Pulmonary Medicine: 2012 Review
Oregon Society of Physician Assistants

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OHSU – Pulmonary and Critical Care Medicine

To be covered…

• Obstructive lung diseases
  – Asthma
  – COPD
• Restrictive lung disease
  – Interstitial lung disease
• Potpourri

Asthma and COPD

• Diagnosis
• Assessing control and severity
• Management
  – Chronic
  – Acute
• Differential diagnosis
**Asthma: Diagnosis**

**Symptoms**
- Cough, wheezing, dyspnea, phlegm
- Triggers? Allergies? Nocturnal? Seasonal?
- Exercise-induced? NSAIDs?

**Exam**
- Wheezing
- Expiratory-Inspiratory Signs of allergy
- Normal

Key Diagnostic Test: Pulmonary Function Testing

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**Spirometry**

Measured forced expiratory volumes after maximal inhalation

<table>
<thead>
<tr>
<th>FVC</th>
<th>Forced Vital Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Volume exhaled after minimum 6 seconds</td>
</tr>
</tbody>
</table>

| FEV1 | Forced Expiratory Volume during 1st second of exhalation |

**Obstruction**: FEV1/FVC < 0.70
- Normal FEV1/FVC: ~0.70-0.80

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**Asthma: Spirometry**

[Graph showing Forced Expiratory Volume in 1 second (FEV1) vs time.]

Normal
- Female: 55 yrs, 161cm
  - FEV1 = 3.20 L
- Predicted FEV1 = 3.03 L
  - Predicted % = 105.90
Asthma: Spirometry

Obstruction
FEV₁ = 1.5
FVC = 2.75
Ratio: 0.55

Asthma Diagnosis

Post Bronchodilator Response
After inhaler, >12% improvement in FVC and FEV₁
“Reversibility”
Normalization

Asthma with Normal Spirometry?
Methacholine Testing
Increasing doses of bronchoconstrictor
Drop in FEV₁ by 20% of baseline

Asthma: Spirometry

Obstruction
FEV₁ = 1.5
FVC = 2.75
Ratio: 0.55
Asthma: Spirometry

Post BD
FEV1 = 2.80
FVC = 3.30
Ratio: 0.85

Asthma Severity and Control

Asthma Severity
Impairment
- Frequency of symptoms; emphasis on nocturnal
- Interference with normal activity
- Rescue inhaler use
- Spirometry (FEV1/FVC, FEV1 % predicted)
Risk

Asthma Control
Impairment
- Frequency of symptoms; emphasis on nocturnal
- FEV1 or PEF variability
- Rescue inhaler use
- Questionnaires: ACT (Asthma Control Test)
Risk

PEF-meter: Portable monitoring

- Exhale forcibly into chamber
- Measures expiratory flow rates
- Zones
  - Green: > 80% personal best
  - Yellow: 50-80%
  - Red: < 50%
- ACTION PLAN
Asthma Risk

Exacerbations requiring oral steroids
- 0-1 per year: Mild, intermittent
- > 2 per year: Persistent

Spirometry
FEV1 % predicted

RF for death: intubations, ICU admissions, >2 SABA canisters/month, low socioeconomic status, drug use, psychiatric illness, other medical problems

Meds for chronic asthma control:
Anti-inflammatories take the lead

- INHALED CORTICOSTEROIDS (ICS)
- Long-acting B-agonists (LABA)
  - Bronchodilator
  - Salmeterol (Serevent)*
- ICS + LABA

*Black box warning with solo therapy with LABA

Methylxanthines
Leukotriene modifiers
  - LTRA (e.g. montelukast)
  - Zileuton
Cromolyn (kids)
Rescue inhaler (Short acting B-agonist = SABA)
  - Albuterol

Components of Severity

Classification of Asthma Severity
(Youths <12 years of age and adults)

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment</td>
<td>Mild/Moderate</td>
</tr>
<tr>
<td>Impairment: Normal FEV1/FVC, 25-75%</td>
<td>FEV1/FVC</td>
</tr>
<tr>
<td>Impairment: &gt;75%</td>
<td>FEV1/FVC</td>
</tr>
<tr>
<td>Risk</td>
<td>Low</td>
</tr>
<tr>
<td>Low</td>
<td>FEV1/FVC</td>
</tr>
<tr>
<td>High</td>
<td>FEV1/FVC</td>
</tr>
</tbody>
</table>

