AMSER Case of the Month July 2025

19-year-old male with persistent cough and sore throat

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Patient Presentation

HPI: A 19-year-old male presents to ED with a chief complaint of a 1-day history of cough and sore throat and worsening of symptoms within the past 24 hours. Patient adds that sore throat started recently due to COVID-19 infection, but symptoms progressed to sore throat, vomiting, and persistent coughing in the past 24 hours.

PMH: Longstanding history of asthma, intentional 50-pound weight loss over last 6 months, patient's mother denies family history of early cardiac death or pulmonary embolism.

Physical Exam: Tachycardic, chest atraumatic, coarse lung sounds on left with expiratory wheeze

Pertinent Labs

- WBC – 13.9 k/ul (Normal: 4.0 – 12.0 k/ul)
- Neutrophils Abs – 11.8 k/ul (Normal: 1.5 – 8.0 k/ul)
- Lymphocytes Abs – 0.8 k/ul (Normal: 1.0-4.5 k/ul)
- D-Dimer – 1.35 mg/L (Normal: < or =0.50 mg/L)
- COVID-19 Qualitative PCR – Negative

What Imaging Should We Order?

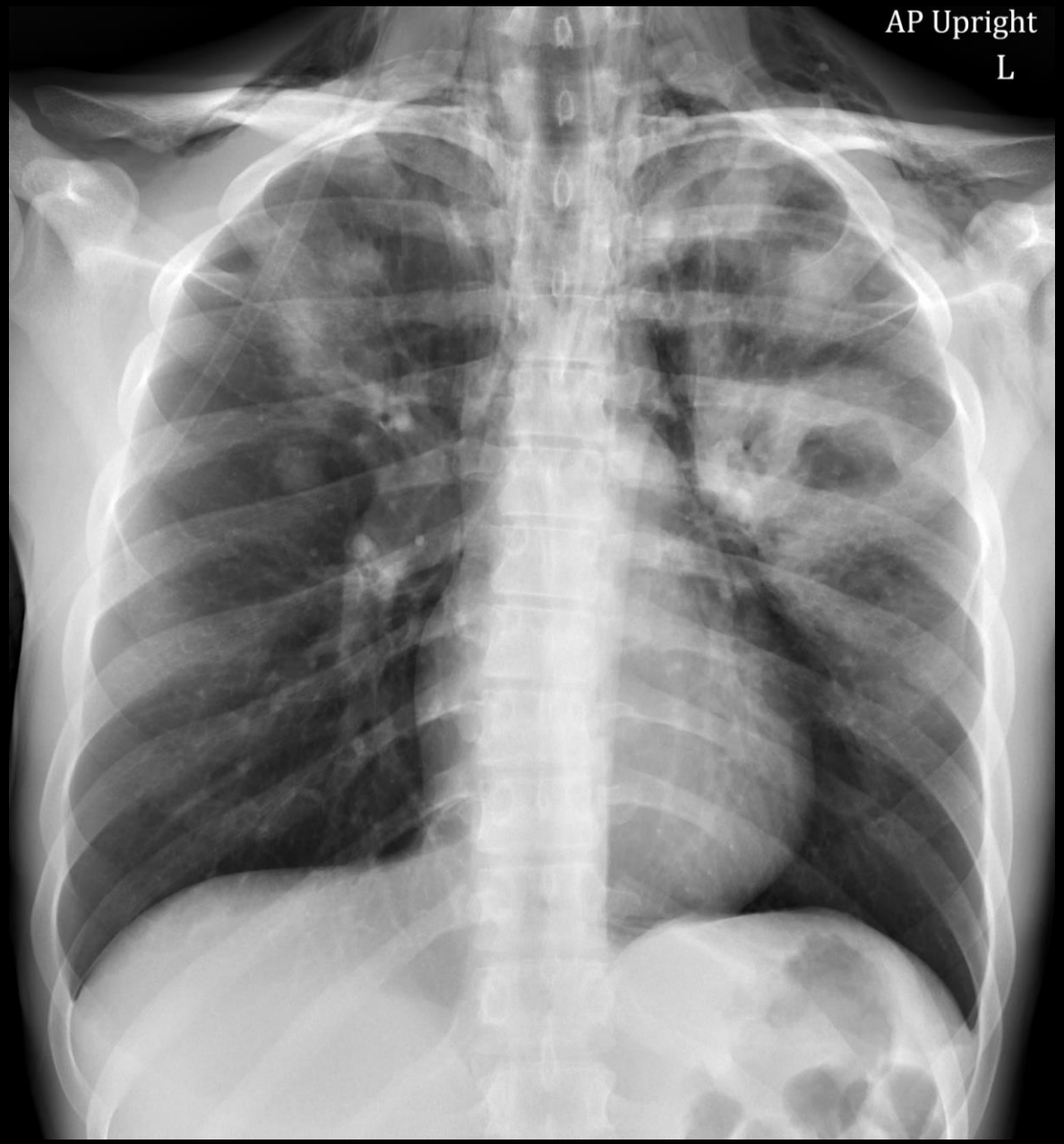
Variant 1: **Nontraumatic chest wall pain. No history of malignancy. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Appropriate	☢
US chest	May Be Appropriate	O
Radiography rib views	May Be Appropriate	☢☢☢
MRI chest without and with IV contrast	Usually Not Appropriate	O
MRI chest without IV contrast	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢
CT chest with IV contrast	Usually Not Appropriate	☢☢☢
CT chest without and with IV contrast	Usually Not Appropriate	☢☢☢
CT chest without IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
WBC scan chest	Usually Not Appropriate	☢☢☢☢

