



# Plain Film Radiography of Unusual Pneumonias including SARS and Anthrax

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Akira Shishido, Harvard Medical School Year III  
Gillian Lieberman, MD



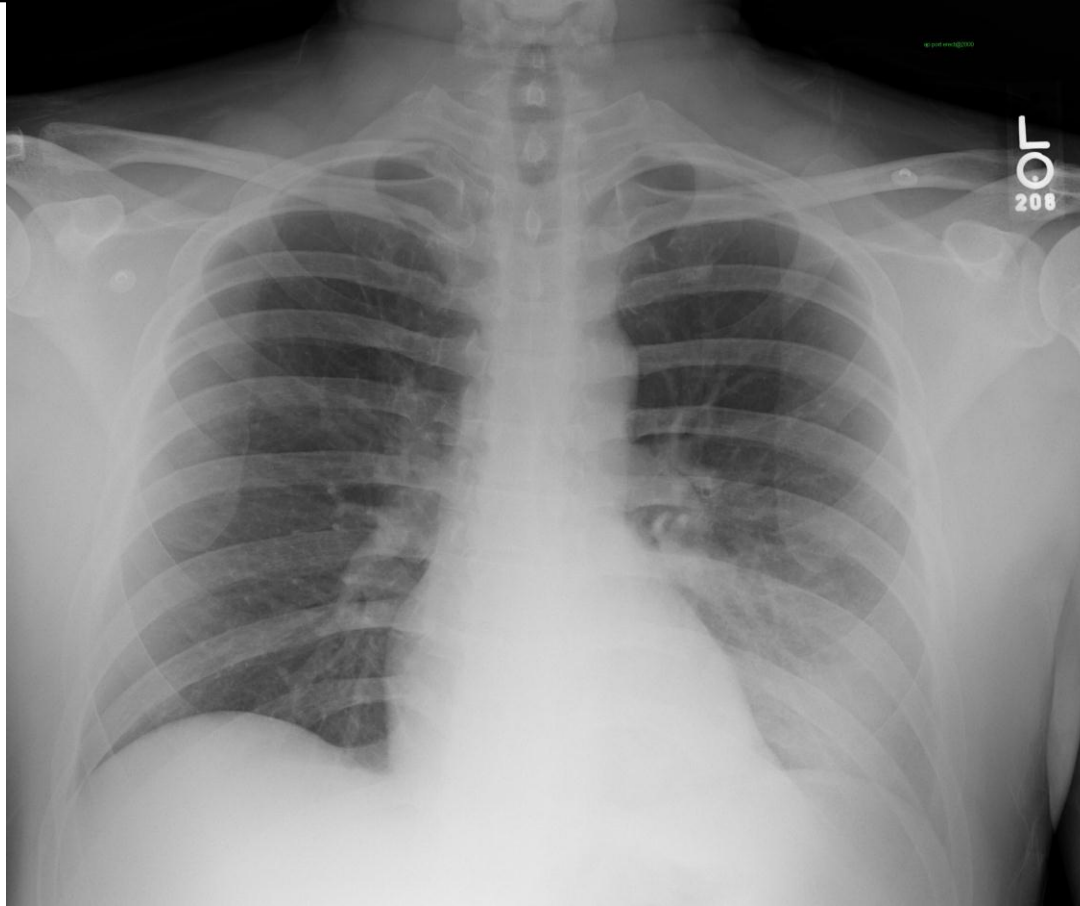
# Objectives/Overview

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- ❑ 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.



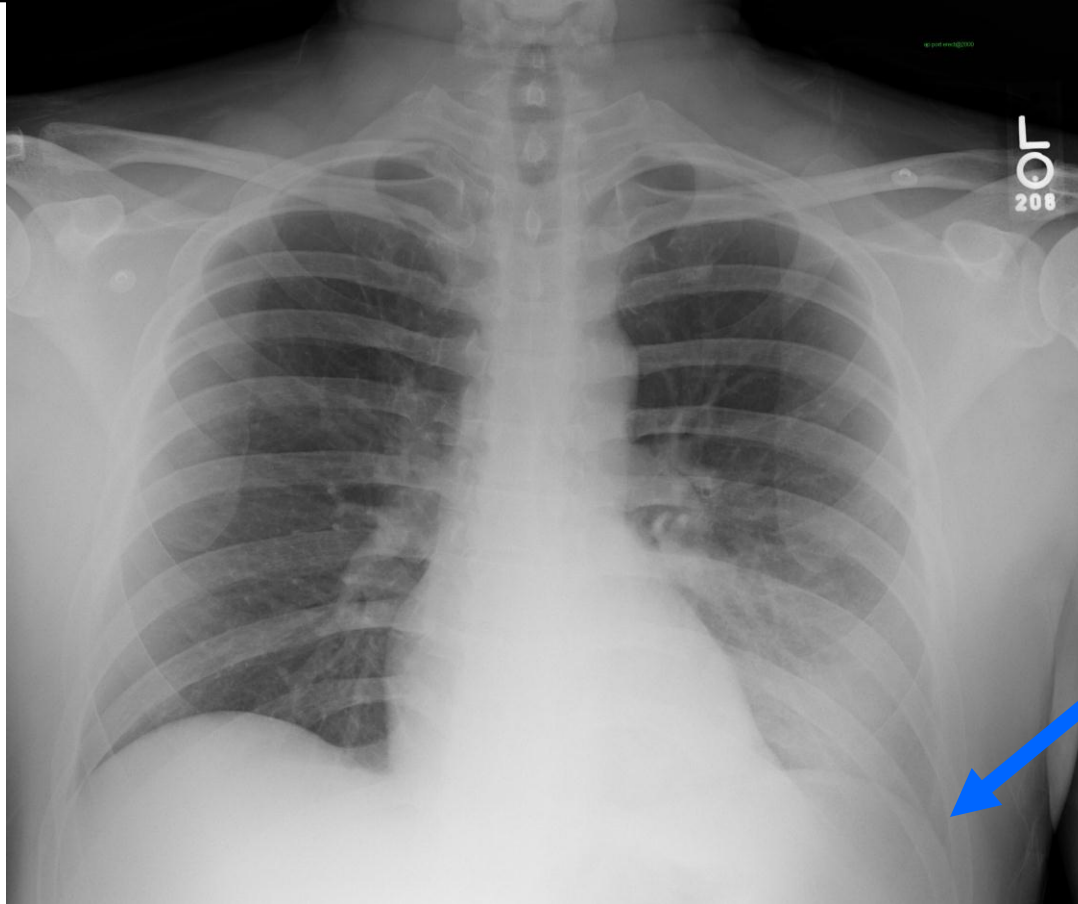
# Our Patient, Plain Film Chest X-ray



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

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- 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