*Consider chronic use of inhaled corticosteroids for severe asthma.
### Steps of Asthma Care

- **Severity of asthma – 4 levels**
  - Mild Intermittent (step 1)
  - Mild Persistent (step 2)
  - Moderate Persistent (step 3)
  - Severe Persistent (steps 4-6)

- **6 steps of care: Step up/Step down**
  - Gain control as quickly as possible
  - Review treatment in 2-6 weeks
    - Phone, PEF, office visit, ACT, spirometry
### Step 1: Intermittent Asthma

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
</table>
| • Daytime symptoms: <2x/week  
• Nighttime symptoms: <2x/month  
• PEF or FEV1: >80% predicted | B-agonist as needed*  
Avoid Risk Factors*  
- Smoking, pollution, occupational exposures, allergens  
Vaccinations*  
- Influenza |

*Apply to all asthmatics

### Step 2

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
</table>
| • Daytime symptoms: 2-6x/week  
• Nighttime symptoms: 3-4x/month  
• PEF or FEV1: >80% predicted  
• ≥ 2 exacerbations per year | Low-dose Inhaled Corticosteroid (ICS)  
Alternatives:  
- Leukotriene receptor antagonist (LTRA), theophylline, Cromolyn or Nedocromil |

### Step 3

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
</table>
| • Daytime symptoms: Daily  
• B-agonist use: Daily  
• Nighttime symptoms: > 1x/week  
• PEF or FEV1: 60-80% predicted | Low dose Inhaled Corticosteroid (ICS) + LABA OR Med dose ICS  
Alternatives:  
- Low-dose ICS + either LTRA, Theo or Zileuton |

Referral to asthma specialist should be considered
Step 4

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Continual symptoms</td>
<td>Med dose Inhaled Corticosteroid (ICS) + LABA</td>
</tr>
<tr>
<td>• Frequent nighttime symptoms and exacerbations</td>
<td></td>
</tr>
<tr>
<td>• Activity very limited</td>
<td>Alternatives:</td>
</tr>
<tr>
<td>• PEF or FEV1: ≤ 60% predicted</td>
<td>- Med dose ICS + either LTRA, Theo, or Zileuton</td>
</tr>
</tbody>
</table>

All patients at Step 4 and beyond should be referred to a specialist.

Steps 5 and 6

Step 5 - High dose ICS + LABA
Step 6 - High dose ICS + LABA + oral corticosteroid

Consider omalizumab for patients who have allergies.

<table>
<thead>
<tr>
<th>Asthma Exacerbation</th>
<th>Symptoms and Signs</th>
<th>Initial PEF (or FEV1)</th>
<th>Clinical Course</th>
</tr>
</thead>
</table>
| Mild                | Dyspnea with only activity                            | ≥ 70% predicted or personal best | Home
|                     |                                                       |                       | - SABA relief quickly with minimal use
|                     |                                                       |                       | - Possible prednisone                                |

| Moderate            | Dyspnea interferes or limits usual activity           | 40-69% predicted or personal best | Office or ED
|                     |                                                       |                       | - SABA: decent relief with frequent use
|                     |                                                       |                       | - Prednisone
|                     |                                                       |                       | - Sxms last 1-2 days after tx has begun |

| Severe              | Dyspnea at rest: interferes with conversation        | < 40% predicted or personal best | ED: likely hospital
|                     |                                                       |                       | - SABA: partial relief from frequent use
|                     |                                                       |                       | - Prednisone
|                     |                                                       |                       | - Sxms last > 3 after tx has begun |

| Life-threatening    | Too dyspneic to speak; sweating                       | < 25% predicted or personal best | ED/hospital; possible ICU
|                     |                                                       |                       | - SABA: minimal relief with frequent use
|                     |                                                       |                       | - IV steroids |
Management of Acute Asthma Exacerbation: Bronchodilators

<table>
<thead>
<tr>
<th>Short-acting B-agonist:</th>
<th>Short-acting anticholinergic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>high-dose MDI or nebulizer</td>
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</tr>
<tr>
<td>Albuterol Neb: 2.5-5 mg every 20 minutes for 3 doses, then 2.5-10 mg q 1-4 h pm, or 10-15 mg/hr cont; MDI: 4-8 puffs q 20 min</td>
<td>Ipratropium Neb: 0.5 mg q 30 minutes for 3 doses, then q 2-4 h pm</td>
</tr>
</tbody>
</table>

There is no evidence nebulizers deliver medicine better than properly used MDI.

