Diagnosis of TB Disease: Radiology

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July 17, 2024

TB Intensive
July 16 – 18, 2024
San Antonio, Texas

Megan Devine, MD has the following disclosures to make:

- No conflict of interests
- No relevant financial relationships with any commercial companies pertaining to this educational activity

Diagnosis of TB Disease: Radiology

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Pulmonary Medicine

Associate Professor of Medicine
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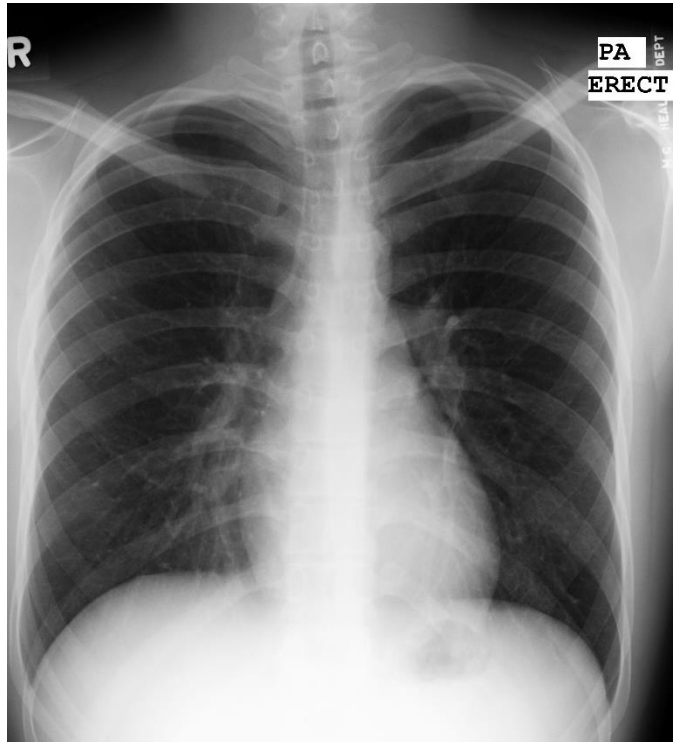
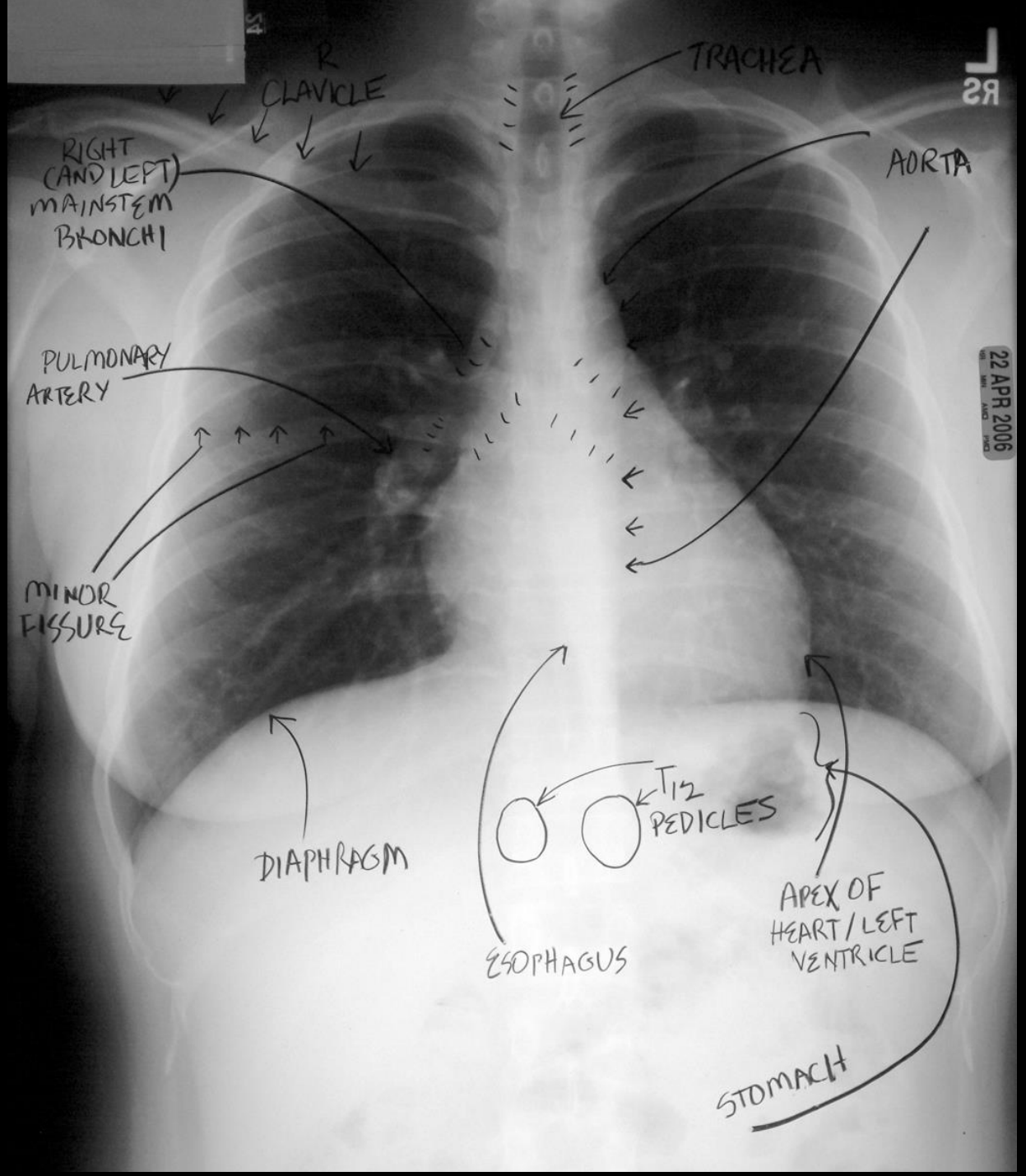
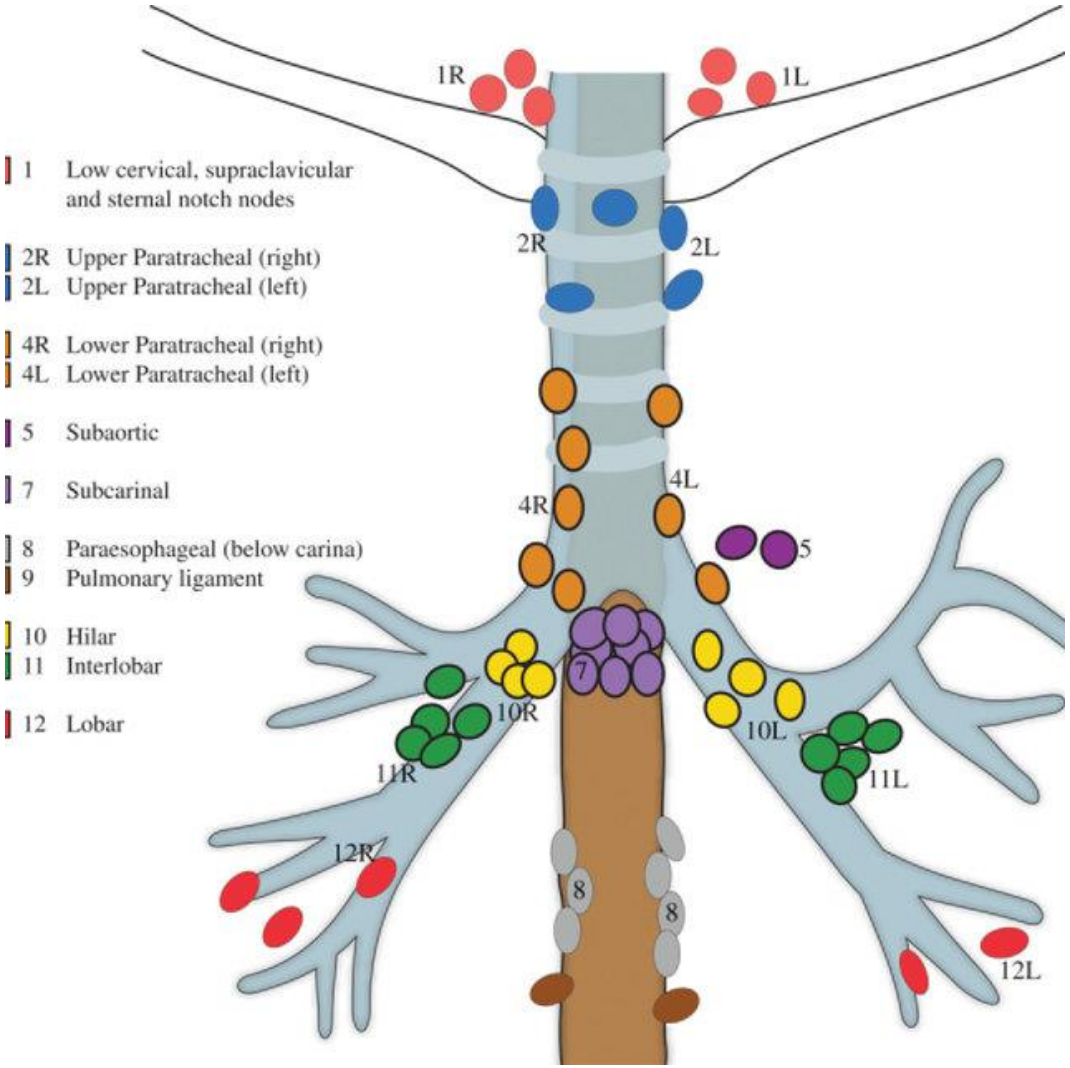


