

# **Pulmonary Infection I: Immunocompetent patients**

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“Clinical and radiologic manifestations [of] infection of lower respiratory tract can mimic those of virtually all other lung diseases . . . .”

– Fraser and Pare, Diagnosis of Diseases of the Chest

# Infection

- Is in differential diagnosis for most chest radiographic abnormalities
- What should we know about radiographic manifestations?

# Objectives

- Recognize a broad range of potential radiographic findings of acute infection
- Recognize findings that are NOT characteristic of community-acquired pneumonia

# Value of CXR?

- Not well established

# CXR

- Outcomes not altered\*
- Scant data (2 trials) of CXR v. no CXR
  - 522 children
    - No difference in clinical outcomes
  - 1502 adults
    - No difference in length of illness

\*Swingler et al. (2008). Cochrane Database of Systematic Reviews(1): CD001268

# Management not altered\*

- 2706 pts hospitalized with CAP
  - 911 (1/3) with negative CXR
  - Similar rates of positive sputum and blood cultures whether + or – CXR

\*Basi et al Am J Med 2004: 305-311.

# Management not altered\*

- 300 pts with high pretest probability
  - Substantial minority no CXR
  - Pts treated based on clinical suspicion

\*Aagard et al Med Dec Making 2006 26(6) 599-605.

**CXR nevertheless**

# ATS/IDS criteria

- “a demonstrable infiltrate by chest radiograph or other imaging technique, with or without supporting microbiological data, is required for the diagnosis of pneumonia”  
(Moderate recommendation; level III evidence.)

# Assess for

- Complications
  - Pleural fluid possibly requiring drainage
- Severity (multilobar involvement)
- Unusual radiographic patterns

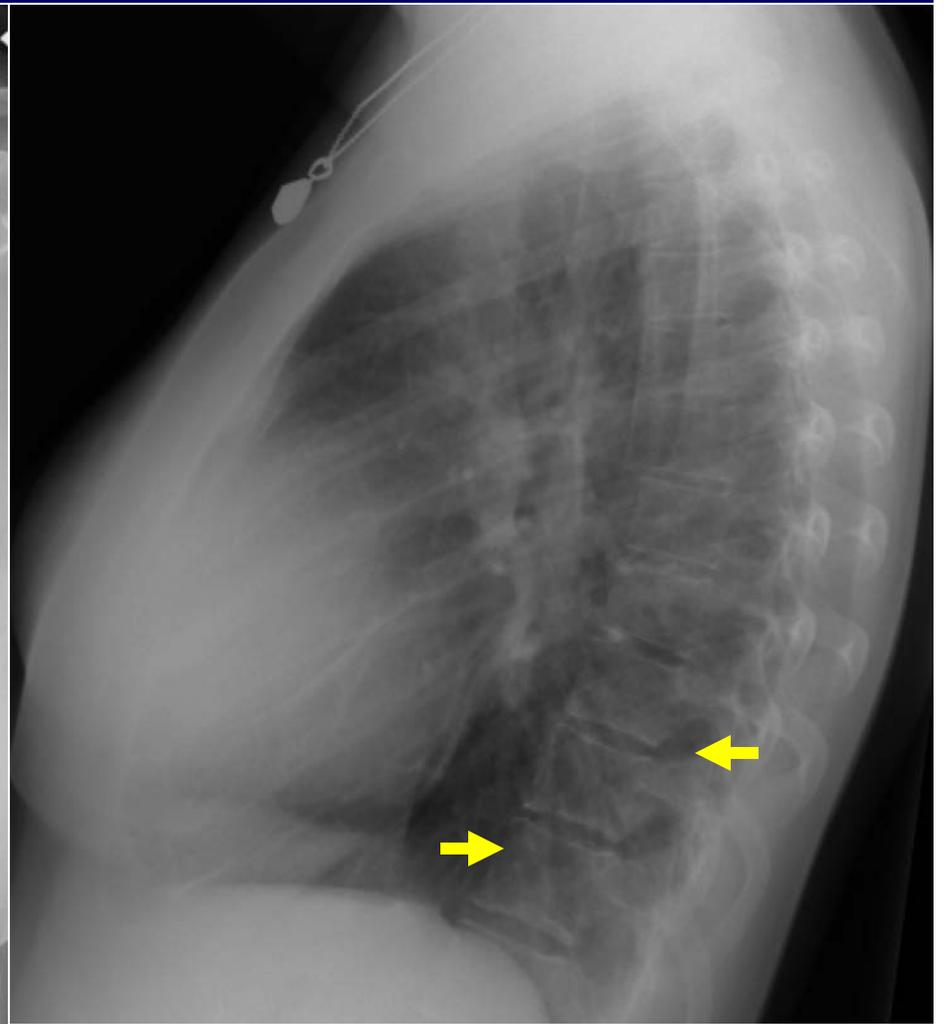
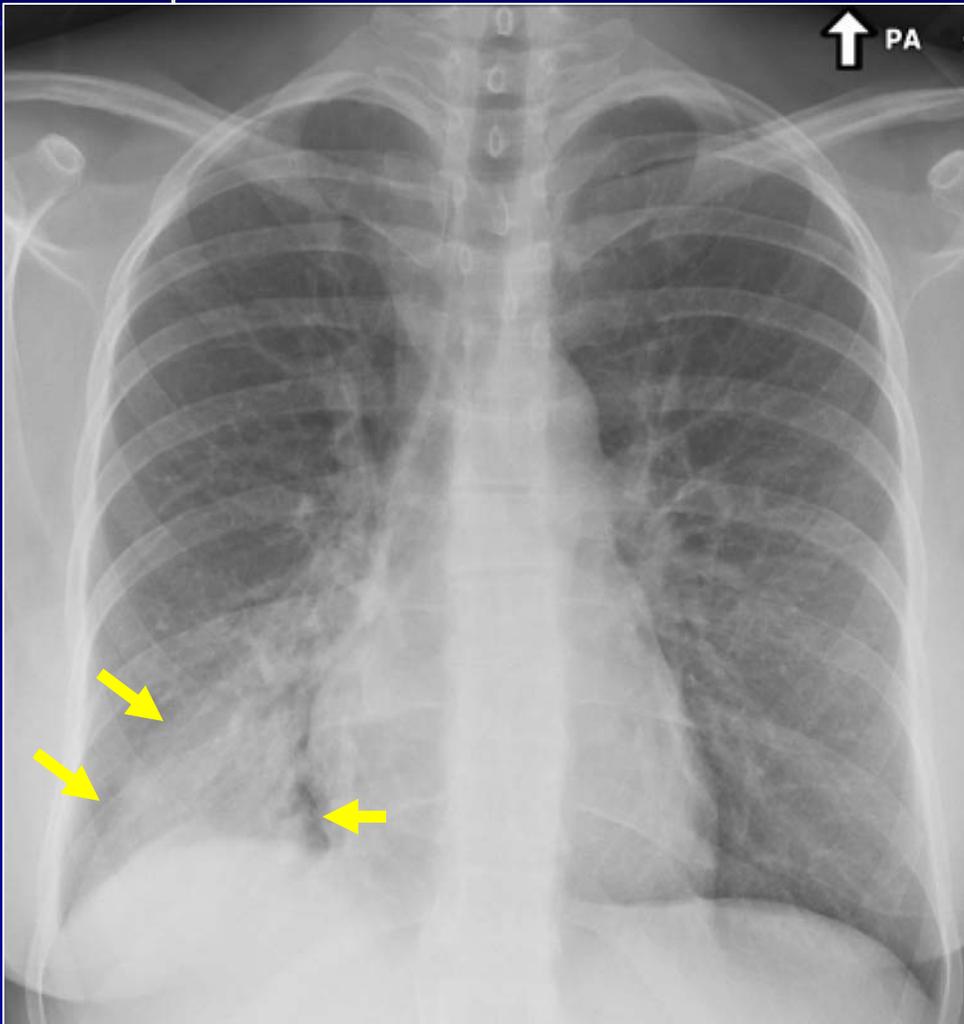
# Classical division

