Plain Film Radiography of Unusual Pneumonias including SARS and Anthrax

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Objectives/Overview

- Pneumonia Imaging is an extremely broad topic – I am simply giving you a few interesting examples to emphasize specific points about understanding the Disease Processes.
- We will review patient-based cases – each with specific teaching points.
- Each case will have a quiz. Participation is required. Those who do not participate will be punished.
Our Patient, Plain Film Chest X-ray

Please PAUSE to evaluate the image and then CONTINUE to confirm your findings.
Our Patient, findings

Hazy opacity in L-lower lobe distribution, diminished visualization of costophrenic angle of L-hemi diaphragm
Our Patient, Quiz

☐ With this image alone, can you determine our patient’s diagnosis?

☐ A. Klebsiella Pneumonia

☐ B. Viral Pneumonia

☐ C. Strep Pneumonia

☐ D. Legionella Pneumonia
Our Patient, Quiz

- With this image alone, can you determine our patient’s diagnosis?
  - A. Klebsiella Pneumonia
  - **B. Viral Pneumonia** Wrong!
  - C. Strep Pneumonia
  - D. Legionella Pneumonia

Our patient’s chest x-ray is consistent with a bacterial process, but we cannot be any more specific than that. In order to determine between most bacterial pneumonias, you require a history. CONTINUE to learn the difference between viral and bacterial pneumonias on plain film radiography.
Viral vs. Bacterial Pneumonias

- **In general:**
  - Viral pneumonia initially presents as an interstitial process with diffuse or perihilar distribution [1]
    - Viral particles are tiny, travel on droplets, and can widely distribute in the lungs (diffuse) [1]
    - Viruses infiltrate and destroy epithelial cells of bronchioles and interstium (interstitial) [1]
  - Bacterial pneumonia usually presents as an alveolar process with lobar distribution [1]
  - There are ALWAYS exceptions

CONTINUE to see examples of a Bacterial and a Viral pneumonia
Examples of bacterial and viral pneumonias

A) Pneumococcal pneumonia w/ lobar consolidation  B) influenza pneumonia w/diffuse reticulonodular pattern

These are two different patients. Can you tell if these are viral or bacterial?
These patients have NEITHER viral nor bacterial pneumonia.

Mycoplasmata are the smallest living organisms on earth and can cause pneumonia in an ALVEOLAR or INTERSTITIAL pattern. The key is history; mycoplasmata causes an afibrile pneumonia in otherwise healthy individuals.

Back to Our Patient, H&P

- 36M presents to the ED w/ BRBPR
- Over past 3 days, experienced bloody diarrhea, decreased appetite.
- PMH. Asthma
- PE: Temp 104, according to ED, lungs CTA bilaterally, heme pos stool

CONTINUE to see our patient’s chest x-ray and determine what pathogen he may have
Our patient, Plain Film Chest X-ray

CONTINUE to see our patient’s diagnosis
Our Patient has Legionella Pneumonia

- Indistinguishable from S. pneumo on CXR – Lobar Consolidation
- Radiographic Appearance:
  - “peripheral patchy consolidation” [3]
  - Lobar or Multilobal consolidation
- Key to dx is HISTORY of GI complaints/Bloody Diarrhea and often absence of respiratory symptoms initially.
- Rx w/macrolide and fluoroquinolone
Next Patient

- CONTINUE to see a new patient with a different type of pneumonia
Companion Patient, H&P

- 75yo Asian Male presents with a high fever (104) and cough for 2 days.
- Well established business man with no significant PMH
- Exam – bilateral rales

CONTINUE to see this patient’s CXR
Companion Patient, CXR

Please PAUSE to evaluate the image and then CONTINUE to confirm your findings.
Companion Patient, findings

“Multifocal ill-defined air space opacities in the R-upper and L-lower lung zones”

CONTINUE to take another quiz.
Companion Patient, Quiz

☐ Given this patient’s history and CXR, can you determine the diagnosis?

☐ A. Influenza Pneumonia

☐ B. Mycoplasma Pneumonia

☐ C. Coronavirus Pneumonia

☐ D. TB

Think about your answer, then CONTINUE to see more images of this patient.
Companion Patient, Day 6 CXR

CONTINUE to see this patient’s CXR on Day 10
Companion Patient, Day 10 CXR

Please PAUSE to evaluate the image, then CONTINUE to confirm findings
Companion Patient, findings

Air Bronchograms = Alveolar Pattern Confluent and Diffuse

CONTINUE to return to the QUIZ for this patient
Companion Patient, Quiz

- Given this patient’s history and CXR, can you determine the diagnosis?
  - A. Influenza Pneumonia
  - B. Mycoplasma Pneumonia
  - C. Coronavirus Pneumonia
  - D. TB
Companion Patient, Quiz

- Given this patient’s history and CXR, can you determine the diagnosis?

