UNMC Pulmonary Consult Service
Rotation Goals and Objectives
Pulmonary/Critical Care Medicine Fellowship Program
University of Nebraska Medical Center
Revised: March 2010

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.

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 drainage 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) Evaluations from clinic nurses, CF Team members and the PFT Lab staff
    (c) Mini-CEX (to be arranged with attending)

B) Medical Knowledge

1) Demonstrate an ability to interject a discussion of recent readings relevant to patients during rounds.
2) Develop familiarity with seminal literature covering topics in pulmonary medicine, especially those extant in patients on the pulmonary consult 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 one performance measure to demonstrate improvement over the course of the year on this service.
    (a) Examples could include adherence to guidelines regarding care of asthma patients, referrals to pulmonary rehab, etc.
    (b) The fellow should inform the program coordinator, Sheryl Latenser of the performance measure chosen.
2) 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.
3) 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.
4) Facilitate the learning of other health care professionals by providing at least one lecture to the resident(s) and student(s) and impromptu teaching sessions.
5) Evaluation methods for this competency
    (a) Attending evaluation
    (b) Chart-stimulated recall sessions
    (c) Performance on presentation at case conference during the month

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.
6) Demonstrate an ability to develop professional relationships with residents, students 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 clinic nurses, CF Team members and the PFT Lab staff
(d) Mini-CEX

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 clinic nurses, CF Team members and the PFT Lab staff
   (d) Mini-CEX

F) System-based Practice
1) 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 clinic nurses, CF Team members and the PFT Lab staff

III) Instructional Methods

A) Clinical experience

1) The PCCM fellow on this rotation spends a full calendar month on the Pulmonary Consult Rotation at the Nebraska Medical Center, providing high quality and timely care to include:

   (a) Pulmonary consultative care for inpatients of the Nebraska Medical Center. The fellow will:
      (i) Evaluate and provide effective consultative care for all consult patients
      (ii) Write or confirm a daily progress note on all patients on the service
   (b) Primary care for patients admitted by faculty of the Pulmonary, Critical Care, Sleep Medicine and Allergy Section

      (i) The fellow is encouraged to meet with the on-call CF physician as needed to discuss questions regarding the daily care of the Cystic Fibrosis inpatients. If the CF staff have specific concerns regarding the care of CF inpatients, such concerns will be registered with the attending physician on service. The Cystic Fibrosis team will communicate any therapeutic suggestions to the attending on

the service. This interaction can occur during consult team rounds by mutual agreement. Members of the CF team may intermittently make "social" rounds on CF inpatients in order to provide continuity. If the discussion between the CT team and the CF patient leads to any treatment recommendations, the CF attending physician will communicate these suggestions to the inpatient attending physician.

(ii) Any member of the Consult Service is encouraged to attend the weekly CF Care Conference that occurs on Friday morning in the Rennard Conference Room at 8:15 to review inpatients and upcoming admissions with CF physicians and staff.

(iii) Plans for outpatient care and/or end-of-life care will be discussed in care conference with the CF team and communicated jointly to the patient.

(iv) If a patient followed by a faculty member or fellow through the outpatient clinic is admitted to the Pulmonary Inpatient service, the fellow assigned to the Pulmonary Consult Service is responsible for informing them of their patient's admission. If said patient is being admitted by the faculty member or fellow directly from the clinic, the clinic provider should communicate with the attending or fellow on service as to the nature of the admit and the reason the patient is being admitted to the Pulmonary Consult Service.

(v) Evaluate and manage all primary pulmonary patients on the service

(vi) Write or confirm a daily progress note on all primary pulmonary patients on the service

2) Supervision and Performance of Procedures

(a) The fellow will be expected to supervise those procedures that should be performed by the residents. These include but are not limited to thoracentesis and central line placement.

(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) Faculty 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 faculty will provide feedback on a regular basis, at least weekly, on what the fellow has done well and what could be improved.

2) Fellow and supervising staff physician will review these goals and objectives at the beginning of the rotation

3) Fellow and attending physician will meet in order to provide verbal feedback at the completion of the attending physician's rotation. This verbal feedback may be given by phone but the attending physician is required to provide a written evaluation of the fellow that will be transmitted electronically to them.

