

AMSER Case of the Month

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23 y.o. female with painful cough

Irene Antony, MS2

Harvard Medical School

Angela Giardino, MD

Brigham and Women's Hospital, Dana-Farber Cancer Institute, Harvard Medical School

Department of Radiology



Patient Presentation

- HPI: 23 y.o. female patient presented with 3 months of painful cough, fatigue and weight loss
- PMHx: None
- PSHx: No drug/alcohol use
- FHx: No reported family medical conditions
- Labs
 - WBC: 7.06 K/ul
 - HGB 9.7 g/dL
 - HCT 31.9%
 - PLT: 491 K/ul

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 1:

Chronic cough lasting more than 8 weeks. No known risk factors for lung cancer. Initial imaging.

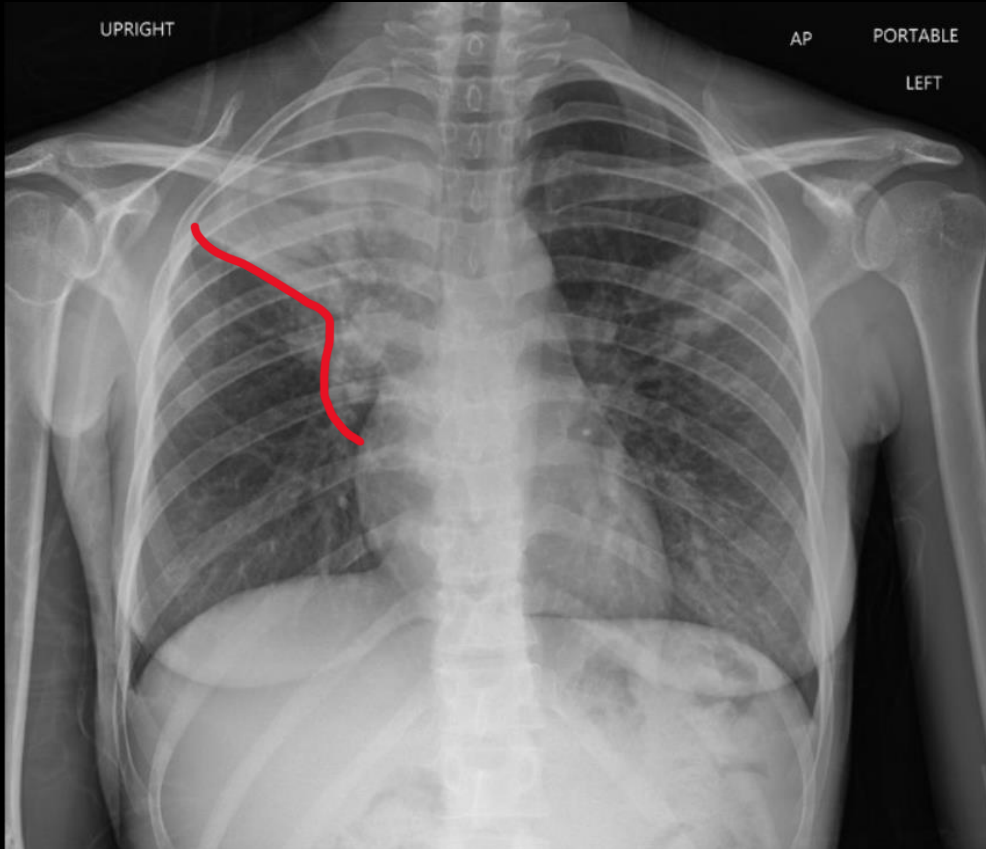
| Procedure | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| Radiography chest | Usually Appropriate | ☼ |
| CT chest with IV contrast | May Be Appropriate | ☼☼☼ |
| CT chest without IV contrast | May Be Appropriate | ☼☼☼ |
| MRI chest without and with IV contrast | Usually Not Appropriate | ○ |
| MRI chest without IV Contrast | Usually Not Appropriate | ○ |
| CT chest without and with IV contrast | Usually Not Appropriate | ☼☼☼ |
| FDG-PET/CT skull base to mid-thigh | Usually Not Appropriate | ☼☼☼☼ |

