Pulmonary Medicine
Pearls for Inpatient Medicine

Mayo School of Continuous Professional Development

2nd Annual Inpatient Medicine for NPs & Pas:
Hospital Care from Admission to Discharge

Wednesday-Saturday, October 19-22, 2016
Sawgrass Marriott Hotel • Ponte Vedra Beach, Florida
Disclosures

• I have no relevant financial relationships to disclose
Outline

• Review best practices for treatment of an COPD exacerbation
• Recall the evaluation a pleural effusion
• Discuss management of massive hemoptysis
• Understand the management of pneumothorax
• ? Pneumonia treatment (new guidelines)
Case 1:

• 54 M smoker (60+ pack years) presents to the ED with shortness of breath, increased cough and sputum production.

• PMHx: COPD (FEV₁ 34%)

• Exam: T 37.0 C, P 106, RR 28, BP 152/84 O₂ sat 82% on RA

Lungs: Diffuse bilateral expiratory wheezing
Q1: In addition to starting this patient on oxygen and nebulizers which of the following is indicated?

A. Azithromycin and prednisone
B. Levaquin and beclomethasone
C. Doxycycline and roflumilast
D. Ceftriaxone and salmeterol/fluticasone
Acute Exacerbation of COPD

- Mostly caused by bacterial or viral infections
- Antibiotics use not well defined but felt to be helpful in the following scenarios
  1. increased cough, dyspnea and sputum purulence above baseline
  2. Requirement for mechanical ventilation

Antibiotics

• Most common bacterial pathogens
  • *Haemophilus influenzae*
  • *Haemophilus parainfluenzae*
  • *Streptococcus pneumoniae*
  • *Moraxella catarrhalis*

• Choice based on local resistance patterns
  • Advanced macrolide
  • Cephalosporin
  • Doxycycline

• Duration: 5-10 days
Treatment of Acute Exacerbation of COPD

• Oxygen
  • Maintain PaO2 > 60 mmHg (sats 88-92%)
  • Close monitoring for signs of respiratory failure
  • NPPV

• Nebulizers
  • Short- acting bronchodilators (SABA +/- SAMA)

• Systemic Glucocorticoids
Q2: The patient is feeling much better on prednisone, azithromycin, oxygen and nebs and is ready for discharge. What is the appropriate duration of glucocorticoids?

A. 7 days
B. 14 days
C. 5 days
D. 10 days
Glucocorticoids

- Decrease recovery time
- Improve lung function
- Improve arterial hypoxemia
- Reduce risk of early relapse
- Inhaled agents (fluticasone) do not show the same benefit
- Duration: 5 days sufficient (REDUCE trial)

Leuppi. JAMA. 2013;309:2223-31
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• Antibiotic use in acute exacerbations of COPD should be limited to patients with increased dyspnea and purulent sputum or those who require mechanical ventilation

• 5 days of glucocorticoids was non-inferior to 14 days for reducing re-exacerbation rate
Case 2: 56 M with right lower chest pain, night sweats, fatigue, weight loss. Previous episode of pneumonia 2 months prior, treated with 7 days of levofloxacin. What is the next best step in management?

A. IV antibiotics
B. Thoracentesis
C. CT Chest
D. Bronchoscopy
E. PET scan
Pleural Effusion

Abnormal collection of fluid in pleural space

Fluid formation is affected by:

• Hydrostatic pressures
• Increased permeability of pleural vessels
• Decreased osmotic pressures
• Decreased lymphatic drainage
Pleural Effusion on bedside ultrasound
Back to the patient

• Thoracentesis performed
  • LDH 3300 u/L
  • Total Protein 4.6
  • pH 6.8
  • Glucose <10
  • Gram stain: gram positive cocci
  • Culture pending
Q4: What is the most likely cause of his pleural effusion?