Management of Acute Asthma Exacerbation: Steroids

| Mild symptoms: Increase SABA +/- Prednisone | Prednisone: ~5-10 day burst (no taper!) 40-60 mg/day (qD or divided) |
| Moderate symptoms: Prednisone | Hospitalized patient: IV or oral: 40-80 mg/day until PEF reaches ~70% personal best |
| Mild-mod exacerbations often treated at home | Antibiotics: Generally NOT needed for asthma exacerbation (viruses, allergies, smoke) |
| Severe symptoms: Prednisone; ED visit for monitoring, aggressive tx | |

Asthma: Final points

- Asthma
  - Most do well
  - #1 chronic disease causing missed school days
  - Good outpatient management can prevent morbidity/mortality
    - Inhaled corticosteroids; Action Plan –sxms; PEF
    - Exacerbations: viruses, non-compliance, allergies, sinus disease, GERD
  - Lung function can be stabilized
  - Cost to society in billions of dollars: hospitalization, medications, missed work days
COPD: Causes

- Smoking
- Occupational dusts and chemicals – intense and prolonged exposures
  - Indoor air pollution – cooking in poorly ventilated areas
  - Outdoor air pollution
  - Passive smoke exposure (2nd hand)

Of the six leading causes of death in the United States, only COPD has been increasing steadily since 1970.

Trends in US COPD deaths by gender
You've Come a Long Way, Baby…

Sometimes “reversible” (>12% change); damage is irreversible
Unless very early in disease, NEVER normalizes
COPD: Chronic Management

• General points
  – QUIT SMOKING!!!
    • Ask, Advise, Assess, Assist, Arrange
  – Symptom driven
    • Medications increased in a step-wise fashion
  – Unclear if any medication will slow/reverse the decline in lung function
  – Non-pharmacologic interventions

Management of COPD

Stage I: Mild COPD

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• FEV₁/FVC &lt; 70 %</td>
<td>• Short-acting bronchodilator as needed</td>
</tr>
<tr>
<td>• FEV₁ ≥ 80 % predicted</td>
<td>• Albuterol</td>
</tr>
<tr>
<td>• With or without chronic symptoms</td>
<td>• Ipratropium</td>
</tr>
<tr>
<td></td>
<td>• Combivent®</td>
</tr>
</tbody>
</table>

Avoid risk factors*: Smoking, pollution, occupational exposures
Vaccination*: Influenza, pneumococcal

Stage II: Moderate COPD

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• FEV₁/FVC &lt; 70%</td>
<td>• Short-acting bronchodilator as needed</td>
</tr>
<tr>
<td>• 50% ≤ FEV₁ &lt; 80% predicted</td>
<td>• Albuterol</td>
</tr>
<tr>
<td>• With or without chronic symptoms</td>
<td>• Ipratropium</td>
</tr>
<tr>
<td></td>
<td>• Combivent®</td>
</tr>
</tbody>
</table>

*LABA: Salmeterol, Formoterol
*ULABA: Indacaterol
*LAAC: Tiotropium

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Management of COPD
Stage III: Severe COPD

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
</table>
| • FEV₁/FVC < 70% • 30% ≤ FEV₁ < 50% predicted • With or without chronic symptoms | • Short-acting bronchodilator as needed • Regular treatment with one or more long-acting bronchodilators • Inhaled glucocorticosteroids* if repeated exacerbations • Roflumilast? Azithromycin? • Rehabilitation • Pulmonary consultation?