- Lobar pneumonia
- Bronchopneumonia
- Acute interstitial pneumonia
  - Not to be confused with an inflammatory noninfectious entity, AIP

# Lobar pneumonia

- Airspace consolidation
- Confined to one lobe or segment
  - Or group of segments
- Anatomic distribution
- Most common manifestation of bacterial pneumonia
- Particularly *Strep. pneumoniae*,  
*Klebsiella*

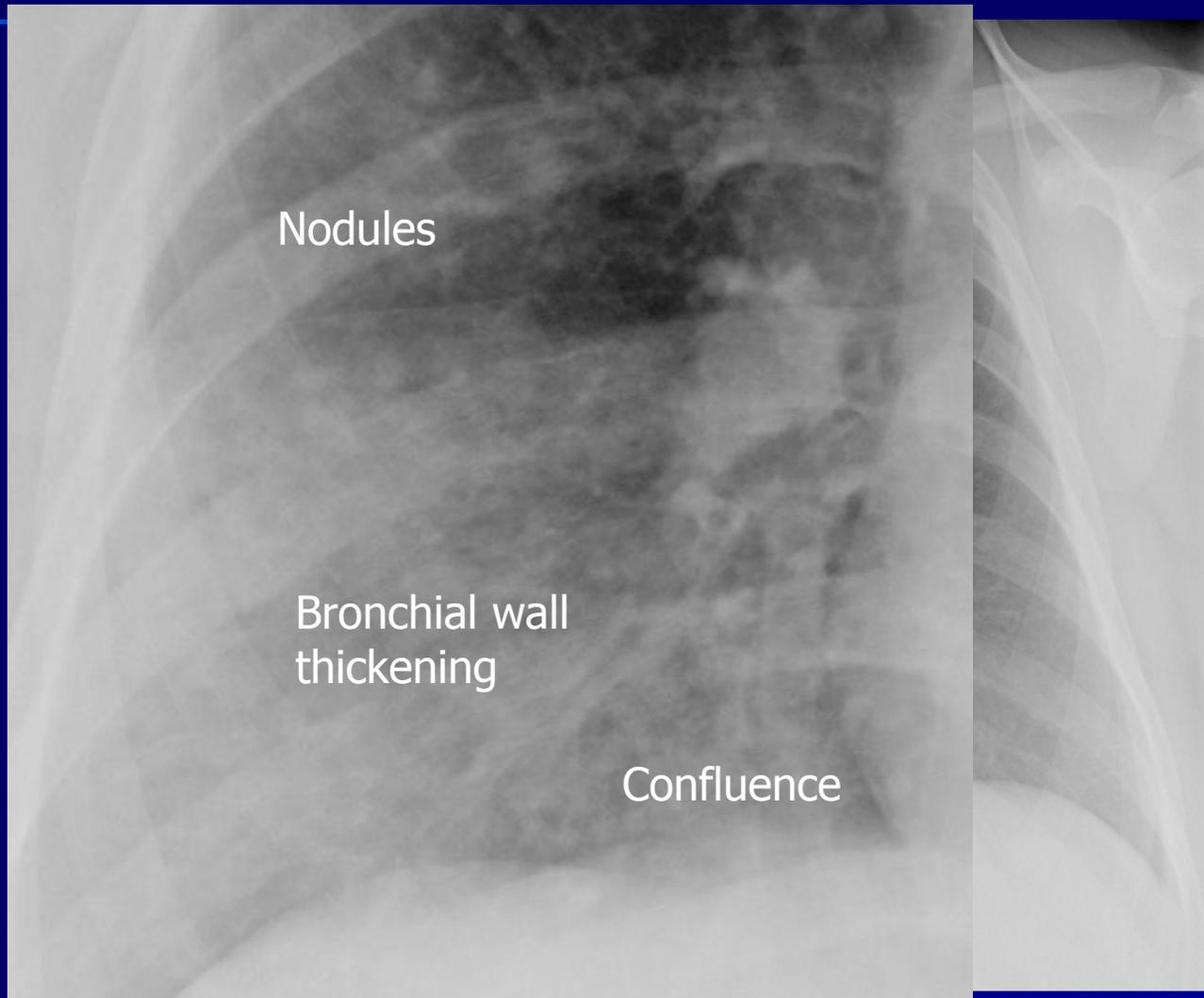
# Lobar pneumonia



# Bronchopneumonia

- Multifocal
- Nodules that tend to join
- Produce confluent areas of segmental consolidation
- Classically: *Staph*, *S. pneumoniae*, *H. flu*

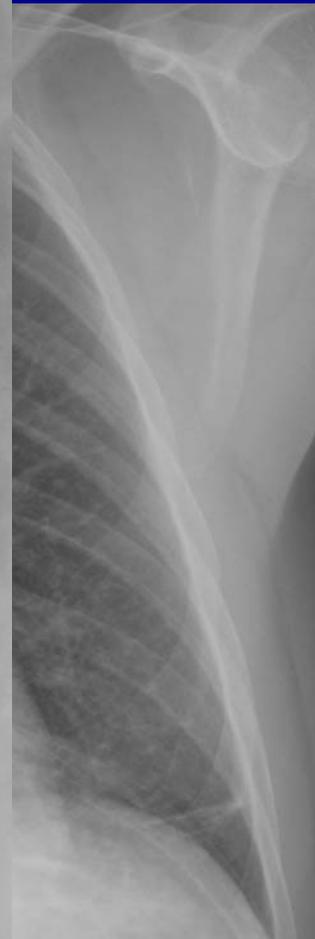
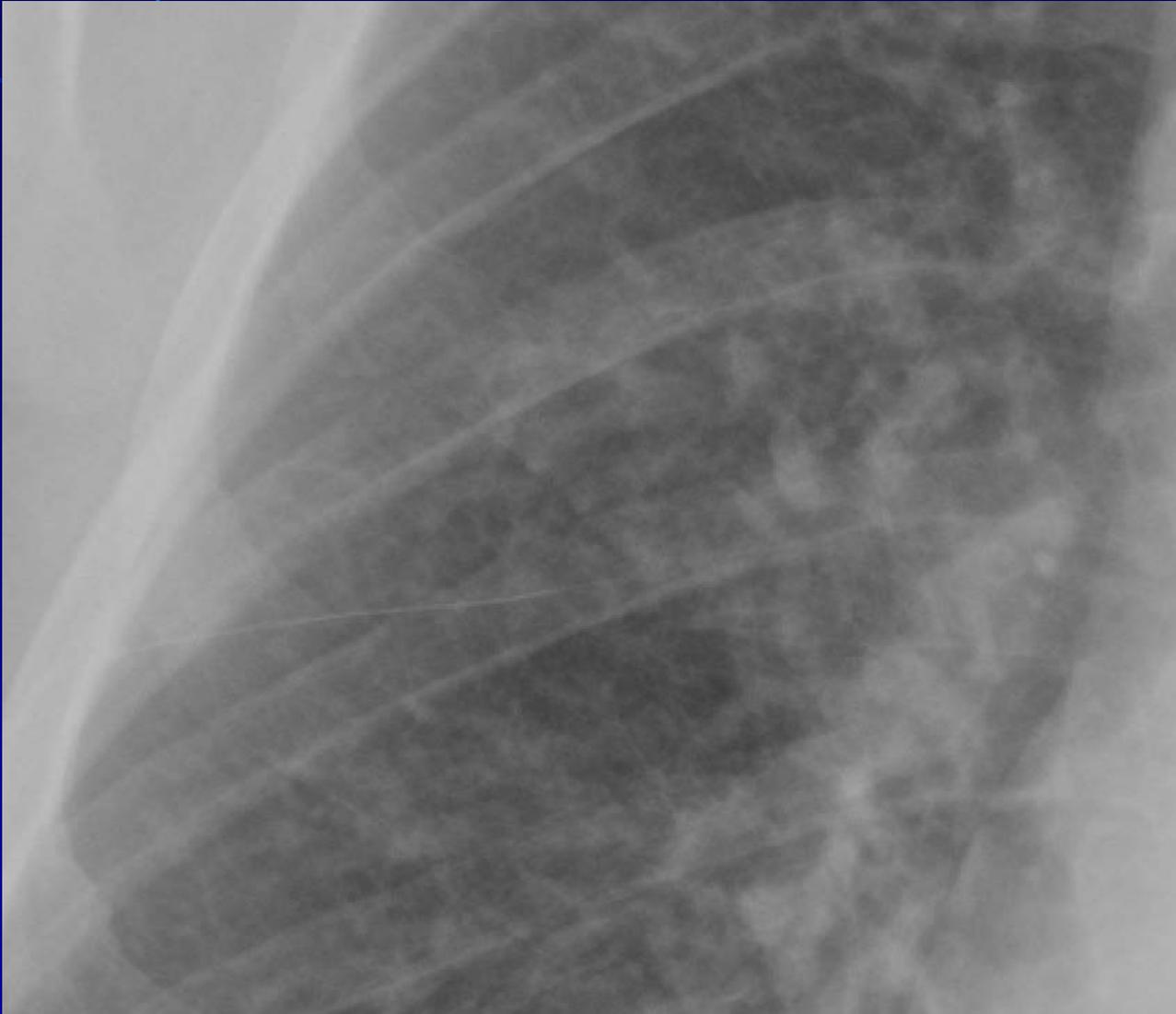
# Bronchopneumonia