This imaging modality was ordered by the ER physician

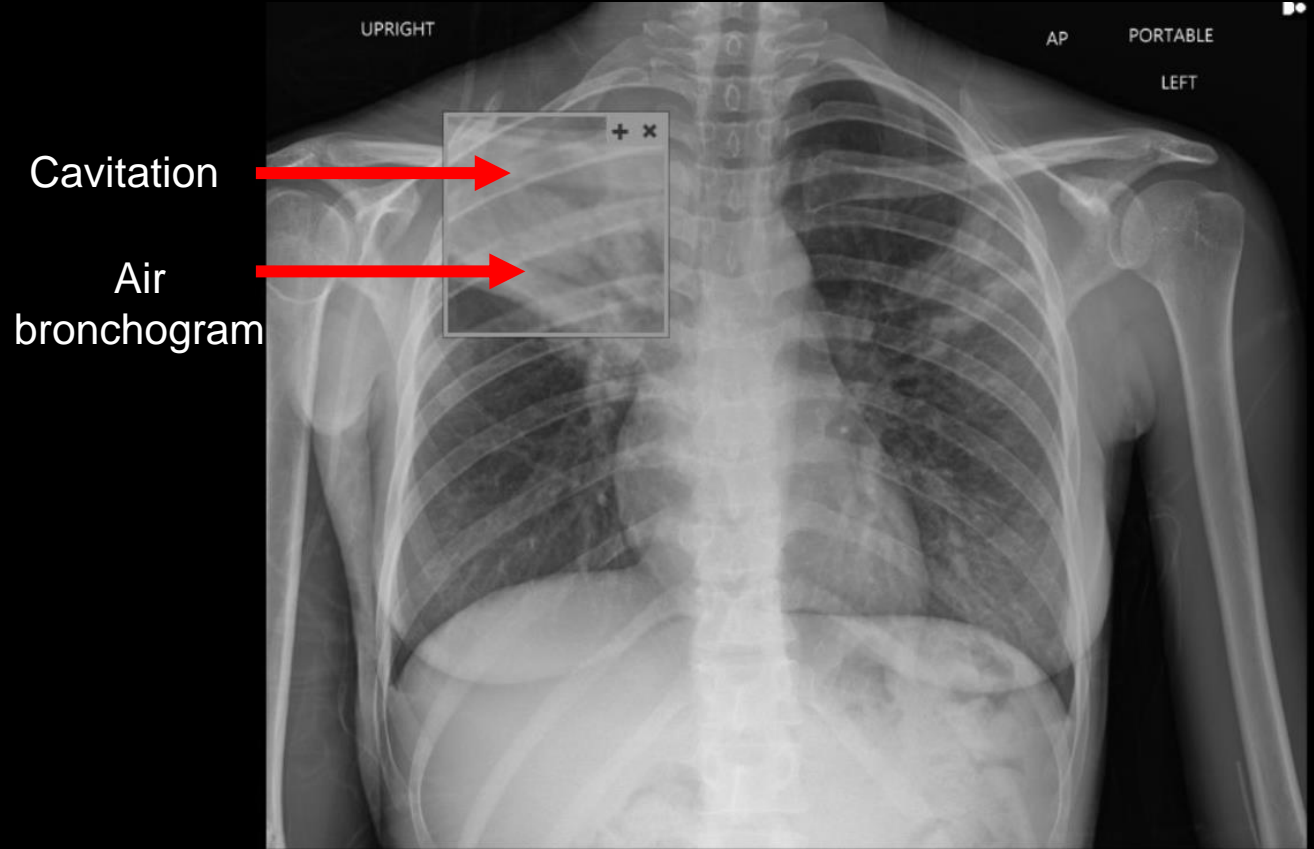
Findings: (unlabeled)



Findings: (unlabeled)



