Common Pulmonary Problems

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Obstructive Sleep Apnea
ILD
Cancer, Nodules

Patrick J. Lynch, medical illustrator; C. Carl Jaffe, MD, cardiologist
Obstructive Sleep Apnea
56 year old obese man complaining of daytime somnolence.
Difficulty concentrating at work, falls asleep during meetings.
Wife notes loud snoring at night and episodes of interrupted breathing.
Obstructive Sleep Apnea

- Repeated episodes of apnea during sleep
- Defined as >5 episodes per hour
- Present in 2-4% of population
Sequelea

Neurocognitive

• Excessive daytime sleepiness
• Decreased cognitive performance
• Increased automobile accidents
• Decreased quality of life
• Mood disturbance

Sequealae

Cardiac and metabolic
- Pulmonary hypertension
- Coronary artery disease
- Cerebrovascular disease
- Arrhythmias
- Systemic hypertension
- Insulin resistance

Physical Exam

- Obesity
- Crowded pharynx (Friedman Tongue Position)
- Systemic hypertension
- Nasal obstruction
- Neck circumference > 17"
- Lower extremity edema
Diagnostic testing: Polysomnography
“Sleep Study”

• Apnea-Hypopnea Index: Number of apneas, hypopneas/hour

• Respiratory Disturbance Index: Number of apneas, hypopneas, or RERAs/hour (respiratory event related arousals)

• Titrate CPAP pressure and delivery mechanism

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>&lt;5</td>
<td>Normal</td>
</tr>
<tr>
<td>5-15</td>
<td>Mild</td>
</tr>
<tr>
<td>15-30</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt;30</td>
<td>Severe</td>
</tr>
</tbody>
</table>
Diagnostic Testing

• Split night polysomnography
  – Gold standard test
  – Diagnostic study for 2-3hr, then titrate and monitor effects of CPAP (therapeutic)

• Home sleep apnea testing (HSAT)
  – respiration, heart rate, and O2 sat
Treatment

Behavior Modification:

• Weight loss
  – Also ameliorates cardiovascular risk

• Tobacco cessation

• Avoid sedative hypnotics, alcohol

• Positioning
  – Sleep position trainer
Continuous Positive Airway Pressure

• Most effective treatment
  – Reduces apneic events
  – Reduces sleepiness
  – Reduces systolic BP

• Should be offered to anyone with AHI>15 or AHI>5 and symptoms or signs

• Efficacy directly correlates with hours/night used
Oral Appliances

- Reduce night-time awakenings, hypoxia
- Improve neurocognitive function, reduce sleepiness, improve QOL
- Less effective than CPAP
- Can be offered to patients with mild-moderate OSA who do not want or tolerate CPAP
Surgery

- Effective if an obstructing lesion is present
  - Tonsilar hypertrophy
- Uvulopalatopharyngoplasty (UPPP) for other patients
  - Scant evidence of efficacy
  - Cure achieved in a minority of patients
Upper Airway Stimulation Therapy

- Approved by FDA in 2014
- Senses inspiration and provides mild stimulation to upper airway muscles to maintain airway patency
- Reduces apneic events by 68%
- Improves quality of life measures
- Small RCTs so far
- Not yet recommended by any national guidelines
Mr. Nap

- Polysomnography showed an AHI of 21.
- During the test, CPAP was administered and improved the AHI to normal at a pressure of 5 mm Hg
- You prescribe CPAP and on follow up, the patient’s daytime sleepiness has resolved
Ms. Wheeze

34 year old woman complains of episodic shortness of breath and wheezing, particularly severe when she visits her neighbor, who has a dog.

Has episodes of dyspnea 3-4 times a week, and wakes at night coughing twice a week.

She was hospitalized on multiple occasions for respiratory issues as a child.

