Lec. 4 | Diagnosis and Treatment of patients with pneumonia

35-years old male presented with **cough** of **one week** duration, with **thick yellow purulent** sputum.

He also complained of **fever** and right sided chest pain, **stabbing**, **localized**, **increased** respiration and cough.

He denied chills but there were **muscle aches.**

Physical examination:

Pulse =113 beat/minute, BP=130/80 mmHg, Temperature=39°C. Respiratory Rate =25 cycle/minute.

Chest examination revealed:

Diminished mobility, increased TVF, dullness, wet crepitation and bronchial breath sound at the right infraclavicular and mammary areas.
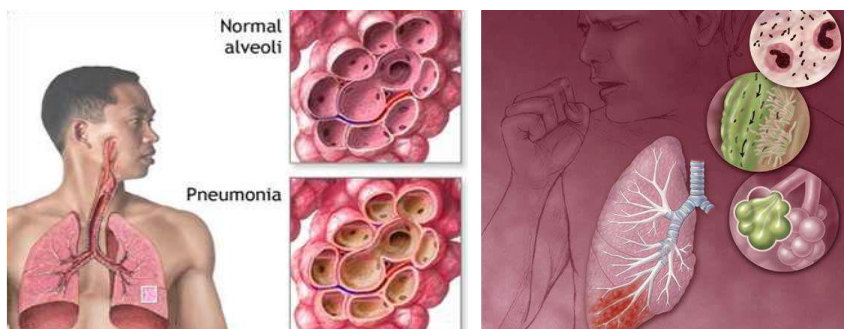
What is the most likely diagnosis?

High-Yield

From past exams

1. I

Definition of Pneumonia:

An inflammation, in general acute, of the lung substance, leading to consolidation of a part or the whole lung due to intra-alveolar exudation.

Pneumonia a leading cause of death all over the world, it is an infection of the lung parenchyma, most common **types and Causes include:**

Community acquired pneumonia (CAP)	Hospital acquired pneumonia (HAP)
o S. pneumoniae (most common cause) o Subsequent causes may vary. o but S. pneumoniae is always number 1	o Gram-negative bacilli such as E. coli, the other o Enterobacteriaceae, or Pseudomonas o MRSA

Community Acquired Pneumonia (CAP)

» Community- acquired pneumonia (CAP) refers to pneumonia acquired outside of hospitals or extended- care facilities.

» Internationally CAP is a common problem both for community & hospital physicians.

» It occurs with an annual incidence of about 5-11 per 1000 adult population & rises with age to about 34 per 1000 population for patients aged over 75 years.

» The annual incidence of patients that require hospital admission varies from approximately 1-4 per 100000 population.

» The morality rate are low (<1%) for patients managed in the community, higher in patients admitted to hospital around 5-12% and highest for patients requiring mechanical ventilation with rates from around 35% to 50%

» It is thus a common disease & can have a considerable impact on health care resources.

Community acquired pneumonia (CAP) Causes include:

Typical	Atypical
— Strep. pneumoniae 15-35% — Haemophilus 2-10% — Moraxella 5%	— Legionella 0-15% — Mycoplasma 10% — Chlamydia 5-10% — Viral 2-20% — Unknown 30-60%

Specific predispositions are as follows:

o Cigarette smoking,
o Diabetes,
o Alcoholism,
o Malnutrition,
o Obstruction of the bronchi from tumors,
o Immunosuppression in general

Clinical Presentation

o Patients with pneumonia present with cough, fever, and often sputum production. Severe pneumonia of any cause may present with dyspnea.

o The quality and degree of sputum produced might provide useful clues to the microbiologic etiology of pneumonia at the initial presentation.

o Bacterial infections such as S. pneumoniae, Haemophilus, and Klebsiella have significant purulent sputum production because they are infections of the alveolar air space.

o The sputum with S. pneumoniae is described as **rusty**. The "rust" is simply hemoptysis. As the blood oxidizes, it becomes brownish red color.

o Interstitial infections such as those caused by viruses, Mycoplasma, and sometimes Legionella often give a **non-productive or "dry" cough.**

o Any cause of pneumonia may be associated with pleuritic chest pain. This pain is worsened by inspiration.

o Commonly, **pleuritic pain** is associated with lobar pneumonia, such as that caused by Pneumococcus. This is because of localized inflammation of the pleura by the infection.

o Lobar pneumonia is the type most commonly associated with signs of **consolidation** on examination.