D) Didactic Sessions

1) Attend all scheduled fellow conferences within the Pulmonary, Critical Care, Sleep Medicine and Allergy Section. These are held each noon Tuesday through Thursday in the Rennard

Conference Room, SwH 4009 during July and August. 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 Nebraska Medical Center Pulmonary Consult 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 on the service, the fellow will prepare a diagnostic and management plan and discuss this with the resident.
   (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.
   (c) Provide primary care for all patients admitted to the service by faculty members of the section.
      (i) The fellow must assume primary care duties for some portion of the patients on the primary care service depending on the number of residents on the service.
      (ii) Ensure that all necessary orders are written/entered.
      (iii) Ensure that the H&P and discharge summary are dictated.
      (iv) 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. Fellows should obtain a lecture schedule for the month from the Education Coordinator and if service responsibilities require an alteration in the schedule, fellow is responsible for notifying the Education Coordinator in advance. For residents and students, education (lectures) have priority over service obligations and the fellow should plan accordingly.
4) Complete an evaluation of the rotation and the attending.
5) Take at-home call as scheduled.

B) First Year Fellows

1) At the end of the first year of training the fellow should be expected to:
   (a) Demonstrate a solid fund of general medical and pulmonary medicine knowledge.
   (b) Exhibit sound clinical judgment in regards to general medical and most pulmonary medicine problems.
   (c) Be able to elicit a complete history of present illness and past medical history in regards to pulmonary presentations, including occupational exposures.
   (d) Perform a complete physical examination of the respiratory system, including the upper airway.

(e) Demonstrate competency in insertion of the bronchoscope, via oral and nasal routes and be able to visualize all segments of the lung and to name them using a conventional system.
(f) Demonstrate competency in central line placement, including triple lumen catheters and introducers.
(g) Achieve competence in establishing and maintaining an open airway in non-intubated, unconscious, paralyzed patients.
(h) Achieve competence in ventilator management, including pressure-cycled, volume-cycled, time-cycled, and flow-cycled mechanical ventilation. They should be able to explain, compare and contrast such modes as pressure support, pressure control, volume control, SIMV, and such ventilator management strategies such as inverse ratio ventilation, and permissive hypercapnia.
(i) Achieve competencies in choosing an appropriate oxygen delivery device, such as nasal cannula, venturi mask, non-rebreather mask, high flow oxygen systems, and knowledge of the ambulatory sources of oxygen, such as the C, D, and E cylinders, as well as the M-6 cylinder.
(j) Utilize weaning parameters and the spontaneous breathing trial for liberation from the ventilator.
(k) List indications for and utility of various respiratory therapy techniques, such as bronchial hygiene, and volume expansion therapies.
(l) Achieve competency in interpretation of pulmonary function tests, including spirometry, flow volume loops, lung volumes defusing capacity, arterial blood gas analysis, and exercise studies.
(m) Achieve competency at interpreting chest roentgenograms and chest CT scans.
(n) Achieve competency in obtaining arterial blood gases, placing arterial catheters and insertion of the pulmonary artery catheter, including interpretation of the waveform.
(o) Complete the on-line Blackboard course covering the ACGME competencies.

C) Second Year Fellows
1) Second year fellows will take overnight or weekend call on this rotation.
2) Performance should reflect completion of the first year of fellowship
(a) Competencies listed for first year fellows should be solid

D) Third Year Fellows
1) At the end of the third year the fellow should be expected to:
(a) Maintain all competencies listed above that were achieved during the first and second year of fellowship training.
(b) Understand the fundamentals of clinical research, including the process of Institutional Review Board approval.
(c) Have facility with discussing the report of a clinical study including the validity of the statistics used.
(d) Demonstrate a solid fund of pulmonary disease knowledge.
(e) Exhibit sound clinical judgment in regards to pulmonary problems.
(f) Demonstrate competency in chest thoracostomy tube placement.

E) Consult Attending

1) These guidelines for the Nebraska Medical Center Pulmonary Consult rotation will be made available to the attendings and any attending-specific expectations 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 hour 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 consults with the consult team.

F) Mid-Level Providers

1) Physician Assistants and Nurse Practitioners
   (a) Mid-level providers assisting in General Pulmonary Consult Clinic will review the clinical data for all new patients scheduled to the clinic and determine if there are diagnostic tests that should be performed prior to their being seen, such as chest radiographs and/or pulmonary function tests. They will order these tests so that the results will be available when the Pulmonary Consult team comes to see the patient in clinic. The mid-level provider may be asked to see a patient or two if the team will be unavoidably delayed but it is optimal for the team to see all new patients.
   (b) The mid-level provider may, at times, be asked to coordinate any admissions from the clinic to the inpatient team.
   (c) If involved in the care of inpatients, the mid-level provider will serve in an advisory role only and not be responsible for direct patient care, i.e. they will write no orders except in emergency situations and only after conferring with the resident or fellow on the service.