*Many ICS preps
ICS/LABA combo: Multiple available

Management of COPD
Stage IV: Very Severe COPD

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Recommended Treatment</th>
</tr>
</thead>
</table>
| • FEV₁/FVC < 70% • FEV₁ < 30% predicted or FEV₁ < 50% predicted plus chronic respiratory failure | • Short-acting bronchodilator as needed • Regular treatment with one or more long-acting bronchodilators • Inhaled glucocorticosteroids if repeated exacerbations • Treat complications • Rehabilitation • Long-term oxygen therapy* if respiratory failure • Consider surgical options • TXP or LVRB

*O₂ sat ≤ 88%** with rest or activity
**Oxygen improves mortality

Therapy at Each Stage of COPD

<table>
<thead>
<tr>
<th>Stage</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Mild</td>
<td>Add short-acting bronchodilator (when needed); influenza vaccination</td>
</tr>
<tr>
<td>II: Moderate</td>
<td>Add regular treatment with one or more long-acting bronchodilators (when needed); add rehabilitation</td>
</tr>
<tr>
<td>III: Severe</td>
<td>Add long-term oxygen if chronic respiratory failure; consider surgical options</td>
</tr>
<tr>
<td>IV: Very Severe</td>
<td>Roflumilast is an option for stage III and IV with chronic bronchitis and repeated exacerbations; Azithromycin is an option for stage III and IV with repeated exacerbations</td>
</tr>
</tbody>
</table>
Managing Acute COPD exacerbations

**Causes**
- Infection: viral > bacterial
  - Acute-on-chronic bronchitis >> pneumonia
- Air pollution
  - Co-morbidities

**Exacerbation Severity**
- Symptoms: Degree of breathlessness
- Signs: General appearance, WOB, other disease (heart failure)
- Tests: Spirometry, CXR

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**Managing Acute COPD exacerbations**

**BD/steroid Treatment**
- Short-acting BD: Albuterol, Ipratropium
- ?Theophylline
- Steroids
  - Systemic (po vs. IV)
- Bipap > Intubation

**Antibiotics?**
- Signs of airway infection?
  - Increased sputum
  - Change in color
- Fever
- Abx may benefit*

*Usually can use narrow spectrum (doxycycline, bactrim) unless colonized with more resistant bugs

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**COPD exacerbations**

- COPD summary
  - Progressive decline in lung function
  - Older and more co-morbidities than asthma patients
  - Much higher mortality
  - Similar initial assessment as asthmatics
- History/Physical, assess severity, ABC’s, IV access, oxygen (more controlled), monitoring; assess response to therapy
Guidelines on Management of COPD
www.goldcopd.com

Differential Diagnosis
– Chronic cough (> 6 weeks)
  • Asthma, GERD, sinusitis, post-infection = 95%!!!
  • Bronchiectasis-dilation/destruction of large airways
    – Chronic productive cough; copious sputum
    – Pseudomonas aeruginosa and staph aureus respiratory infections
    – Cystic fibrosis (younger)
  • Chronic infections: Tb
  • Medications: ACE Inhibitors

Cystic Fibrosis
• Most common fatal genetic disease of Caucasians
• Autosomal recessive
• Chronic cough; clubbed fingers
• Bronchiectasis
• Respiratory Failure
• Regular Airway Clearance
• Antibiotics for exacerbations
CF Bronchiectasis

Clubbing

Chronic SOB

- Chronic SOB
  - Lung disease:
    - Parenchymal lung disease: ILD (IPF, sarcoidosis), Parenchymal damage.
    - Pulmonary vascular disease: PE (usually acute), pulmonary HTN. Clear CXR!
  - Heart disease: CHF, ischemic heart disease
  - Neuromuscular disease
Restrictive lung disease

- Spirometry
  - Low FVC, normal/elevated FEV1/FVC
- Reduced lung volumes
- DDx
  - Interstitial lung disease
  - Neuromuscular disease
  - Pleural disease

Interstitial lung disease

- Generally, a slow decline in lung function due to increasing inflammation and scarring (fibrosis)
  - Several months - years
- Causes
  - Idiopathic
    - IPF: Scarring, very progressive
    - Sarcoidosis: Nodules, indolent generally
  - Exposures – especially occupations ("Pneumoconioses")
    - Asbestos, beryllium, Silica

Interstitial lung disease

- Diagnosis
  - Early, may not have any findings
  - History
    - Exposures?
  - Physical
    - Clubbing (IPF)
    - "dry velcro crackles" (IPF)
  - PFT's: Restriction
    - Low DLCO
  - Imaging. CT > CXR
Management
Remove exposure
Steroids/Immunosuppression?
Transplant?

