Learning Objectives

- Discuss the etiologies, clinical presentation, and approach to the management of the following pulmonary infections:
  - Acute bronchitis
  - Influenza
  - Pneumonia
    - Bacterial
    - Viral
    - Fungal

Learning Objectives

- Compare and contrast the etiologies and clinical presentation of bacterial, viral, fungal and HIV-related pneumonias
- Describe the diagnostic studies used in the evaluation of pulmonary infections along with the expected findings
- Discuss treatment options for pulmonary infections based on treatment location (inpatient vs outpatient)
Which of the following is the primary complaint for a patient with acute bronchitis?
- Wheezing
- Cough
- Hemoptysis
- Dyspnea

A 46-year-old male presents to an outpatient clinic with the acute onset of fever and chills with a cough that is productive of yellow-green sputum. He is dyspneic with minimal exertion and also complains of left-sided pleuritic chest pain. Chest x-ray reveals a dense left lower lobe infiltrate. Which of the following pathogens is the most common etiology for the patient’s presentation?

1. Streptococcus Pneumoniae
2. Klebsiella pneumoniae
3. Mycoplasma pneumonia
4. Chlamydomphile (Chlamydia) pneumonia

Which of the following pathogens is associated with a lobar consolidation on chest film?

1. Mycoplasma pneumoniae
2. Pneumocystis jiroveci
3. Legionella pneumophila
4. Haemophilus influenza
Which of the following antibiotics is recommended for the outpatient treatment of a community-acquired pneumonia?

1. Azithromycin
2. Cephalexin
3. Amoxicillin-clavunate
4. Trimethoprim-sulfamethoxazole

Which of the following laboratory findings is associated with coccidiomycosis?

1. Basophilia
2. Eosinophilia
3. Neutropenia
4. Thrombocytopenia

Acute Bronchitis

- Inflammation of the trachea and large bronchial airways
- Etiology
  - Predominantly viral
    - Influenza A & B, Adenovirus, Rhinovirus, Respiratory Syncytial Virus
  - Common bacterial pathogens include:
    - *Haemophilus influenzae*, *Moraxella catarrhalis*, *Streptococcus pneumoniae*, and *Staphylococcus aureus*
Acute Bronchitis - Clinical Presentation

• Symptoms
  - Primary complaint is a **cough** following a viral prodrome
  - Duration of cough can last 10 – 20 days
  - Cough dry initially, becomes more productive in later stages
  - May see associated bronchospasm
  - Fever if present is low-grade

Acute Bronchitis - Clinical Presentation

• Signs
  - Physical exam is consistent with upper respiratory infection
  - May see erythema of pharynx
  - May hear rhonchi, crackles or wheezing on lung exam

Acute Bronchitis - Diagnostic Evaluation

• Indications for a chest x-ray in a patient with an acute cough:
  - Patients > 75 years of age
  - Abnormal vital signs (HR > 100, RR > 24, or T > 100.4°F)
  - Rales or other signs of consolidation on exam
  - Persistent cough > 2 weeks
  - Comorbidity
Acute Bronchitis - Management
- Treatment is primarily supportive
- Cough suppressants
  - Dextromethorphan
  - Codeine based cough syrups (watch sedation)
  - Bronchodilators may be helpful to relieve wheezing
    - Albuterol or levalbuterol

Influenza
- Acute febrile illness secondary to Influenza A or B
- Transmitted by respiratory droplets
- Outbreaks common during the winter
- Increased infection rates in children
- Increased complication rates in the elderly
  - Especially patients with history of COPD, diabetes mellitus, heart disease, or an immunocompromised state
  - Deaths due to secondary bacterial pneumonia

Influenza
- Prevention with vaccination
  - Recommended to ALL after 6 months of age.
  - Know contraindications to vaccine
  - Different vaccine developed each year for most likely strain to appear
  - Very important to recommend vaccine to your elderly patients
Influenza

- Clinical presentation:
  - Abrupt onset of fever and chills
  - Fever can be as high as 106°F
  - Sore throat, headache, myalgias, malaise
  - Non-productive cough
  - Severity of presentation separates influenza from URI
  - Symptoms last from 3 days-2 weeks with convalescence 1-4 weeks