A. Heart failure
B. Malignancy
C. Empyema
D. Rheumatoid arthritis
E. Cirrhosis
PLEURAL EFFUSION

**Transudate** (non-inflammatory)
- Appearance: serous (hydrothorax)
- Chemistry: low protein, low LDH, few cells
- Formation: hydrostatic/oncotic pressure changes

**Causes:** CHF, cirrhosis, ascites, nephrotic syndrome, myxedema, Meigs’ syndrome
PLEURAL EFFUSION

**Exudate** (usually inflammatory)
- Appearance: serous, cloudy, pus, serosanguineous
- Chemistry: high protein and LDH, increased cells
- Formation: permeability change

**Causes:** infection, infarction, malignancy, RA, SLE, radiation
### Common causes of transudates and exudates

<table>
<thead>
<tr>
<th>Transudates</th>
<th>Exudates</th>
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<tbody>
<tr>
<td>Congestive Heart Failure</td>
<td>Parapneumonic</td>
</tr>
<tr>
<td>Hepatic hydrothorax</td>
<td>Malignancy</td>
</tr>
<tr>
<td>Nephrotic syndrome</td>
<td>Pulmonary Embolism</td>
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<tr>
<td>Hypoalbuminemia</td>
<td>Tuberculosis</td>
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<tr>
<td>Iatrogenic (e.g., CVC migration)</td>
<td>Autoimmune diseases (RA, SLE)</td>
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<tr>
<td>Trapped lung</td>
<td>Benign asbestos effusion</td>
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<tr>
<td>Urinothorax</td>
<td>Post-coronary artery bypass</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Peritoneal dialysis</td>
<td>Post-myocardial infarction</td>
</tr>
<tr>
<td>Cerebrospinal fluid leak into the pleural space</td>
<td>Yellow nail syndrome (lymphatic disorders)</td>
</tr>
<tr>
<td></td>
<td>Drugs</td>
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</tbody>
</table>
Complicated pleural effusion

Septated pleural effusion

Diaphragm
Pleural fluid chemistries

• pH if < 7.2
  • indicates a high metabolic rate
  • Seen in complicated parapneumonic effusions, malignancy, tuberculous pleuritis, rheumatoid and lupus pleuritis and esophageal rupture

• Glucose
  • Should be same as blood
  • low (<60 mg/dL) suggests increased utilization (infection, malignancy) or decreased transport (rheumatoid pleuritis)
### Pleural fluid Cell Count and Differential

<table>
<thead>
<tr>
<th>Cell Type</th>
<th>Cell count</th>
<th>Clinical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Blood Cells</td>
<td>5,000-10,000/μL</td>
<td>bloody appearance, hemothorax if pleural fluid hematocrit &gt;50% peripheral hematocrit</td>
</tr>
<tr>
<td>Nucleated cells</td>
<td>&gt;50,000/μL</td>
<td>Complicated parapneumonic effusions and empyema</td>
</tr>
<tr>
<td></td>
<td>&gt;10,000/μL</td>
<td>Bacterial pneumonia, acute pancreatitis and lupus pleuritis</td>
</tr>
<tr>
<td></td>
<td>&lt;5,000/μL</td>
<td>Chronic exudates (TB pleurisy and malignancy)</td>
</tr>
<tr>
<td>Lymphocytosis</td>
<td>&gt;80%</td>
<td>Suggests TB, lymphoma, chronic rheumatoid pleurisy, sarcoidosis and late post CABG effusions. Pleural biopsy is indicated if no diagnosis.</td>
</tr>
<tr>
<td>Eosinophilia</td>
<td>&gt;10%</td>
<td>Suggests air or blood in the pleural space but is non-specific. Can be seen in parapneumonic effusions, drug-induced pleurisy, Churg-Strauss syndrome, benign asbestos effusions, malignancy (lymphoma), pulmonary infarction and parasitic disease</td>
</tr>
</tbody>
</table>
Pleural fluid analysis

• Amylase
  • pleural fluid to serum ratio >1 suggests pancreatic disease, esophageal rupture or malignant effusion
  • Not routinely tested unless suspect esophageal or pancreatic cause

• Triglycerides
  • >110 mg/dL – characteristic of chylothorax
  • <50 mg/dL – excludes chylothorax
  • Between 50-110 mg/dL- check chylomicrons
Management of Empyema

- Frequently polymicrobial and usually includes anaerobes
- Requires chest tube drainage and antibiotics
- Small bore chest tubes (<14Fr) do not increase risk of surgery
- Intrapleural tpa-dnase (MIST-2) improve drainage
- May require decortication

Rahman. Chest 2010;137:536-43
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• Characterization of pleural fluid as a transudate or exudate helps narrow the differential diagnosis and direct subsequent investigations.