- A. Influenza Pneumonia **WRONG!**

- B. Mycoplasma Pneumonia

- C. Coronavirus Pneumonia

- D. TB

Very good try though! CONTINUE to see this patient’s diagnosis
This Patient has SARS

- Severe Acute Respiratory Syndrome
- CORONAVIRUS that causes an acute viral syndrome that quickly progresses into ARDS [3]
- Pathophysiology can be tracked by Chest Imaging: interstitial inflammation from viral infection → diffuse distribution → widespread pulmonary edema due to capillary permeability and interstitial tissue breakdown [2]
- It is extremely unlikely that you’ll see SARS, but this concept applies to all SEVERE VIRAL PNEUMONIAS.

CONTINUE to learn more about severe viral pneumonia
Severe Viral Pneumonia

- Confluent widespread consolidation (vs. diffuse interstitial pattern) Due to ARDS [3]
- Can Occur w/any Viral Pneumonia
  - Flu, Coronavirus, Adenovirus, Herpes, Varicella
- Can Occur in either order:
  - interstitial → alveolar
  - Alveolar → interstitial
Next Patient

- CONTINUE to see another patient with yet another type of pneumonia
Companion Patient 2, H&P

- 56yoM postal worker presented to ED w/ 3 days of low grade fever, chills, cough, dyspnea with exertion and general malaise.
- Pt’s cough became blood tinged and he experienced mid-sternal tightness.

CONTINUE to see this patient’s CXR.
Companion Patient 2, CXR

PA and Lateral CXR views

PAUSE to evaluate the images, then CONTINUE to confirm findings
Companion Patient 2, findings

CONTINUE to see this patient’s CXR on Day 3
Companion Patient 2, CXR Day 3

PAUSE to evaluate the image, then CONTINUE to confirm findings
Companion Patient 2, findings

**Bilateral Pleural Effusions**

**Mediastinal Widening**

CONTINUE to see the QUIZ for this patient

Earls JP, et. al. [4]
Companion Patient 2, Quiz

☐ Given this patient’s history, and imaging, what is the diagnosis?

☐ A. Inhalational Anthrax Hanes Strain
☐ B. Inhalational Anthrax Ames Strain
☐ C. Inhalation Anthrax Lieberman Strain
☐ D. TB
☐ E. Just plain old Flu, silly.
Companion Patient 2, Quiz

- Given this patient’s history, and imaging, what is the diagnosis?
  - A. Inhalational Anthrax Hanes Strain
  - B. Inhalational Anthrax Ames Strain
  - C. Inhalation Anthrax Lieberman Strain
  - D. TB
  - E. Just plain old Flu, silly.

CONTINUE to learn about Inhalational Anthrax
Inhalational Anthrax

- Spores are inhaled directly into the lungs, and carried into regional lymph nodes where they germinate and disseminate throughout the lungs [3]
- Initial appearance: marked lymphadenopathy – hilar, peritracheal, and mediastinal [4]
- Progresses into patchy consolidation and pleural effusions once widespread infection is established [4]
We have one last Patient

☐ What type of pathogen will we see next?
☐ A. Viral
☐ B. Bacterial
☐ C. Fungal
We have one last Patient

- What type of pathogen will we see next?
  - A. Viral
  - B. Bacterial
  - C. Fungal
  - D. Parasitic

**OF COURSE!**

CONTINUE to meet our last patient
Companion Patient 3, H&P

- 83 yo M w/3 weeks of GI pain, bloody diarrhea, now presents coughing up “chocolate syrup”
- Recent travel hx to South America
- He is a very highly regarded American Politician

CONTINUE to see this patient’s CXR
Companion Patient 3, CXR

PAUSE to evaluate the image, then CONTINUE to confirm findings
Companion Patient 3, findings

Large R pleural effusion w/consolidation and collapse of R lower lobe

CONTINUE to learn this patient’s diagnosis
Entamoeba Histolytica

- Protozoan parasite found worldwide, infects GI tract through water transmission
- Usually a GI illness presenting with bloody diarrhea — however it can travel to the Liver forming an abscess
- Fistula can form between liver abscess → pleura/R-lung parenchyma creating empyema, consolidation, and lung abscess [3]
- Thomas Jefferson is thought to have died from this
Conclusions

- Pathologic Processes are reflected by plain film imaging
- Understanding the disease process will save you from simple pattern recognition/memorization
- Don’t trust Akira’s leading questions and prompts
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References