Right upper lobe collapse, as highlighted by the reverse S-sign of Golden



Right upper lobe cavitory consolidation with air bronchograms

Additional Social History

Emigrated to the United States in 2017 with recent travel to Cape Verde

Further workup

T-spot: **Positive**

Select the applicable ACR Appropriateness Criteria

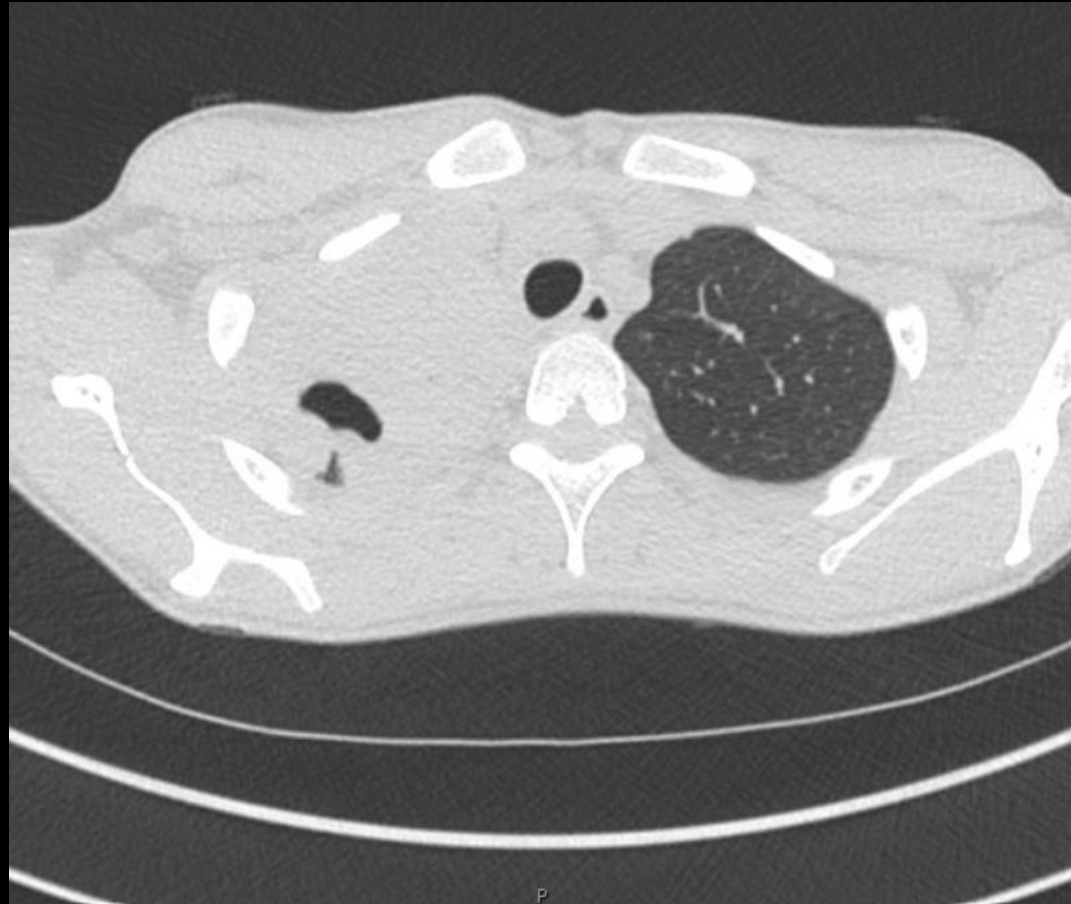
Variant 1: Suspect active tuberculosis.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|--|----------------------------------|
| X-ray chest | 9 | | ☢ |
| CT chest without IV contrast | 7 | This procedure is recommended if x-ray is equivocal. | ☢ ☢ ☢ |
| CT chest with IV contrast | 6 | | ☢ ☢ ☢ |
| CT chest without and with IV contrast | 3 | | ☢ ☢ ☢ |
| MRI chest without IV contrast | 3 | | ○ |
| MRI chest without and with IV contrast | 3 | | ○ |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

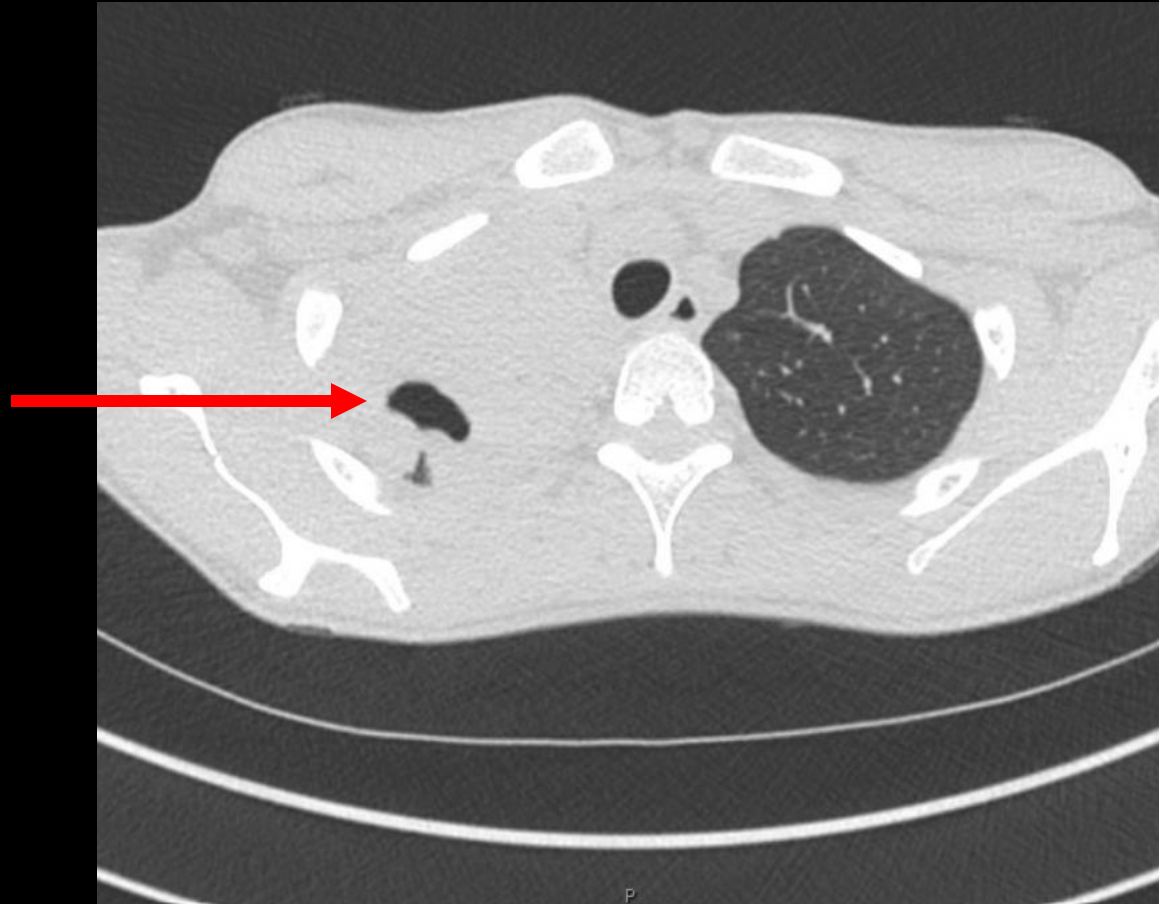
This imaging modality was ordered by the ER physician