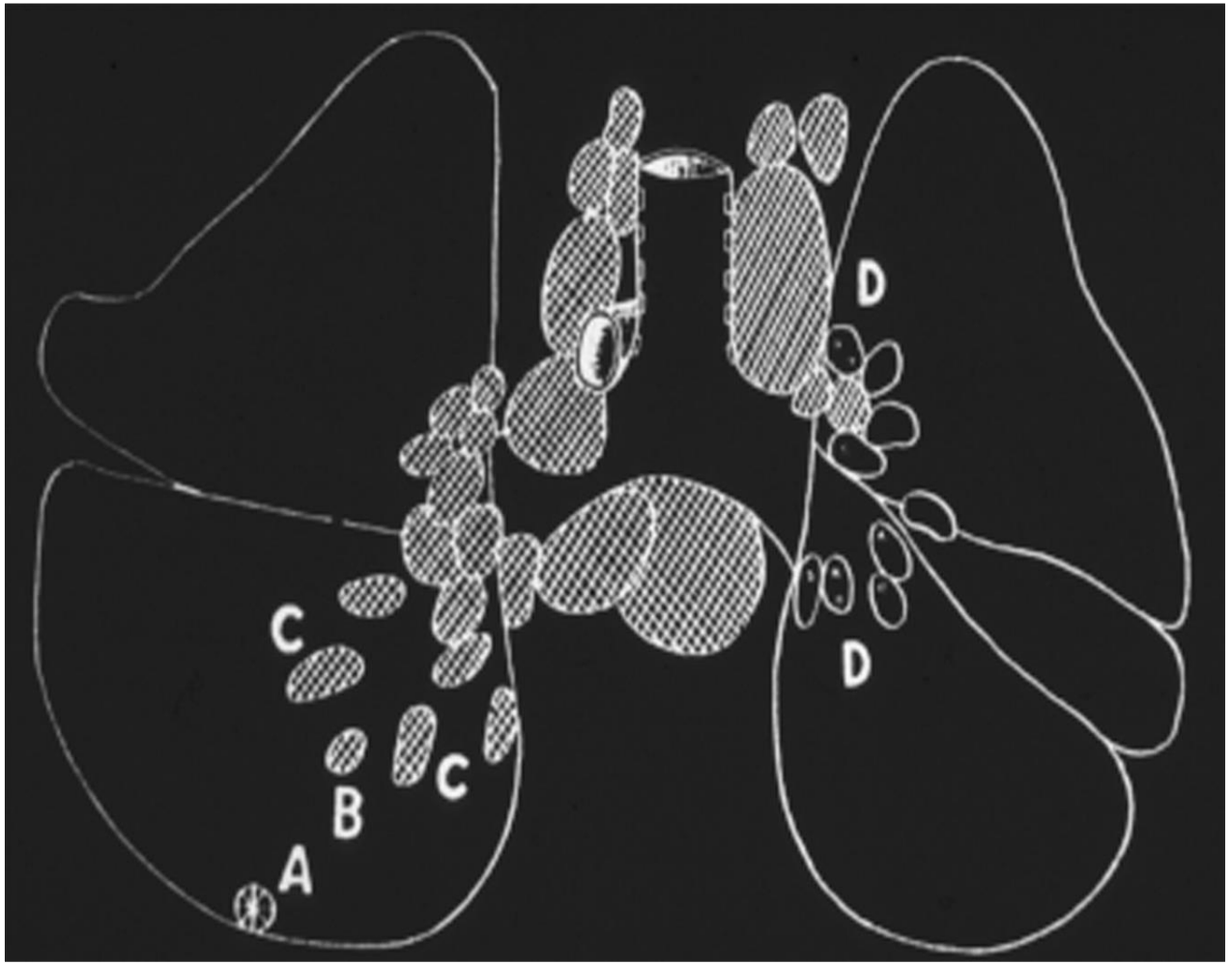
Chest Radiology in TB

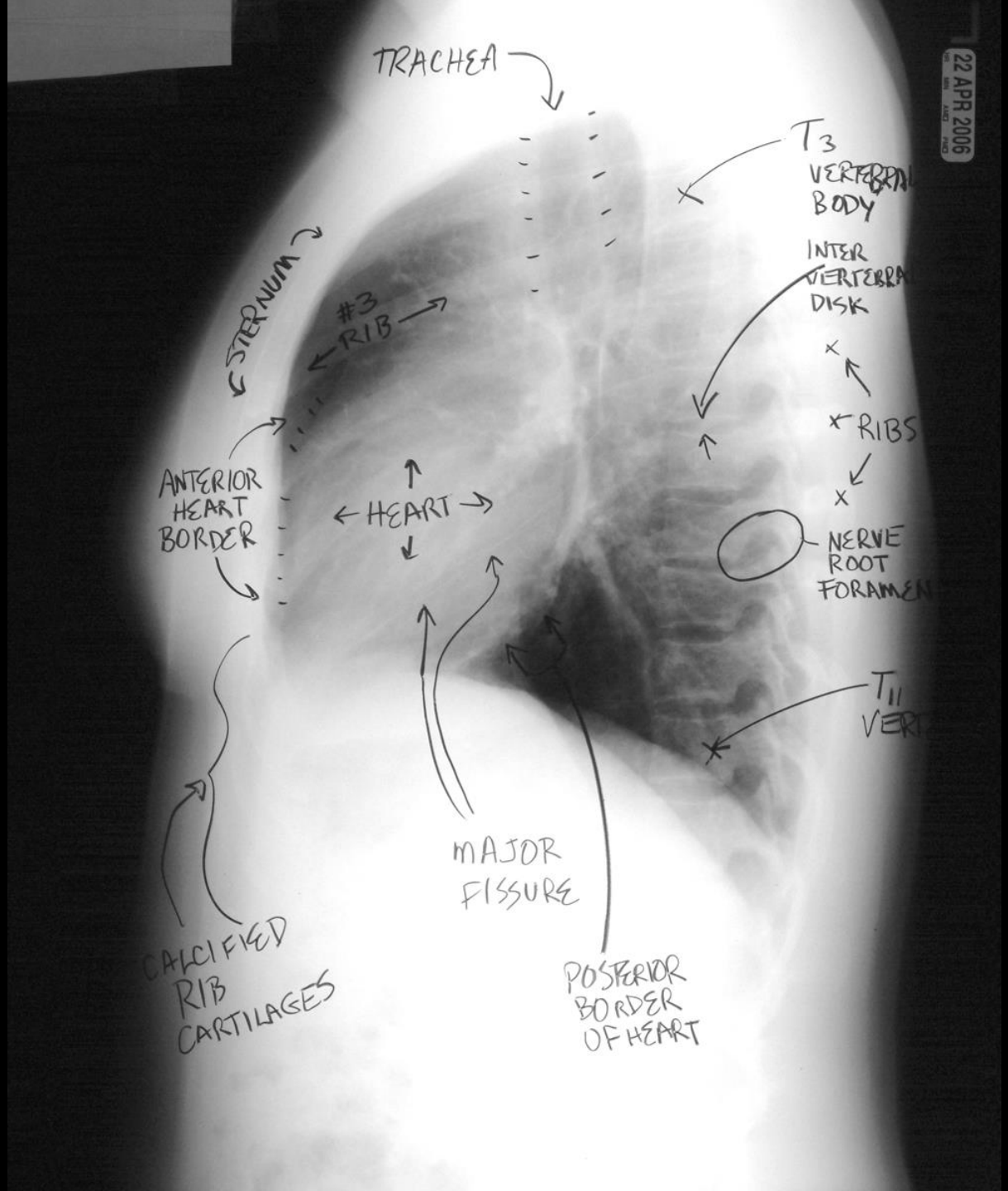
- X-Rays penetrate air, absorbed by fluids/solids
  - Dark = Air
  - Dense White = Calcium (Bone Density)
  - White = Water Density (Everything else)
    - Water
    - Blood
    - Fat
    - Tissue
    - Pus
- Chest radiographs are just shadows
- Interpretation of a chest radiograph is pattern recognition that requires clinical correlation for diagnosis