Influenza - Diagnostic Evaluation

- CBC – signs of infection, anyone with a fever. Look for right shift.
- Chest x-ray – for productive cough/fever
- Viral culture from nose or pharynx
  - (Best test)
- Immunofluorescence assays and/or enzyme immunoassays (EIA).
- Also reverse transcriptase-polymerase chain reaction (RT-PCR)

Influenza

- Management
  - Supportive care, including bedrest and anti-pyretics
  - Rimantadine and amantadine can help shorten the course, good for influenza A. (Resistance)
  - Neuraminidase inhibitors: Zanamivir and oseltamivir, are active about influenza A & B
    - Oseltamivir for > 1 year of age
    - Zanamivir for > 7 years of age
Influenza
• If started within 12 hours, shorten course by 3 days, if started within 2 days, shorten by 1 day
• Approximately 10% develop bacterial pneumonia as a complication

Pneumonia
• 6th leading cause of death in the US
• 2-3 million cases/year
• 500,000 (+) and growing admissions/year
• 50,000 deaths/year
• Mortality:
  - outpatient < 1%
  - admitted 10-15%, ICU 30-40%

Pneumonia
• Inflammation and consolidation of the lung parenchyma secondary to an infectious cause
• Community-acquired pneumonia (CAP) occurs outside the hospital or less than 48 hours after an admission to the hospital.
• Nosocomial or hospital-acquired pneumonia (HAP) occurs > 48 hours after an admission, excluding any infection present on admission.
Etiology of Pneumonia

- **CAP**
  - *Streptococcus pneumoniae* (30-60%)
  - *Haemophilus influenzae*
  - *Staphylococcus aureus*
  - *Klebsiella, Pseudomonas, E. Coli* – uncommon
- Atypical pneumonia
  - *Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella pneumophila*

Pathogen Predilection for Sites

Hospital-Acquired Pneumonia

- Second most common hospital-acquired infection
- Leading cause of death – mortality 50%
- Most common pathogens:
  - *Pseudomonas aeruginosa*
  - *Staphylococcus aureus* – both MSSA and MRSA
  - *Enterobacter sp.*
Pneumonia - Clinical Presentation

- Fever
- Leukocytosis
- Cough
- Sputum production
- Night sweats
- Weakness
- Hemoptysis
- Dyspnea
- Pleuritic chest pain
- Hypoxemia
- Hypercapnia

Pneumonia - Diagnostic Evaluation

- CBC look for elevated WBC with a left shift
- Blood cultures will be positive in 10 to 20%
- Sputum gram stain and cultures. Hard to do!!
- Urine antigens for S. pneumoniae and Legionella
- ABGs/Pulse oximetry may show hypoxemia
  - pO2 < 60 mmHg is a criteria for hospital admission

Chest Radiographs

- Presence of an infiltrate on chest films is the “gold standard” in diagnosing pneumonia
- CXR findings vary
  - Lobar pneumonias (S. pneumoniae, H. influenzae) present as a density involving a distinct section of the lung
  - Interstitial pneumonias (such as atypical, viral and pneumocystis pneumonia) present with diffuse infiltrates
Normal PA & Lateral CXR

Mass vs. Infiltrate

Consolidation of right upper lobe
Diffuse Bilateral Perihilar Infiltrates (Pneumocystis in HIV Patient)

CT scan

- More sensitive than CXR
  - Hilar areas
- Look at other structures
- Incidental findings

- Cost
  - CT scan 6X cost
- Radiation exposure
  - 50-450 CXR equivalents
Testing Summary

- Chest X-ray: Generally Indicated
- CT scan: Not 1st line
- Blood Cultures: Typically not unless admitted
- Sputum Cultures: Typically not helpful
- Serology Testing: Helpful

Pneumonia - Treatment

- Avoid smoking, oxygen, hydration
- Antibiotic therapy should be based upon clinical and radiographic findings and should be continued for 7-10 day course
- Macrolides (azithromycin or clarithromycin) and/or doxycycline are recommended for outpatient treatment of CAP