Findings (unlabeled)

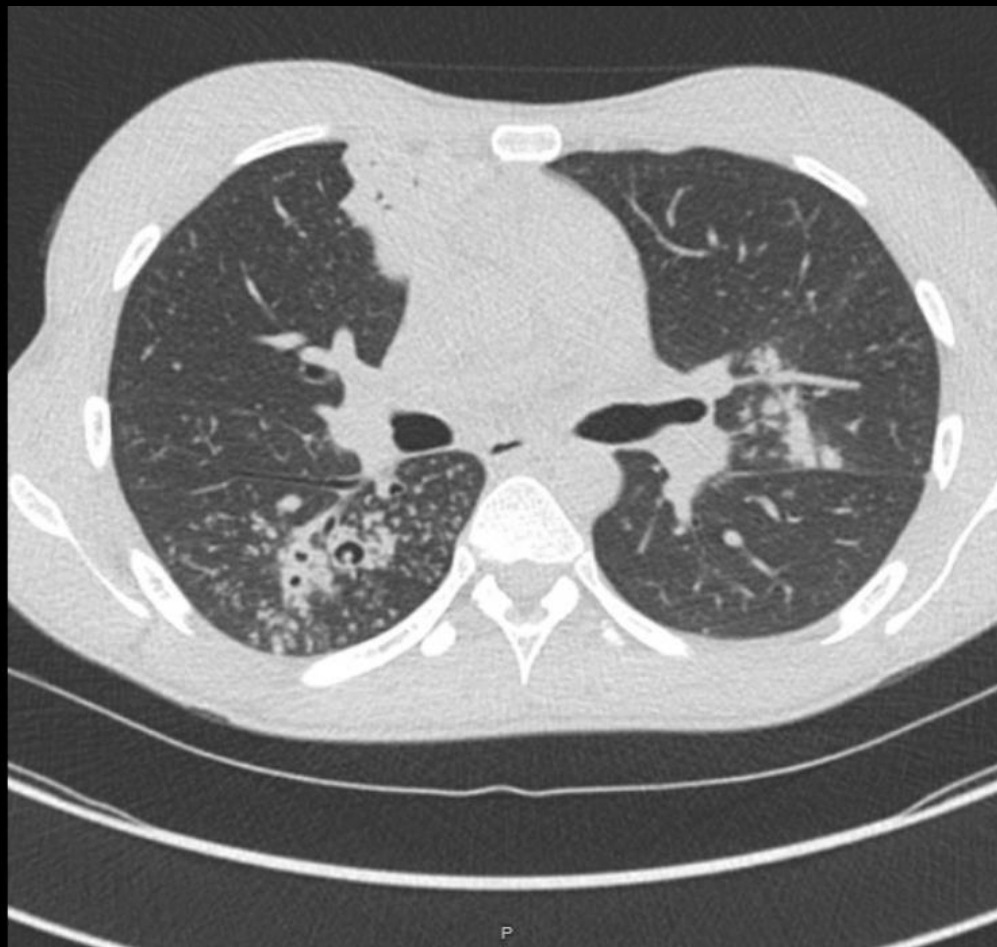


Findings (labeled)

