger society
2) Practice cost-effective health care and resource allocation that does not compromise quality of care
3) Advocate for quality patient care and assist patients in dealing with system complexities.
4) Evaluation methods for this competency
   (a) Attending evaluation
   (b) Evaluations from key consultants
   (c) Evaluations from PMI clinic nurses and the PFT Lab staff

III) Instructional Methods

A) Clinical experience

1) The PCCM fellow on this rotation spends a full calendar month with the Pulmonary Medicine Institute, providing high quality and timely care to include:
   (a) Pulmonary consultative care for outpatients of the Pulmonary Medicine Institute. The fellow will:
      (i) Evaluate and provide effective consultative care for all consult patients
      (ii) Write a daily progress note on any inpatients on the service

2) Supervision and Performance of Procedures
   (a) The fellow will be expected to perform procedures for which competency has been demonstrated. These include but are not limited to thoracentesis and arterial blood gases.
   (b) The fellow will be expected to perform procedures that are expected of a fellow-level trainee including but not limited to, bronchoscopy and chest tube placement.

B) Clinical Teaching

1) The supervising physician will be expected to discuss each clinical presentation by the fellow and provide guidance as needed on diagnosis and treatment.
2) The fellow will be expected to gather appropriate data and present in a succinct, yet complete manner.

C) Performance Feedback
   1) The supervising physician will provide verbal feedback on a regular basis, at least weekly, on what the fellow has done well and what could be improved.
   2) Fellow and supervising physician will review these goals and objectives at the beginning of the rotation
   3) Fellow and supervising physician will meet in order to provide verbal, preferably face-to-face feedback at the completion of the rotation. This verbal feedback may be given by phone but the supervising physician is required to provide a written evaluation of the fellow and attest that they have discussed this with the fellow. If the feedback was not face-to-face, the evaluation will be transmitted electronically to the fellow.

D) Didactic Sessions
   1) The fellow will attend all scheduled fellow conferences. These are held each noon Tuesday and Wednesday in the Rennard Conference Room, SwH 4009 throughout the year and during July and August on Fridays as well. Journal Club and Research Conference are held in DRC 1004 on Thursdays from September through June.
   2) Attend all Internal Medicine Conferences that do not conflict with Section Conferences. Internal Medicine Grand Rounds is held on Friday at noon in the Durham Research Center Auditorium.
   3) The fellow will provide at least one didactic session to students and residents on the service

E) Self-Learning
   1) Review literature appropriate to care of patients on the service.
   2) Fellows will be expected to read the appropriate chapters in a Pulmonary Medicine textbook of their choice. Appropriate sections of eMedicine or Up-to-Date may be substituted.
   3) Complete the reading assignments as outlined below.

IV) Responsibilities

A) All Fellows assigned to the Service
   1) These guidelines for the Pulmonary Medicine Institute rotation will be made available to each fellow and must be read prior to starting the rotation.
   2) Participate in all patient care responsibilities expected.
      (a) For each patient seen, the fellow will prepare a diagnostic and management plan and discuss this with the supervising physician.
      (b) The fellow will evaluate each patient to determine the need for specialized testing and learn the indications for involvement of the pulmonary disease specialist in the care of the patient.
         (i) Ensure that all necessary orders are written/entered.
         (ii) Ensure that the H&P and discharge summary are dictated.
         (iii) Communicate as necessary with consultants and ancillary providers of care.
   3) Provide education to any residents or students who may be assigned to the service.
   4) Complete an evaluation of the rotation and the attending.
   5) Take at-home call as scheduled.
B) First Year Fellows
   1) Will not be scheduled on this rotation

C) Second Year Fellows
   1) Will not be scheduled on this rotation

D) Third Year Fellows
   1) The fellow should be expected to:
      (a) Demonstrate a solid fund of pulmonary disease knowledge.
      (b) Exhibit sound clinical judgment in regards to pulmonary problems.
      (c) Demonstrate competency in clinic-based pulmonary procedures.