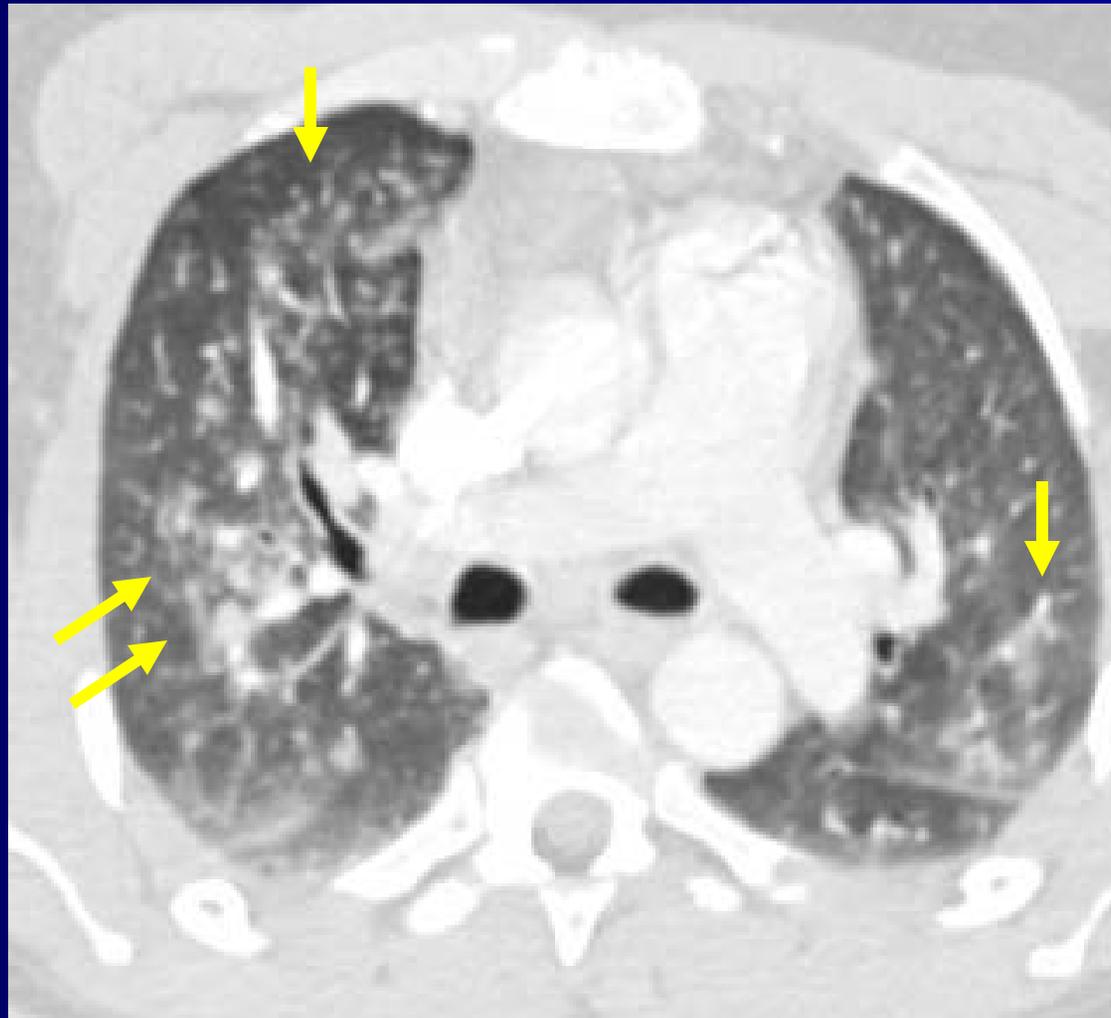
# Acute interstitial pneumonia

- Involvement of
  - Bronchial and bronchiolar walls
  - Pulmonary interstitium
- Classically associated with mycoplasma, chlamydia

# Interstitial pneumonia



# Interstitial pneumonia



# Problems

- Poor correlation between patterns and agents
- Attributed to:
  - Aging population
  - Early antibiotic treatment

# Problems

- Also, infrequent isolation of causative agent
- Selection bias:
  - Hospitalized patients
  - Patients with definitive diagnosis
    - Cultures
      - Blood
      - Pleural fluid

# Problems

- Considerable overlap of patterns:
  - Up to 50% of mycoplasma may have lobar consolidation

# Problems

- Imperfect inter-reader agreement\*
  - Presence/absence of abnormalities, 80%
  - Distribution, 75%

\*Albaum et al; Chest 110:343, 1996

# Inter-reader agreement

- Decreases with portable radiographs, nursing home patients:
- Intra-class correlation coefficient: 0.54 or fair\*

\*Loeb, et al. (2006). Journal of the American Medical Directors Association 7(7): 416-9.