ACR Appropriateness Criteria

Chest X-ray obtained initially

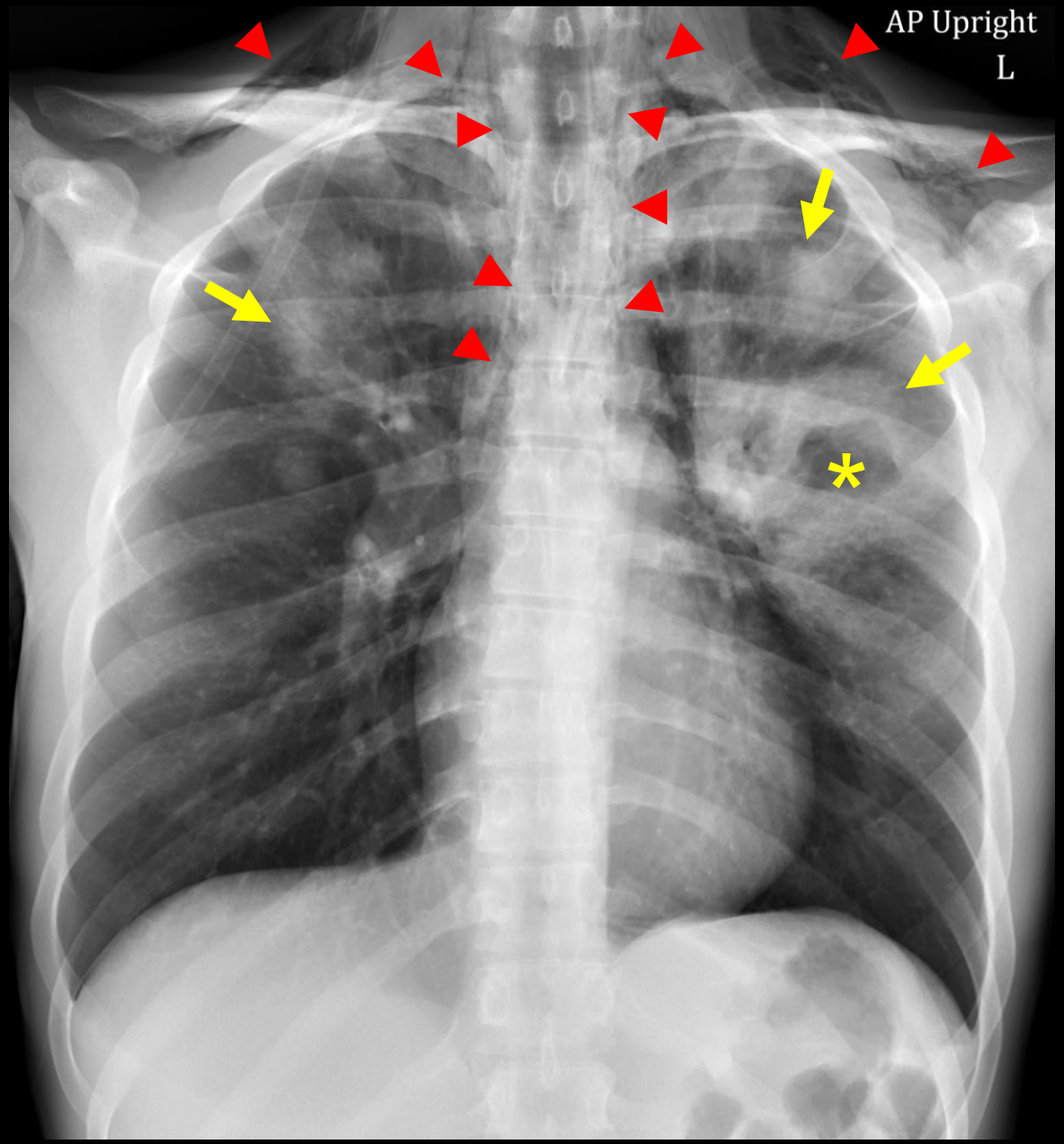
Chest X-Ray (unlabeled)