E) Supervising Physician
   1) These guidelines for the Pulmonary Medicine Institute rotation will be made available to the supervising physician(s) and any expectations by the supervising physician not specifically expressed in this document must be reviewed with the fellow at the start of the rotation.
   2) Supervise procedures performed by the fellow.
   3) Provide education to the fellow in the form of a one on one session at least one time per week.
   4) Complete a written evaluation of the fellow, review it verbally with the fellow, check the attestation box and electronically sign the form.
   5) Discuss the evaluation and management of all patients with the fellow.

F) Rotation
   1) Clinic Responsibility
      (a) Attend each assigned clinic unless excused.
      (b) Be in the clinic at the assigned start time and remain until excused by the supervising physician or by 11:45, whichever comes first, in order to attend noon conference on the days it is being held.
   2) On Call Responsibility
      (a) Be available, in house, from 8:00 am to 5:00 PM except for officially sanctioned events
      (b) Take after hours call as assigned by the Program Director. Call may be altered by mutual agreement with the supervising physician
   3) Vacation
      (a) Up to 5 working days of vacation time may be taken during this rotation but this must be approved by the supervising physician and the program director.
      (b) Emergency leave may be requested after discussion with the program director.

V) Methods of Evaluation
   A) Focused Observation and Evaluation
1) The supervising physician should give immediate feedback if necessary and a formal verbal evaluation should be given at the mid-point of the rotation to review performance and suggest improvements.

B) Clinical Performance Ratings

1) Each supervising physician must prepare a written evaluation of the fellow at the conclusion of their rotation. This evaluation will assess each of the competencies as listed in the educational objectives above.
2) The supervising physician must also provide verbal feedback at the conclusion of the rotation either in person or by phone and will sign an attestation that this verbal interaction has occurred.

C) 360 degree Assessment

1) Evaluations may be sent to health care professionals in the clinic, who interact with the fellow. These evaluations will focus on the fellow’s professionalism and interpersonal and communication skills.

D) Fellow Evaluations of Attending(s) and Rotation

1) At the conclusion of the fellow’s service period, he/she should complete an evaluation form assessing the quality of the rotation; these will be sent through New Innovations
2) He/she should complete an evaluation, available in New Innovations, of the instruction undertaken by the supervising physician(s) during the rotation.

VI) Readings will be provided periodically on the following topics:

A) This list is available on the ATS Reading List at the following link:
   http://www.thoracic.org/education/career-development/residents/ats-reading-list/index.php

B) PFTs

1) Clinics in Chest Medicine, volume 22, number 4, December 2001 contains reviews on the measurement and interpretation of the entire spectrum of pulmonary function testing. A particular strength is the discussion of how the pathophysiologic changes associated with various disease states are reflected in studies of pulmonary function.


C) Exercise studies and Indirect Calorimetry

1) Weisman IM, Zeballos RJ. Clinical exercise testing. Clin Chest Med 2001;22:679-701. The focus is on cardiopulmonary exercise testing, but this review also briefly summarizes the 6-minute walk, testing for exercise-induced bronchoconstriction, and cardiac stress testing. An excellent starting point for the novice.
2) ATS/ACCP Statement on cardiopulmonary exercise testing. Am J Respir Crit Care Med 2003; 167:211-77. Somewhere between a textbook and a clinical review, this article provides more details on CPET than the above Weisman article.


D) Asthma
   1) See ATS Reading list on Subspecialty Clinic Goals and Objectives

E) COPD
   1) See ATS Reading list on VA Pulm Consult Goals and Objectives

F) Chronic Cough

G) Pleural Effusions

   2) Light RW, Girard WM, Jenkinson SG, et al. Parapneumonic effusions. Amer J Med 1980;69:507-12. The notion that a parapneumonic effusion with pH less than 7.0 or glucose < 40mg/dl is "complicated" and requires drainage is derived from this study. Study included a total of 10 patients (7 with + cultures, 3 with pus). 6 of 10 met the pH criteria and 7 of 9 met the glucose criteria.