R CLAVICLE
TRACHEA
RIGHT (AND LEFT) MAINSTEM BRONCHI
AORTA
PULMONARY ARTERY
MINOR FISSURE
DIAPHRAGM
T12 PEDICLES
ESOPHAGUS
APEX OF HEART / LEFT VENTRICLE
STOMACH
22 APR 2006

Thoracic Lymph Nodes






TRACHEA
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INTER VERTEBRAL DISK
RIBS
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T11 VERT
STERNUM
#3 RIB
ANTERIOR HEART BORDER
HEART
MAJOR FISSURE
POSTERIOR BORDER OF HEART
CALCIFIED RIB CARTILAGES
22 APR 2006

Normal CXR Child

Role of CT in the Diagnosis of TB

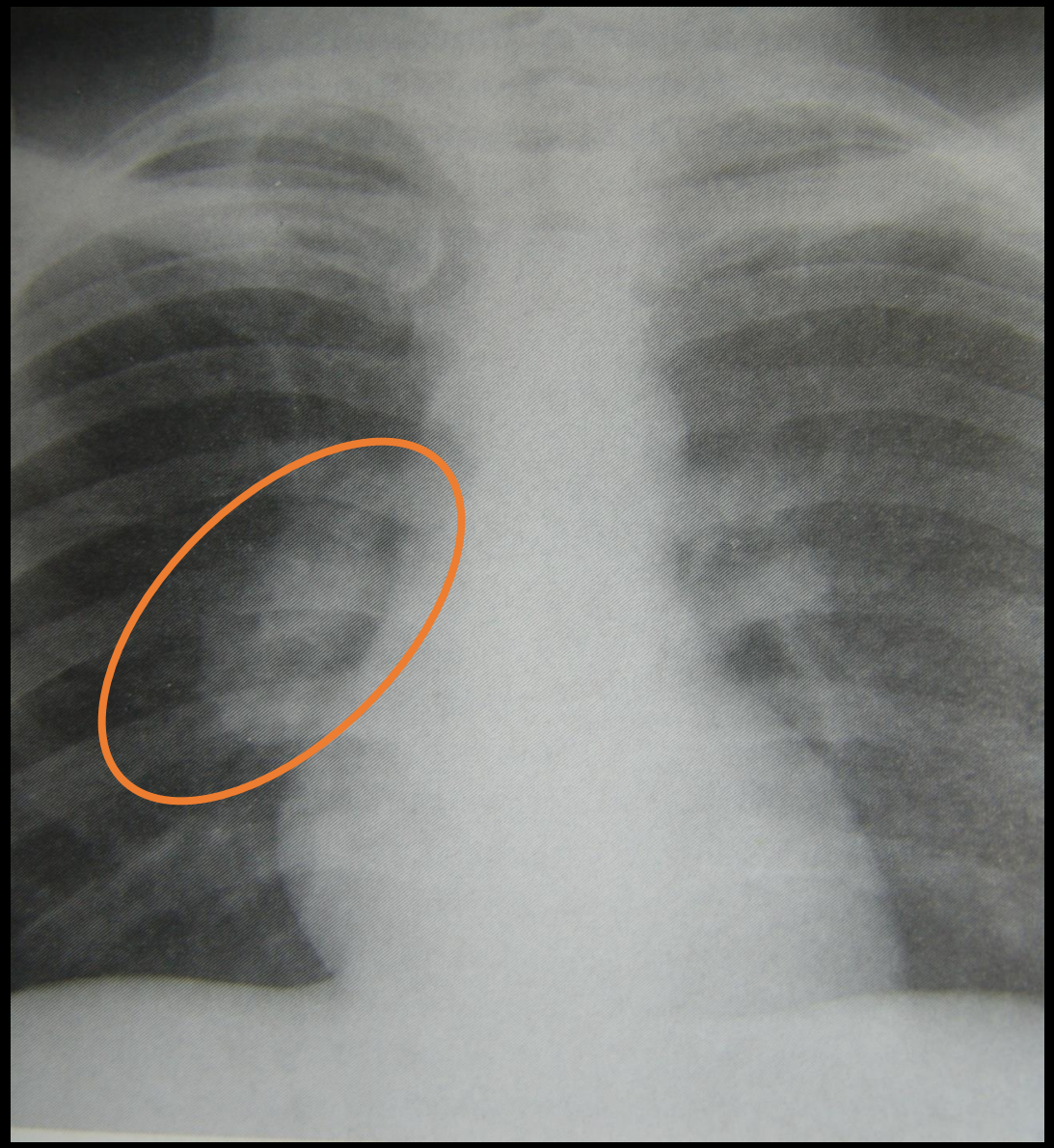
- CT is not the primary radiologic diagnostic test for TB (CT is overused in the US)
- Usually don't need CT for cavitary consolidation
- If TB is a possible diagnosis, sputum for AFB should be obtained prior to CT
- In most instances, CT should be reserved for patients in whom the diagnosis is unclear