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- D. Legionella Pneumonia

**Wrong!**

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

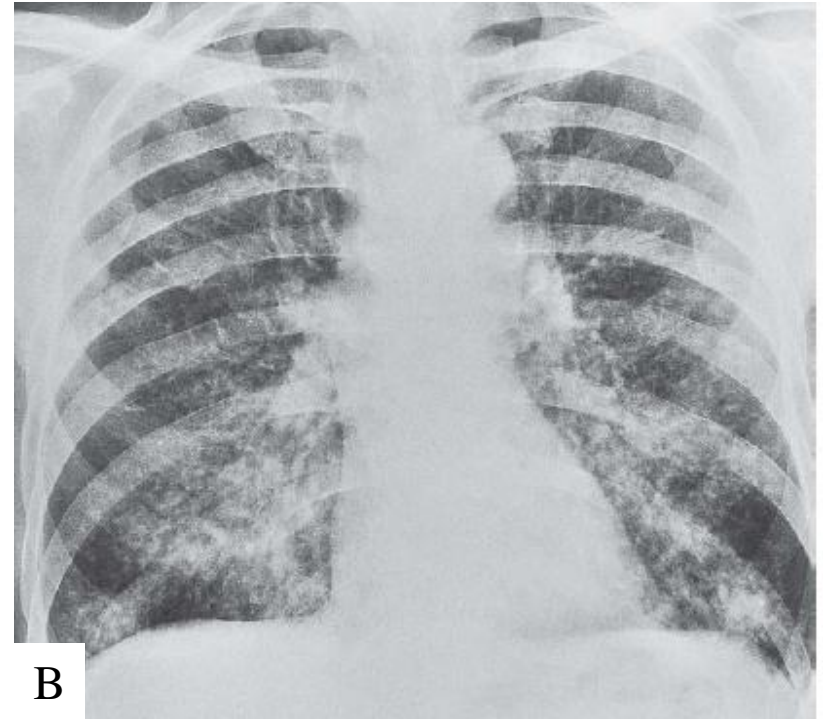
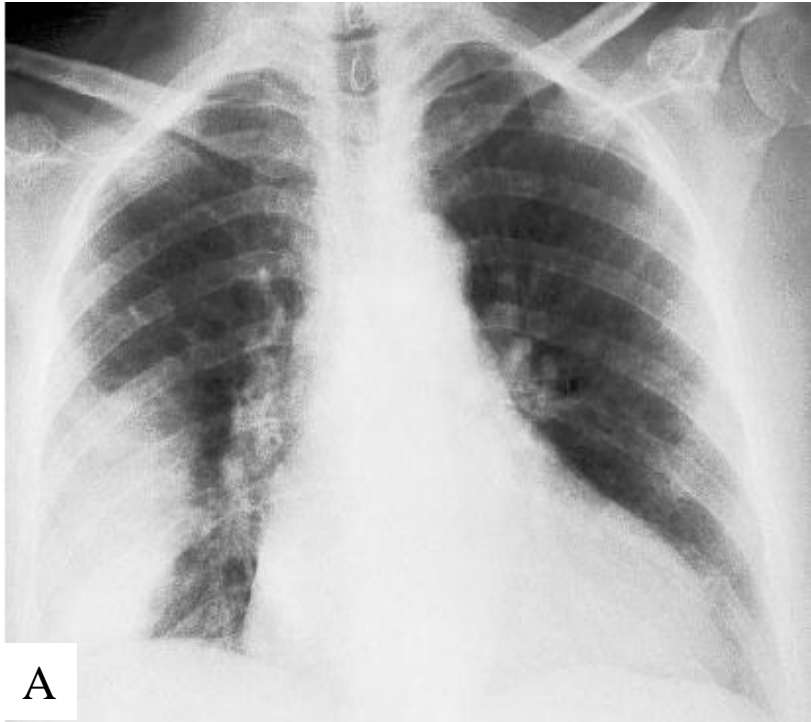
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- In general:
  - Viral pneumonia initially presents as an interstitial process with diffuse or perihilar distribution [1]
    - Viral particles are tiny, travel on droplets, and can widely distribute in the lungs (diffuse) [1]
    - viruses infiltrate 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

B

Hansell D, Lynch D, McAdams H, Bankier A. *Imaging Diseases of the Chest*, 5th Ed. Elsevier. London, 2009. [3]

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?

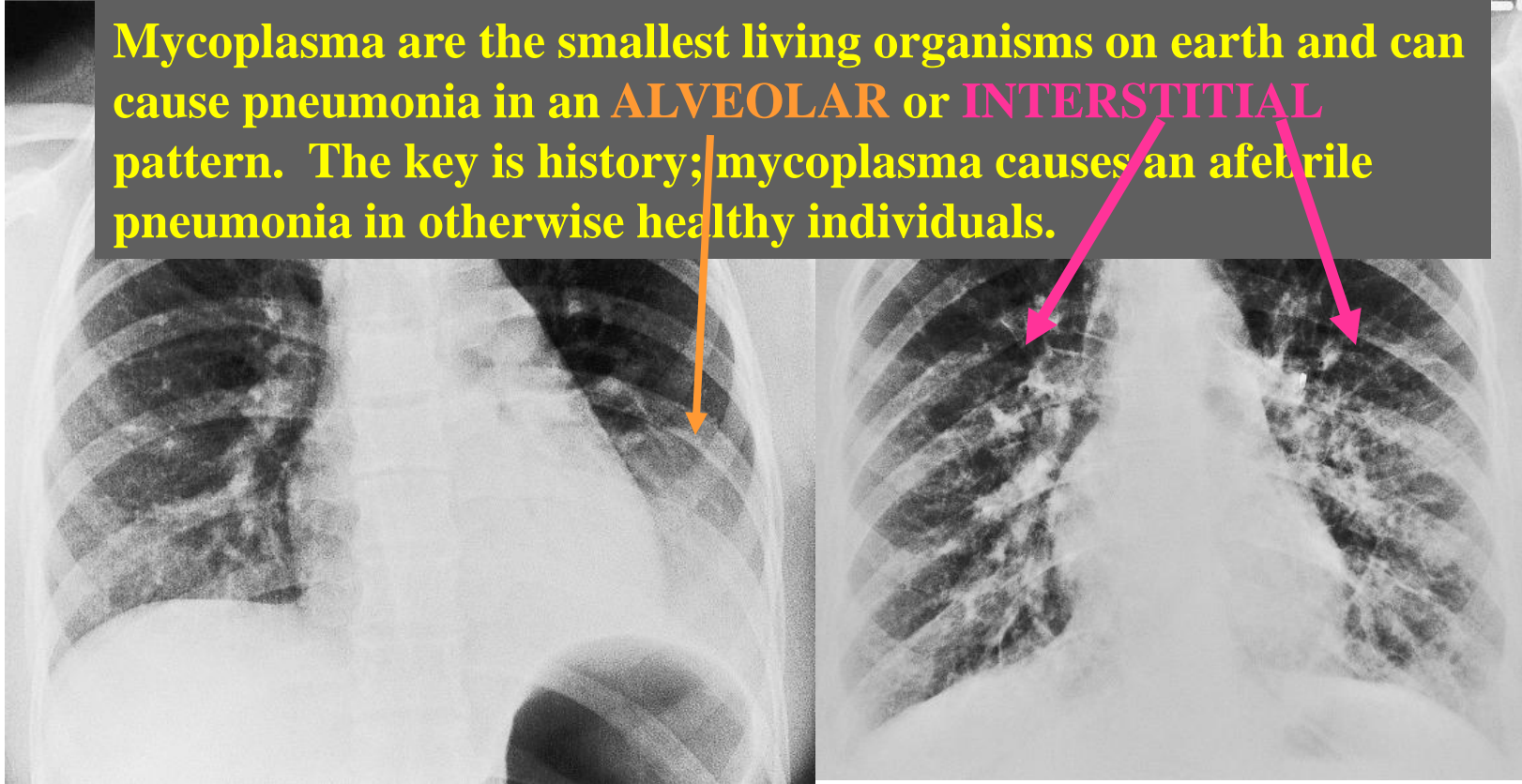


Hansell D, Lynch D, McAdams H, Bankier A. Imaging Diseases of the Chest, 5th Ed. Elsevier. London, 2009. [3]