Sanford Guide to Antimicrobial Therapy, 2015

Pneumonia - Treatment

- Inpatient treatment – 2nd or 3rd generation cephalosporin is indicated along with a macrolide or fluoroquinolone
- Example: ceftriaxone and azithromycin

Sanford Guide to Antimicrobial Therapy, 2015
Pneumonia - Treatment

- Inpatient treatment of HAP – anti-pseudomonal cephalosporin along with an aminoglycoside and a fluoroquinolone
- Additional coverage of anaerobes for aspiration pneumonia

Pneumonia Treatment Overview

- Uncomplicated outpatient
  - Macrolide or doxycycline
- Complicated outpatient OR Non-ICU
  - Beta-lactam plus macrolide
  - OR respiratory fluoroquinolone
- ICU
  - Beta-lactam plus azithromycin
  - OR Beta-lactam plus respiratory fluoroquinolone
  - OR PCN allergy: respiratory fluoroquinolone plus aztreonam

Indications for Hospitalization

- Hypoxemia – oxygen saturation < 90% on room air
- Hemodynamic instability
- Intolerant of medications
- Active co-morbidities
- Concern over compliance
  - Substance abuse
  - Cognitive impairment
  - Living situation
Pertussis

- Pertussis, or Whooping cough, is a prolonged bacterial infection of the upper respiratory tract that is characterized by paroxysms of coughing
- Peak age – children less than 1 year of age
- Etiology – *Bordetella pertussis*

Clinical presentation characterized by three stages:
- Catarrhal phase: 1 to 2 week prodrome similar to an URI
- Convalescent stage: cough subsides
  - Lasts weeks to months
- Paroxysmal phase: intense, paroxysms of coughing that are associated with an inspiratory whoop
  - Coughing associated with post-tussive gagging and vomiting
  - May see cyanosis and anoxia
  - When symptoms are prolonged, there may be exhaustion or apnea
  - Lasts 2-6 weeks
Pertussis - Management

- Supportive care
  - Hydration, maintaining airway
- Antibiotics
  - Erythromycin for 2 week course
  - Can also use: azithromycin, clarithromycin, or trimethoprim-sulfamethoxazole
- Admission for respiratory distress or pneumonia
- Vaccination is successful in preventing pertussis
  - Erythromycin is recommended for all close contacts in the household

Viral Pneumonia

- Viral etiologies
  - Influenza A & B, RSV, adenovirus, varicella, CMV
- Presentation varies with virus
  - Common symptoms: headache, malaise, low grade fever, and non-productive cough
  - Adenovirus: hoarseness, pharyngitis, tachypnea, and cervical adenopathy
  - Varicella: fever, maculopapular or vesicular rash, few findings on lung exam
  - CMV: fever, paroxysmal cough, occasional hemoptysis

Diagnostic Evaluation – Viral Pneumonia

- CXR shows diffuse or patchy infiltrates

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Viral Pneumonia - Management

- Treat symptomatically
- Amantadine and rimantadine may be used for influenza. Resistance is seen.
- May also use neuraminidase inhibitors (osteltamivir or zanamivir) for influenza
- Isolation important for RSV infections

Fungal Pneumonia

- Etiology
  - Histoplasmosis capsulatum
    - Organism found in soil contaminated with bird and bat droppings
  - Coccidioidomycosis immitis ("Valley Fever")
    - Organisms are found in the soil in semi-arid areas

Histoplasmosis - Clinical Presentation

- Most cases asymptomatic or mild
- If acute, see flu-like symptoms, fever, fatigue, headache, nonproductive cough, dull chest pain
- Chronic, progressive pulmonary histoplasmosis
  - Usually occurs in older COPD patients
- If disseminated, see fever, marked fatigue, cough, dyspnea, weight loss
  - Seen in profoundly immunocompromised host
- Can be fatal within 6 weeks due to multiple organ involvement
Histoplasmosis - Diagnostic Evaluation

- Laboratory studies:
  - Antigen detected in bronchoalveolar lavage fluid, blood, and urine
  - Serology (may take several weeks)
  - Biopsy
  - Cultures may be helpful if chronic