No smoking history.
Asthma

Caused by bronchial inflammation

Increased secretions

Bronchial constriction
Recent guidelines emphasize

- Assess asthma severity
- Assess and monitor asthma control
- Use inhaled corticosteroids early
- Use written asthma action plans
- Control environmental exposures
# Assessing Asthma Severity

<table>
<thead>
<tr>
<th></th>
<th>Mild Intermittent</th>
<th>Mild Persistent</th>
<th>Moderate Persistent</th>
<th>Severe Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>≤ 2 per week</td>
<td>&gt; 2 per week</td>
<td>daily symptoms</td>
<td>continual symptoms</td>
</tr>
<tr>
<td><strong>Nighttime symptoms</strong></td>
<td>≤ 2 per month</td>
<td>&gt; 2 per month</td>
<td>&gt; 1 per week</td>
<td>frequent</td>
</tr>
<tr>
<td><strong>Lung function FEV1 or PEFR</strong></td>
<td>≤ 80% predicted</td>
<td>≤ 80% predicted</td>
<td>&gt; 60% - ≤ 80%</td>
<td>≤ 60%</td>
</tr>
</tbody>
</table>

- Albuterol PRN
  - Low dose inhaled steroid
  - ↑ steroid or Add LABA
  - LABA + mod dose steroid
Assess Control
Persistent Asthma: Daily Medication
Consult with asthma specialist if step 4 care or higher is required.
Consider consultation at step 3.

Step 1
Preferred:
Low-dose ICS
Alternative:
SABA PRN

Step 2
Preferred:
Low-dose ICS + LABA
OR
Medium-dose ICS
Alternative:
Low-dose ICS + either LTRA, Theophylline, or Zileuton

Step 3
Preferred:
Medium-dose ICS + LABA
AND
Consider Omalizumab for patients who have allergies

Step 4
Preferred:
High-dose ICS + LABA
AND
Consider Omalizumab for patients who have allergies

Step 5
Preferred:
High-dose ICS + LABA + oral corticosteroid
AND
Consider Omalizumab for patients who have allergies

Step 6
Preferred:
High-dose ICS + LABA + oral corticosteroid
AND
Consider Omalizumab for patients who have allergies

Quick-Relief Medication for All Patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Use of SABA >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.

Each step: Patient education, environmental control, and management of comorbidities.
Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Step up if needed (first, check adherence, environmental control, and comorbid conditions)
Assess control
Step down if possible (and asthma is well controlled at least 3 months)
My Asthma Action Plan  
Age ≥5 years

Patient Name: __________________________
Medical Record #: ______________________

Physician’s Name: ______________________
DOB: __________________________

Physician’s Phone #: ____________________
Completed by: ______________________
Date: __________________________

<table>
<thead>
<tr>
<th>Long-Term-Control Medicines</th>
<th>How Much To Take</th>
<th>How Often</th>
<th>Other Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>times per day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EVERY DAY!</td>
<td></td>
<td></td>
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</tbody>
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<th>How Often</th>
<th>Other Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Take ONLY as needed</td>
<td></td>
<td>NOTE: If this medicine is needed frequently, call physician to consider increasing long-term-control medications.</td>
</tr>
</tbody>
</table>

Special instructions when I feel good, not good, and awful.

I feel good.  
(My peak flow is in the GREEN zone.)

PREVENT asthma symptoms everyday:

☐ Take my long-term-control medicines (above) every day.
☐ Before exercise, take _____ puffs of ________
☐ Avoid things that make my asthma worse:

I do not feel good.  
(My peak flow is in the YELLOW zone.)

My symptoms may include one or more of the following:

- Wheeze
- Tight chest
- Cough
- Shortness of breath
- Waking up at night with asthma symptoms
- Decreased ability to do usual activities

CAUTION: I should continue taking my long-term-control asthma medicines every day AND:

☐ Take

If I still do not feel good, or my peak flow is not back in the Green Zone within 1 hour, then I should:

☐ Increase

☐ Add

☐ Call

I feel awful.  
(My peak flow is in the RED zone.)

WARNING signs may include one or more of the following:

- It's getting harder and harder to breathe
- Unable to sleep or do usual activities because of trouble breathing

MEDICAL ALERT! Get help!

☐ Take

until I get help immediately.

☐ Take

☐ Call

Danger! Get help immediately! Call 9-1-1 if you have trouble walking or talking due to shortness of breath or lips or fingernails are gray or blue.
Ms. Wheeze

• You diagnose mild persistent asthma and prescribe
  – Albuterol PRN
  – Low dose inhaled steroid
  – Avoidance of dogs and other triggers

• On follow up, the patient reports dyspneic episodes once or twice a month, no nighttime awakening
Mr. Hack

72 year old man complaining of 2 years of progressively worsening dyspnea and cough productive of white sputum. Needs to rest every 2 blocks when walking.

50 pack year smoking history.