# These patients have NEITHER viral nor bacterial pneumonia.

**Mycoplasma are the smallest living organisms on earth and can cause pneumonia in an ALVEOLAR or INTERSTITIAL pattern. The key is history; mycoplasma causes an afebrile pneumonia in otherwise healthy individuals.**





# Back to Our Patient, H&P

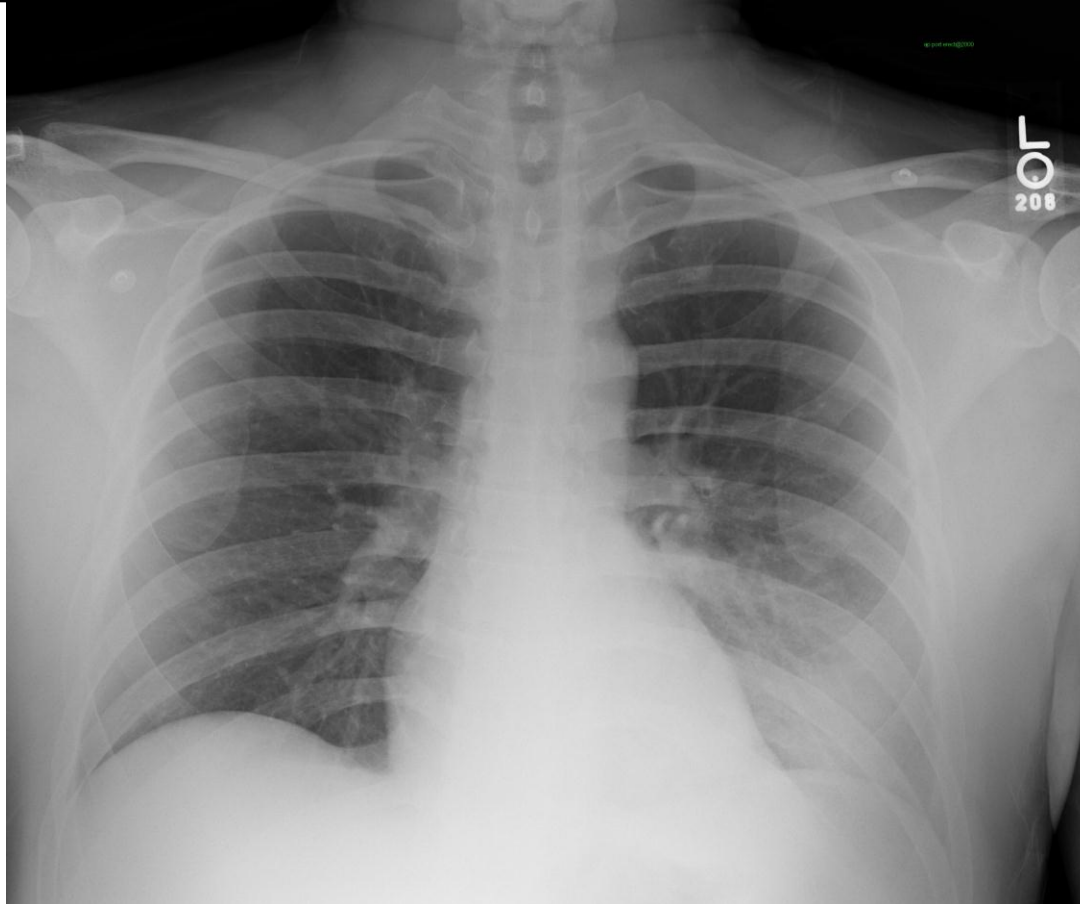
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- 36M presents to the ED w/ BRBPR
- Over past 3 days, experienced bloody diarrhea, decreased appetite.
- PMH. Asthma
- PE: Temp 104, according to ED, lungs CTA bilaterally, heme pos stool

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

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- Indistinguishable from *S. pneumo* on CXR – Lobar Consolidation
- Radiographic Appearance:
  - “peripheral patchy consolidation” [3]
  - Lobar or Multilobar 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

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- CONTINUE to see a new patient with a different type of pneumonia



# Companion Patient, H&P

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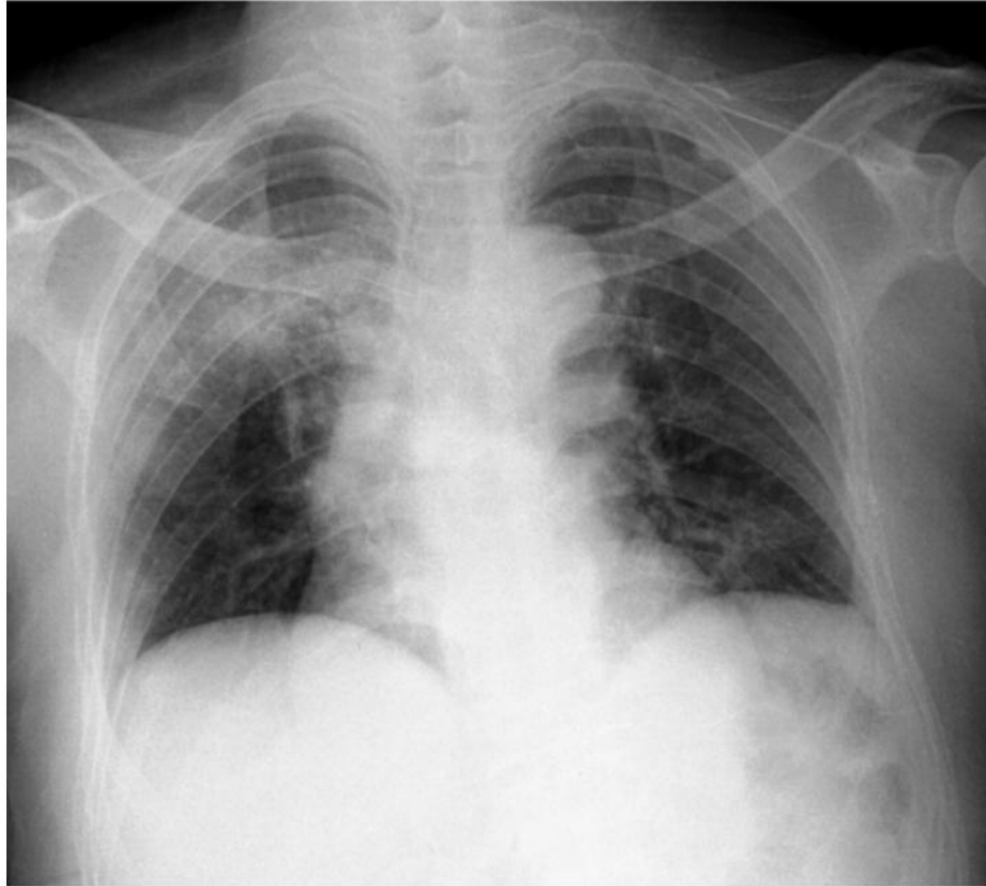
- 75yo Asian Male presents with a high fever (104) and cough for 2 days.
- Well established business man with no significant PMH
- Exam – bilateral rales