# Commonly

- Identify as pneumonia based on
  - Radiographic appearance
  - Clinical symptoms
  - **Resolution over time**

# RML opacity

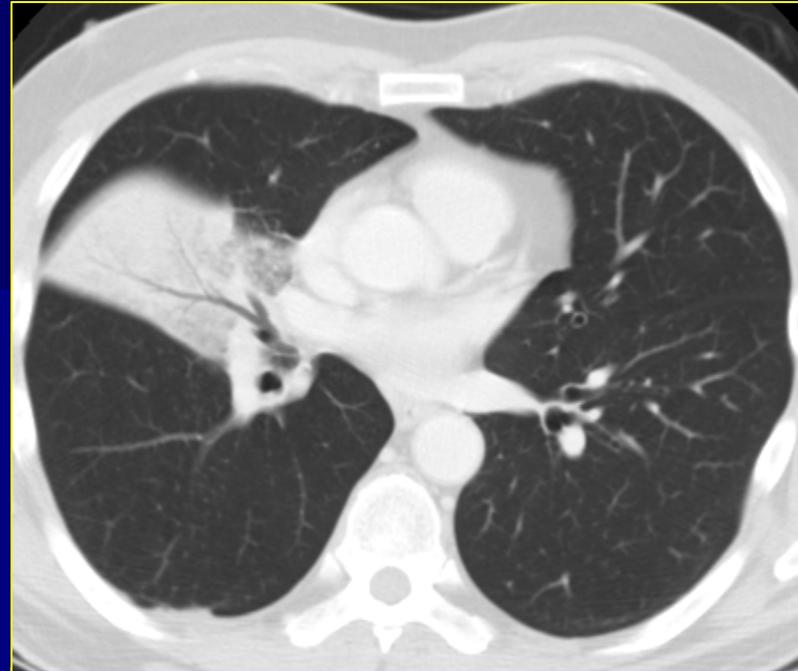


# ?Pneumonia

- Pt does not have symptoms
- Radiographic abnormality does not change over 3 weeks

# CT

- Right middle lobe consolidation
- Air bronchograms
- No CT evidence of bronchial obstruction
- Diagnosis?



# Diagnosis

- Bronchoscopy
  - Biopsy
  - Lavage
- Bx yield:
  - Atypical lymphoid infiltrate
  - Final dx:
    - extranodal marginal zone B-cell lymphoma of mucosa-associated lymphoid tissue=MALT lymphoma

# Follow-up “to resolution”

- Paucity of literature on timing
- 288 hospitalized patients\*
  - Little utility for followup before 28 days

\*Bruns et al. (2007). Clinical Infectious Diseases 45(8): 983-991.

# Follow-up radiographs

- 81 non-immuno-compromised patients
- Serial CXRs q 2 wk x 8 wk
- then q 4 wk until
  - 24 wk had passed
  - or nl CXR
- 50.6% normal at 2 wk
- 66.7% normal at 4 wk

Mittl et al Am. J. Respir. Crit. Care Med., 1994, 630-635.

# Follow-up radiographs

- More rapid clearing
  - Single lobe
  - Younger patients

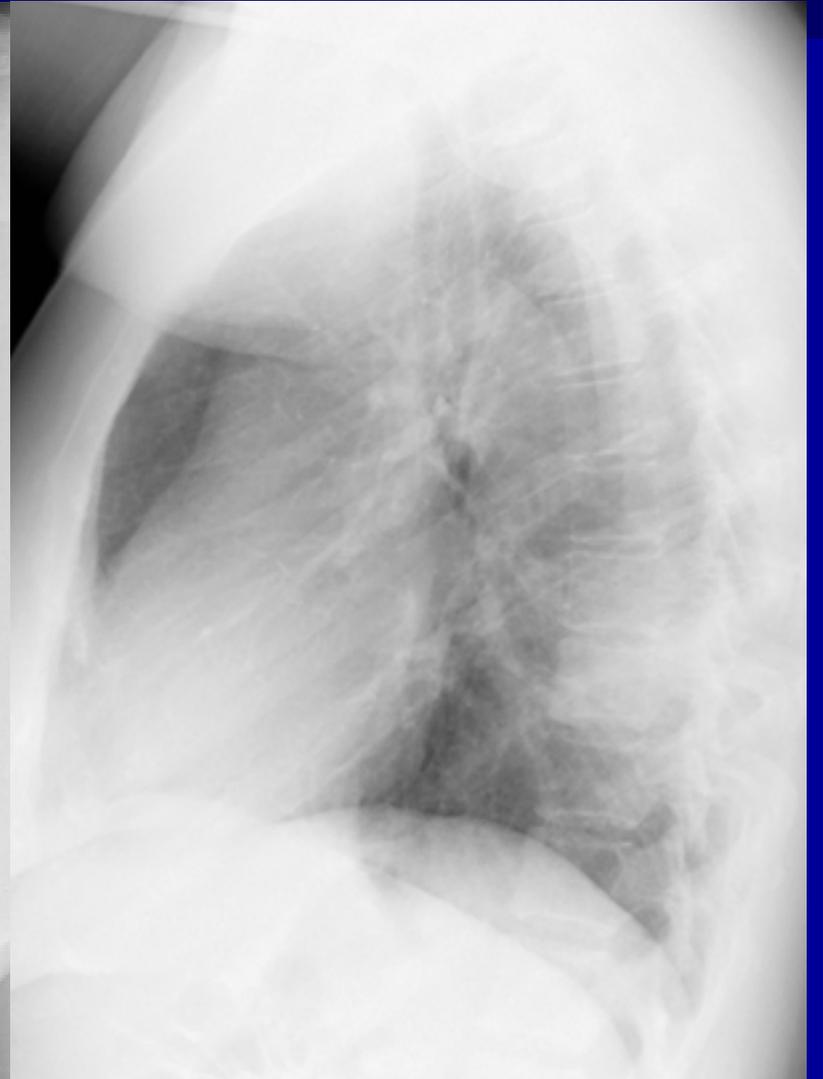
# Follow-up radiographs

- Persistent symptoms and signs
- Risk of bronchial neoplasm
- In severe pneumonia, according to clinical judgment
  - Increase in area of opacity by  $> 1/2$  indicates poor prognosis

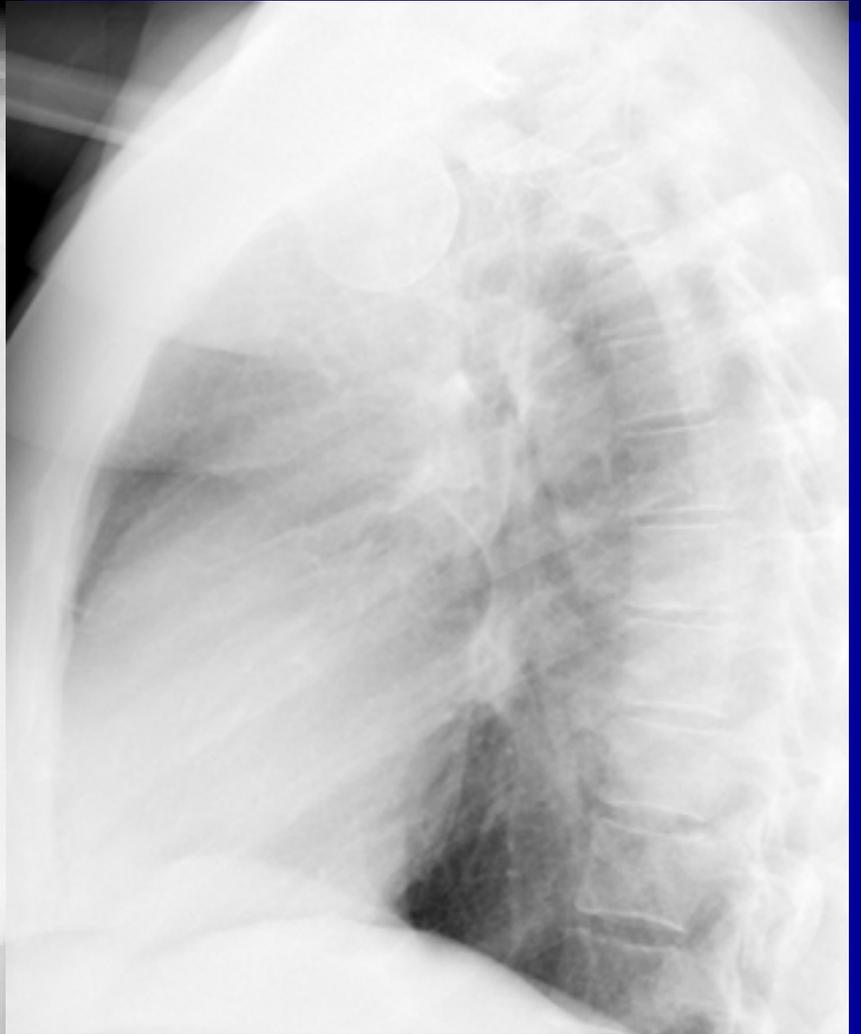
Woodhead et al Eur Respir J 2005; 26:1138-1180