- CXR findings:
  - May be normal
  - Single or multiple patchy or nodular infiltrates in the lower lung fields
  - Hilar adenopathy

Histoplasmosis - Management

- No treatment for asymptomatic patients
- For acute pulmonary infection
  - Often don’t need treatment - symptoms improve within several weeks
  - If no improvement within a month, itraconazole is effective for mild-moderate symptoms
- Severe infections – Amphotericin B
- Chronic infection - Amphotericin B or itraconazole
- AIDS patients - Amphotericin B, maintenance therapy with itraconazole
Clinical Presentation – Cocci

- Symptoms of primary disease occur in approximately 40% of patients
  - Fever, cough, pleuritic chest pain
  - Headache, fatigue, arthralgias
  - Rash (erythema multiforme or erythema nodosum)
- Disseminated disease
  - HIV / immunocompromised patients at greater risk
  - Pulmonary findings more pronounced, eg. lung abscess
  - Meningitis

Diagnostic Studies – Cocci

- Eosinophilia, mild leukocytosis
- Elevated ESR
- Serologic antibody tests for IgM, IgG
- Fungal cultures
- CXR will show unilateral patchy infiltrates, thin-walled cavities and hilar adenopathy

Treatment of Cocci

- For disease limited to chest without evidence of progression - majority of cases resolve without antifungal therapy
  - If treated, therapy is symptomatic
  - Fluconazole, Amphotericin B IV for severe cases
- Prognosis
  - Limited disease – good (fatigue may persist x mos.)
  - Disseminated & meningeal forms with high mortality rate (50% in absence of therapy)
Treatment of All Fungal Pneumonia
• As a general rule of thumb
• While waiting for serology or culture results, it is usually advisable to initiate treatment for Community Acquired Pneumonia.

HIV-Related Pneumonia
• Pneumocystis jirovecii (carinii) pneumonia is seen primarily in patients with AIDS
• Approximately 11 cases/100 patients among HIV-patients with CD4 counts < 100/mm³
• May also see with other immunocompromised patients – acute leukemia, lymphoma, or with bone marrow or organ transplant patients

HIV-Related Pneumonia
• Clinical Presentation
  • Fever
  • Weight loss
  • Fatigue
  • Dry cough
  • Dyspnea
• Pulmonary exam is usually unremarkable
HIV-Related Pneumonia

- **Diagnostic Evaluation**
  - Elevated LDH
  - Gram stain negative for bacteria
  - CXR will show interstitial infiltrates

**Management**

- Trimethoprim-sulfamethoxazole x 3 weeks
- Pentamidine as an alternate
- May add prednisone if acutely ill or severe disease
- After completion of treatment, lifelong prophylaxis should be maintained with trimethoprim-sulfamethoxazole (one dose/day or double-strength three times/week)

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Which of the following is the primary complaint for a patient with acute bronchitis?

1. Wheezing
2. Hemoptysis
3. Cough
4. Dyspnea

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- [ ] Wheezing 25%
- [ ] Hemoptysis 25%
- [ ] Cough 25%
- [ ] Dyspnea 25%
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Answers

• Question 1 (3) The primary symptom in acute bronchitis is cough which is dry initially, but may become productive later. Cough may last up to three weeks.
• Question 2 (1) The clinical presentation is consistent with a CAP: the most common pathogen in CAP is S. pneumoniae which accounts for up to 60% of cases.
• Question 3 (4) The typical pneumonias (S. pneumo and H. flu) are associated with lobar consolidations; pneumocystis and atypical pneumonias are associated with interstitial infiltrates.

Answers

• Question 4 (1) Macrolides are the recommended treatment for outpatient management of CAP; can use azithromycin or clarithromycin
• Question 5 (2) Diagnostic studies in the evaluation of coccidiomycosis will show eosinophilia and mild leukocytosis. CXR will show hilar adenopathy and patchy infiltrates.
References


Online Resources

- www.aafp.org
- American Family Physician
- www.learningradiology.com
- www.stanford.edu
- www.uptodateonline.com