On exam, diffuse expiratory wheeze is heard.
Chronic Obstructive Pulmonary Disease

- 4th leading cause of death in United States
- Progressive development of airflow limitation that is not fully reversible
Risk Factors

• Smoked tobacco
• Particulate air pollutants
• Indoor wood burning stoves or open fires
• Occupational chemicals
• α1–antitrypsin deficiency (<1%)
## Diagnosis and Severity

<table>
<thead>
<tr>
<th></th>
<th>FEV1/FVC</th>
<th>FEV1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild</strong></td>
<td>&lt;70%</td>
<td>≥ 80%</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>&lt;70%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ FEV1&lt;80%</td>
</tr>
<tr>
<td><strong>Severe</strong></td>
<td>&lt;70%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ FEV1&lt;50%</td>
</tr>
<tr>
<td><strong>Very Severe</strong></td>
<td>&lt;70%</td>
<td>&lt;30%</td>
</tr>
</tbody>
</table>

With emphysema, will see a greater ↓ in DLCO.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Post-Bronchodilat or FEV-1</th>
<th>&gt;50% predicted and &lt;2 per year</th>
<th>&lt;50% predicted and/or ≥2 per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exacerbations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>Low* 0-1 on mMRC</td>
<td>High** ≥2 on mMRC</td>
<td>Low 0-1 on mMRC</td>
</tr>
<tr>
<td>Group</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

* Less = breathless only with strenuous exercise, while hurrying on level ground, or climbing stairs

** More = need to walk slowly or stop on level ground
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C and D</th>
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</thead>
<tbody>
<tr>
<td><strong>First Line</strong></td>
<td>SA anticholinergic PRN or SA β-agonist PRN</td>
<td>LA anticholinergic or LABA</td>
<td>LABA + ICS or LA anticholinergic</td>
</tr>
<tr>
<td><strong>Second Line</strong></td>
<td>LA anticholinergic or LABA or SABA +SA anticholinergic</td>
<td>LA anticholinergic and LABA</td>
<td>LAAC +LABA Combine LABA, LAAC, and ICS or Add PDE-4 inhibitor</td>
</tr>
<tr>
<td></td>
<td>Continue Short Acting Anticholinergic or β-agonist PRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>Reduce occupational and environmental exposures</td>
<td>Exercise/physical therapy</td>
<td>Good nutrition</td>
</tr>
<tr>
<td>Influenza and pneumococcal vaccines</td>
<td>Pulmonary rehabilitation</td>
<td>Pulmonologist referral</td>
<td>Address end of life decisions</td>
</tr>
<tr>
<td>Consider surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other considerations

- Theophylline
  - Third line therapy but can be used as adjunct
  - Use lowest possible dose

- Macrolides
  - Reduce exacerbation rates in severe COPD

- Oral steroids
  - Should not be used to predict response to inhaled steroids
  - Late stage patients may become steroid dependent

Mr. Hack

• PFTs: FEV1/FVC = 64%, FEV1 = 53%.
• Diagnosis: Moderate COPD
• No exacerbations, so class B

You discuss smoking cessation with the patient, who enrolls in a smoking cessation group. You discuss an exercise plan to maintain exercise tolerance. You initiate albuterol PRN and tiotropium daily. You provide a pneumococcal and flu vaccine.

On his return visit, the patient notes much improved dyspnea and the ability to walk to the grocery store without difficulty.
ILD
Cancer, Nodules

Patrick J. Lynch, medical illustrator; C. Carl Jaffe, MD, cardiologist
Ms. Pant

58 year old woman presents with 3 years of slowly progressive dyspnea on exertion and 1 year of nonproductive cough. She tires easily, and is able to walk only 1.5 blocks before resting.

Exam reveals dry rales throughout bilateral lung fields and clubbing of the digits.
Interstitial Lung Disease

• Progressive dyspnea on exertion
• Non-productive cough
• Fatigue, malaise
• History of occupational exposure
• Time course is variable, depending on diagnosis
Exam

• Dry crackle or “velcro rales”
• May be best heard in the posterior axillary line or bases
• Signs of cor pulmonale may be present in advanced cases
  – Accentuated S2
  – Right sided heave
• Clubbing may be present
Categories of interstitial lung disease

• Environmental/Occupational exposure

• Autoimmune disorders
  – polymyositis/dermatomyositis
  – rheumatoid arthritis,
  – systemic lupus erythematosus
  – scleroderma
  – mixed connective tissue disease

