Community Acquired Pneumonia (CAP)

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Objectives

Pathophysiology
- Conditions that may increase the risk for CAP
- How do pathogens get into our lungs
- Review pathogens responsible for CAP

Review patient presentation

Diagnosis

Treatment per IDSA guidelines

Case
Pathophysiology: How do pathogens get into the lungs

Inhalation
- Seen with atypical bacteria and viruses.
- Often patients will have a bilateral PNA

Spread from another source in the body
- IVDUers are prone to right sided endocarditis (tricuspid valve). Vegetation from an endocarditis can go directly into lungs
- Bacteremia. In most cases of PNA and bacteria, the PNA causes the bacteremia. However, some bacteremias can seed the lungs

Aspiration
- Macro-aspiration which is seen in patients that vomit or have swallowing disorders
- **Micro-aspiration is the most common cause of CAP.** Nasopharyngeal colonization of bacteria followed by micro-aspiration during sleep
Pathophysiology: Factors that predispose to CAP

**COPD/smoking:** Damages bronchial epithelial cells and impairs ciliary function

**Alcoholism:** Alcohol depresses cough reflex and epiglottal function
- S. aureus, GNR, aspiration PNA

**Immunosuppressive diseases:** Depressed humoral and cell-mediated immunity
- Corticosteroid use: Gram positive and negative bacteria, PCP
- Asplenic, sickle cell anemia, multiple, myeloma: Encapsulated bacteria including pneumococcus and *H. influenzae*

**Time of year:** Cold weather dries mucous membranes and increases person to person spread of infection

**Swallowing disorder:** Aspiration

**Influenza:** Damage cilia and increased nasopharyngeal colonization of bacteria that can get into the alveoli
- Pneumococcus, *H. influenza* and *S. aureus* are the most common pathogens post influenza
Pathophysiology: Pathogens

Typical pathogens
- *Streptococcus pneumoniae, Haemophilus influenza* and *Moraxella catarrhalis*
- *Staphylococcus aureus* may be seen in patients admitted to ICU

Atypical pathogens
- *Mycoplasma pneumoniae, Chlamydia pneumoniae* and *Legionella pneumoniae* (Legionella is not a common pathogen in Washoe County)
- Viruses including influenza
Presentation

Typical bacteria
- Typically have a productive: The appearance of some sputum may suggest a specific pathogen. Pneumococcus often produces a rust colored sputum
- Temperatures ≥102°F and chills
- Leukocytosis ≥12,000 with an increase in bands ≥10%

Atypical bacteria
- Usually produce scant sputum
- Temperatures ≤102°F. However, legionella produces high fevers and is associated with a pulse-temperature disparity
- Leukocytosis ≤12,000

Macro-aspiration
- Chemical pneumonitis may be the initial presentation with infiltrate (R upper or R lower lobe), plus fever and leukocytosis. Initially, this is secondary to stomach acid causing a chemical reaction in the lungs
- Patient may then develop a PNA after ≥2 days if it is caused by a typical bacteria or after a week if it is caused by oral anaerobes
CURB-65 is used to suggest whether a patient should be treated as an outpatient, admitted to the medical floor or admitted to ICU. Each criteria is one point

- **C**= Confusion
- **U**=Uremia (BUN >19mg/dl)
- **R**=Respiratory rate (≥30 breaths/min)
- **B**=BP (Systolic <90mmHg or Diastolic ≤60mmHg)
- **56**= Age (≤65 yrs)

<table>
<thead>
<tr>
<th>CURB-65 points</th>
<th>% deaths</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>0-1</td>
<td>2.7</td>
<td>Outpatient</td>
</tr>
<tr>
<td>2</td>
<td>6.8</td>
<td>Inpatient</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>Inpatient/ICU</td>
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<tr>
<td>4-5</td>
<td>27.8</td>
<td>ICU</td>
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Influenza background and terminology

Influenza virus produces an “atypical-like” syndrome with fever, headache, shaking chill (rigors), headaches, fatigue and myalgia. Pneumonia is not common, but does occur.