Chest X-Ray (unlabeled)

- Multifocal consolidations (→) including left lung cavitary lesion (*)

- Streaky lucencies in the mediastinum and neck soft tissues, compatible with pneumomediastinum and soft tissue emphysema (>)



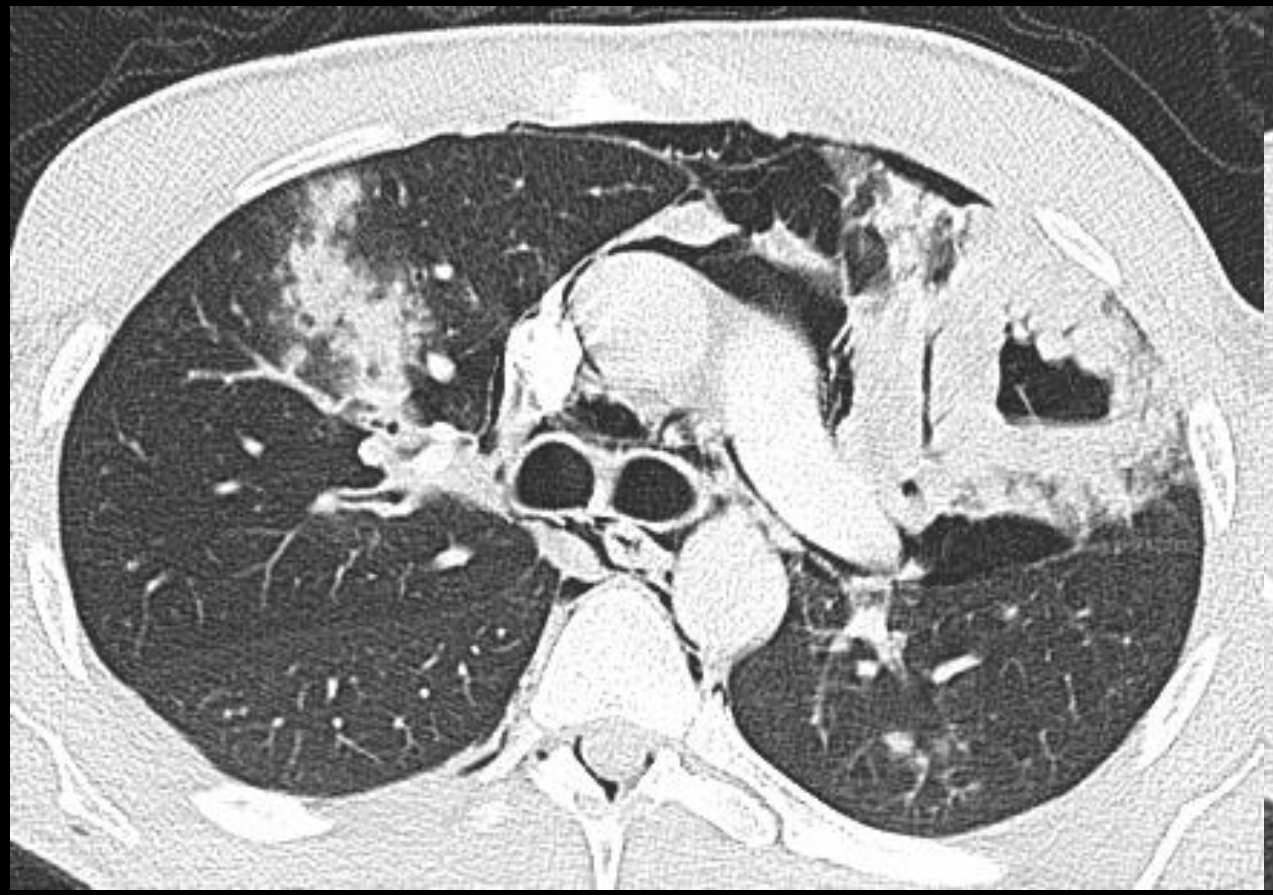
Variant 2: **Suspected pulmonary embolism. Low or intermediate pretest probability with a positive D-dimer. Initial imaging.**