# **Additional manifestation of acute pneumonia**

# Acute respiratory symptoms



**Three days later**



# Round pneumonia

- Classically described in children
  - Attributed to incomplete development of collateral air pathways

# Round pneumonia

- Also occurs in adults
  - Uncommonly reported
- Agents:
  - *Strep. pneumoniae*
  - *Klebsiella pneumoniae*
  - Q fever

\*Durning et al. Chest 124 (1): 372. (2003)

# Round pneumonia

- Consider diagnosis in adult
  - With pulmonary mass
  - Respiratory tract infection symptoms
  - Particularly if young nonsmoker
- In context of recent normal chest radiograph, virtually pathognomonic for round pneumonia

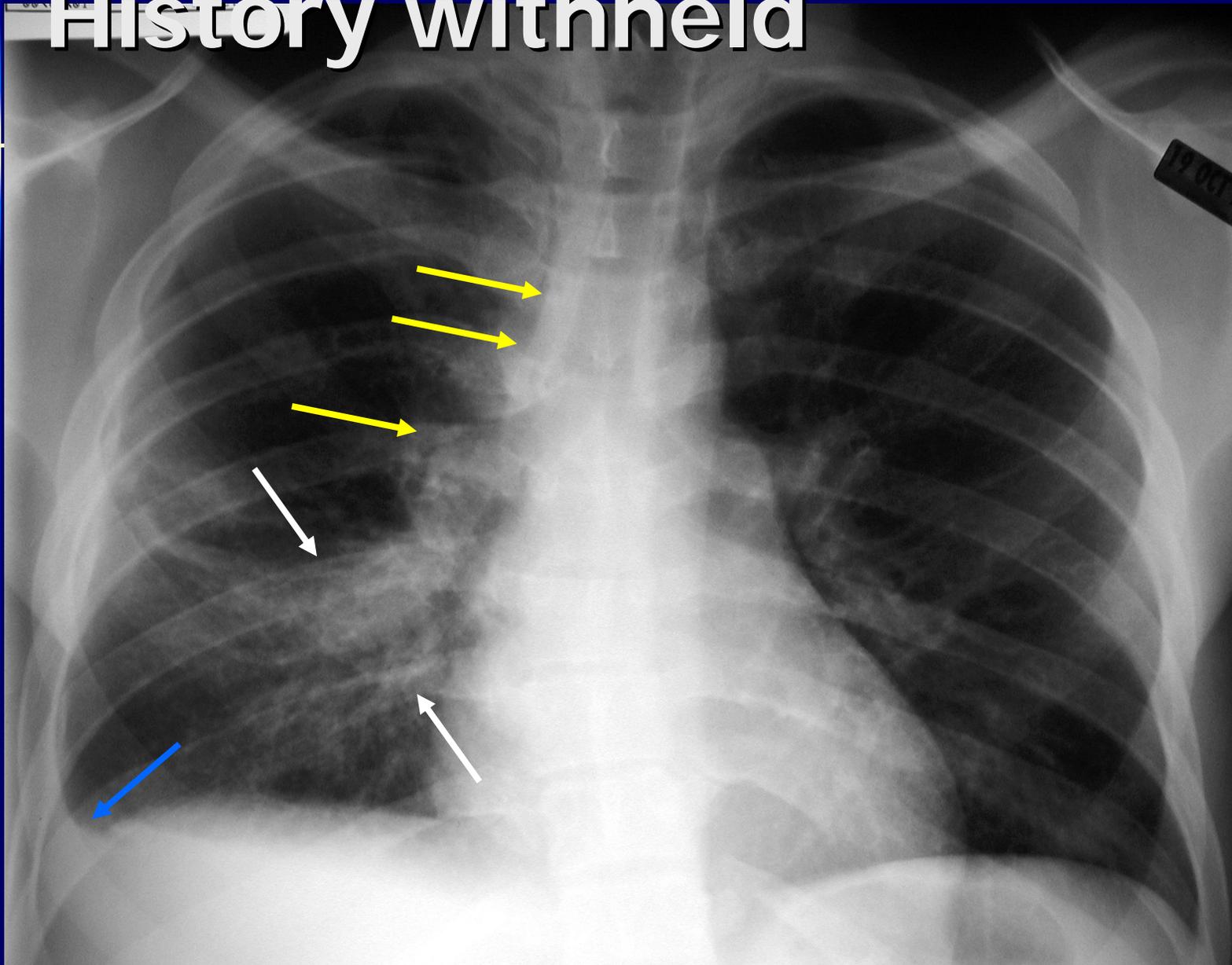
# Objectives

- Recognize a broad range of potential radiographic findings of acute infection
- Recognize findings that are NOT characteristic of community-acquired pneumonia