Occurs during the winter-spring months and is spread by droplets.

Period of contagiousness: 1 day prior to symptoms and 57 days after they occur.

3 types of influenza: A (humans, swine, marine mammals, horses and birds, B (only humans) and C (humans and swine).

Two primary surface antigens:
- Hemagglutinin (HA): There are 15 distinct HAs (HA1-HA15)
- Neuraminidase (NA): There are 9 distinct NAs (NA1-NA9)
- Making vaccines: Each summer the CDC looks at the subtypes combinations seen in parts of the world during their winter months to predict what subtypes we will see during our flu season.
- Last year our vaccine included the subtypes H3N2 and H1N1.
Influenza background and terminology

After we make the vaccine, the HA/NA combination change by the time it gets to the western world. This can be in the form of an Antigenic Drift or Antigenic Shift

Antigenic Drift:
- Minor antigenic changes within HA or NA or rarely both
- Primarily in influenza A, but can occur in B and C
- May account for influenza epidemics

Antigenic Shift
- Major changes within a virus where the population has no immunity
- Only seen in influenza A
- This increases the possibility of a pandemic
Diagnosis: CAP and influenza

**CAP**
- Signs and symptoms (vary depending on typical verses atypical pneumonia as reviewed)
- Leukocytosis
- CXR demonstrating an infiltrate
- Increased O2 needs

**Influenza**
- Signs and symptoms
- Rapid influenza test (low sensitivity and high specificity)
- PCR (gold standard)
Treatment

CAP

- Outpatient: Azithromycin (Z-pak), doxycycline 100mg bid x 5-7 days, levofloxacin 750mg bid x 5 days (FQ should be reserved for a more serious patient)
- Admitted to hospital floor: Ceftriaxone 1-2 gm or Unasyn 3gm q6h + either azithromycin or doxycycline 100mg bid, respiratory FQ such as levofloxacin 750mg qd.
- Admitted to ICU: Ceftriaxone + either azithromycin or levofloxacin ± vancomycin
- Macro-aspiration pneumonia: Unasyn or ceftriaxone + metronidazole 500mg tid or q8h

Influenza

- Treatment: Zanamivir 20mg (2 inhalations per plastic device bid) Tamiflu (oseltamivir) 75mg bid
- Prophylaxis: Zanamivir 20mg qd or oseltamivir 75mg qd
Case (Date 12/5/2015)

64 yo m is admitted to RRMC with a 2 day history of fever (103F), sputum production and SOB.

Pt was in normal state of health until 10 days weeks ago when he complained of a 2 day history of muscle aches, fever to 102F and headache. Went to ER. His rapid flu test was negative and he was given Z-pak and sent home. He had no immediate relief from the Z-pak, but started filling better 5 days after ER visit. 3 days later started feeling much worse and came to ER. O2 sats 85% on room air

PMH: Smoker with 30 pack yr, but no hx COPD

Admitted to ICU requiring ventilation, WBC 18,000 with 20% bands, Bun/Cr is 36/2.0 and CXR RLLL infiltrate. Ht 72” and Wt 115kg

What are your thoughts and what would you do?
Case

With the time of year, how the patient initially presented to the ER compared to now and lack of response to Z-pak, this suggests that the patient probably had the flu. The negative rapid flu test has a high specificity but a low sensitivity. False negative are not unusual.

Now the patient is presenting with signs of a bacterial PNA. What are your empiric antibiotic would you choose:

- A. Zosyn 4.5gm q6h + vancomycin
- B. Zosyn 3.375gm q8h + vancomycin
- C. Ceftriaxone 2gm q24h + vancomycin
- D. Ceftriaxone 2gm + azithromycin + vancomycin

B. Ceftriaxone + vancomycin  Don’t need to add azithromycin since patient already failed, and the most likely pathogens are pneumococcus, S aureus and H influenza.