• Empyema should be managed with drainage and antibiotics that will treat anaerobic infection.
Case 3

- 72 M with a history of COPD, CAD, OSA on CPAP came to the ED with shortness of breath.
- He awoke with a sensation of substernal chest heaviness/pressure and dyspnea. He took a nitroglycerin tab which did not help. He used his nebulizer, again with no relief, so he called EMS.
- When EMS arrived they noted him to be in significant respiratory distress. He was started on BiPAP and noted to be tachypnic and tachycardic. He is currently unable to provide any direct history himself at this time but he does point to his substernal chest area and indicate some pain there.
Q6: The patient continues to have increased work of breathing. Based on his CXR you decide to do which of the following.

A. Observation
B. Insert a Chest tube
C. Culture and antitibiotics
D. Nebulizer
Case 3: 22 M with multiple episodes of blood streaked sputum over past 6 months. Was told he had asthma and started on inhaled corticosteroids without improvement. Denies fevers, weight loss or other systemic symptoms. Exam: Focal wheeze over posterior right mid lung. CXR was normal. What is the next best step?

A. Pulmonary function tests
B. Start inhaled steroids
C. Bronchoscopy
D. Empiric antibiotics for pneumonia
Pneumothorax

• Definition: Air in the pleural space

• Types:
  • Spontaneous
    • Primary (idiopathic) - subpleural blebs
    • Secondary - obstructive, interstitial lung disease, TB, CA.
  • Traumatic
  • Iatrogenic
Primary Spontaneous pneumothorax

- Risk Factors
  - Smoking
  - Tall stature
  - Family history
  - Marfan syndrome

- Size
  - Lung margin to chest wall at hilum
  - >2 cm at hilum = large

21 M with spontaneous R pneumothorax
Pneumothorax Management

- Large secondary spontaneous pneumothorax (>2cm)
  - Tension (unstable hemodynamics)
    - Emergent needle thoracostomy
  - Symptomatic but stable hemodynamics
    - Small bore chest tube
Pneumothorax Management

• Small pneumothorax with minimal symptoms can be clinically observed

• Patients presenting with SSP are at higher risk for persistent air leak or further expansion of their pneumothorax due to underlying lung disease

MacDuff. Thorax 2010;65(Suppl 2):ii18-ii31
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- Tension pneumothorax should be managed emergently with needle thoracostomy followed by chest tube placement and hospitalization
- Observation alone has been shown to be safe for small pneumothoraces with minimal symptoms
Case 4

- 47 M (foreign born) with prior hx of MDR-TB on current therapy reports with several day history of worsening cough with blood streaked sputum
- CXR notable for new perihilar infiltrate, right upper lobe cavitary lesion
- Pt admits to ongoing fevers, night sweats, and weight loss.
- Suddenly coughs up bright red blood with significant dyspnea, saturations stabilized on 4LNC.
Q7: What is the next best thing to do?

A. Call the bronchoscopy team
B. Stat CT Chest
C. Place the patient in the right lateral decubitus position
D. Stat Blood transfusion
Massive hemoptysis

- Exact definitions controversial, but may be guided by expectoration of $\geq 500 \text{mL over 24hrs}$, or rate of $\geq 100 \text{ml/hr}$ (whether there is respiratory compromise or not is the controversial part)

- Markers of poor outcome include:
  - Malignancy
  - 2 or more lobes affected on radiography
  - Aspergillosis
  - Pulmonary arterial bleed (vs bronchial)
  - Mechanical ventilation
Hemoptysis

• Two Circulations

• Causes
  • Airways
  • Pulmonary parenchymal
  • Pulmonary vascular
  • Cryptogenic
  • Miscellaneous
Hemoptysis

- Directed history and exam
- CXR
- Bronchoscopy
- Chest CT
Management of Massive Hemoptysis

- **Obtain a thorough hx** (malignancy, chronic infection, cavitary lesions, nosebleed vs hematemesis, laterality of the culprit lesion, *old films*)
- If lesion laterally known, ‘lay that side down’
- Intubate and ventilate, consider selected intubation
- **Treat or manage any bleeding diathesis** (reverse anticoagulation, supportive transfusion)
- **Bronchoscopy**, both diagnostic and therapeutic
  - APC or cauterization
- **Bronchial blocker**
- Arteriogram with coiling if bronchial bleed
- Surgical resection
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- *In active hemoptysis* flexible bronchoscopy is particularly useful, often allowing localization of the site of hemoptysis and visualization of the endobronchial pathology causing the bleeding.
Questions?
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