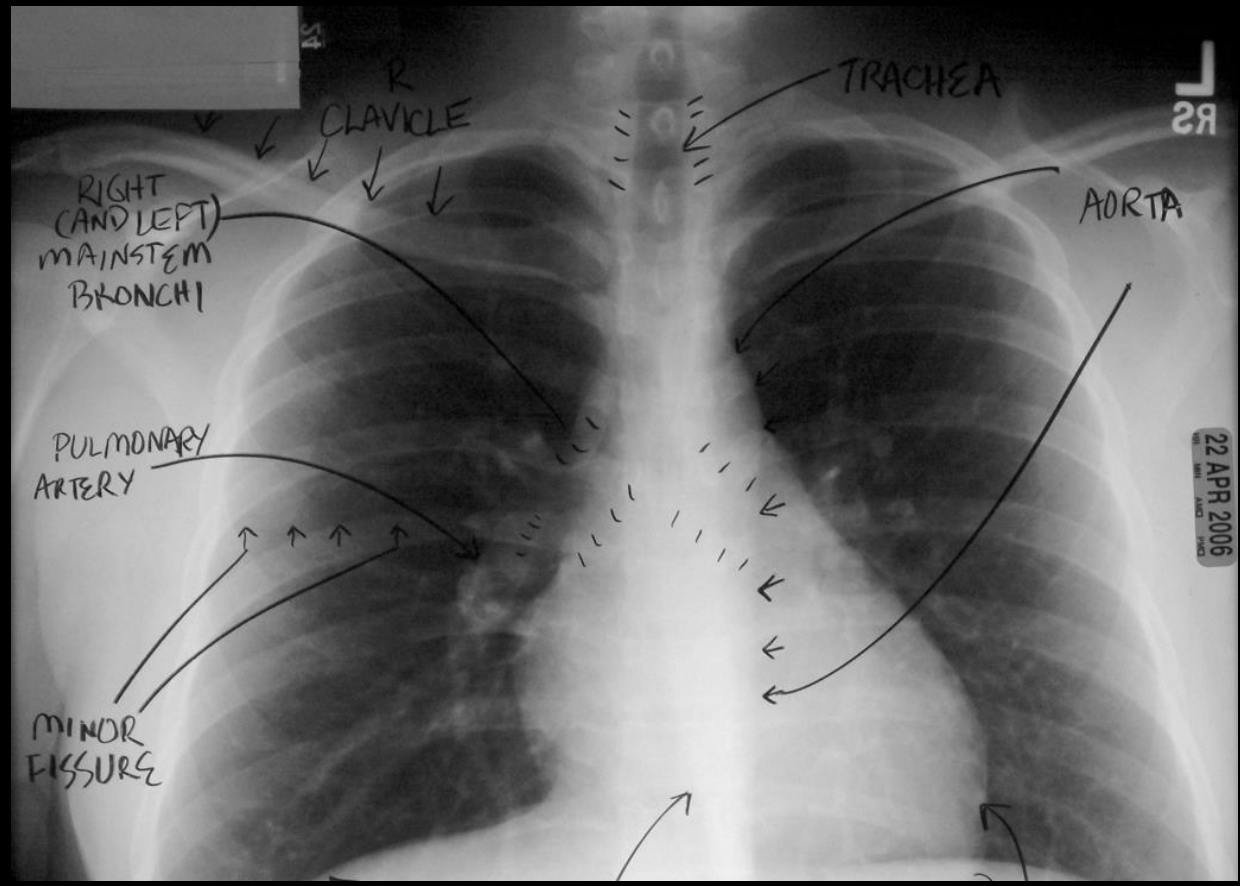
Role of CT in the Diagnosis of TB

- Reveals occult lung disease in patients with pleural effusion, pericarditis, etc.
- Reveals intra-thoracic lymphadenopathy (children, HIV co-infected)
- Can suggest miliary disease
- Can suggest alternative diagnoses (lung cancer)

Primary Tuberculosis

- Most commonly in children and immune compromised patients
- Opacities are seen the in middle and lower lungs
- Commonly unilateral, bilateral 15%
- Lymph node enlargement often occurs, and may cause bronchial compression
- Hilar or paratracheal lymphadenopathy with or without infiltrates is characteristic.