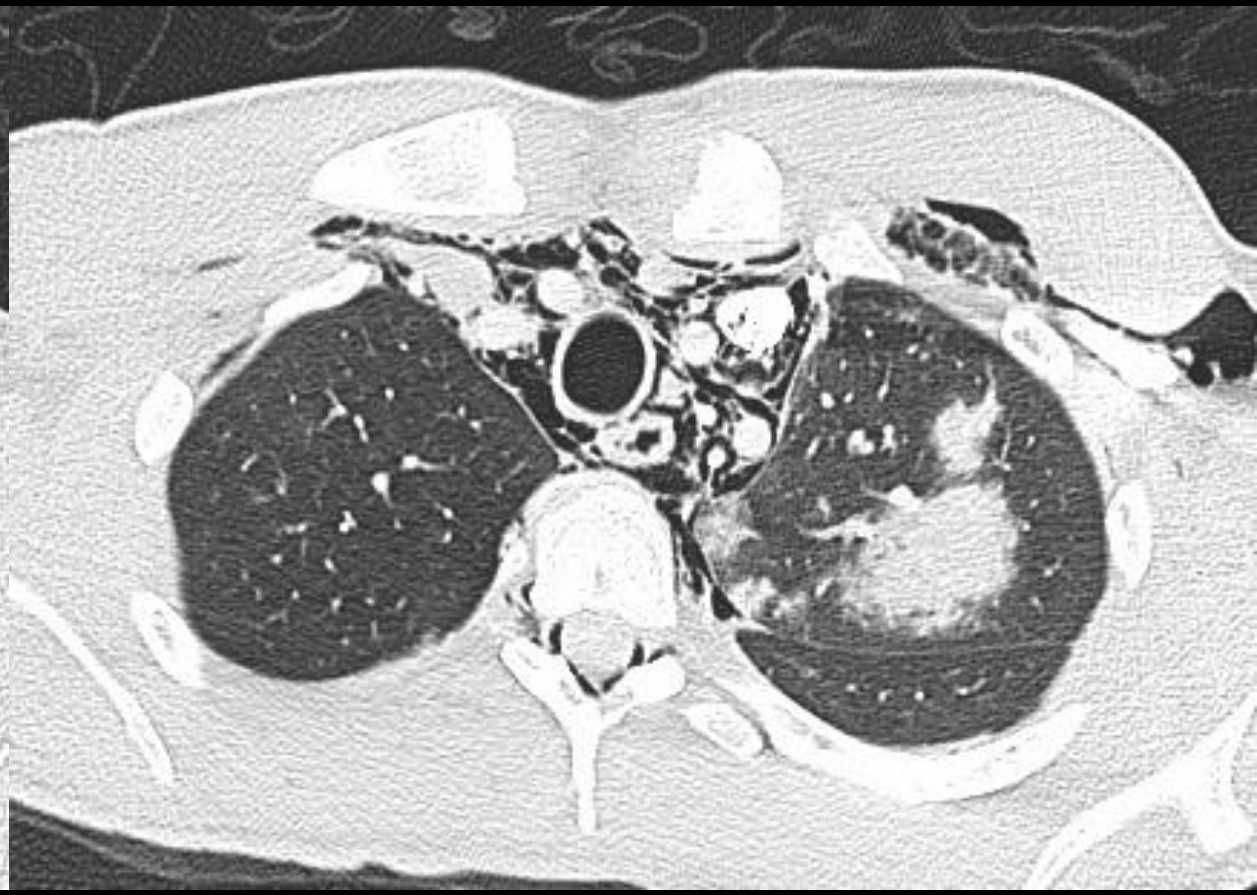
Procedure	Appropriateness Category	Relative Radiation Level
CTA pulmonary arteries with IV contrast	Usually Appropriate	☢☢☢
V/Q scan lung	Usually Appropriate	☢☢☢
MRA pulmonary arteries without and with IV contrast	May Be Appropriate	O
CTA triple rule out	May Be Appropriate (Disagreement)	☢☢☢
US duplex Doppler lower extremity	Usually Not Appropriate	O
US echocardiography transesophageal	Usually Not Appropriate	O
US echocardiography transthoracic resting	Usually Not Appropriate	O
Arteriography pulmonary with right heart catheterization	Usually Not Appropriate	☢☢☢☢
MRA pulmonary arteries without IV contrast	Usually Not Appropriate	O
CT chest with IV contrast	Usually Not Appropriate	☢☢☢
CT chest without and with IV contrast	Usually Not Appropriate	☢☢☢
CT chest without IV contrast	Usually Not Appropriate	☢☢☢
CTA chest with IV contrast with CTV lower extremities	Usually Not Appropriate	☢☢☢