• Drug induced, particularly antineoplastic

• Idiopathic
Diagnostic testing

- Plain chest radiograph variable, but in most cases
  - reduced lung volumes
  - bilateral reticular or reticulonodular opacities
Reticulonodular opacities
Diagnostic Testing

• **Spirometry: Restrictive Pattern**
  – Reduced TLC and FVC
  – Normal FEV1/FVC

• **HRCT sensitive and specific**
  – can be diagnostic or guide biopsy

• **Biopsy diagnostic**
  – not typically recommended for mild, non-progressive disease
Treatment

• Avoid exposures
• Tobacco cessation
• Corticosteroids for some
• Immunosuppressive and cytotoxic therapy for some
• $O_2$ and Bronchodilators
Ms. Pant

Spironolactone was initiated and FEV1 and FVC showed improvement. 

You obtained a HRCT, which shows reticular abnormalities with traction bronchiectasis and honeycombing in a peripheral and basilar predominant pattern consistent with Usual Interstitial Pneumonia, a type of idiopathic ILD.
Mr. Spot

49 yo man requires chest x-ray for a physical exam for work. No cough, dyspnea, or chest pain.

Chest radiograph shows 1 cm nodule in right upper lobe with central calcification

ppd negative

No prior films for comparison
## Solitary pulmonary nodules

A solitary mass <3cm surrounded by normal lung tissue can be found in various contexts.

<table>
<thead>
<tr>
<th>Age</th>
<th>Size</th>
<th>Appearance</th>
<th>Interval change</th>
<th>Smoking History</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>&lt;30 yo</td>
<td>smaller smaller “popcorn” appearance Diffuse, laminar or central calcification</td>
<td>No growth over 2 years</td>
<td>No smoking history</td>
<td>Upper lobe location</td>
</tr>
<tr>
<td>High Risk</td>
<td>&gt;30 yo</td>
<td>larger Spiculated No calcium</td>
<td>Growth on serial imaging</td>
<td>Smoking history</td>
<td>Prior history of cancer</td>
</tr>
</tbody>
</table>
Management

• There are many algorithms and little agreement

• If low risk, serial x-ray or CT scans to assess for change.
  – If unchanged for 2 years, likely benign

• If moderate risk, immediate CT scan and then either
  – Serial CT
  – PET scan

• If high risk, biopsy
Mr. Spot Continued

• Has a history of smoking and, because he is 49 years old, has 2 high risk features. Moderate risk.

• You order a CT scan, but the patient does not follow up and is lost to care.

• Two years later, he returns complaining of fatigue, weight loss and occasional hemoptysis
Lung Cancer
Risk Factors

• Tobacco
• 2$^{nd}$ hand smoke
  — Dose response
• Radon
• Asbestos
• COPD, pulmonary fibrosis, TB
• Family history
Screening

• USPSTF recommends
  – Low dose CT
  – Annually
  – In high risk cohort
    • 30 pack year history
    • If quit, <15 years ago
    • Age 55-80
  – Stop screening after 15 years abstinent

Diagnosis

• Biopsy

• Four types:
  – Small-cell carcinoma
  – Adenocarcinoma
  – Squamous cell carcinoma
  – Large-cell carcinoma

Non-small cell lung cancer (NSCLC)
Small Cell Lung Cancer

- SCLC is considered systemic from the outset
- TNM staging not used
- Surgery not an option
Limited SCLC

- Confined to one half of the chest and ipsilateral supraclavicular nodes
- Treatment: Combination Radiation and Chemotherapy
  - 80-90% Response
  - 50-60% Remission
  - 30-40% 2-yr Survival
  - 10-15% 5-yr Survival
  - Median Survival 15-18 months
Extensive SCLC

- Disease spreading beyond one hemithorax
- Treatment: Chemotherapy only
  - 60-80% Response
  - 20-30% Remission
  - <10% 2-yr Survival
  - Rare 5-yr Survival
  - Median survival 9-10 months
Non small cell lung cancers

• Adenocarcinoma
• Squamous cell carcinoma
• Large cell carcinoma

• Treatment similar for all three
Non small cell lung cancers

Determine TNM stage

• Chest and liver CT and, if resectable, PET scan to look for metastases
• Brain MRI
• Bone scan

• If no metastases, and resectable, surgical cure may be possible
Mr. Spot

- A CT shows that the nodule has grown to 3cm.
- Percutaneous biopsy shows NSCLC, and TNM staging shows that the tumor is stage 2.
- The patient has the tumor resected and begins chemotherapy.
Thank You