2) Nurses and Respiratory Care Providers
   (a) If involved in the care of inpatients, the nurse and RCP will serve in an advisory role only and not be responsible for direct patient care, i.e. they will write no orders except in emergency situations and only after conferring with the resident or fellow on the service.

G) 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 attending or by 11:45, whichever comes first, in order to attend noon conference.

2) On Call Responsibility

   (a) Be available, in house, from 8:00 am to 5:00 PM except for officially sanctioned events
      (i) It is recommended that when the fellow is on call for the weekend that he/she arrive in the ICU earlier than 8 am to evaluate the patients and attend to problems.
      (ii) For unstable or decompensating patients it is imperative that the resident, fellow and attending be readily available to come to the bedside so that the highest quality of care can be delivered.
   (b) Take after hours call as assigned by the Program Director. Call may be altered by mutual agreement with the CCM attending physician
   (c) The On-Call fellow will receive a check-out report on each patient on each service they are picking up, from the fellow going off-call and will give an updated check-out report to the fellow coming on-call the following morning.
   (d) Fellows covering the weekends will be expected to see all new consults requiring urgent intervention, even if initially seen and evaluated by the resident.

(e) New patients to the service that are seen after-hours should be seen promptly by the resident who will, after making a quick assessment, call the fellow.
   (i) The CCM resident will see all new admissions and consults to the CCM service and call the fellow
   (ii) New admissions or consults to the Pulmonary Consult service after hours will be seen by the pulmonary resident on call or will need to be seen by the fellow if there is no resident on-call

3) Vacation

(a) Vacation time may not be taken during this rotation.
(b) Emergency leave may be requested after discussion with the Program Director or surrogate (Consult attending for days to be missed).

V) Methods of Evaluation

A) Focused Observation and Evaluation

1) The Consult Attending should give immediate feedback after rounds each day and a formal verbal evaluation should be given at the mid-point of the rotation.

B) Clinical Performance Ratings

1) Each consult attending 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 attending 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 will be sent to health care professionals in the clinic, on the floor, in the PFT lab and on the CF team who interact with the fellow. They will include PA's, Nurse Practitioners, Nurses, Respiratory Therapists and Clerks. These evaluations will focus on the fellow's professionalism.
2) Patients will be asked from time to time to provide written feedback in the form of a questionnaire regarding professionalism as well as 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 are available through New Innovations
2) He/she should complete an evaluation, available in New Innovations, of the teaching undertaken by the attending 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/sections/career-development/fellows-and-fellowships/ats-reading-list-intro.html

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.
2) Pellegrino R, Viegi G, Brusasco V, et al. Interpretative strategies for lung function tests. Eur Respir J 2005: 26:948-68. An excellent comprehensive review of reference equations, types of ventilatory defects, commentary of PFT and DLCO interpretation, severity classifications, bronchodilator response thresholds, central and upper airway processes, and interpretation in changes in pulmonary function.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?itool=abstractplus&db=pubmed&cmd=Retrieve&dopt=abstractplus&list_uids=16264058

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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11787659
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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12524257
3) Wooley JA. Indirect calorimetry: applications in practice. Respir Care Clin N Am. 2006 Dec;12(4):619-33.

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

1) Pratter MR, Brightling CE, Boulet LP, Irwin RS. An empiric integrative approach to the management of cough: ACCP evidence-based clinical practice guidelines. Chest. 2006; 129(1 Suppl):222S-231S. Excellent review of algorithms that provide a "road map" for managing acute, subacute, and chronic cough.
http://www.ncbi.nlm.nih.gov.floyd.lib.umn.edu/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16428715&itool=iconfft&query_hl=17&itool=pubmed_docsum

G) Cystic Fibrosis

1) Pryor JA. Physiotherapy for airway clearance in adults. Eur Respir J 1999;14:1418-24. Somewhat cursory overview of common airway clearance techniques used in the setting of CF, neuromuscular disease, and other diseases associated with impaired secretion clearance.