   3) Berger HA, Morganroth ML. Immediate drainage is not required for all patients with complicated parapneumonic effusions. Chest 1990; 97:731-5. Oft-cited retrospective study found 13 of 16 patients with complicated effusions (defined as pH < 7.2 or positive GS or positive culture, but without pus present) had resolution of effusions with antibiotics alone.

   4) Maskell NA, Davies CW, Nunn AJ et al. UK controlled trial of intrapleural streptokinase for pleural infection. New Engl J Med 2005;352:865-74. This study of 454 patients randomly assigned to streptokinase or placebo is noteworthy for contradicting previous small studies supporting the use of lytics in complicated parapneumonic effusion. The study found no difference in mortality, need for surgery, radiographic outcome, or length of hospital stay.
5) Wait MA, Sharma S, Hohn J, Dal Nogare A. A randomized trial of empyema therapy. Chest 1997;111:1548-51. Only randomized trial comparing immediate VATS to tube thoracostomy plus 3 days of daily SK (only 20 patients total). The surgical group had better primary treatment success and earlier hospital discharge, but outcomes of patients randomized to chest tube/lytics was much worse than other reported series, suggesting suboptimal management of those patients. All medical failures were salvageable with VATS.

6) Davies CWH, Kearney SE, Gleeson FV, Davies RJO. Predictors of outcome and long-term survival in patients with pleural infection. Am J Respir Crit Care Med 1999; 160:1682-7. In the absence of frank empyema, tube thoracostomy plus lytics had a PPV of 93% for successful treatment (i.e. no need for surgery). The presence of pus had a PPV for failure of medical management of 26%. Fluid characteristics, effusion size, and degree of pleural thickening were not predictive of medical failure. Study didn't consider presence of loculations or assess long-term outcomes.

7) Ashbaugh DG. Empyema thoracis. Factors influencing morbidity and mortality. Chest 1991;99:1162-5. Study of 122 consecutive patients looked at the morbidity and mortality of delaying treatment of empyema. Waiting more than 3 days to place a chest tube, and more than 14 days to proceed to surgical drainage when chest tubes fail, was associated with increased morbidity and mortality.

H) Preoperative Evaluation


2) Pollock M, Roa J, Benditt JO, et al. Estimation of ventilatory reserve by stair climbing: a study in patients with chronic airflow obstruction. Chest 1993;104:1378-83. Study found linear increases in VO2 and Ve with stair climbing. In order to reach a VO2 of 20ml/kg/min, subjects had to walk 4.6 flights of stairs, suggesting the tradition of walking patients up one or two flights is an inadequate stress to predict tolerance of surgery.

3) Thoren L. Post-operative pulmonary complication: observations on their prevention by means of physiotherapy. Acta Chir Scand 1954;193-205. Pioneering study on the prevention of post-op pulmonary complications found initiation of chest PT prior to surgery was superior to exclusively post-operative therapy, which in turn was better than no therapy.

severe hypoxemia after major elective abdominal surgery. Patients received oxygen vs. oxygen plus CPAP. Use of CPAP resulted in lower intubation rates, lower risk of pneumonia and sepsis, and shortened ICU stays.


I) Pulmonary Embolism

1) Diagnosis without use of chest CT scans:

(a) PIOPED Investigators. Value of the ventilation / perfusion scans in pulmonary embolism: results of the PIOPED. JAMA 1990;263:2753-9. This ubiquitously-cited study found that VQ scans are useful when they are high probability and normal, but that most of the time PE can't be ruled in or out by VQ scan. Includes a useful table comparing clinical suspicion and VQ scan result relative to PA gram result.