ACR Appropriateness Criteria

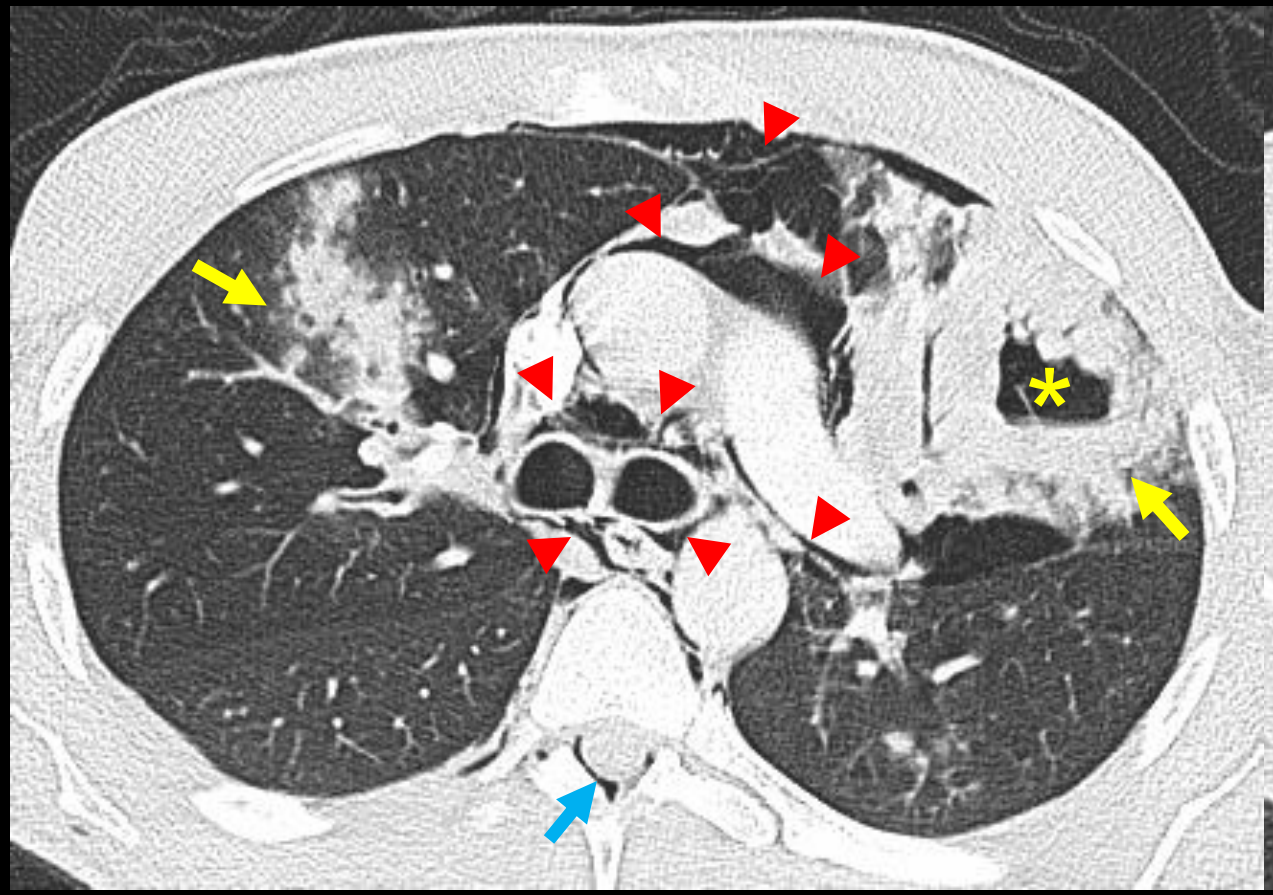
CTA Pulmonary Arteries was obtained to assess suspicions of pulmonary embolus