The author also touches on the paucity of evidence supporting the superiority of any one approach.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10624775

2) Fuchs HJ, Borowitz DS, Christiansen DH, et al. Effect of aerosolized recombinant human DNase on exacerbations of respiratory symptoms and on pulmonary function in patients with cystic fibrosis: the Pulmozyme Study Group. New Engl J Med 1994;331:637-42. Large RCT found patients receiving a 24-week course of Pulmozyme had an improvement in FEV1 of 5% compared to placebo and decreased exacerbation rate (28 vs. 37% in placebo group).
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=7503821
3) Ramsey BW, Pepe MS, Quan JM, et al. Intermittent administration of inhaled tobramycin in patients with cystic fibrosis. New Engl J Med 1999;340:23-9. Study found use of TOBI on alternating months improved lung function, decreased bacterial burden, and decreased the relative risk of hospitalization. The rate of acquired tobramycin resistance was about 7% over 24 weeks.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9878641
4) Saiman L, Marshall BC, Mayer-Hamblett N, et al. Azithromycin in patients with cystic fibrosis chronically infected with pseudomonas aeruginosa. JAMA 2003;290:1749-56. Large multicenter RCT of 6 months duration found chronic azithromycin resulted in a 4.4% improvement in FEV1% predicted compared to a 1.8% decline in placebo. The azithromycin group had fewer exacerbations and gained more weight.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14519709
5) Balfour-Lynn IM, Lees B, Hall P, et al. Multicenter randomized controlled trial of withdrawal of inhaled corticosteroids in cystic fibrosis. Am J Respir Crit Care Med 2006; 173:1356-62. This study of 171 children and adults with mean baseline FEV1 of 76% predicted found no difference in to time to 1st exacerbation, or use of rescue bronchodilators and antibiotics over the first 6 months of withdrawing inhaled steroid. These results suggest that many CF patients may be able to safely discontinue inhaled steroids.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16556691&query_hl=12&itool=pubmed_docsum
6) Aaron SD, Vandemheen KL, Ferris W, et al. Combination antibiotic susceptibility testing to treat exacerbations of cystic fibrosis associated with multiresistant bacteria: a randomised, double-blind, controlled clinical trial. Lancet 2005; 366:463-71. This study of 132 CF patients found selection of intravenous antibiotics based on multiple combination bactericidal susceptibility testing did not reduce the time to next exacerbation compared to antibiotic selection based on conventional culture and sensitivity tests and there was no difference in the rate of treatment failure.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16084254&query_hl=14&itool=pubmed_docsum
7) Elkins MR, Robinson M, Rose BR, et al. A controlled trial of long-term inhaled hypertonic saline in patients with cystic fibrosis. New Engl J Med 2006; 354:229-40. This study of 164 children and adults with CF found the combination of bronchodilator and 7% saline neb bid had only a modest impact on pulmonary function but reduced exacerbations (76% exacerbation free vs. 62% placebo, p = .03). These results may not be applicable to patients on more aggressive baseline regimens than the study population.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16421364&query_hl=17&itool=pubmed_docsum

8) Kerem E, Reisman J, Corey M, et al. Prediction of mortality in pts with cystic fibrosis. New Engl J Med 1992;326:1187-91. Established FEV1 < 30% predicted as the strongest, albeit suboptimal, predictor of mortality. See also Lung Transplantation. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=1285737

H) Pleural Effusions

1) Light RW, MacGregor MI, Luchsinger PC, et al. Pleural effusions: the diagnostic separation of transudates and exudates. Ann Intern Med 1972;77:507-13. This paper is the basis for using pleural fluid LDH and protein to classify effusions as transudative or exudative. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=4642731
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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=7424940
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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=2306975
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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15745977
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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9187172
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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10556140
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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=2019172

I) Pneumonitis in Immunocompromised Host

1) Chin DP, Hopewell PC. Mycobacterial complications of HIV infection. Clin Chest Med 1996;17:697-711. Covers the atypical presentation of TB and atypical mycobacterium in this population.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9016372
2) Gagnon S, Boota AM, Fischl MA, et al. Corticosteroids as adjunctive therapy for severe PCP in AIDS. New Engl J Med 1990;323:1444-50. One of three studies published in the same year establishing the efficacy of steroids in severe PCP in patients with AIDS.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=2233916
3) Hirschtick RE, Glassroth J, Jordan MC, et al. Bacterial pneumonia in persons infected with the human immunodeficiency virus. Pulmonary Complications of HIV Infection Study Group. New Engl J Med 1995;333:845-51. Part of the landmark PCHIS study, this is the first and best prospective study of CAP in HIV-infected patients.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=7651475
4) Beck JM, Rosen MJ, Peavy HH. Pulmonary complications of HIV infection. Report of the 4th NHLBI Workshop. Am J Respir Crit Care Med 2001;164:2120-6 Summarizes current knowledge of HIV-associated pulmonary diseases since the advent of HAART.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11739145