(b) Wells PS, Ginsberg JS, Anderson DR, et al. Use of a clinical model for safe management of patients with suspected pulmonary embolism. Ann Intern Med 1998;129:997-1005. Study used a "minimally invasive" approach to managing patients with suspected PE, emphasizing use of serial Dopplers rather than PA grams in patients with a non-diagnostic initial work-up. Approach is comparable to the 1999 ATS guidelines; it does not include CT angiography. A particular strength of the study was the use of set criteria to establish clinical suspicion.


(c) Wells PS, Anderson DR, Rodger M, et al. Excluding pulmonary embolism at the bedside without diagnostic imaging: management of patients with suspected pulmonary embolism presenting to the emergency department by using a simple clinical model and d-dimer. Ann Intern Med 2001;135:98-107. Large prospective cohort study using the SimpliRED d-dimer assay (which has sensitivity lower than, and specificity higher than, most other d-dimer tests) found the combination of a low clinical suspicion for PE and a negative d-dimer safely ruled out pulmonary embolism without additional testing.


2) Studies suggesting chest CT alone is sufficient to evaluate for PE

(a) Perrier A, Roy PM, Sanchez O, et al. Multidetector-row computed tomography in suspected pulmonary embolism. New Engl J Med 2005;352:1760-8. Study of 756 patients found it is safe to withhold anticoagulation and defer additional evaluation in patients with a low or intermediate clinical probability of PE and a negative D-dimer. This study also found a low risk of withholding treatment in patients with a negative multidetector-row CT. The overall 3-month risk of VTE in patients with a negative evaluation based on clinical probability, D-dimer, and chest scans, but without lower extremity ultrasound, would have been 1.5%.


(b) van Belle A, Buller HR, Huisman MV, et al. Effectiveness of managing suspected pulmonary embolism using an algorithm combining clinical probability, D-dimer testing, and computed tomography. JAMA 2006; 295:172-9. This study classified 3306 patients
as “PE likely” or “PE unlikely” based on a dichotomized version of Wells criteria. “PE unlikely” plus a negative D-dimer sufficiency ruled out PE without further testing (0.5% with PE diagnosis in subsequent 3 months). Patients with “PE likely” or a positive D-dimer underwent CT angiogram. 95% of patients with a negative CT had anticoagulation withheld without further testing and 1.3% were subsequently diagnosed with PE over 3 months. 88% of scans were multidetector row studies. 


3) Studies suggesting chest CT alone is not sufficient to evaluate for PE

(a) Musset D, Parent F, Meyer G, et al. Diagnostic strategy for patients with suspected pulmonary embolism: a prospective multicenter outcome study. Lancet 2002;360:1914-20 This prospective cohort study found the combination of a good quality negative single-row-detector CT and negative lower extremity ultrasound safely excluded PE in outpatients with low or moderate clinical probability (0.8% diagnosed with PE during follow-up). Among inpatients, 4.8% with negative CT and ultrasound were diagnosed with PE, or possibly had a PE, during follow-up. Of note, 15% of patients diagnosed with PE had a negative CT but positive ultrasound. 


(b) Stein PD, Fowler SE, Goodman LR, et al. Multidetector computed tomography for acute pulmonary embolism. New Engl J Med 2006; 354:2317-27. The much-anticipated PIOPED II study of 824 patients found CT angiogram had a sensitivity of 83% and specificity of 96%, excluding the 6% with poor quality images. The sensitivity improved to 90% with addition of CT venography. The positive predictive value was 96% when the result was concordant with a high or low clinical suspicion, but CT was non-diagnostic if there was discordance. For instance, there were 42% false-positives among patients with low clinical suspicion and a positive scan, and 40% false negatives among patients with high clinical probability but negative scan. CTs were primarily performed with 4-slice scanners. 