# Atypical radiographs

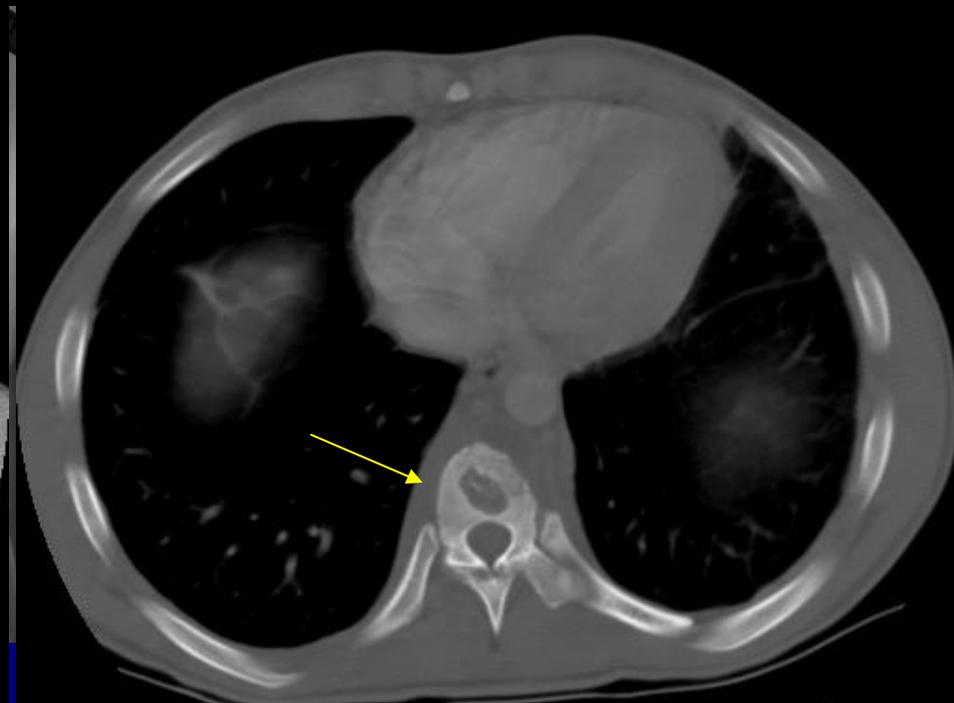
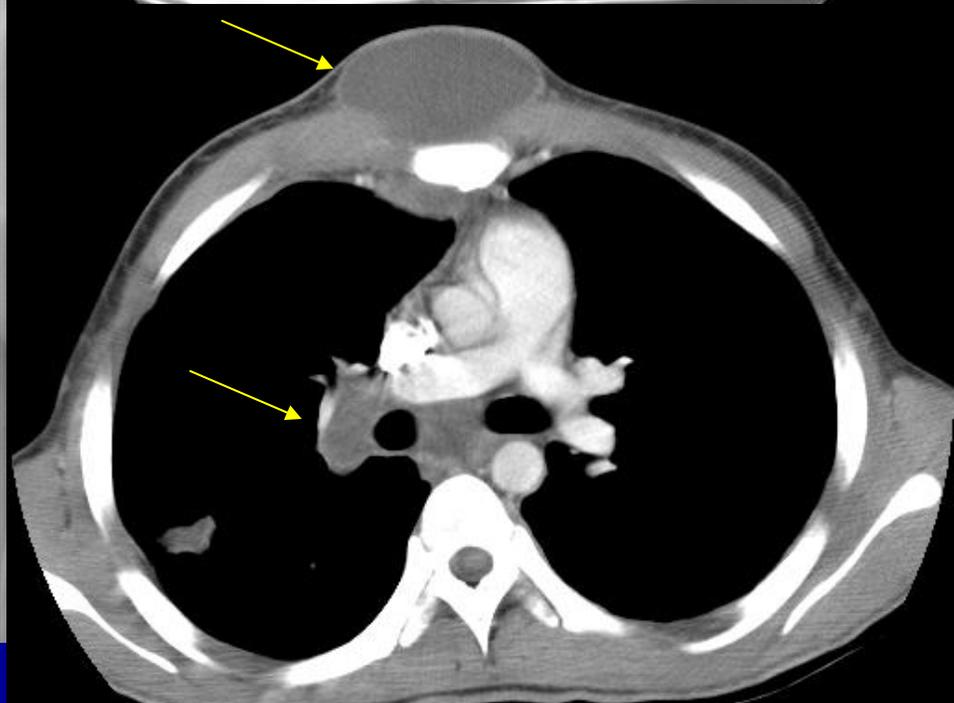
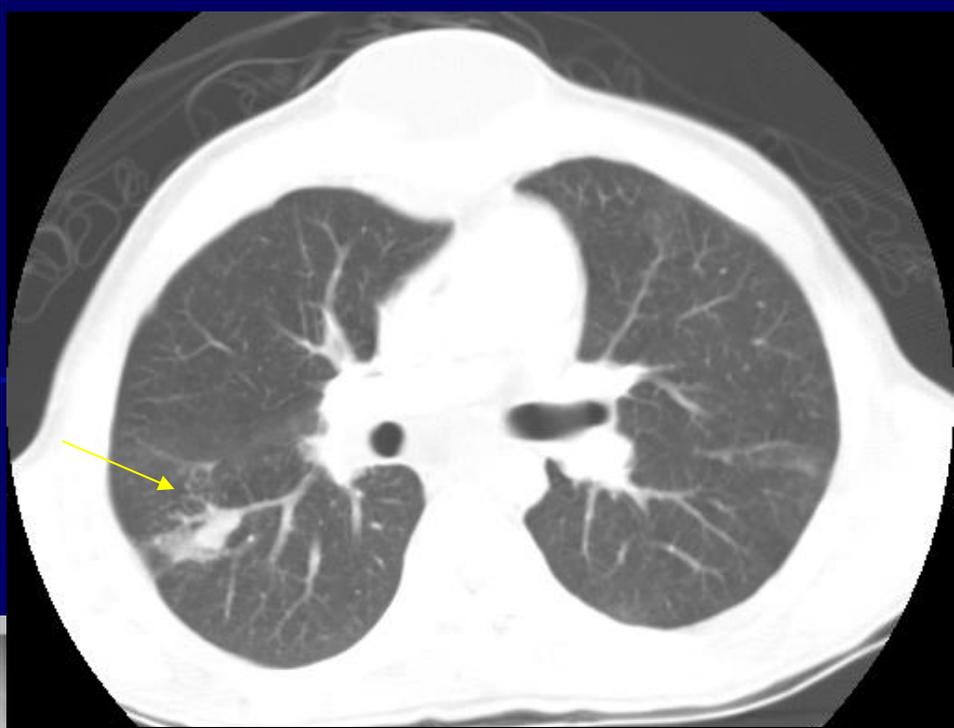
- Lymphadenopathy and pulmonary opacities
- Multiple pulmonary nodules
- Apical cavitation
- Diffuse lung disease

History withheld



# Lymphadenopathy

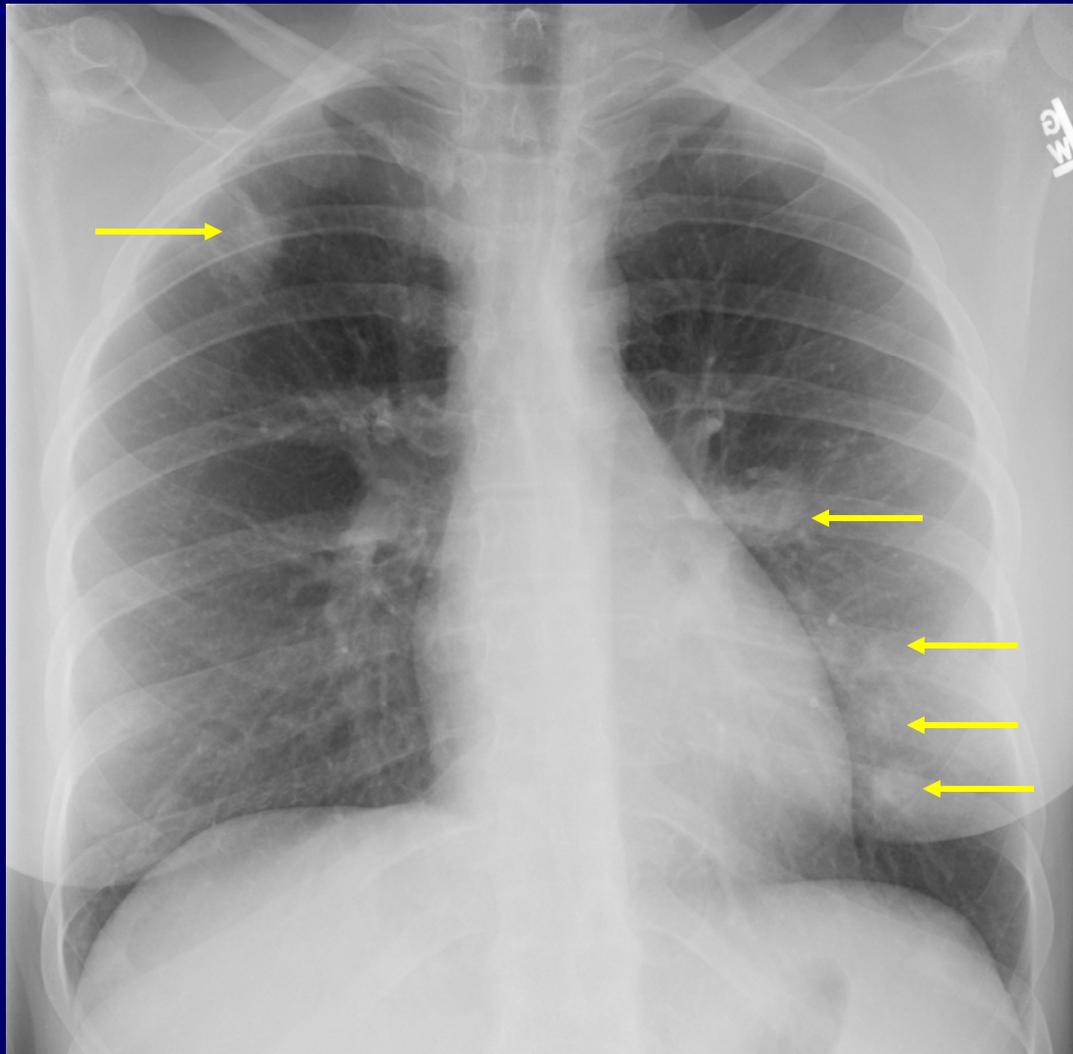
- Underlying disease
  - Neoplasm
  - Sarcoidosis
- Few specific infections