On physical examination pneumonia presents with:

o **Inspection:** ↓movement sudden breath catches

o **Palpation:**
  - ↑T.V.F.
  - Central mediastinum
  - Palpable friction rub

o **Percussion:** Impaired note → dull note

o **Auscultation:**
  - Bronchial breathing "high pitch"
  - ↑Whispering & ↑ vocal resonance.
  - Crepitations (medium sized, late inspiratory).
  - Pleural rub

Diagnosis:

1.Chest x-ray

is The most important initial test for pneumonia, which both shows the presence of disease and gives the initial clues to determining the diagnosis.
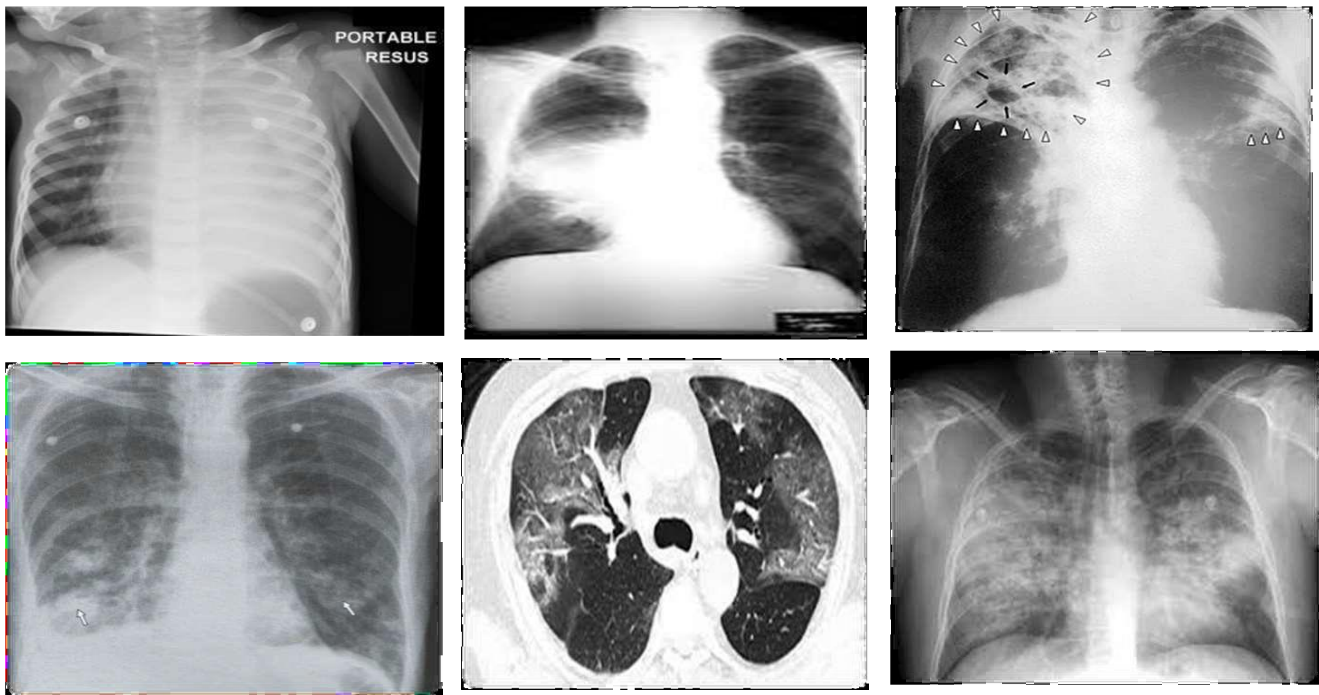
» **Infiltrates are either:**
  - localized to a single lobe or the whole lung.
  - Bilateral and interstitial

» It is the most important clue.

» SS. pneumoniae (and other causes of "typical" pneumonia) usually appear as a **lobar pneumonia**, sometimes with parapneumonic pleural effusion.

» **Interstitial infiltrates** are associated with viral, Mycoplasma, Chlamydia, Coxiella, and sometimes Legionella pneumoniae.

2.Hematology:

» **Neutrophil leukocytosis** is usual in pneumococcal pneumonia & other bacterial pneumonias. The total white blood cell count doesn't often exceed 30,000 & is more frequently 12,000 – 15,000/mm3.
» **Lymphopenia** in legionella & viral pneumonia
» Sometimes there is **eosinophilia** in convalescence.
» **Normocytic anemia** is commonly seen in severe pneumonia.
» **The erythrocyte sedimentation rate** is usually raised & may be very high, a rate of 100mm or more isn't uncommon. It decreases in convalescence.
» **Increased Inflammatory markers** as c-reactive protein.
» **Raised procalcitonin** level in bacterial infection.

3.Sputum sample

» should be obtained for both Gram stain as well as culture.
» Sputum culture is the most specific diagnostic test for lobar pneumonia, such as with S. pneumoniae, Staphylococcus, Klebsiella, and Haemophilus.
» The other "atypical" organisms (viral, Mycoplasma, Chlamydia, Coxiella, etc.) will not show up on Gram stain or regular bacterial culture for various reasons, so serology must be done to detect them.