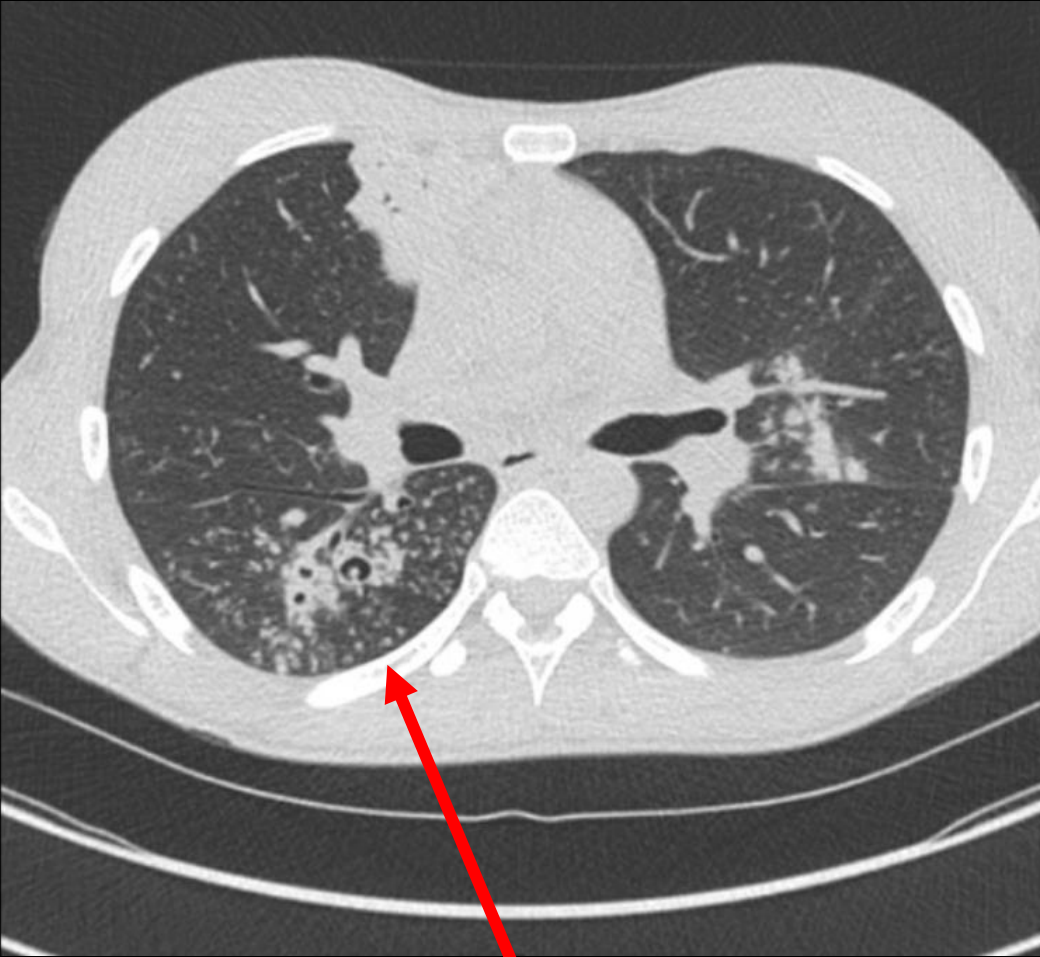


Right upper lobe cavitary consolidation

Findings (unlabeled)



Findings (labeled)