CONTINUE to see this patient's CXR



# Companion Patient, CXR

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Antonia, GE. et. al. [2]

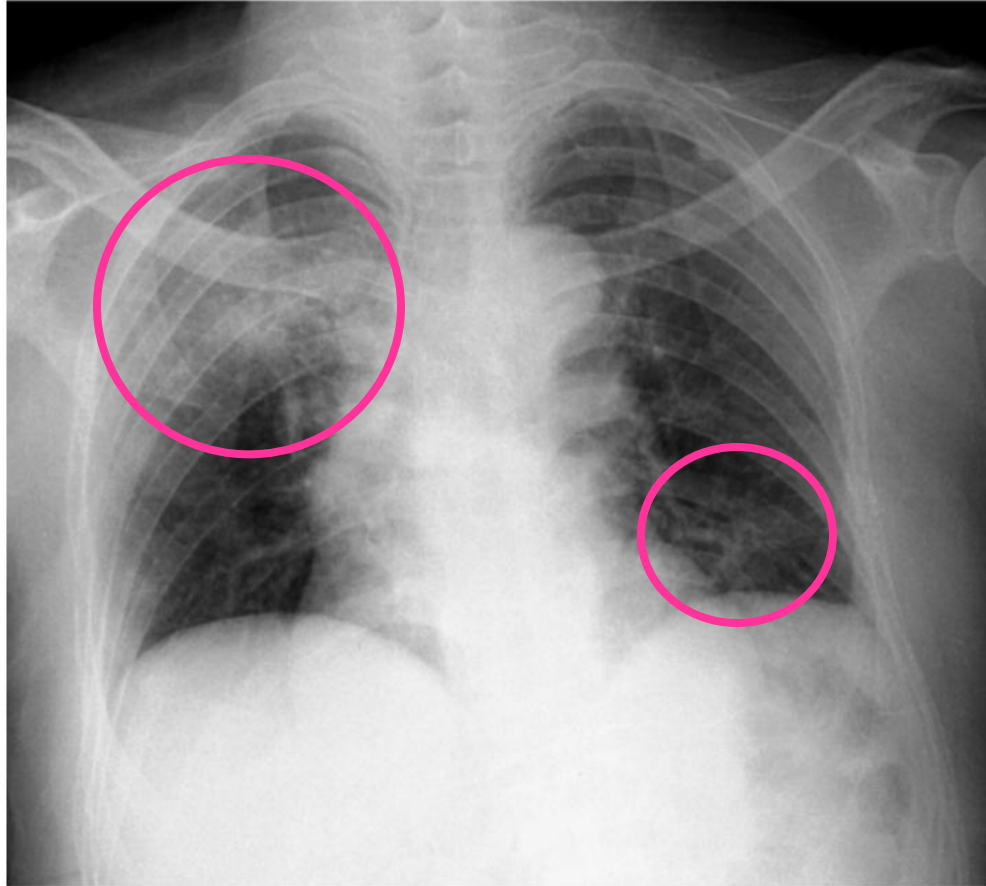
Please PAUSE to evaluate the image and then CONTINUE to confirm your findings.<sup>16</sup>





# Companion Patient, findings

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

CONTINUE to take another quiz.



# Companion Patient, Quiz

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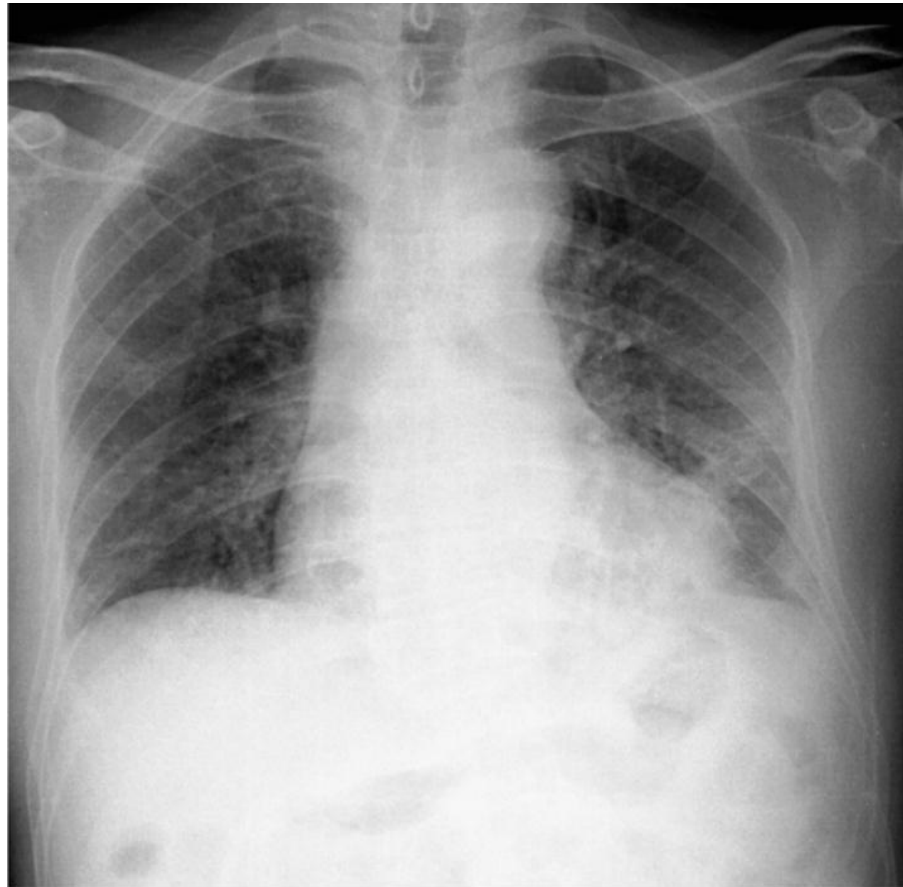
- Given this patient's history and CXR, can you determine the diagnosis?
- A. Influenza Pneumonia
- B. Mycoplasma Pneumonia
- C. Coronavirus Pneumonia
- D. TB