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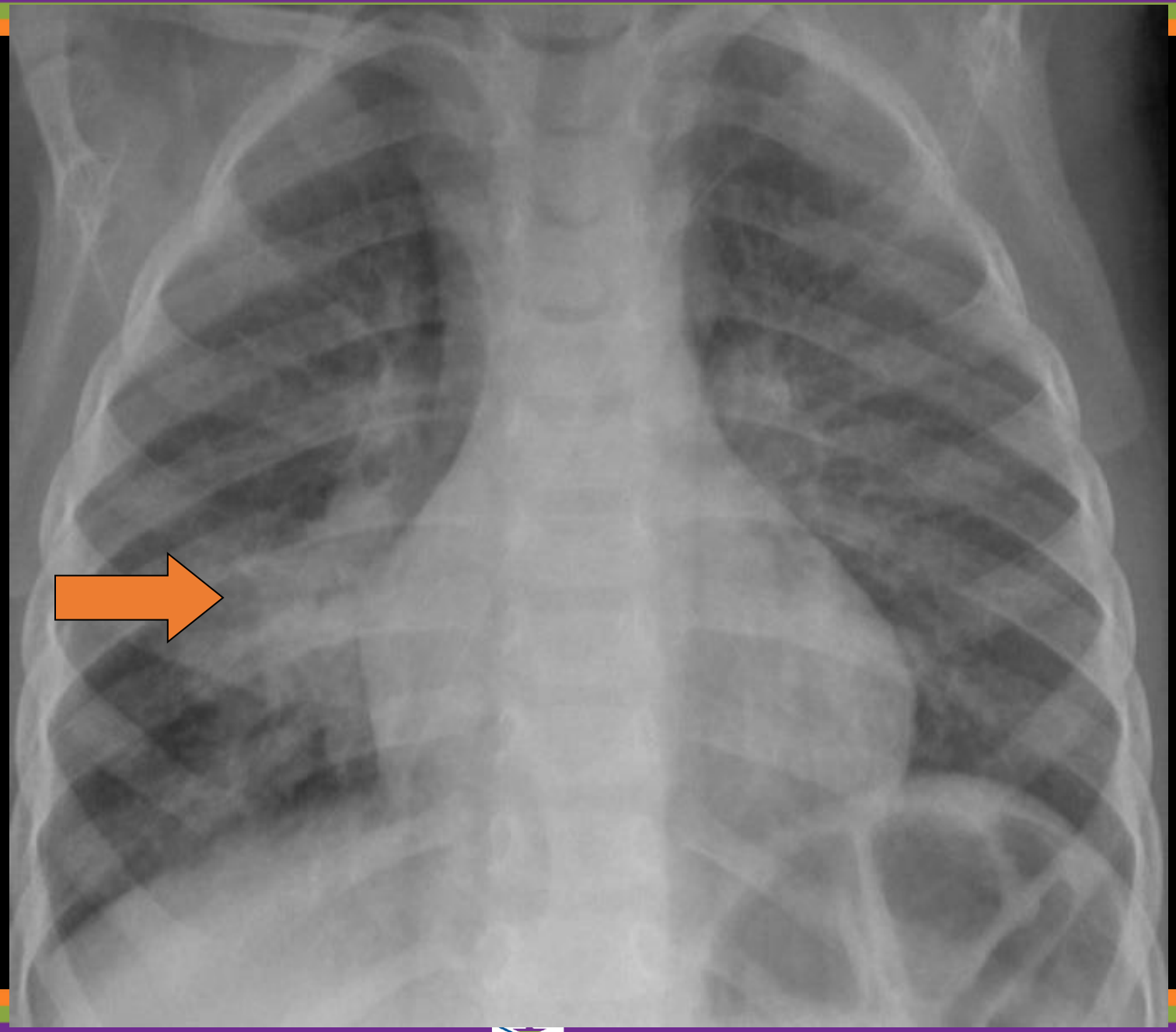
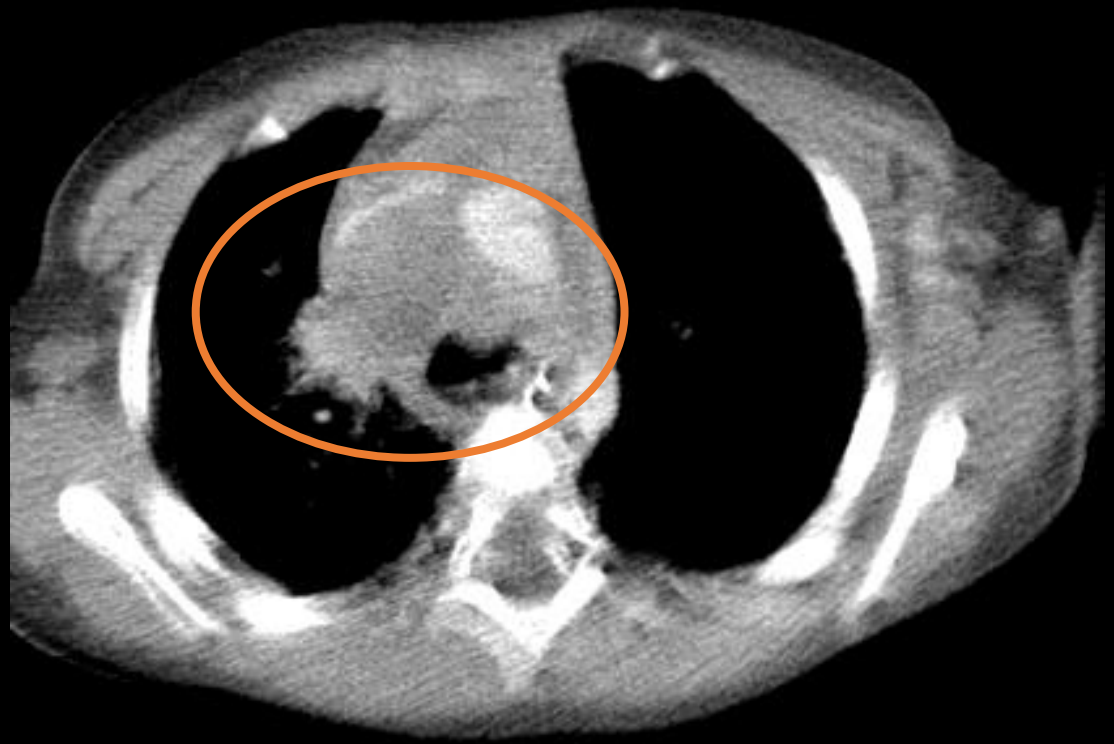
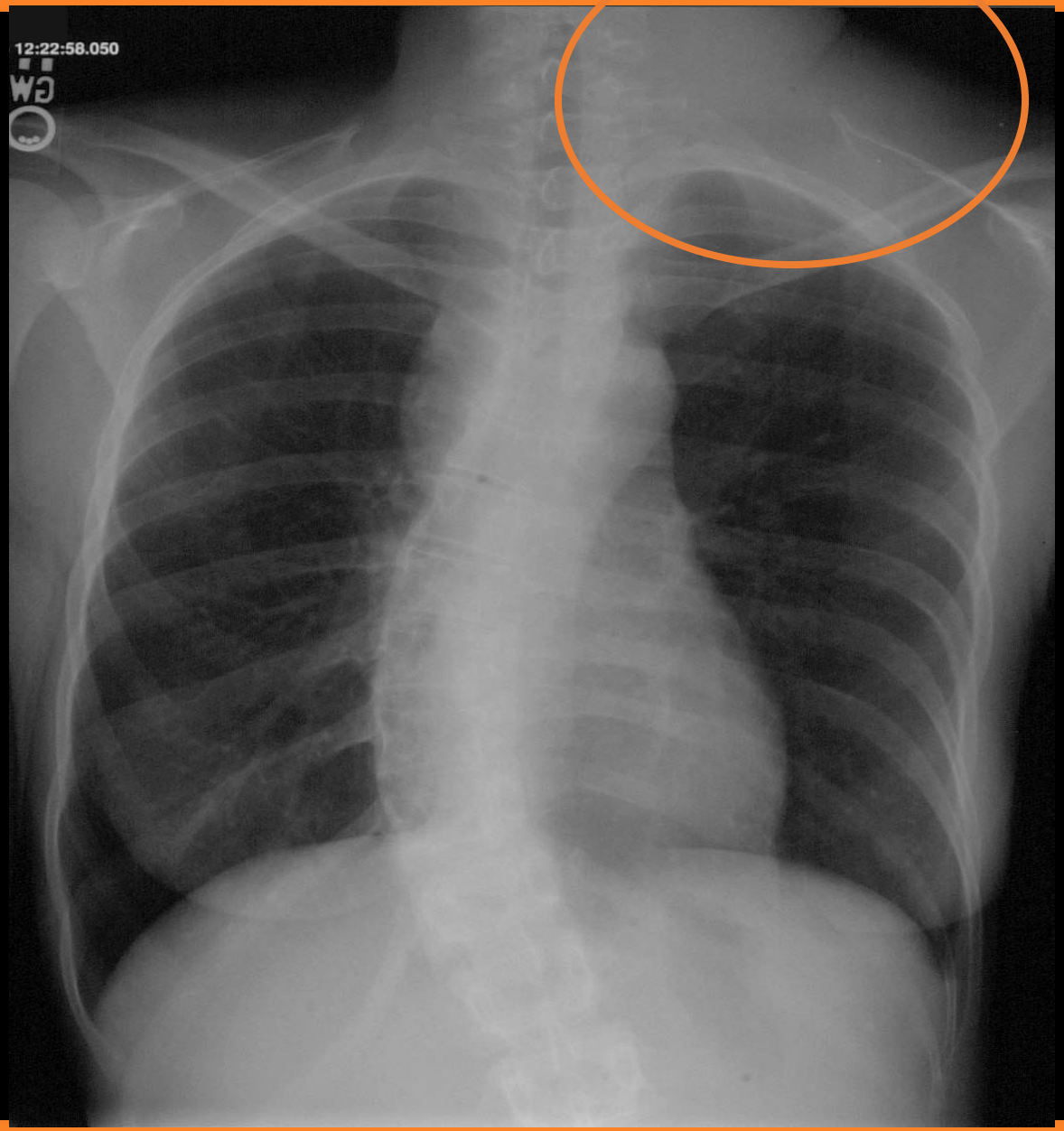