J) Preoperative Evaluation

1) Bolliger CT, Perruchoud AP. Functional evaluation of the lung resection candidate. Eur Respir J 1998;11:198-212. Good summary of use of PFTs, split function tests, and exercise tests to assess operative risk of lung resection.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9543294
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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=8222791
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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=13188561&query_hl=22&itool=pubmed_DocSum
4) Squadrone V, Coha M, Cerutti E, et al. Continuous positive airway pressure for treatment of postoperative hypoxemia: a randomized controlled trial. JAMA. 2005; 293:589-95. Multi-

center,unblinded RCT with concealed allocation on 209 consecutive patients who developed 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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=15687314&query_hl=7&itool=pubmed_docsum

K) 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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=2332918&query_hl=24&itool=pubmed_docsum

(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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9867786

(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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11453709

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%.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15858185&query_hl=24&itool=pubmed_docsum

(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 sufficiently 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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16403929&query_hl=21&itool=pubmed_docsum

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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12493257

(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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16738268&query_hl=24&itool=pubmed_docsum

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.
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12020524

(b) Nicod P, Peterson K, Levine M, et al. Pulmonary angiography in severe chronic pulmonary hypertension. Ann Intern Med 1987;107:565-8. This study established the safety of angiography in patients with chronic, severe pulmonary hypertension.

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=3631791

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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=13713631
   (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 f/u. Major bleeding occurred in 5% of patients, of whom 18% died. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9010144
   (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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12834314
   (d) Konstantinides S, Geibel A, Heusel G, et al. Heparin plus altepase 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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12374874

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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10845895

(b) Decousus H, Leizorovicz A, Parent F, et al. A clinical trial of vena caval filters in the prevention of pulmonary embolism in patients with proximal DVT. New Engl J Med 1998; 338:409-15. This is the only randomized trial involving filters. All patients were 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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9459643

7) Thromboendarterectomy for chronic thromboembolic disease

(a) Snyder WA, Kent DC, Baisch BF. Successful endarterectomy of chronically occluded pulmonary artery: clinical report and physiologic studies. J Thorac Cardiovasc Surg 1963; 45:482-9. This, and the Moser article below, is the first reports of the procedure. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=13993170

(b) Moser KM, Rhodes G, Hufnagel CC. Chronic unilateral pulmonary artery thrombosis: successful thromboendarterectomy with 30-month follow-up. New Engl J Med 1965; 272:1195-9. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14284991

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14602267

L) 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.

(b) Fontana RS, Sanderson DR, Taylor WF, et al. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Mayo Clinic study. Am Rev Respir Dis 1984;130:561-5. Also includes a summary of the combined results of the Mayo, Sloan-Kettering, and Johns Hopkins study sites on pp 565-70. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=6091507

(c) Melamed MR, Flehinger BJ, Zaman MB, et al. Screening for lung cancer: results of the Memorial Sloan-Kettering study in New York. Chest 1984;86:44-53. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=6734291

(d) Frost JK, Ball WC, Levin ML, et al. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Johns Hopkins study. Am Rev Respir Dis 1984;130:549-54

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=6091505

(e) Kubik A, Parkin DM, Khlat M, et al. Lack of benefit from semi-annual screening for cancer of the lung: follow-up of a randomized controlled trial on a population of high-risk males in Czechoslavakia. Int J Cancer 1990;45:26-33. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=2404878

(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: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=17341714&itool=pubmed_AbstractPlus

(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. http://www.ncbi.nlm.nih.gov.floyd.lib.umn.edu/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=17065637&itool=iconabstr&query_hl=35&itool=pubmed_docsum

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=17341709&query_hl=14&itool=pubmed_docsum

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10408484

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15695622&query_hl=11&itool=pubmed_docsum

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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12815140

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=8404158

(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. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14990809

(d) MacMahon H, Austin JH, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: A statement from the Fleischner Society. Radiology 2005; 237:395-400. This statement recommends less aggressive follow-up of small (6 mm or less) pulmonary nodules based on findings from recent lung cancer screening studies. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16244247&query_hl=5&itool=pubmed_docsum