

429 Medicine Team

Pneumonia

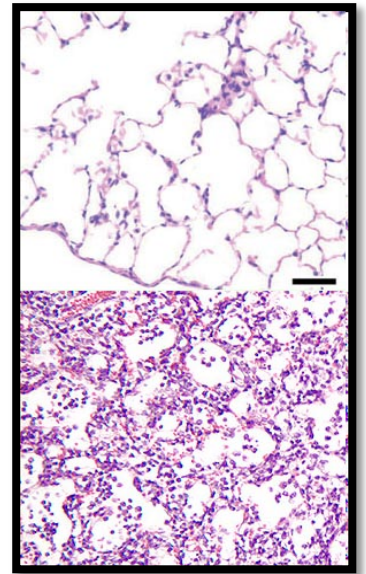
Slides (Handout version) + Notes from books

What is pneumonia? What is it characterised by?

-**Pneumonia** is an inflammatory condition of the lung

Characterized by:

- inflammation of the parenchyma of the lung (alveoli)
- Abnormal alveolar filling with fluid causing Air space disease (consolidation and exudation)



Pneumonia definitions/classifications:

- Community-acquired pneumonia (CAP)
 - Cough/fever/sputum production + infiltrate
 - Occurs in the community
 - Typical or atypical
 - Most common organism: **strep pneumoniae**
- Hospital-acquired pneumonia (HAP)
 - Pneumonia \geq 48 hours after admission
 - Most common organism: Gram-negative rods and staph a.
- Ventilator-associated pneumonia (VAP)
 - pneumonia \geq 48 hours after intubation
- Healthcare-associated pneumonia (HCAP)
 - Pneumonia that develops **within 48 hours** of admission in pts with:
 - Hospitalization in acute care hospital for ≥ 2 d in past 90 d
 - Residence in NH or LTC facility
 - Chronic dialysis within 30 days
 - Home IV therapy, home wound care in past 30 days
 - Family member with MDR (multidrug resistance) pathogen

Pathogenesis:

- Inhalation:
 - organisms bypass normal respiratory defense mechanisms
 - Pt inhales aerobic GN organisms that colonize the upper respiratory tract or respiratory support equipment
 - TB, viruses, *Legionella*

- Aspiration:
 - occurs when the Pt aspirates colonized upper respiratory tract secretions
 - Stomach: reservoir of GNR (Gram-negative Rods) that can ascend, colonizing the respiratory tract
 - Microaspiration from nasopharynx: *S. Pneumonia*
 - Anaerobes
- Hematogenous :
 - originate from a distant source and reach the lungs via the blood stream
 - Staph endocarditis, septic emboli

Pathogens involved:

- CAP usually caused by a single organism
- Even with extensive diagnostic testing, most investigators cannot identify a specific etiology for CAP in $\geq 50\%$ of patients.
- Caused by a variety of Bacteria, Viruses, Fungi
- *Streptococcus pneumonia* is the most common pathogen 60-70% of the time
- #1 cause of CAP in all ages: *Strep pneumoniae*
- the ordering within each box is from most common to least common

Pathogenic Organisms

| | |
|--------------------|---|
| Outpatient | <i>Strep pneumo</i> <i>Mycoplasma / Chlamydo</i> <i>H. influenzae</i> Respiratory viruses |
| Inpatient, non-ICU | <i>Strep pneumo</i> <i>Mycoplasma / Chlamydo</i> <i>H. influenzae</i> <i>Legionella</i> Respiratory viruses |
| ICU | <i>Strep pneumo</i> <i>Staph aureus</i> , <i>Legionella</i> <u>Gram neg bacilli</u> , <i>H. influenzae</i> |

Investigations:

- CXR!
- CBC with diff
- Sputum gram stain, culture susceptibility
- Blood Culture
- ABG(arterial blood gasses)
- Urea / Electrolytes

Clinical diagnoses:

- Chest X-ray:
 - Demonstrable infiltrate by CXR or other imaging technique
 - Establish Dx and presence of complications (pleural effusion, multilobar disease)
 - May not be possible in some outpatient settings
 - CXR: classically thought of as the gold standard
 - Blood cultures
 - Sputum culture
 - special stain (acid fast: TB, silver stain: pneumocystis carinii in HIV patients)
 - Empirical treatment: antimicrobials
 - Previously Healthy Patients:
 - Outpatient
 - Organisms: S. pneumoniae, Mycoplasma, viral, Chlamydia pneumo, H. influenza
 - Recommended antibiotic: Macrolide (azithromycin or clarithromycin) or Doxycycline
 - These drugs cover all of the organisms
 - If the patient received antibiotics within the past three months:
 - Respiratory quinolone (moxi-, levo-, gemi-)
 - Advanced macrolide + amoxicillin
 - Advanced macrolide + amoxicillin-clavulanate
 - Patients with co morbidities: {Co morbidities such as: cardiopulmonary disease or immune compromised state}
 - Outpatient
 - Recommended Antibiotic:
 - Respiratory quinolone, OR advanced macrolide
 - Recent Antibiotic:
 - Third generation cephalosporin
 - Respiratory quinolone
 - Advanced macrolide + beta-lactam
 - Management-Medical Ward
 - Inpatient
 - Organisms:
 - all of the above plus polymicrobial infections (+/- anaerobes), Legionella
 - Recommended Parenteral Abx:
 - Respiratory fluoroquinolone, OR
 - Advanced macrolide plus a beta-lactam
 - Recent antibiotics:
 - As above. Regimen selected will depend on nature of recent antibiotic therapy
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Complications of pneumonia:

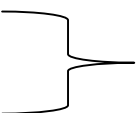
- Pleural effusion:
 - Seen in more than 50% of patients
 - Pleural fluid always needs analysis in setting of pneumonia (do a thoracentesis)
 - Always needs drainage: Chest tube, surgical
 - Pleural empyema
 - Bacteremia
 - Respiratory and circulatory failure
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First: Typical CAP:

- **causative agents:**
 - Strep. Pneumoniae (60%)
 - Most common cause
 - Gram positive diplococci
 - Hemophilus influenzae (15%)
 - Nonmotile, Gram negative rod
 - Secondary infection on top of Viral disease, immunosuppression, splenectomy patients
 - Encapsulated type b (Hib)
 - The capsule allows them to resist phagocytosis and complement-mediated lysis in the nonimmune host
 - Hib conjugate vaccine (this means that it is preventable)
 - Klebsiella and gram negative rods (6-10%) (**common in alcoholics**)
 - Staph. aureus (2-10%)
 - Streptococcus pneumoniae
 - Caused by strep. Pneumoniae (60% of the time)
 - Symptoms:
 - acute shaking chills and fever
 - cough with thick purulent rusty sputum
 - pleuritic chest pain
 - malaise
 - Lobar infiltrate on CXR
 - 25% of patients are bacteremic
 - Risk Factors:
 - **Splenectomy** (Asplenia)
 - Sickle cell disease, hematologic diseases
 - Smoking
 - Bronchial Asthma and COPD
 - HIV
 - ETOH (means alcohol/alcoholics)
 - Prevention
 - **Pneumococcal conjugate vaccine (PCV)**

- vaccine used to protect infants and young children
 - 7 serotypes of *Streptococcus*
 - **Pneumococcal polysaccharide vaccine (PPSV)**
 - 23 serotypes of *Streptococcus*
 - recommended (routine vaccination) for those over the age of 65
 - For both children and adults in special risk categories:
 - Serious pulmonary problems, e.g. Asthma, COPD
 - Serious cardiac conditions, e.g., CHF
 - Severe Renal problems
 - Long term liver disease
 - DM requiring medication
 - Immunosuppression due to disease (e.g. HIV or SLE) or treatment (e.g. chemotherapy or radiotherapy, long-term steroid use)
 - Asplenia
- Specific treatments:
 - Guided by susceptibility testing when available
 - *S. pneumoniae*:
 - β-lactams Cephalosporins: Ceftriaxone, Penicillin G
 - Macrolides : Azithromycin
 - Fluoroquinolone : levofloxacin
 - Highly Penicillin Resistant: Vancomycin
 - *H. influenzae*:
 - Ceftriaxone
 - Amoxicillin/Clavulinic Acid (Augmentin)
 - FQ
 - TMP-SMX

Second: atypical CAP:

- 15% of all CAP
 - Organisms:
 - *Mycoplasma pneumoniae*
 - *Chlamydophila pneumoniae*
 - *Legionella*
 - *Coxiella burnetii* (Q fever)
 - *Francisella tularensis* (tularemia)
 - *Chlamydia psittaci* (psittacosis)
 - *Viruses*
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Zoonis infection – ask about pets
- ‘Atypical’: not detectable on gram stain; won’t grow on standard media
 - Unlike bacterial CAP, often extra pulmonary manifestations:
 - Mycoplasma: otitis, nonexudative pharyngitis, watery diarrhea, erythema multiforme, increased cold agglutinin titre