Courtesy: Dr. Santiago Res

Where is the Adenopathy?



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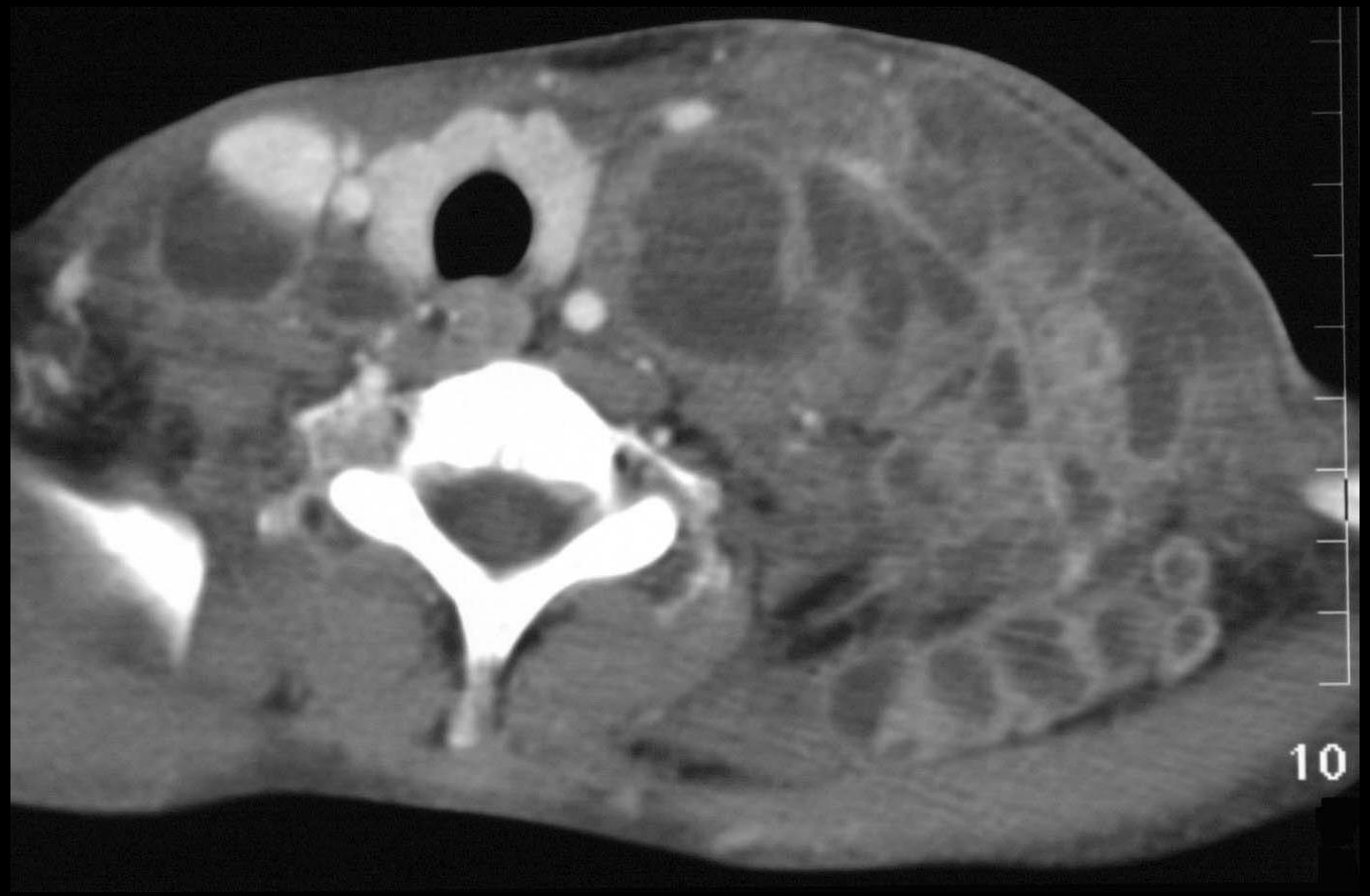