The diagnosis of CAP require:

1. **Basic finding** → a new pulmonary infiltrate seen on a chest radiograph that is obtained within 24 h of presentation.
2. **at least one of Major criteria** → cough, sputum production, or temperature≥37.8°C.
or at least two of Minor criteria:
o pleuritic chest pain, dyspnea,
o altered mental status,
o pulmonary consolidation, and WBC ≥ 12,000 cells/L.

How would you stratify and evaluate a patient with pneumonia?

- ❖ Severity assessment and site-of-care decisions are critical when managing patients who present with CAP.
- ❖ Can affect diagnostic work-up, therapeutic interventions, and clinical outcomes.
- ❖ Several severity assessment tools are available that can help doctors to predict mortality and determine the optimal setting for patient care.
- ❖ can be used to distinguish between patients who can be treated safely in an outpatient setting versus those who require inpatient observation and treatment.

The most widely recommended score for assessing patients who present with CAP is:

CRB-65, one point for each
- Confusion (altered mental status)
- Respiratory rate > 30 breaths per minute
- Blood pressure (BP: systolic BP < 90 mm Hg or diastolic BP < 60 mm Hg)
- 65 years of age or older

Interpretation

- ➤ Patients who display one or no adverse prognostic features → low risk→ outpatient treatment.
- ➤ Patients who display two or more adverse prognostic features → high risk → hospitalization.

Criteria for severe community-acquired pneumonia for ICU admission

Type of criteria	Severity criteria
Minor	Respiratory rate ≥30 breaths/min[a]
	$P_{AO_2}/F_{IO_2} \leqslant 250$[a]
	Multilobar infiltrates
	Confusion and/or disorientation
	Uremia (BUN level ≥20 mg/dL)
	Leukopenia (WBC count <4 × 10⁹ cells/L)
	Thrombocytopenia (platelet count <100 × 10⁹ platelets/L)
	Hypothermia (core temperature <36°C)
	Hypotension (SBP <90 mm Hg; requiring aggressive fluid resuscitation)
Major	Receipt of invasive mechanical ventilation
	Septic shock with the need for vasopressors[b]

Treatment of CAP

General lines	Antibiotic therapy for CAP should
• Treatment of predisposing factors • Bed rest & proper nursing; easily digested food & excess Fluid. • Cough sedatives early; then expectorants • Supportive measures: vitamin A, B & C • Analgesics to control pleurtic pain. • Oxygen therapy.	• Started empirically. • Selected with patient's characteristics, place of acquisition and severity of the disease. • When specific pathogen is identified; specific antibiotic could be used

Empiric Therapy of Community-Acquired Pneumonia

➢ **Outpatient treatment**
   » Young, healthy patients with no comorbidities or antibiotic use in preceding 3 months:
     ▪ Azithromycin, clarithromycin, or doxycycline
   » With comorbidities, or antibiotic use in preceding 3 months use either:
     ▪ Respiratory fluoroquinolones (Levofloxacin, moxifloxacin)
     ▪ or oral beta-lactam (Oral second- and third generation cephalosporins or amoxicillin/clavulanate) + a macrolide or doxycycline

➢ **Hospitalized patients**
   o Respiratory fluoroquinolones (levofloxacin, or moxifloxacin,)

<div align="center">Or</div>

   o Second- or third generation cephalosporins (cefuroxime or ceftriaxone) combined with a macrolide or doxycycline.

<div align="center">Or</div>

   o Beta-lactam/beta-lactamase combination drug (ampicillin/sulbactam; ticarcillin/ clavulanate; piperacillin/tazobactam) combined with doxycycline or a macrolide.

N·B
   o **If risk factors for Community acquired MRSA,** use above therapy + vancomycin or linezolid or ceftaroline + a macrolide or doxycycline.
   o **If risk factors for Pseudomonas**, use antipseudomonal beta-lactam (like cefepime or meropenem) +ciprofloxacin; for penicillin-allergy, use a respiratory quinolone + aztreonam.

Duration of therapy

➢ Patients with CAP should be treated with antibiotics for a minimum of 5 days, however 7-10 days is usually adequate.
➢ Should be afebrile for 3-4 days and have no more than one CAP-associated sign of clinical instability prior to discontinuation.

➤ Patients who have been hospitalized and are receiving intravenous antibiotics should be **switched to oral therapy** as soon as they are:

- » hemodynamically stable,
- » improving clinically,
- » able to ingest medications, and
- » have normal digestion.

➤ Chest x-ray should be done every week.

➤ Usually, the x-ray film returns to normal within 2-6 weeks however in old age patients; it may take longer duration.

➤ If resolution is delayed, we must search for underlying cause.

Causes of delayed resolving pneumonia:

- inadequate ttt (type, dose, or time)
- Specific pathogen, eg; TB
- Underlying pathology (neoplasia, foreign body, bronchiectasis)
- Empyema
- Immunocompromised: DM, CHF, alcoholism, etc.