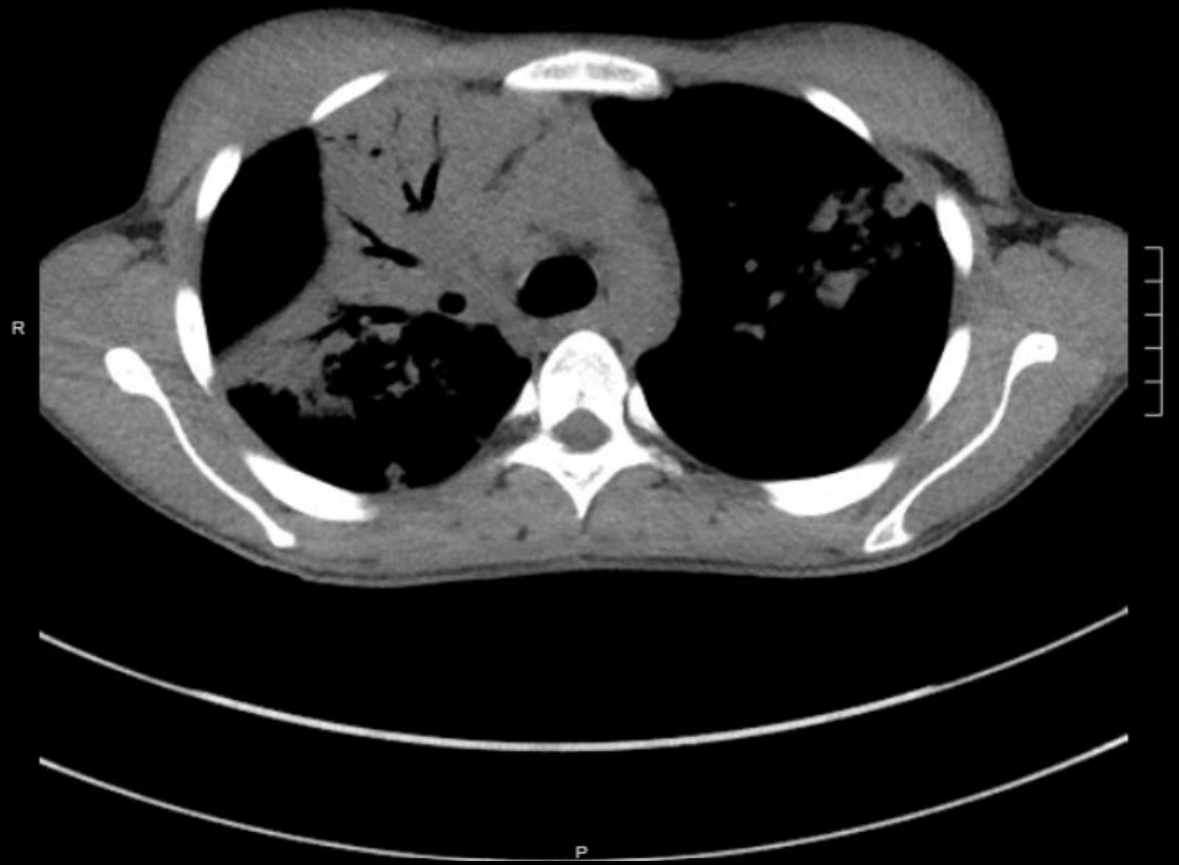


Tree-in-bud nodularity in right lower lobe on CT

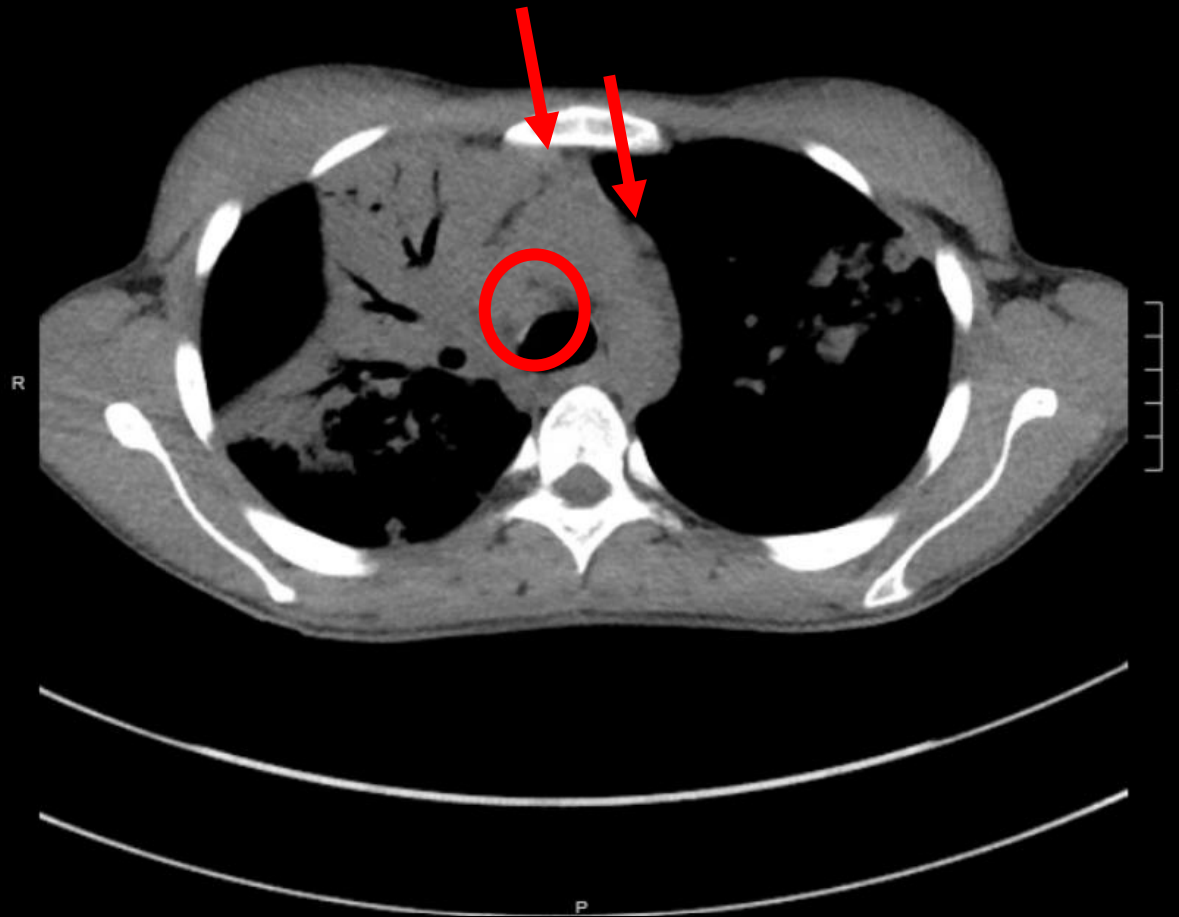


Reference of a tree-in-bud: schematic and photo

Findings (unlabeled)



Findings (labeled)



Mildly enlarged right lower paratracheal lymph node and additional smaller prevascular lymph nodes

Differential Diagnosis

Pulmonary Cavity

- Cavitating malignancy
- Pulmonary tuberculosis
- Pulmonary bacterial abscess/cavitating pneumonia
- Post-pneumonic pneumatocele
- Non-infective granuloma
- Granulomatosis with polyangiitis

Tree-in-Bud Nodularity

- Infective bronchiolitis
- Bacterial pneumonia, ex. *Staphylococcus aureus*, *Haemophilus influenzae*, *Mycobacterium tuberculosis*
- Fungal pneumonia, e.g. *Aspergillus*
- Bronchial obliterative bronchiolitis
- Diffuse or follicular panbronchiolitis
- Neoplasia, ex. bronchovascular interstitial infiltration or carcinomatous endarteritis

Microbiology

Rule out:

Strep pneumococcal urine antigen: Negative

Legionella urine antigen: Negative

Respiratory culture/smear: Normal flora

Mycobacterial PCR: **Positive AFB smear**

Mycobacterial smear/culture: **Positive AFB smear**

Final Dx:

Primary Tuberculosis (TB)

Case Discussion

- Common findings in pulmonary TB include:
 - Air bronchograms: bronchioles are filled with air and not normally visible on X-ray. Their visibility suggests that surrounding bronchioles are filled, with inflammatory exudate, fluid or blood.
 - Consolidation: both general consolidation and fibrosis leading to lung collapse and cavitory lesions
 - Tree-in-bud nodules: endobronchial spread of infection
 - Unilateral adenopathy: enlarged lymph nodes near site of consolidation
 - Parenchymal granuloma + involved hilar lymph node = Ghon Complex
 - Calcified Ghon Complex = Ranke Complex

Case Discussion

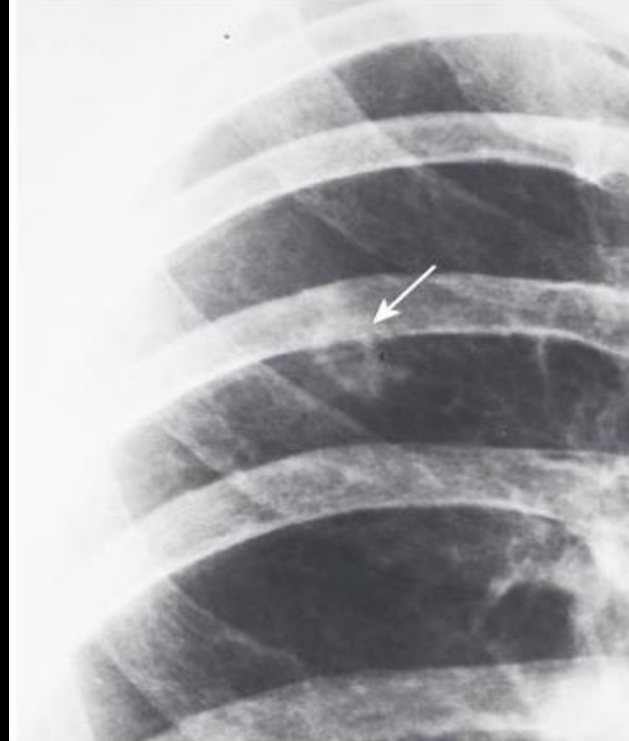
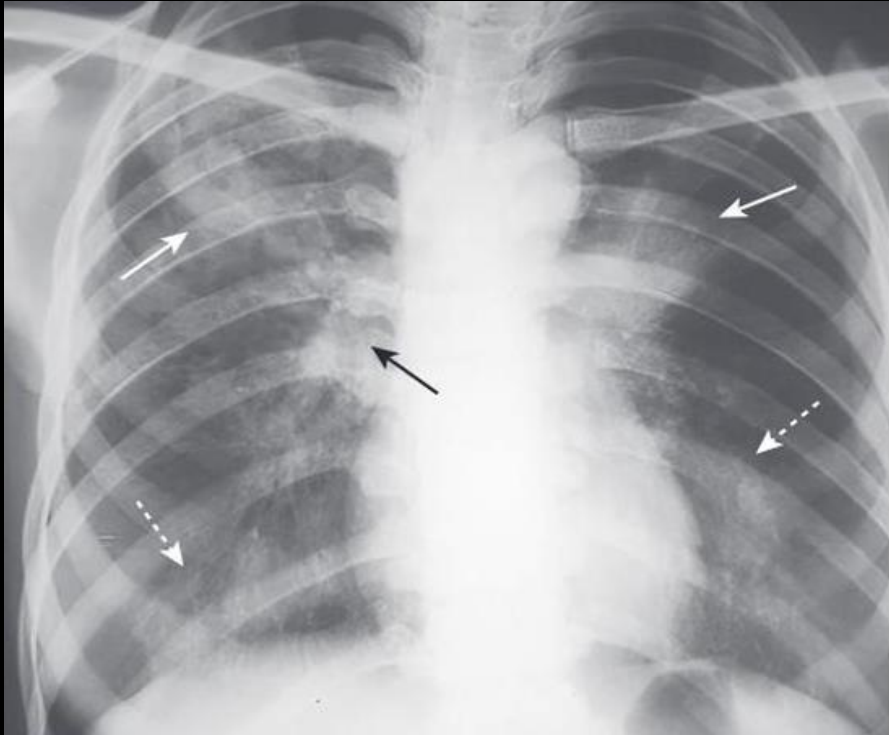