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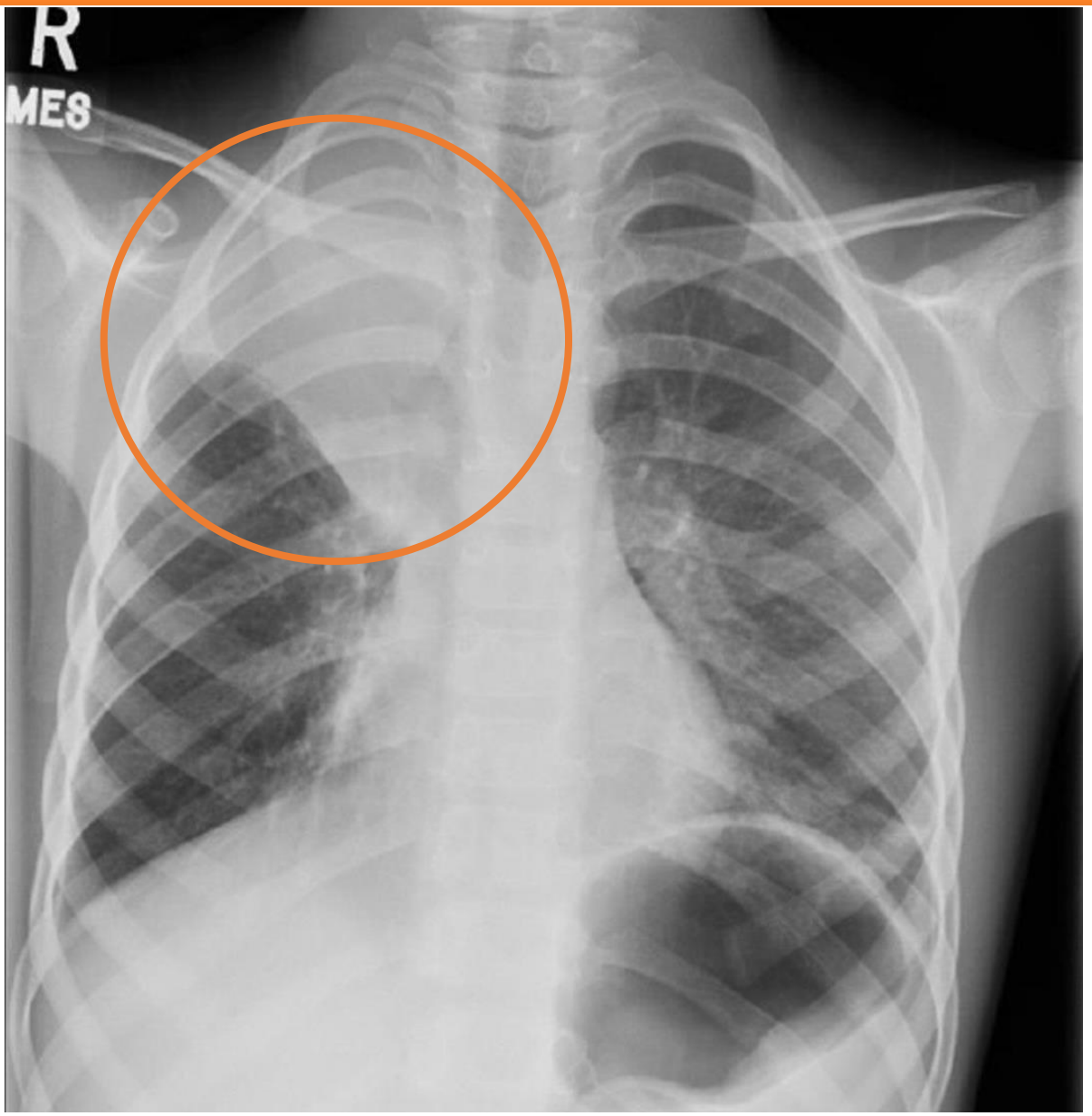
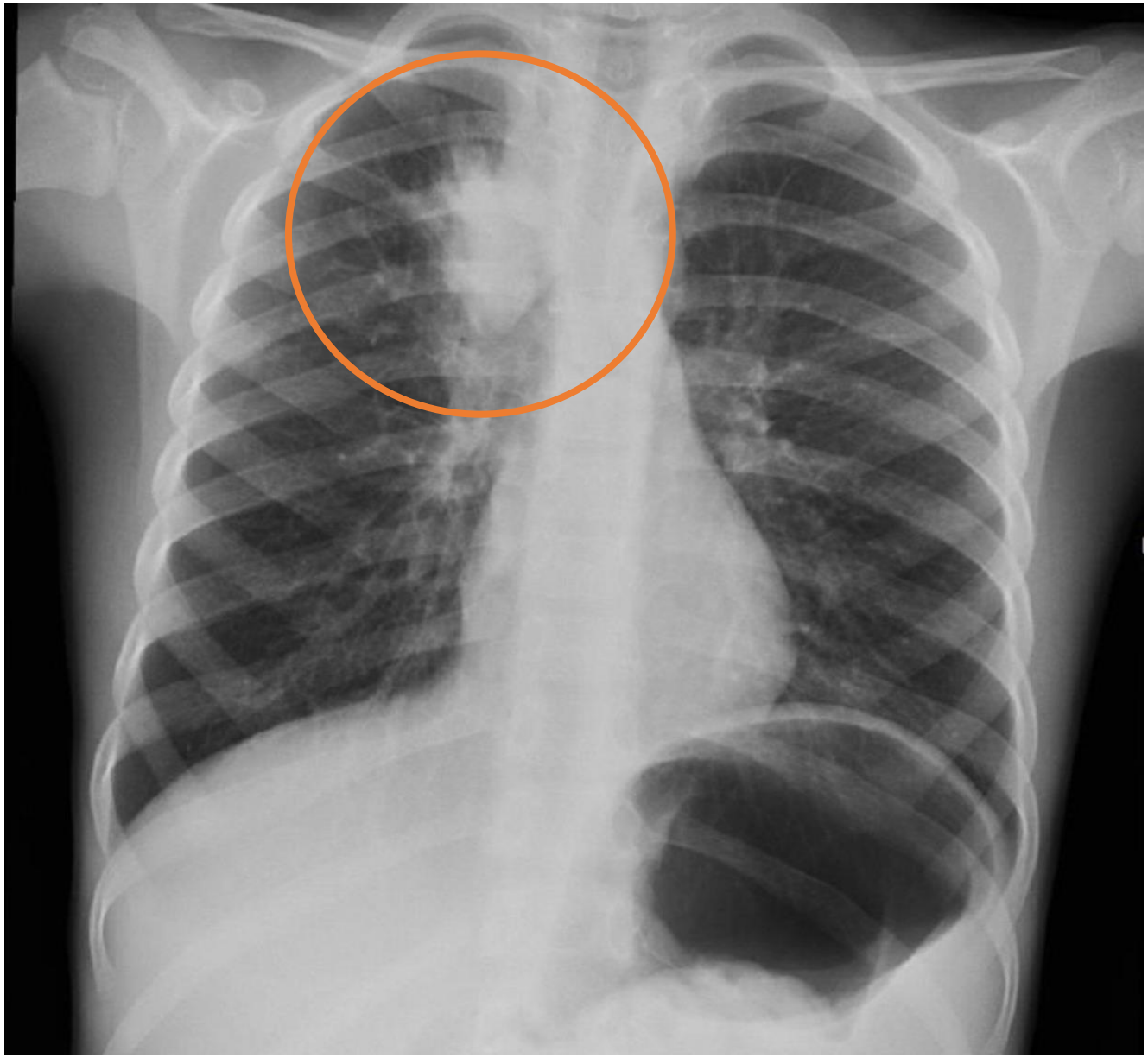
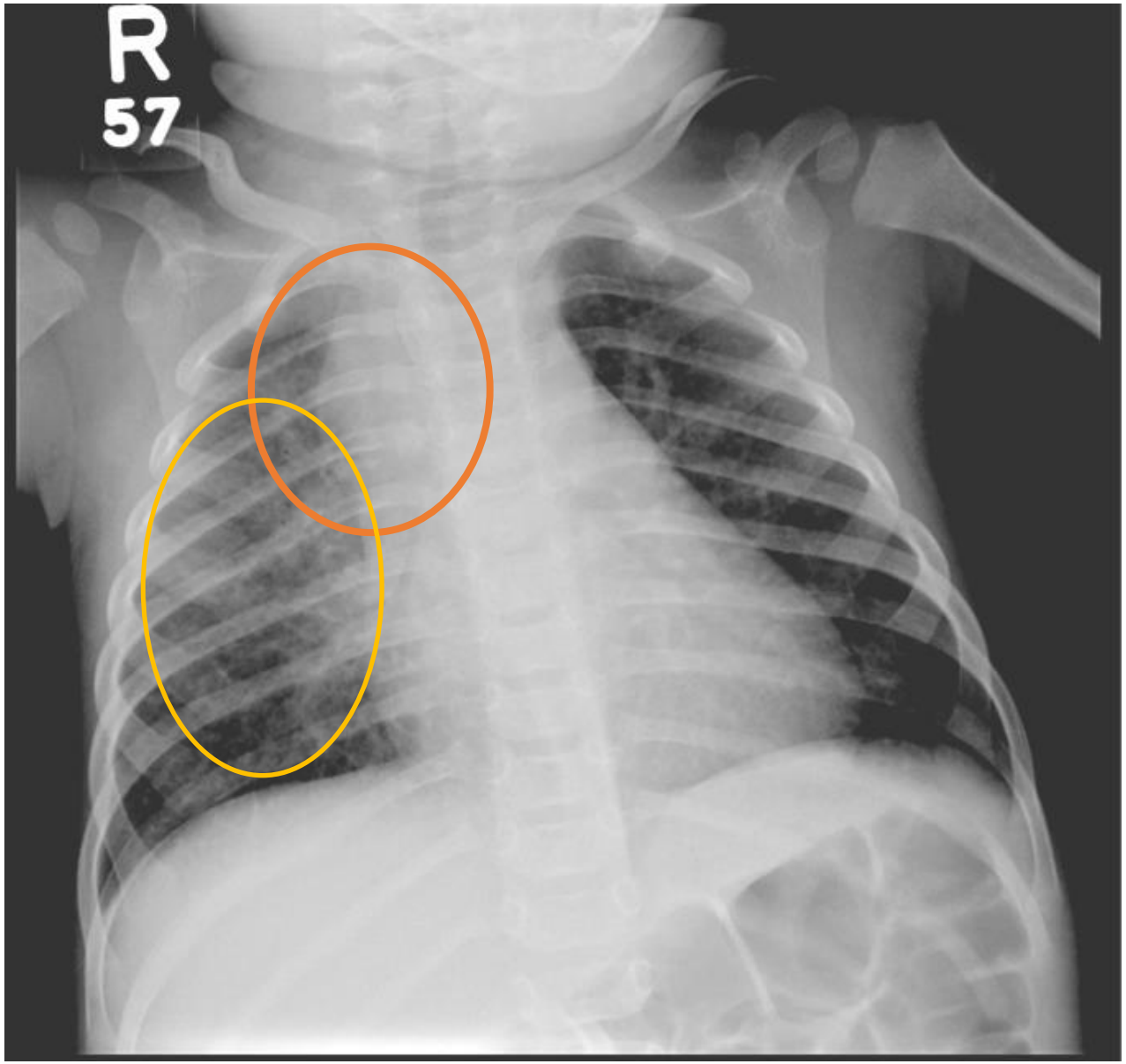