Think about your answer, then CONTINUE to see more images of this patient



# Companion Patient, Day 6 CXR

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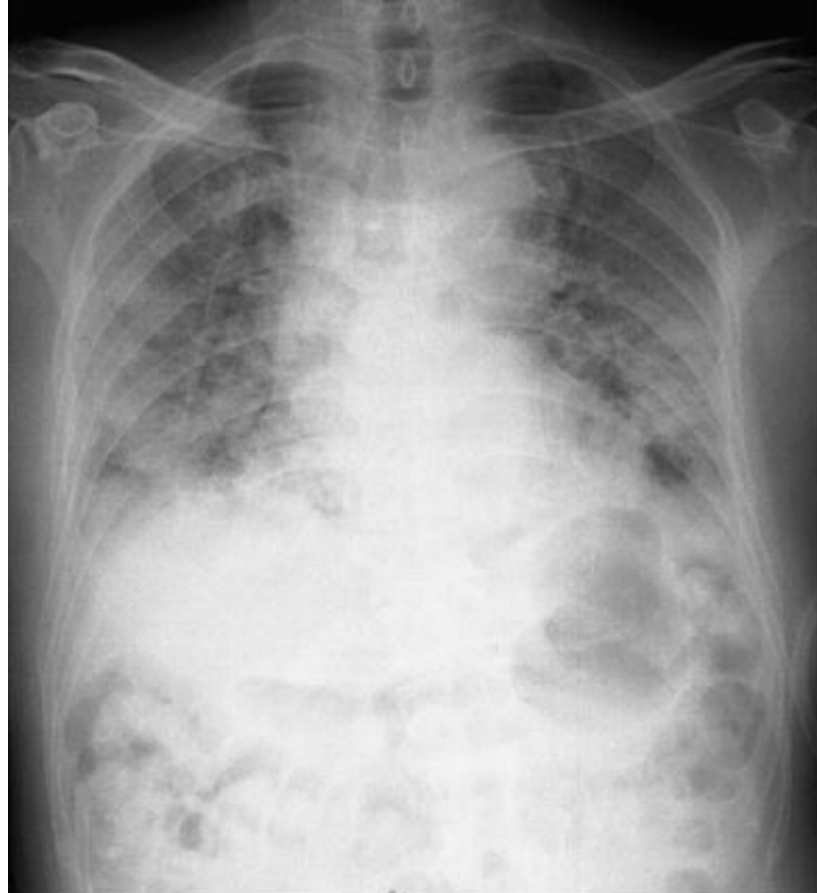
Antonia, GE. et. al. [2]

CONTINUE to see this patient's CXR on Day 10



# Companion Patient, Day 10 CXR

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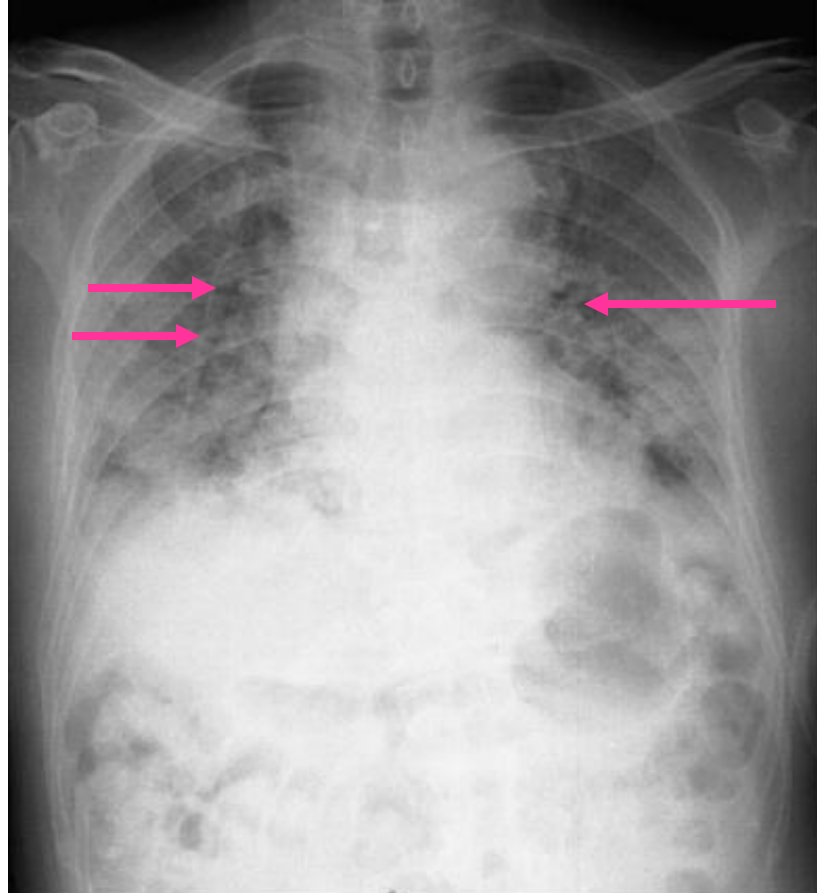


Antonia, GE. et. al. [2]

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



# Companion Patient, findings



**Air  
Bronchograms =  
Alveolar Pattern  
Confluent and  
Diffuse**

Antonia, GE. et. al. [2]

CONTINUE to return to the QUIZ for this patient



# Companion Patient, Quiz

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- 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

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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

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- ❑ 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.





# Severe Viral Pneumonia

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- 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

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- CONTINUE to see another patient with yet a another type of pneumonia