- Chlamydomphila: laryngitis
- Most don't have a bacterial cell wall → **Don't respond to β -lactams**
 - Therapy: macrolides, tetracyclines, quinolones → (intracellular penetration, interfere with bacterial protein synthesis)
- Important associations:
 - Splenectomised patients → *Strep pneumoniae*, *H. influenzae*
 - Alcoholism → *Strep pneumoniae*, *Klebsiella*, oral anaerobes, *Acinetobacter*, TB
 - **Aspiration** → *Klebsiella*, *E. Coli*, oral anaerobes
 - **COPD/smoking** → *H. influenzae*, *Pseudomonas*, *Legionella*, *Strep pneumo.*, *Moraxella catarrhalis*, *Chlamydomphila pneumoniae*
 - **HIV** → *S. pneumo*, PCP (*pneumocystis carinii*), *H. influenzae*, *P. aeruginosa*, MTB, *Crypto*, *Histo*, *Aspergillus*, atypical mycobacteria
 - **Recent hotel, cruise ship** → *Legionella*
 - **Structural lung disease (bronchiectasis)** → *Pseudomonas*, *Burkholderia cepacia*, *Staph. aureus*
 - **ICU, Ventilation** → *Pseudomonas*, *Acinetobacter*
- CAP: influenza:
 - More common cause in children
 - RSV, influenza, parainfluenza
 - Influenza most important viral cause in adults, especially during winter months
 - Inhale small aerosolized particles from coughing, sneezing → 1-4 day incubation → 'uncomplicated influenza' (**fever, myalgia, malaise, rhinitis**) → Pneumonia
 - Adults ≥ 65 account for 63% of annual influenza-associated hospitalizations and 85% of influenza-related deaths
 - Recent worldwide pandemic of H1N1 Influenza A (2009-2010) and Current epidemic in Saudi Arabia (2010-2011)
 - H1N1 risk factors
 - **pregnant, obesity, cardiopulmonary disease, chronic renal disease, chronic liver disease**
 - CXR findings often subtle, to full blown ARDS (adult respiratory distress syndrome)
 - Respiratory (or Droplet) isolation for suspected or documented influenza (Wear mask and gloves) NP swab for, Rapid Ag test Infl A,B. H1N1 PCR RNA
 - Current Seasonal Influenza Vaccine prevents disease (given every season)
 - Bacterial pneumonia (*S. pneumo*, *S. aureus*) may follow viral pneumonia
 - Treatment:
 - **Adamantanes**
 - Influenza A
 - **Amantadine / Symmetrel 100mg orally twice daily**
 - **Rimantadine / Flumadine 100mg orally 4 times daily**
 - Not effective on H1N1 (its resistant)
 - **Neuraminidase inhibitors**

- Influenza A and B
- 70-90% effective for prophylaxis
- Give within 48h of symptom onset to reduce duration/severity of illness, and viral shedding
- **Oseltamivir / Tamiflu 75gm oral twice daily**
- **Zanamivir / Relenza 10gm (inhalation) twice daily**
- Oseltamivir dose in severe disease 150mg bid

How to treat a pneumonia patient?

1. First we decide if he should be treated as an outpatient or an inpatient (most important decision), 2 methods:

- **CURB-65** (1st Method)
 - i. Confusion of new onset
 - ii. blood Urea greater than 7 mmol/l (19 mg/dL)
 - iii. Respiratory rate of 30 breaths per minute or greater
 - iv. Blood pressure less than 90 mmHg systolic or diastolic blood pressure 60 mmHg or less
 - v. age **65** or older
 1. every one of these is scored with 1 point
 2. if the score is
 - a. 0-1 → outpatient
 - b. 2 → inpatient
 - c. 3 or more → ICU
 3. Mortality: 2 factors → 9%, 3 factors → 15%, 5 factors → 57%

- **Pneumonia Severity Index (PSI)** (2nd Method)
 - i. 20 variables including underlying diseases; stratifies pts into 5 classes based on mortality risk (check step up to medicine)

2. Should we admit him to the medical floor or the ICU?

- **1 major criteria or 3 minor criteria → ICU**
 - i. **Major criteria:**
 1. Invasive ventilation
 2. septic shock on pressors
 - ii. **Minor criteria**
 1. Respiratory Rate more than 30
 2. Multilobar infiltrates on CXR
 3. Confusion
 4. Blood Urea Nitrogen >20
 5. WBC <4,000
 6. Platelets <100,000
 7. Temp <36,

8. hypotension requiring aggressive fluids
9. PaO₂/FiO₂ <250

3. CAP inpatient therapy:

➤ Medical floor:

- i. Respiratory quinolone OR
- ii. IV β-lactam PLUS macrolide (IV or PO)
 1. β-lactams: cefotaxime, ceftriaxone, ampicillin; ertapenem
 2. May substitute doxycycline for macrolide (level 3)

➤ ICU:

- i. β-lactam (ceftriaxone, cefotaxime, Amox-clav) **PLUS EITHER** quinolone **OR** azithromycin
- ii. Penicillin-allergic: respiratory quinolone **PLUS** aztreonam

➤ Pseudomonal coverage :

- i. Antipneumococcal, antipseudomonal: β-lactam (pip-tazo, cefepime, imi, mero) **PLUS EITHER:**
 1. (cipro or levo) **OR**
 2. (Aminoglycoside AND Azithromycin) **OR**
 3. (aminoglycoside AND respiratory quinolone)

➤ CA-MRSA(Methicillin-resistant Staphylococcus aureus) coverage:

Vancomycin or Linezolid

4. Pearls of treatment:

- **Give 1st dose Antibiotics in ER (no specified time frame)**
- **Switch from IV to oral when pts are hemodynamically stable and clinically improving**
- **Discharge from hospital:**
 - i. As soon as clinically stable, off oxygen therapy, no active medical problems
- **Duration of therapy is usually 7-10 days:**
 - i. Treat for a minimum of 5 days
 - ii. Before stopping therapy:
 1. afebrile for 48-72 hours,
 2. hemodynamically stable,
 3. RR <24,
 4. O₂ sat >90%,
 5. normal mental status
 - iii. Treat longer if initial therapy wasn't active against identified pathogen; or if complications (lung abscess, empyema)