# Specific infections

- Primary tuberculosis
- Endemic fungal infection
- Tularemia
- Anthrax

# Young woman with fever



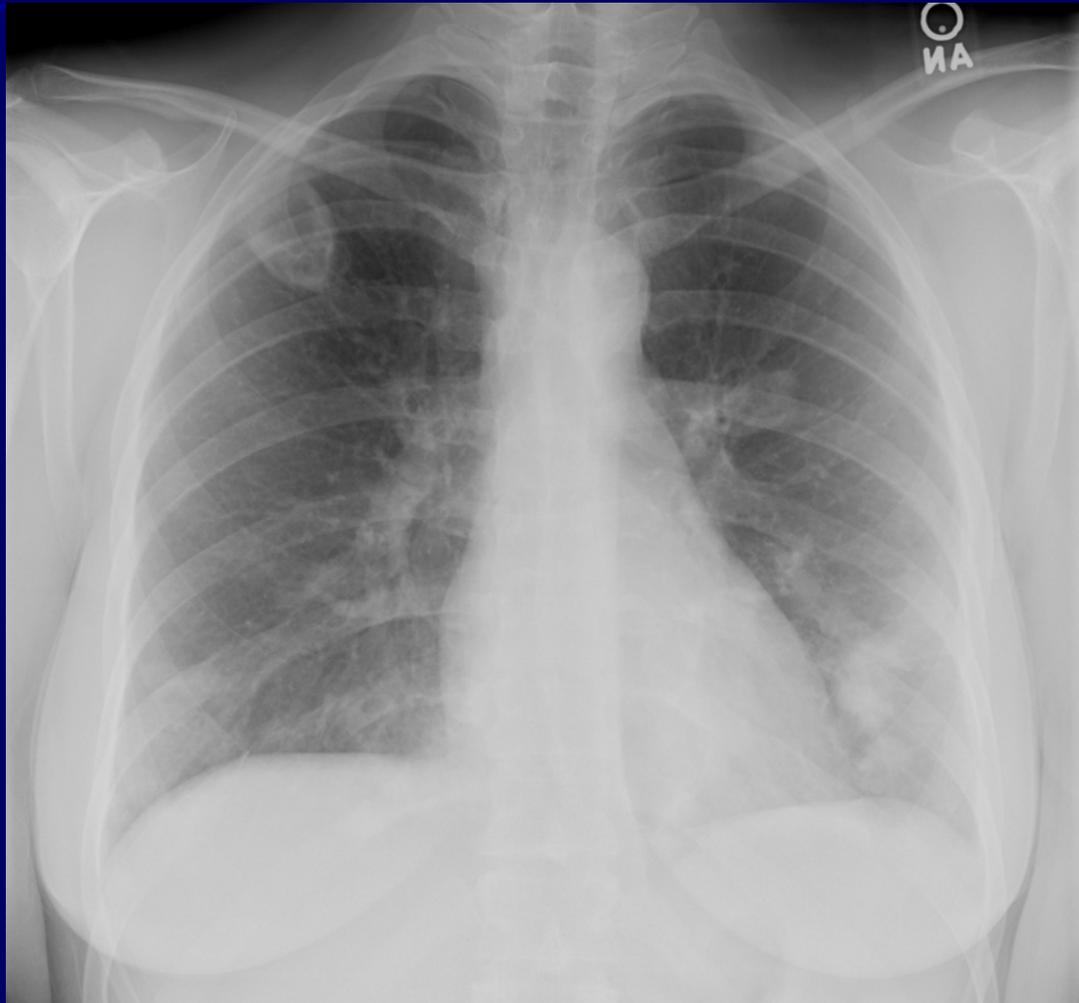
# Multiple pulmonary nodules

- Differential diagnosis:
  - AVMs
  - Wegener's
  - Sarcoid
  - Metastases
  - Traumatic hematomas
  - Silicosis, coal-worker's pneumoconiosis
  - A few infections