Figure 1 (left): Unilateral hilar adenopathy (black arrow) is often the main sign of primary TB infection. Upper lung lobes (white arrows) are generally more affected than lower lobes (dashed arrows).

Figure 2 (middle): A cavitation is a thin-walled hypodensity often within a mass, nodule or consolidation. Combined with clinical findings, this can indicate active TB.

Figure 3 (right): Miliary TB often presents as diffuse bilateral pulmonary micronodules (1-3 mm) on CT.

Case Discussion

- Tuberculosis is a significant public health issue worldwide, including in the United States, especially in immunocompromised and high-risk groups.
- Active TB can develop soon after infection (primary TB) or remain latent and emerge after many years (postprimary TB). Nontuberculous mycobacterial disease can mimic active TB, so a thorough travel history (especially to TB-endemic regions) and laboratory testing are essential for accurate diagnosis.
- Pulmonary TB can also spread to other organs. The bacteria can spread hematogenously anywhere in the body, including the brain, bone, and intestines and form tuberculomas (solitary nodules).
- A patient with a progressive or previous TB infection may develop fever, night sweats, and chills. A chest CT scan is recommended if the CXR is equivocal.
- Miliary TB is fatal without treatment: a combination of antimycobacterial drugs: rifampin, isoniazid, pyrazinamide, and ethambutol—also known as RIPE therapy—that is also used for primary TB infection. This patient was treated with RIPE therapy.

References:

- American College of Radiology. ACR Appropriateness Criteria®. Available at <https://acsearch.acr.org/list> .
- Burrill J;Williams CJ;Bain G;Conder G;Hine AL;Misra RR; (n.d.). Tuberculosis: A Radiologic Review. Radiographics : a review publication of the Radiological Society of North America, Inc. <https://pubmed.ncbi.nlm.nih.gov/17848689/>
- Ghon Complex. Learning radiology - ghon complex, Ranke, lesion. (n.d.). <https://learningradiology.com/notes/chestnotes/rankecomplex.htm>
- Nachiappan, A. C., Rahbar, K., Shi, X., Guy, E. S., Mortani Barbosa, E. J., Shroff, G. S., Ocazonez, D., Schlesinger, A. E., Katz, S. I., & Hammer, M. M. (2017). Pulmonary Tuberculosis: Role of Radiology in Diagnosis and Management. *RadioGraphics*, 37(1), 52–72. <https://doi.org/10.1148/rg.2017160032>
- Ordonez, A. A. et al. (2020, February 17). Dynamic imaging in patients with tuberculosis reveals heterogeneous drug exposures in pulmonary lesions. *Nature News*. <https://www.nature.com/articles/s41591-020-0770-2>
- Tree-in-bud pattern : *American Journal of roentgenology* : Vol. 193, no. 6 (AJR). (n.d.). <https://www.ajronline.org/doi/full/10.2214/AJR.09.3401>