# Companion Patient 2, H&P

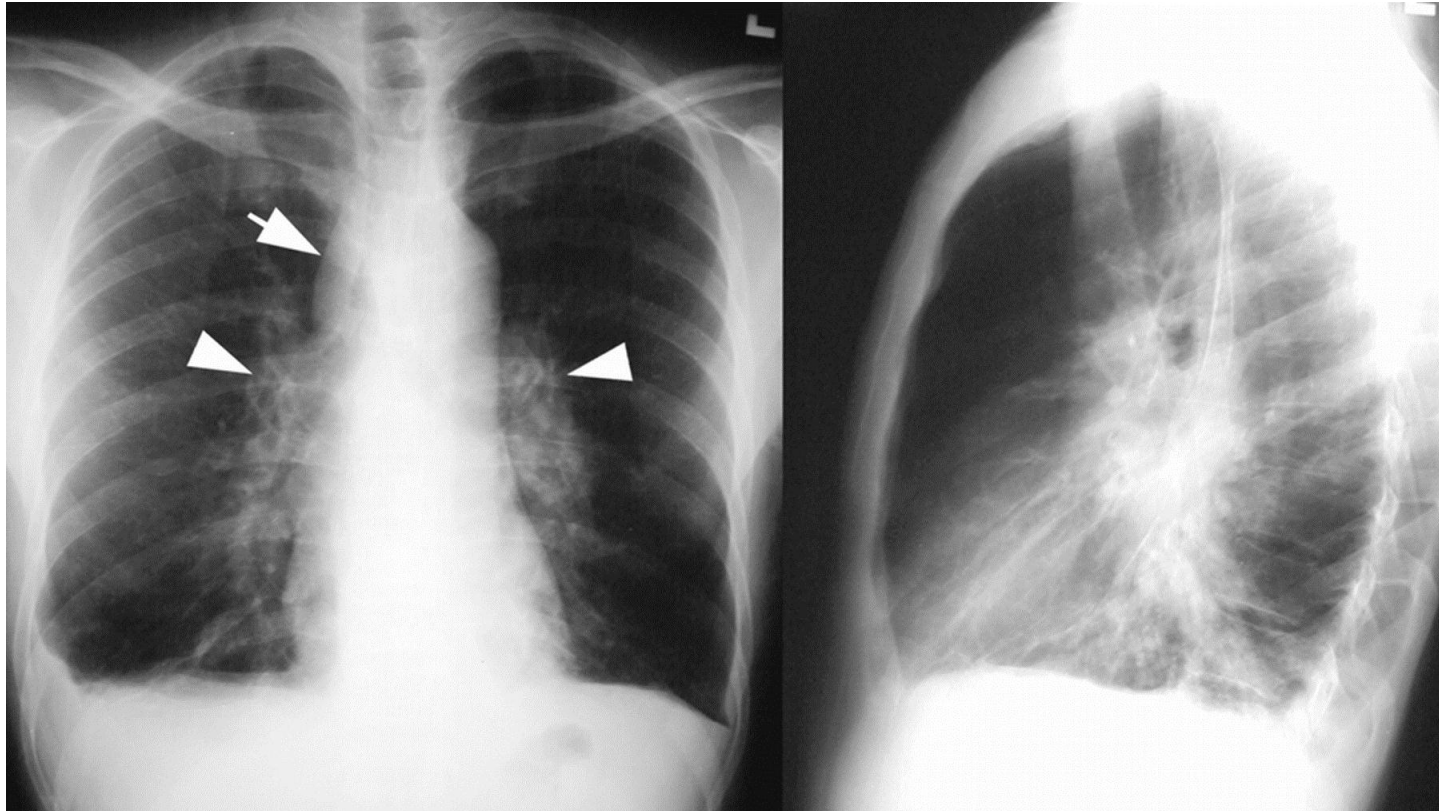
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- 56yoM postal worker presented to ED w/3 days of low grade fever, chills, cough, dyspnea with exertion and general malaise
- Pt's cough became blood tinged and he experienced mid-sternal tightness.

CONTINUE to see this patient's CXR



# Companion Patient 2, CXR



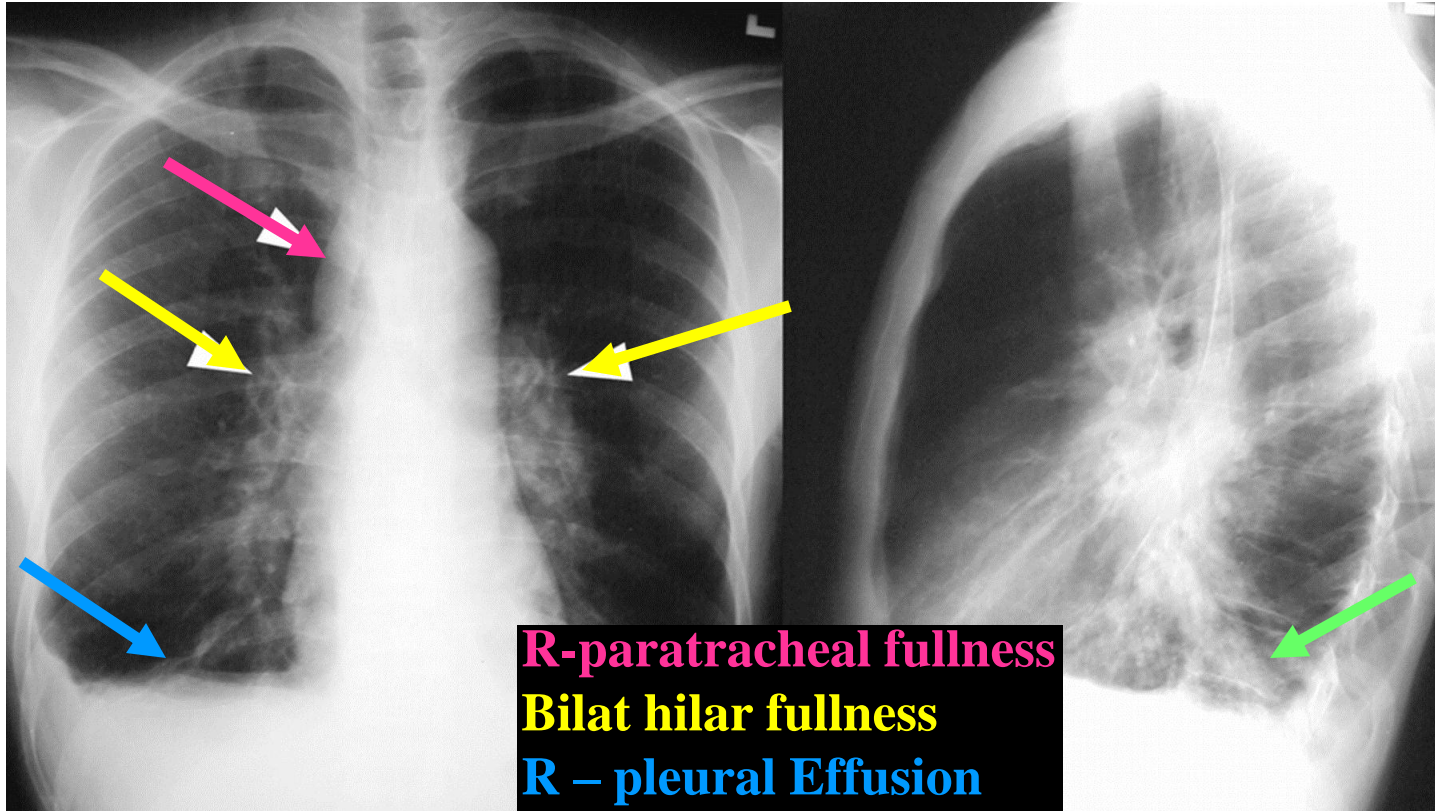
PA and Lateral CXR views

Earls JP, et. al. [4]