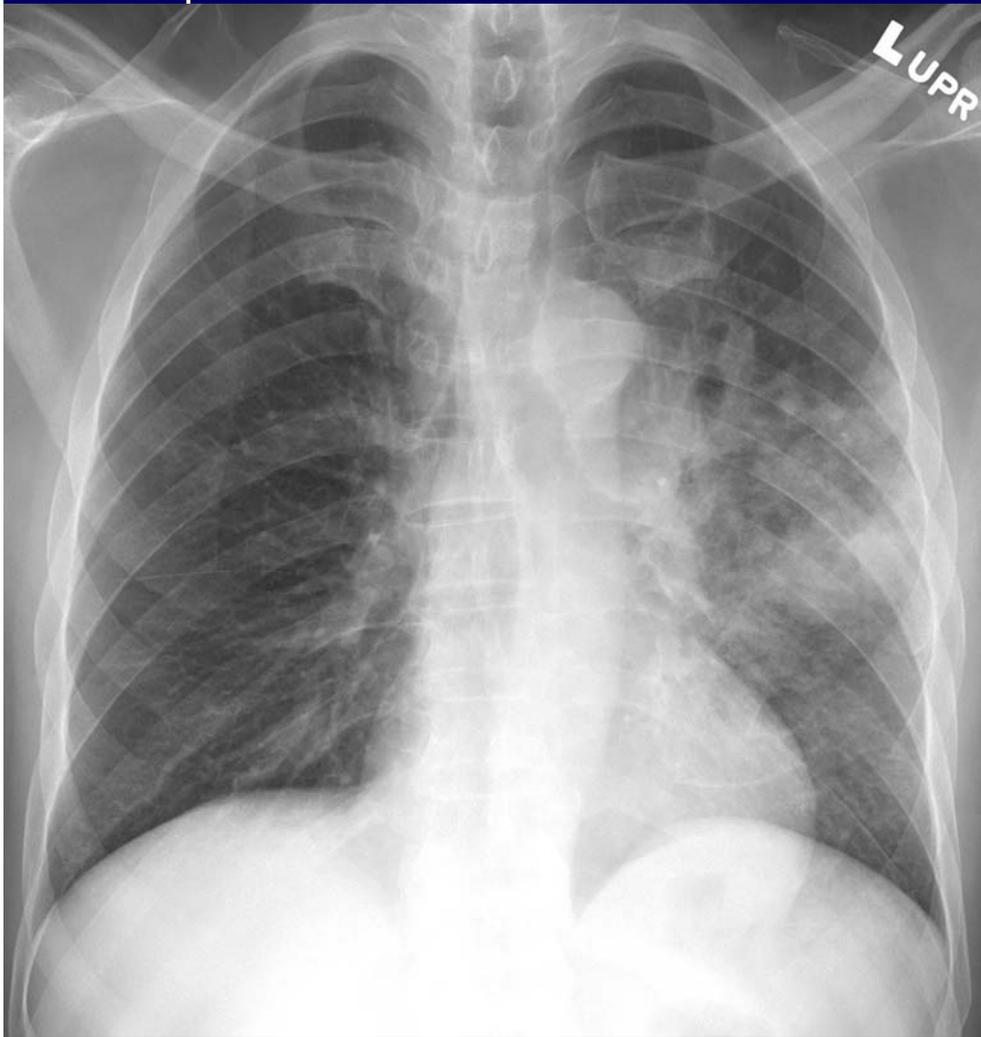
# Multiple pulmonary nodules

- Differential diagnosis does not include community-acquired pneumonia
- Infections:
  - Invasive aspergillosis
  - Histoplasmosis
  - Paragonimiasis
  - **Septic emboli**

# Five days later



# Nigerian pt with fever, nausea, vomiting, hyperglycemia



# Cavitary disease

- Differential diagnosis:
  - Broad array of bacterial infections:
    - Staphylococcus
    - Klebsiella
    - Pseudomonas
    - Anaerobes
    - Mycobacteria

# Cavitary disease

- Other infections

- Pneumocystis
- Histoplasma
- Coccidioides
- Cryptococcus
- Aspergillus
- Paragonimus
- Echinococcus

# Cavitary disease

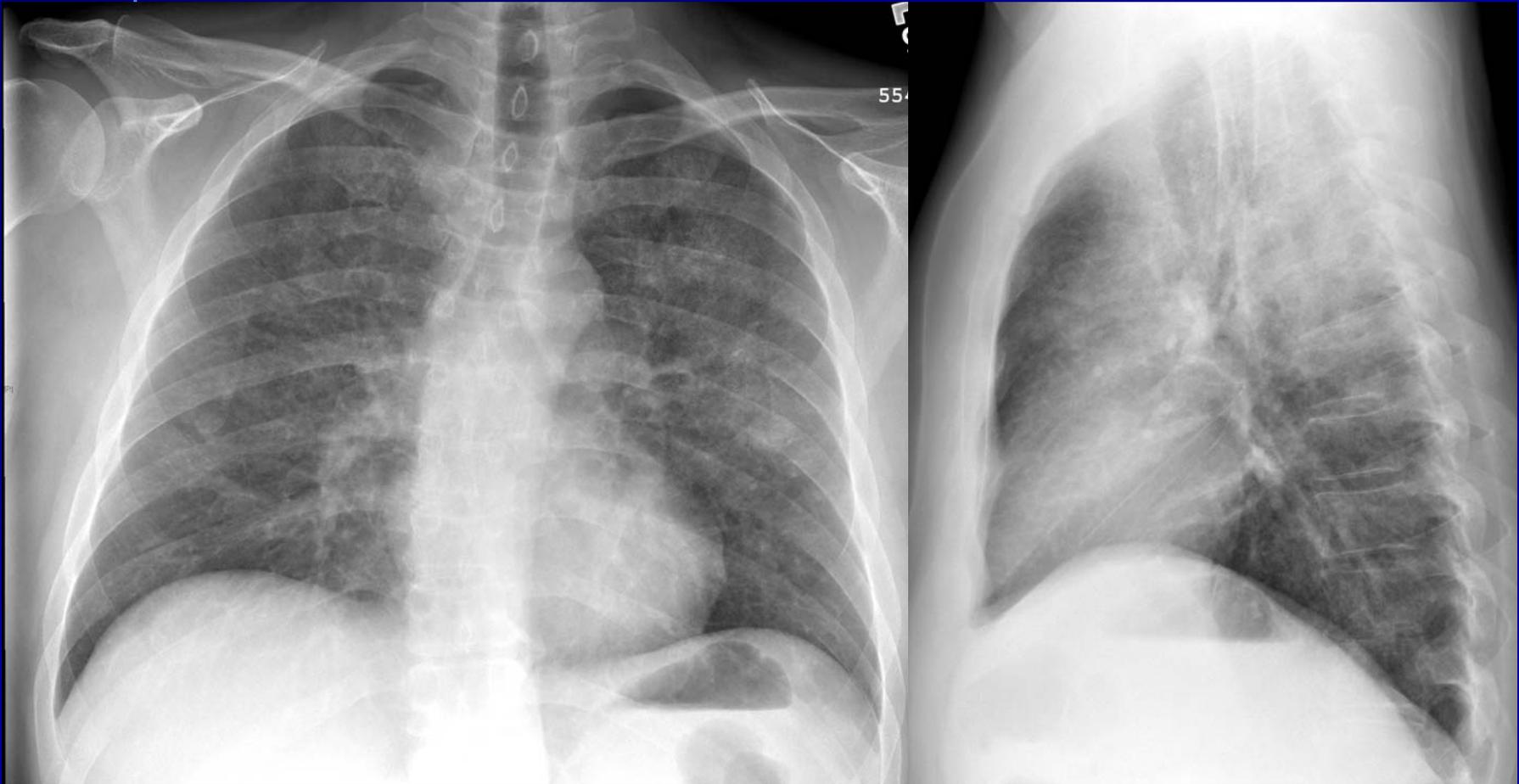
- Noninfectious:
  - Wegener's
  - (Sarcoid)
  - Malignancy
  - Septic emboli
  - Bullae
  - Traumatic pneumatoceles

# Always consider TB

- Isolated anterior segment postprimary TB classically considered rare
- Series of 142 pts: 6% had isolated anterior segment disease\*
  - More common in diabetes—statistically significant difference

\*Spencer et al Chest 1990: 97; 384-88

# 51-year-old male for VQ scan



# Clinical presentation

- 2 weeks dry cough
- Hypoxia
- No past medical history

# 51-year-old male for VQ scan



# Diffuse lung disease

- Differential diagnosis:
  - Diffuse alveolar hemorrhage
  - Hydrostatic edema
  - Permeability edema/ARDS
  - Near-drowning
  - Extrinsic allergic alveolitis
  - Some infections

# Diffuse lung disease

- Infectious:
  - CMV
  - Influenza
  - **Pneumocystis**

# Conclusions

- Community-acquired pneumonia has a broad range of manifestations
- Clinical presentation is an important factor in diagnosis
- Consider CAP in pt with mass

# Conclusions

- Usual recommendation is to follow all infections to exclude underlying neoplasm
- Think of alternate diagnoses in presence of:
  - Lymphadenopathy—think primary TB
  - Multiplicity of nodules
  - Diffuse lung disease
- Consider postprimary TB when disease is cavitory