Test time!

1. Which of the following is NOT routinely used in the outpatient assessment of asthma control?

- A. Spirometry
- B. Peak Expiratory Flow
- C. Chest x-ray
- D. Asthma control test
- E. Frequency of albuterol use
- F. Frequency of nighttime symptoms
2. Which of the following agents should NOT be used alone as the sole controlling therapy in asthma?

- A. Fluticasone/Salmeterol (Advair)
- B. Salmeterol
- C. Budesonide
- D. Budesonide/Formoterol (Symbicort)
- E. Montelukast (Singulair)

3. Which of the following is NOT an obstructive lung disease?

- A. Idiopathic Pulmonary Fibrosis
- B. Asthma
- C. COPD
- D. Cystic Fibrosis

4. In COPD, inhaled corticosteroids are best used in patients with:

- A. Frequent exacerbations
- B. Emphysema
- C. COPD (all patients should be on)
- D. Hypoxia
- E. Pulmonary Hypertension
5. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Pleural Effusion
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb

Pulmonary Embolism

- Clots in pulmonary artery circulation
  - Origin: DVT – lower ext > upper
  - Risk factors: Cancer, surgery, age, immobilization, hypercoagulability
  - Treatment: Early and adequate anticoagulation (heparin)
    - Transition to coumadin for 6 months to lifetime
  - DVT prophylaxis! Prevent it!!!!
    - LMWH; unfractionated heparin

6. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Pleural Effusion
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb
Tb!

• 1 in 3 in the world are infected!!!
  – Latent infection
    • Early treatment reduced risk of reactivation
      (10% overall risk decreased by ½)
  – Active infection
    • Up to 4 drugs needed for 6 months!
    • Can become resistant
    • Very infectious
      – Public Health issue
    • DOT

7. Name that lung disease!

• A. COPD
• B. Pneumothorax
• C. Pleural Effusion
• D. Pulmonary Fibrosis
• E. Pulmonary Embolism
• F. Lung Cancer
• G. Tb

Pleural Effusion

• Sample it if no clear diagnosis
  – Transudate – Treat underlying issue
    • Low protein, low LDH
    • CHF, cirrhosis; nephrotic syndrome
  – Exudate
    • High protein, high LDH
    • Infection (bacterial, Tb); cancer; trauma
      – If infected fluid, DRAIN ASAP!!!
      – Call for assistance.
8. Name that lung disease!

• A. COPD
• B. Pneumothorax
• C. Strep pneumonia
• D. Pulmonary Fibrosis
• E. Pulmonary Embolism
• F. Lung Cancer
• G. Tb

8. Name that lung disease!

• A. COPD
• B. Pneumothorax
• C. Strep Pneumonia
• D. Pulmonary Fibrosis
• E. Pulmonary Embolism
• F. Lung Cancer
• G. Tb

8. Name that lung disease!

• A. COPD
• B. Pneumothorax
• C. Strep Pneumonia
• D. Pulmonary Fibrosis
• E. Pulmonary Embolism
• F. Lung Cancer
• G. Tb
Lung Cancer

• Leading cause of cancer death in the country
  – More deaths than breast, colon and prostate cancer COMBINED! (yes)
  – Early stage potentially curable - Surgery
  – Late stage – chemo +/- XRT
  – Overall 5 year survival ~ 15%
  – Role for screening? Latest study concluded it may happen (CT for high-risk smokers)

9. Name that lung disease!

  • A. COPD
  • B. Pneumothorax
  • C. Strep Pneumonia
  • D. Pulmonary Fibrosis
  • E. Pulmonary Embolism
  • F. Lung Cancer
  • G. Tb

Pneumothorax

• Types
  – Primary- Normal lungs
    • Usually won’t get unless trauma
  – Secondary- Underlying lung disease that predisposed to Pneumothorax (e.g. COPD)
  – Spontaneous
    • Usually underlying lung disease
  – Traumatic
  – Tension- one-way valve effect. Air pressure builds in chest

• Treatment – Evacuate air (chest tube)
Good Luck!
Alladag@ohsu.edu