PAUSE to evaluate the images, then CONTINUE to confirm findings



# Companion Patient 2, findings



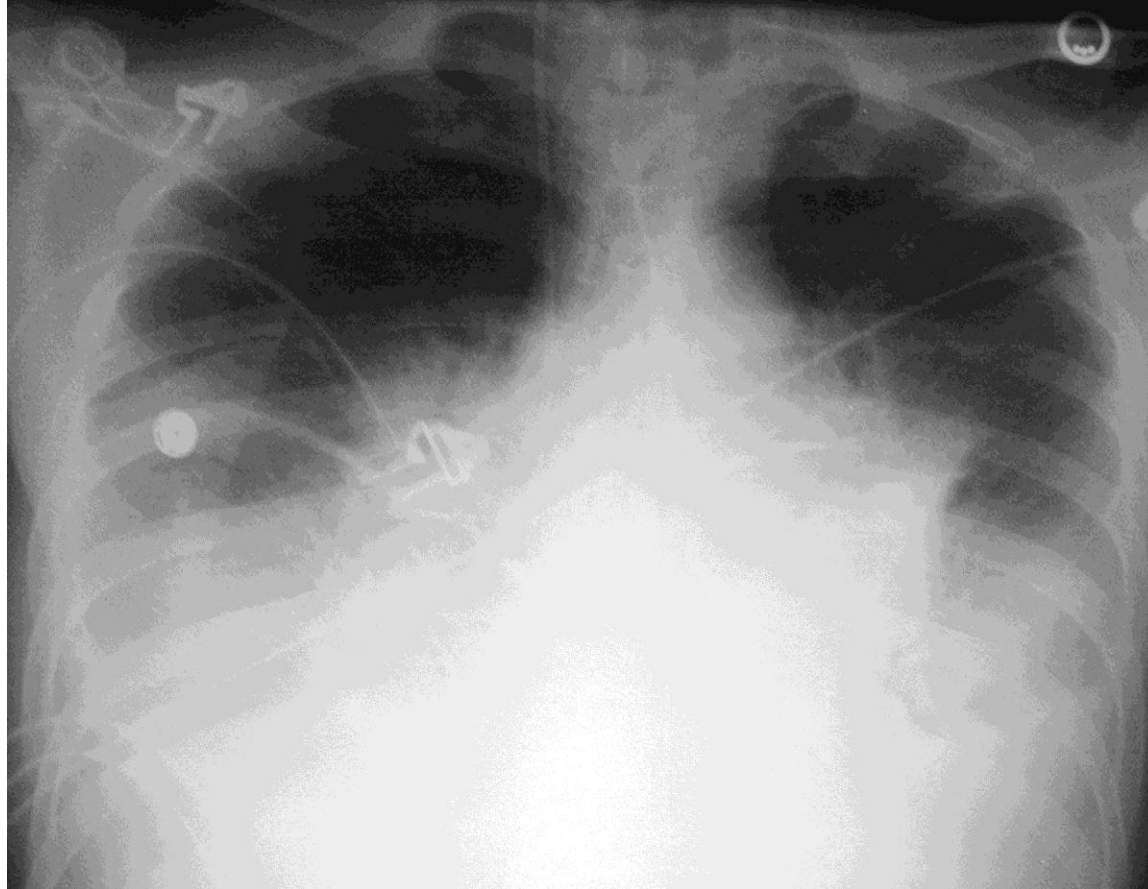
Earls JP, et. al. [4]

CONTINUE to see this patient's CXR on Day 3



# Companion Patient 2, CXR Day 3

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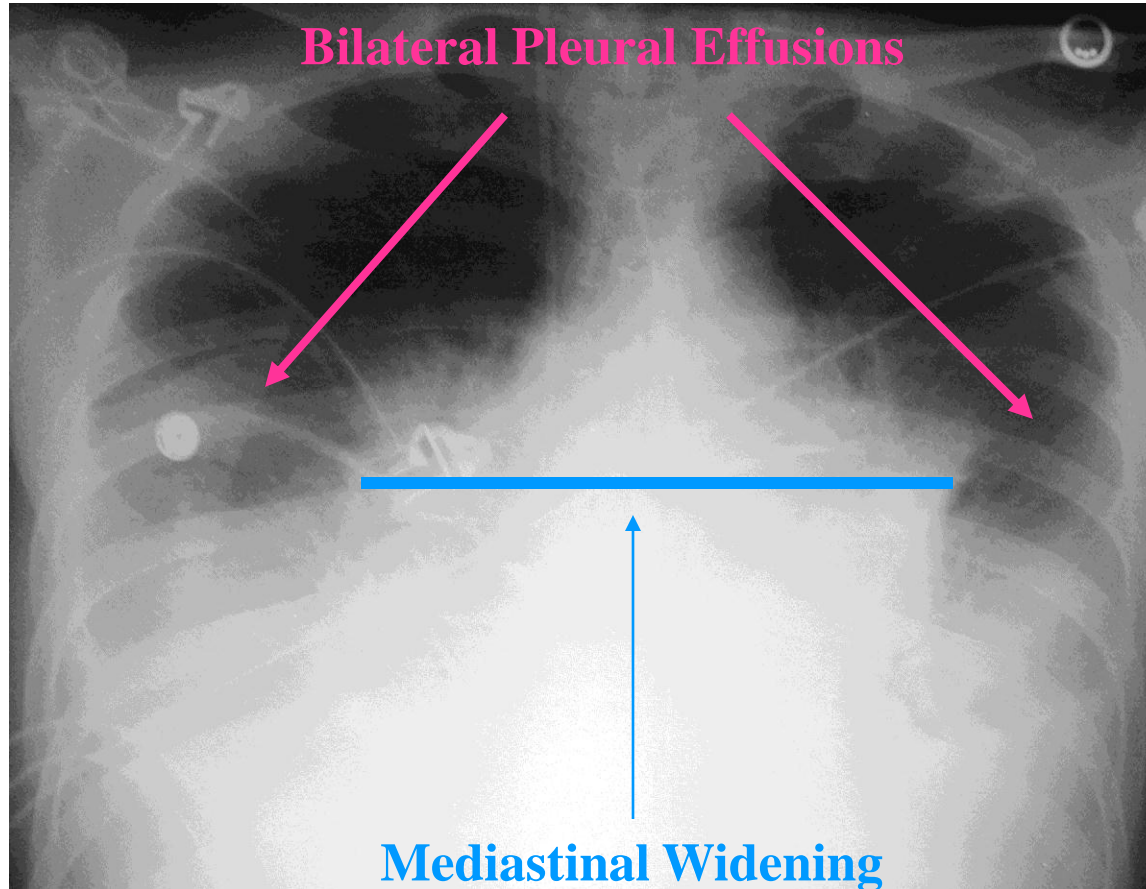


PAUSE to evaluate the image, then CONTINUE to confirm findings

Earls JP, et. al. [4]



# Companion Patient 2, findings



Earls JP, et. al. [4]

CONTINUE to see the QUIZ for this patient



# Companion Patient 2, Quiz

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- 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

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- 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

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- 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

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



# We have one last Patient

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- 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