4) Other diagnostic studies

(a) Oudkerk M, van Beek EJ, Wielopolski P, et al. Comparison of contrast-enhanced magnetic resonance angiography and conventional pulmonary angiography for the diagnosis of pulmonary embolism: a prospective study. Lancet 2002;359:1643-7. MRA is a potentially attractive alternative in the substantial number of patients with a non-diagnostic work-up and a contraindication to CT angiogram. This study included 118 unselected patients with non-diagnostic perfusion scans who all underwent MRA and PA-grams. MRA had a sensitivity of 77% and specificity 98% with higher sensitivity for central clot. 


5) Treatment
(a) Hermann RE, Davis JH, Holden WD. Pulmonary embolism: a clinical and pathologic study with emphasis on the effect of prophylactic therapy with anticoagulants. Amer J Surg 1961;102:19-28. Study helped establish anticoagulation as the standard of care for the treatment of PE. The 40% mortality from embolism in this series likely reflects the ability to detect only larger emboli at that time. Regardless, this high mortality has been cited as the rationale for anticoagulation and aggressive evaluation of suspected PE.

(b) Schulman S, Granqvist S, Holmstrom M, et al. The duration of oral anticoagulation after a second episode of venous thromboembolism. New Engl J Med 1997; 336:393-8. Randomized trial comparing anticoagulation for 6 months compared to indefinitely in patients with a history of recurrent embolism (including idiopathic and with risk factors). Recurrent thromboembolism occurred in 21% of patients in the 6-month group and in 2.7% of the indefinite group after 4 yrs of follow-up. Major bleeding occurred in 5% of patients, of whom 18% died.

(c) Agnelli G, Prandoni P, Becattini C, et al. Extended oral anticoagulant therapy after a first episode of pulmonary embolism. Ann Intern Med. 2003; 139:19-25. Randomized, non-blinded study of extending anticoagulation beyond 3 months in patients with first episode of idiopathic PE and PE associated with temporary risk factors. Extending anticoagulation in patients with idiopathic PE from 3 to 12 months only delayed onset of what proved to be a high recurrence rate (4-5% per patient-year once off anticoagulation). Findings highlight the need for new ways of identifying patients at high risk of recurrence so that they can receive indefinite anti-coagulation.

(d) Konstantinides S, Geibel A, Heusel G, et al. Heparin plus alteplase compared with heparin alone in patients with submassive pulmonary embolism. New Engl J Med 2002; 347:1143-50. Randomized, double blind study found lytic therapy in submassive PE did not improve mortality. Patients randomized to lytics were significantly less likely than the placebo group to require escalation of therapy, which primarily entailed administration of lytics. The indication for rescue therapy was worsening respiratory symptoms, short of intubation, two-thirds of the time.

6) Prevention with vena caval filters.
(a) Streiff MB. Vena caval filters: a comprehensive review. Blood 2000;95:3669-77. Excellent review of the data available on each of the commonly placed filters, including efficacy and rate of complications. A more recent update on the use of retrievable filters is needed. The author notes the paucity of randomized trials and lack of long-term follow-up in existing studies, addresses the controversies surrounding caval filters, and offers recommendations.

aniticoagulated and LMW and unfractionated heparin were equally effective. 4.8% of patients receiving anticoagulation alone had PE vs. 1.1% in filter + anticoagulation group at study day 12. There was no difference in rate of PE after anticoagulation was discontinued, but the filter group had significantly more recurrent DVT.


7) Thromboendarterectomy for chronic thromboembolic disease


(c) Jamieson SW, Kapelanski DP, Sakakibara N, et al. Pulmonary endarterectomy: experience and lessons learned in 1,500 cases. Ann Thorac Surg 2003; 76:1457-64. Summarizes entire UCSD experience with thromboendarterectomy. The most recent 500 cases (through 12/02) are discussed in greater detail. 30-day mortality in this group was 4.4%, which varied according to type of thrombotic lesion and preoperative hemodynamics.