Hospital acquired pneumonia.

The 2016 Infectious Diseases Society of America (IDSA)/American Thoracic Society (ATS) guidelines distinguish the following types of pneumonia:

➤ **Hospital-acquired (or nosocomial) pneumonia (HAP)** is pneumonia that occurs 48 hours or more after admission and did not appear to be incubating at the time of admission.

➤ **Ventilator-associated pneumonia (VAP)** is a type of HAP that develops more than 48 to 72 hours after endotracheal intubation.

Treatment of HAP

Regardless of severity, the initial empirical treatment regimens for HAP who have early-onset HAP (within 4 to 5 days of hospitalization) should include coverage for a group of core organisms that includes:

- » Antibiotic-sensitive, aerobic, enteric gram-negative bacilli **(e.g., E. coli, Klebsiella spp., Proteus spp., and Serratia marcescens),**
- » community pathogens such **as Haemophilus influenzae**
- » Streptococcus pneumoniae, as well **as methicillin sensitive S. aureus**

Early Onset HAP treatment

- o Extended spectrum cephalosporin **Or**
- o B-lactam + B-lactamase inhibitor **Or**
- o Fluroquinolones

Late Onset HAP treatment

o Those patients who develop pneumonia late-onset after 5–7 days in the hospital are at increased risk of infection from:

   ▪ Drug-resistant, gram-negative bacilli (Pseudomonas, Klebsiella, E. coli, Acinetobacter spp..)

   ▪ or gram-positive bacilli such as MRSA.

o Third-generation cephalosporin with antipseudomonal activity (e.g., ceftazidime) or carbapenem (e.g., imipenem)

o Beta-lactam/beta-lactamase inhibitor combinations (such as piperacillin/tazobactam) plus an **antipseudomonal fluoroquinolone** (e.g., ciprofloxacin) and vancomycin or linezolid to cover MRSA.

o Possible addition of polymyxin(colistin) or an aminoglycoside (gentamicin, tobramycin, amikacin) to empiric gram-negative coverage

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N.B

- Pneumonia is a wild monster as even with modern medical care the case mortality is about 12%.
- Prevention through Smoking cessation,
- Pneumococcal & Influenza vaccination must be the main goal in pneumonia management
- Early antibiotic administration within 4-6 hours
- Empiric antibiotic treatment as per guidelines (IDSA / ATS) must be given
- Typical and Atypical pathogens must be considered in the choice of antibiotic therapy

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QUIZ

Q1: A 23-year-old woman has come to your clinic, complaining that she hasn+IBk-t improved on the antibiotic therapy she has been prescribed for her community acquired pneumonia. For 8 weeks, she has been suffering from cough, malaise, anorexia, fever more at night, accompanied by excessive sweating and occasional hemoptysis. She has lost 10 Kgs over the past 4 weeks. Otherwise, the girl has no history of any chronic illnesses. What's the most likely cause for her unresolved pneumonia?

A. Tuberculous pneumonia
B. Diabetes Mellitus.
C. Bronchiectasis
D. Foreign body inhalation.
E. Bronchogenic Carcinoma.

Q2: A 65-year-old lady is brought to the ER by her son. He says she caught common cold 5 days ago, then she started to complain of dyspnea, fever and cough. On examination, she was confused, feverish (38C.), her HR was 120/ min., her BP was 80/50 mmHg, and her RR was 32/min. Her CXR shows right upper lobe pneumonia. What is her CRB-65 score?

A. 1 point
B. 3 points.
C. 2 points.
D. Not enough data to calculate.
E. 4 points.

Q3: A sputum sample has been collected from a 55-year-old man who has been initially diagnosed with pneumonia based on his clinical presentation and CXR findings. Sample was obtained before antibiotics were started. After 5 days, the results were negative for bacterial growth. How would you interpret this result?

A. Antibiotic therapy has affected the results
B. Pneumonia must be excluded as the correct diagnosis.
C. No reasonable explanation
D. Pneumonia is probably caused by atypical organism.
E. Pneumonia is probably caused by typical organism.

Q4: An 83-year-old diabetic lady was found confused in her home. She has been feverish for two days. Her heart rate at admission to the ER was 100/min., her BP was 100/50 mmHg, her RR was 30/min., her temperature was 39 C. Which of the following investigations can help specify the cause of pneumonia?

A. Complete Blood Count
B. ESR
C. Chest ultrasound
D. Sputum Culture
E. Chest x-ray

Q5: Which of the following criteria can justify ICU admission in patients diagnosed with pneumonia?

A. SBP < 90 mmHg.
B. PaO2/FiO2 ≥ 250.
C. Leukocytosis
D. RR ≥25 breath/min.
E. Temperature ≥ 39o C

1	2	3	4	5
A	E	D	D	A