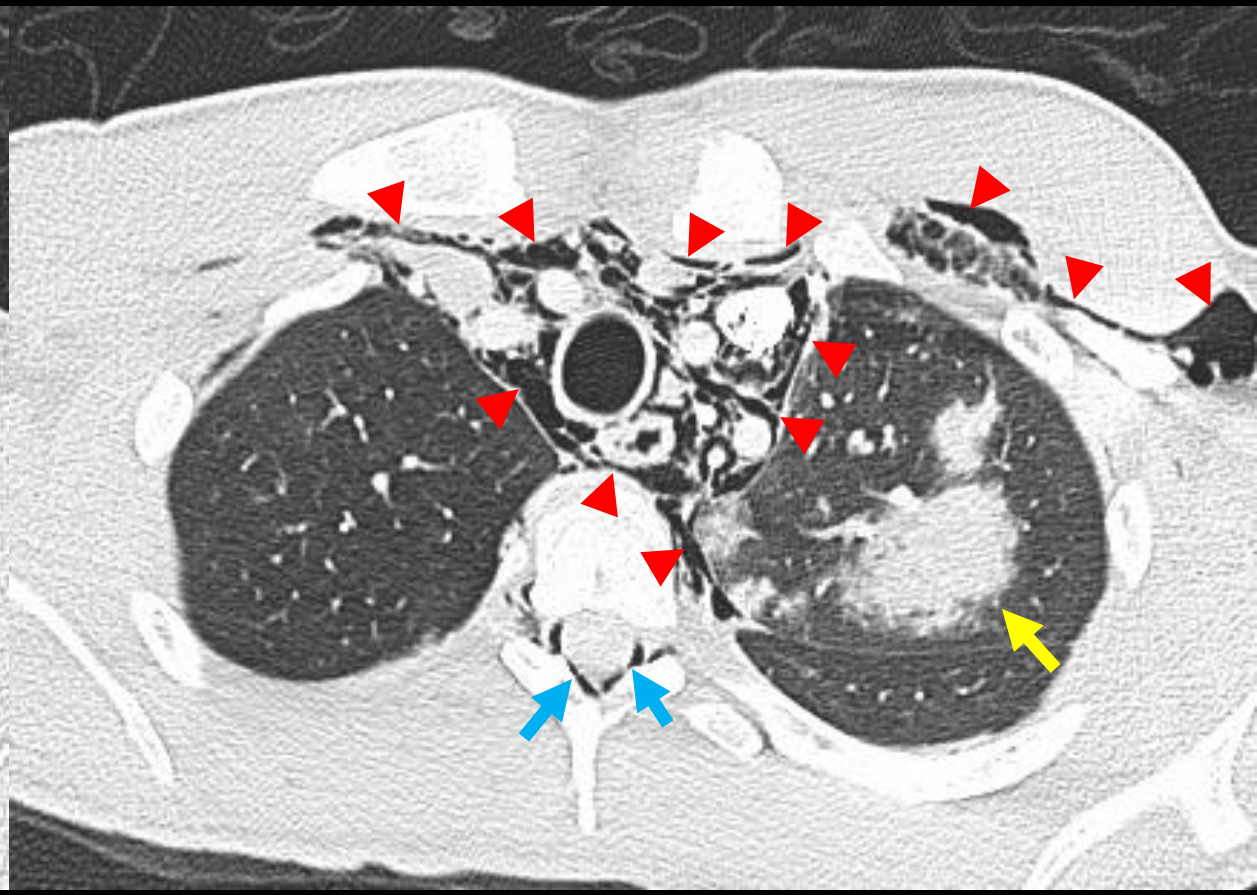
Chest CT Angiogram (unlabeled)