J) Lung Cancer/Solitary Pulmonary Nodules

1) Screening for lung cancer

(a) The following articles are the basis for the belief that screening with CXR and/or sputum cytology don’t improve mortality. Many have expressed concern about the quality of these studies.


(f) The following articles address screening with chest CT scans.

(g) The following 2 studies reached discordant conclusions about the value of CT screening. For a nice discussion of this discrepancy, see the following editorial:  

(h) Henschke CI, Yankelevitz DF, Libby DM, et al. Survival of patients with stage I lung cancer detected on CT screening. New Engl J Med. 2006; 355:1763-71. Very large study (N= 31,567) found screening for lung cancer in asymptomatic at-risk patients for up to 18-months resulted in a lung cancer diagnosis in 484 participants, 412 of whom had clinical stage I disease. The researchers concluded that annual spiral CT screening in at-risk patients can detect lung cancer that is curable.  

(i) Bach PB, Jett JR, Pastorino U, et al. Computed tomography screening and lung cancer outcomes. JAMA. 2007; 297:953-61. This study pooled the results of 3 longitudinal studies of lung cancer screening with CT in asymptomatic current or former smokers (N=3246). The researchers concluded that screening for lung cancer with low-dose CT may increase the rate of lung cancer diagnosis and treatment, but based on models of predicted survival, it does not reduce the risk of death from lung cancer.  

(j) Henschke CI, McCauley DI, Yankelevitz DF, et al. Early lung cancer action project: overall design and findings from baseline screening. Lancet 1999;354:99-105. Study of annual low dose CT in detecting lung cancer in 1000 heavy smokers identified noncalcified nodules in 23% of patients and 12% of nodules were malignant. The yield was extraordinarily high, as 27 of 28 biopsies were positive for malignancy, and 87% of these were stage I. Large scale study to confirm findings and assess long-term survival benefit and costs is in progress.  

(k) Swenson SJ, Jett JR, Hartman TE, et al. CT screening for lung cancer: Five-year prospective experience. Radiology 2005;235:259-65. Updated results from Mayo’s screening study of 1,520 subjects age > 50 with tobacco use > 20 pack-years. After 5 years, 74% of subjects had at least 1 uncalcified nodule and 2.6% were diagnosed with stage I non-small cell cancer. Compared to previous studies, adenocarcinoma (including bronchioloalveolar carcinoma) was over-represented, which raises the possibility of earlier diagnosis without reduction in mortality. 96% of nodules identified on the prevalence scan and 96% of nodules identified on an incidence scan proved to be benign based on observation or resection. 69% of all participants had at least 1 of these “false-positive” nodules.  

2) Solitary pulmonary nodule
(a) Ost D, Fein AM, Feinsilver SH. The solitary pulmonary nodule. New Engl J Med 2003; 348:2535-42. Concise review of risks and yield of the currently used diagnostic modalities, including PET scans. Unlike some recently published guidelines, the authors consider both clinical suspicion for malignancy and operative risk in making management recommendations. The authors advocate the use of serial CT scans in patients with low probability of cancer as well as patients with intermediate probability with negative additional workup.

(b) Torrington KG, Kern JD. The utility of fiberoptic bronchoscopy in the evaluation of the solitary pulmonary nodule. Chest 1993;104; 1021-4. Study found low yield for use of FOB in the work-up of radiographic Stage I lung cancer. FOB confirmed the diagnosis of cancer in 30% of cases (no higher yield with use of fluoroscopic guidance), but this did not affect surgical management. Unsuspected synchronous tumor found in only 1% of cases. Study population skewed in that a high proportion (87%) of SPNs were malignant.

(c) Henschke CI, Yankelevitz DF, Naidich DP, et al. CT screening for lung cancer: suspiciousness of nodules by size. Radiology 2004;231:164-8. Based on data from 2897 high-risk subjects in the ELCAP study, non-calcified nodules < 5mm diameter should be followed with a repeat scan in 12 months rather than shorter-term follow-up.