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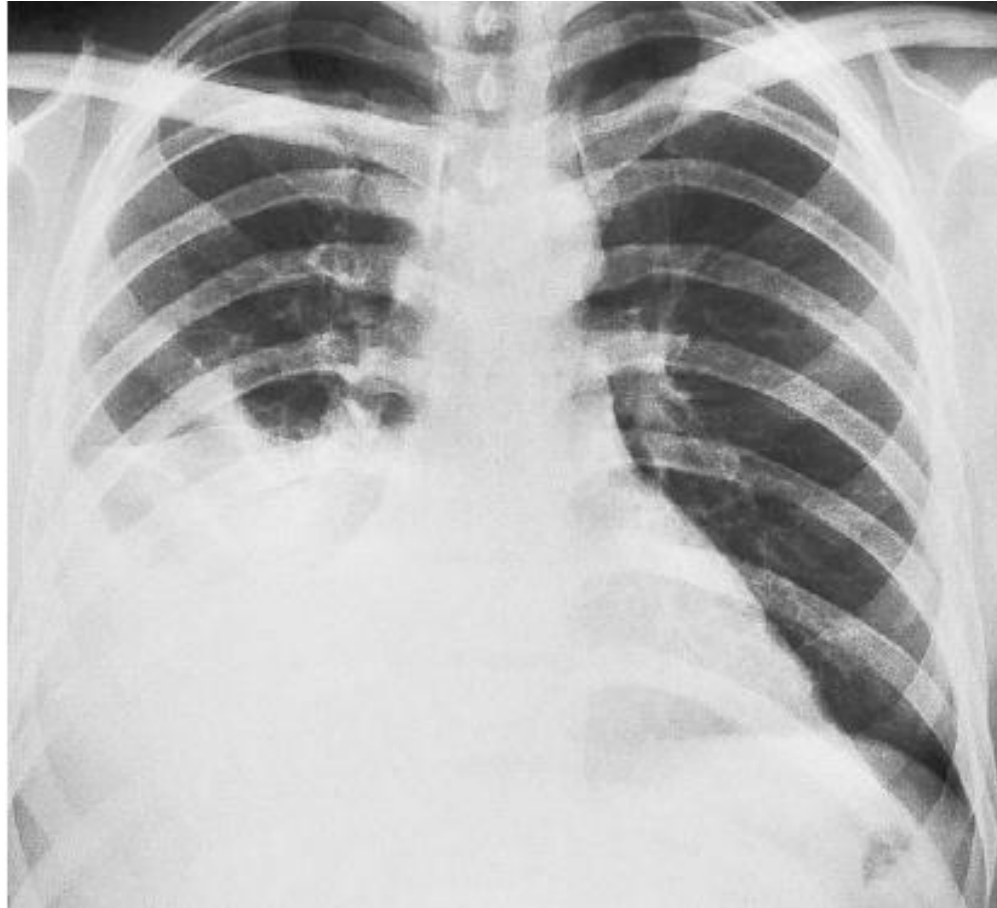
- 83 yo M w/3 weeks of GI pain, bloody diarrhea, now presents coughing up “chocolate syrup”
- Recent travel hx to South America
- He is a very highly regarded American Politician

CONTINUE to see this patient's CXR



# Companion Patient 3, CXR

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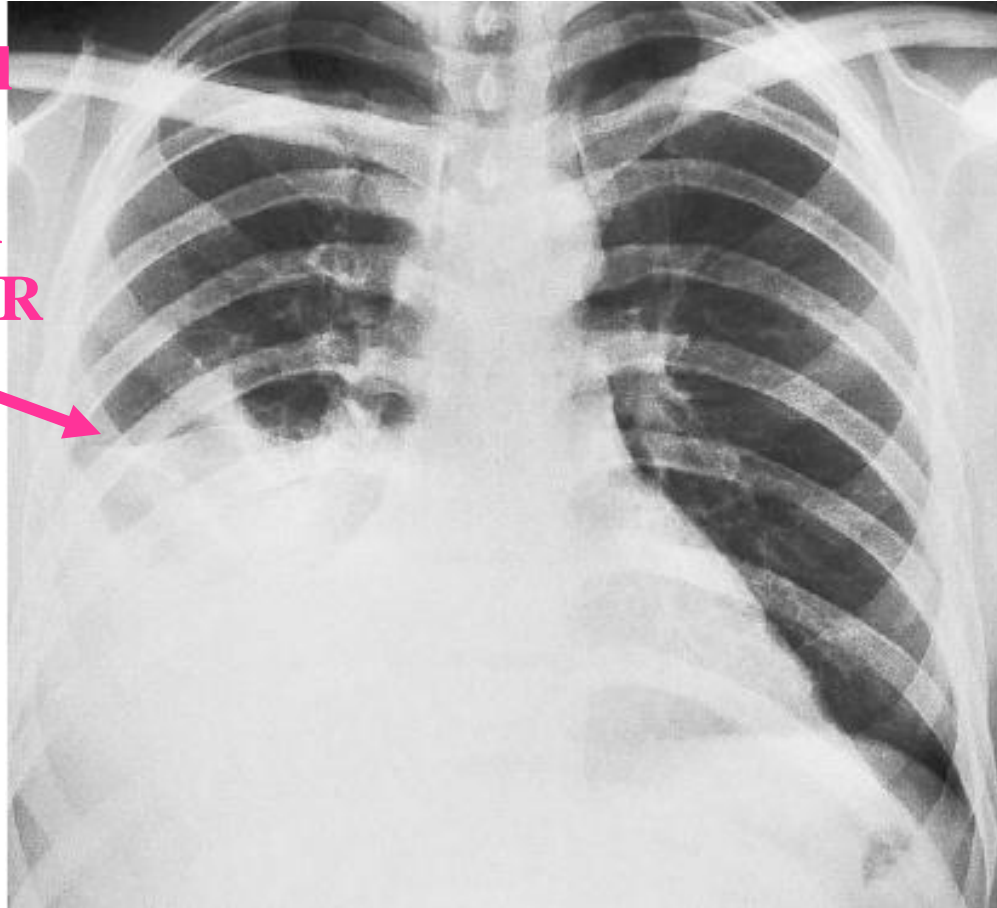
Hansell D, Lynch D, McAdams H, Bankier A. Imaging Diseases of the Chest, 5th Ed. Elsevier. London, 2009. [3]

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**



Hansell D, Lynch D, McAdams H, Bankier A. *Imaging Diseases of the Chest, 5th Ed.* Elsevier. London, 2009. [3]

CONTINUE to learn this patient's diagnosis



# Entamoeba Histolytica

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- Protozoan parasite found world wide, 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

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- 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



# Acknowledgements

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- Dr. Gillian Lieberman, BIDMC
- Dr. Paul Spirn, BIDMC
- Emily Hanson, BIDMC



# References

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- 1. Sutton D, Young J. A Short Textbook of Clinical Imaging. Springer-Verlag. New York, 1990.
- 2. Antonia, GE. et. al. Imaging in Severe Acute Respiratory Syndrome (SARS). *Clinical Radiology*. 2003; 58: 825-832
- 3. Hansell D, Lynch D, McAdams H, Bankier A. Imaging Diseases of the Chest, 5th Ed. Elsevier. London, 2009.
- 4. Earls JP, et. al. Inhalational Anthrax after Bioterrorism Exposure: Spectrum of Imaging Findings in Two Surviving Patients. *Radiology*. 2002; 222: 305-312.