Chest CT Angiogram (labeled)





- Multifocal upper lobe consolidations (→) including left upper lobe cavitary lesion (*)
- Extensive pneumomediastinum (>) extending to chest wall soft tissue emphysema
- Air at the periphery of the spinal canal (→) compatible with pneumorrhachis

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Final Dx:

Multifocal pneumonia w/ cavitary lesion, and extensive pneumomediastinum complicated by pneumorrhachis

Case Discussion: The Macklin Effect

This patient's pneumomediastinum was attributed to the Macklin effect, brought on by forceful coughing and vomiting. The Macklin effect refers to alveolar rupture leading to air dissecting through the:

pulmonary interstitium (pulmonary interstitial emphysema),

which may progress to the pulmonary hila,

mediastinum,

and even the neck and chest soft tissues.

Case Discussion: The Macklin Effect

- The Macklin effect appears in blunt trauma, barotrauma with mechanical ventilation, but also in patients with spontaneous pneumomediastinum, which is associated with asthma and episodes of forceful coughing [1].
- The differential for pneumomediastium includes tracheal rupture as well as a esophageal rupture (Boerhaave syndrome). If the patient has a history of forceful vomiting, evaluation with an esophogram or CT with oral contrast is indicated to exclude esophageal injury.

Case Discussion: Pneumorrhachis

- Pneumorrhachis is the rare phenomenon of air within the spinal canal (either intradural or extradural).
- Many cases are associated with trauma or spinal surgical procedures [2], however it is also described in patients with spontaneous pneumomediastinum [4] and associated with a history of asthma.
- Among patient with pneumomediastinum, pneumorrhachis is more common with broader distributions of mediastinal air and with spontaneous pneumomediastinum compared to secondary pneumomediastinum [4].
- Although pneumorrhachis may have associated neurologic signs, the vast majority of cases assosicated with spontaneous pneumomediastinum are self-limited and treated conservatively [5].

Case Discussion

- Both complicated and uncomplicated spontaneous pneumomediastinum is typically treated conservatively with analgesia, bed rest, and avoiding increasing pulmonary pressure [5].
- If pneumopericardium occurs, management includes monitoring for possible cardiac tamponade [5].
- This patient was given Zosyn and vancomycin for his pneumonia following initial workup and then one dose of morphine following pneumomediastinum diagnosis.
- The patient was then discharged 1 week after admission to hospital with moxifloxacin and antifungals.

References:

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2. Dirie AM, Aydın N, Hussein AM, Osman AA, Ahmed AA. Spontaneous pneumorrhachis, pneumomediastinum, pneumopericardium, and subcutaneous emphysema. rare features of Hamman syndrome. *Annals of Medicine & Surgery*. 2022;74. doi:10.1016/j.amsu.2022.103346
3. Belotti EA, Rizzi M, Rodoni-Cassis P, Ragazzi M, Zanolari-Caledrerari M, Bianchetti MG. Air within the spinal canal in spontaneous pneumomediastinum. *Chest*. 2010;137(5):1197-1200. doi:10.1378/chest.09-0514
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5. 1. Alishlash AS, Janahi IA. Spontaneous pneumomediastinum in children and adolescents. UpToDate. February 9, 2024. Accessed May 26, 2025. https://www.uptodate.com/contents/spontaneous-pneumomediastinum-in-children-and-adolescents?search=spontaneous+pneumomediastinum&source=search_result&selectedTitle=1~25&usage_type=default&display_rank=1#H1232115595.