https://doi.org/10.1136/bcr-2020-236952



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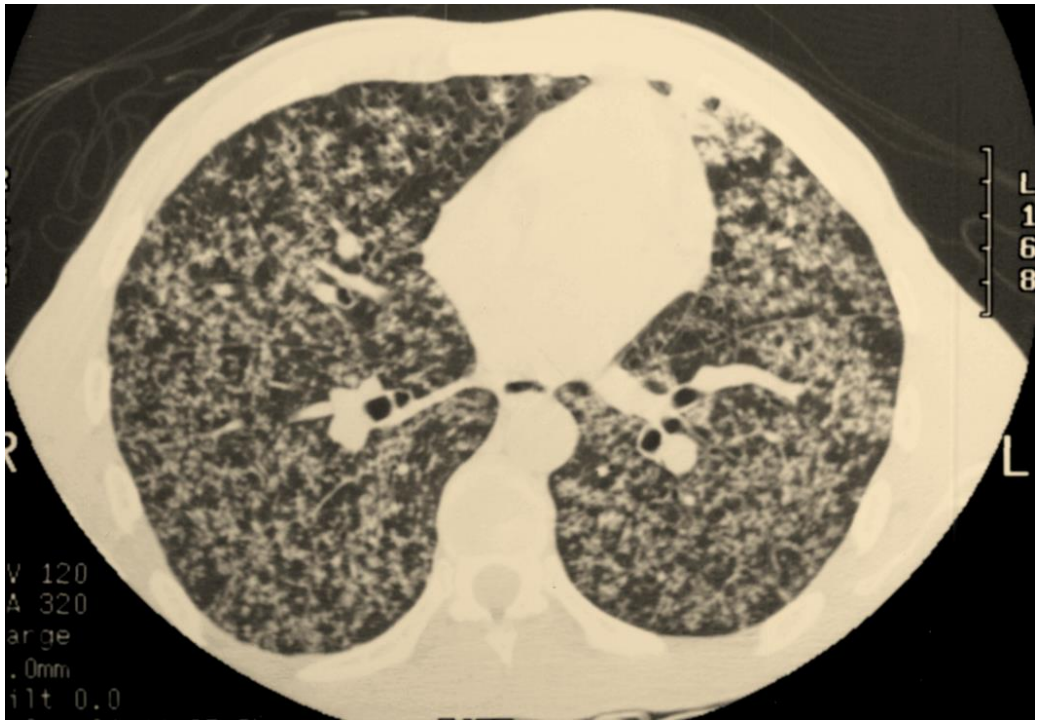
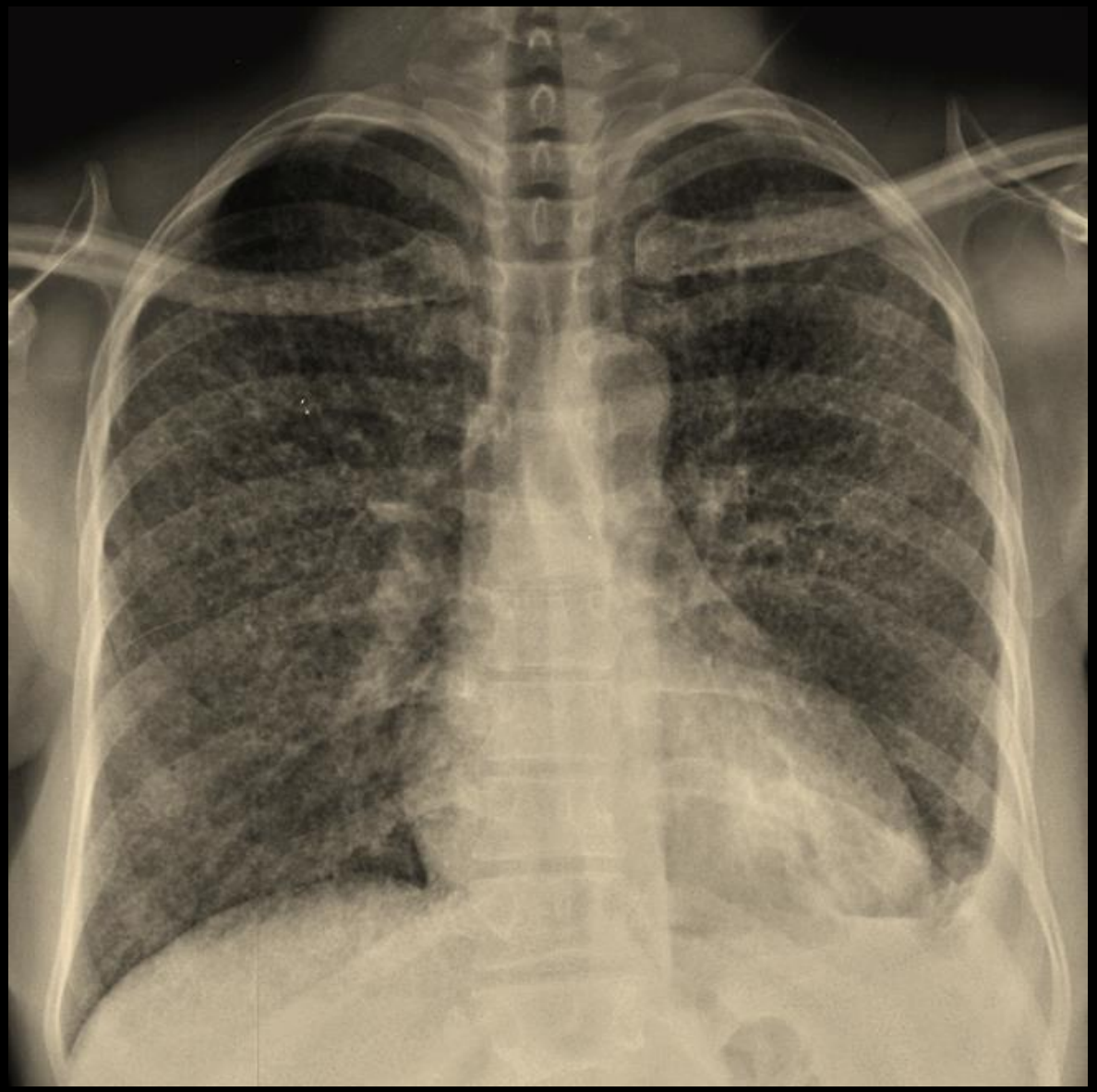
Miliary Tuberculosis



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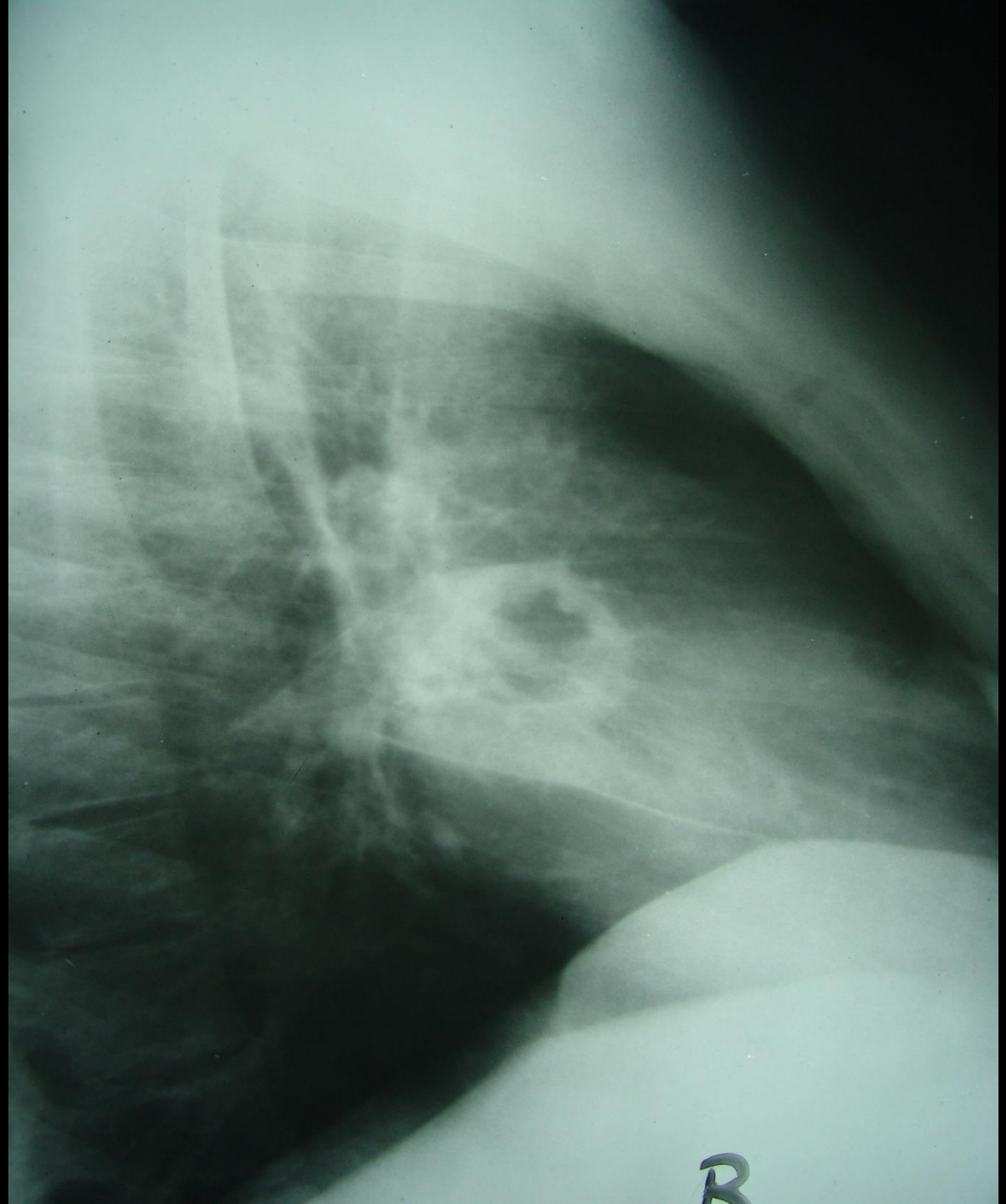
Post Primary, Reactivation Tuberculosis

- Characterized by upper lobe predilection, cavitation and absence of lymphadenopathy.
- Cavitation is the hallmark; can also see parenchymal disease (consolidation), hematogenous dissemination (miliary), bronchogenic spread (tree-in-bud) and pleural disease.
- Fibrosis and calcification are seen after healing.

Tuberculous Cavities

- Usually have thick, irregular walls
- With treatment, walls thin and cavity shrinks and usually collapses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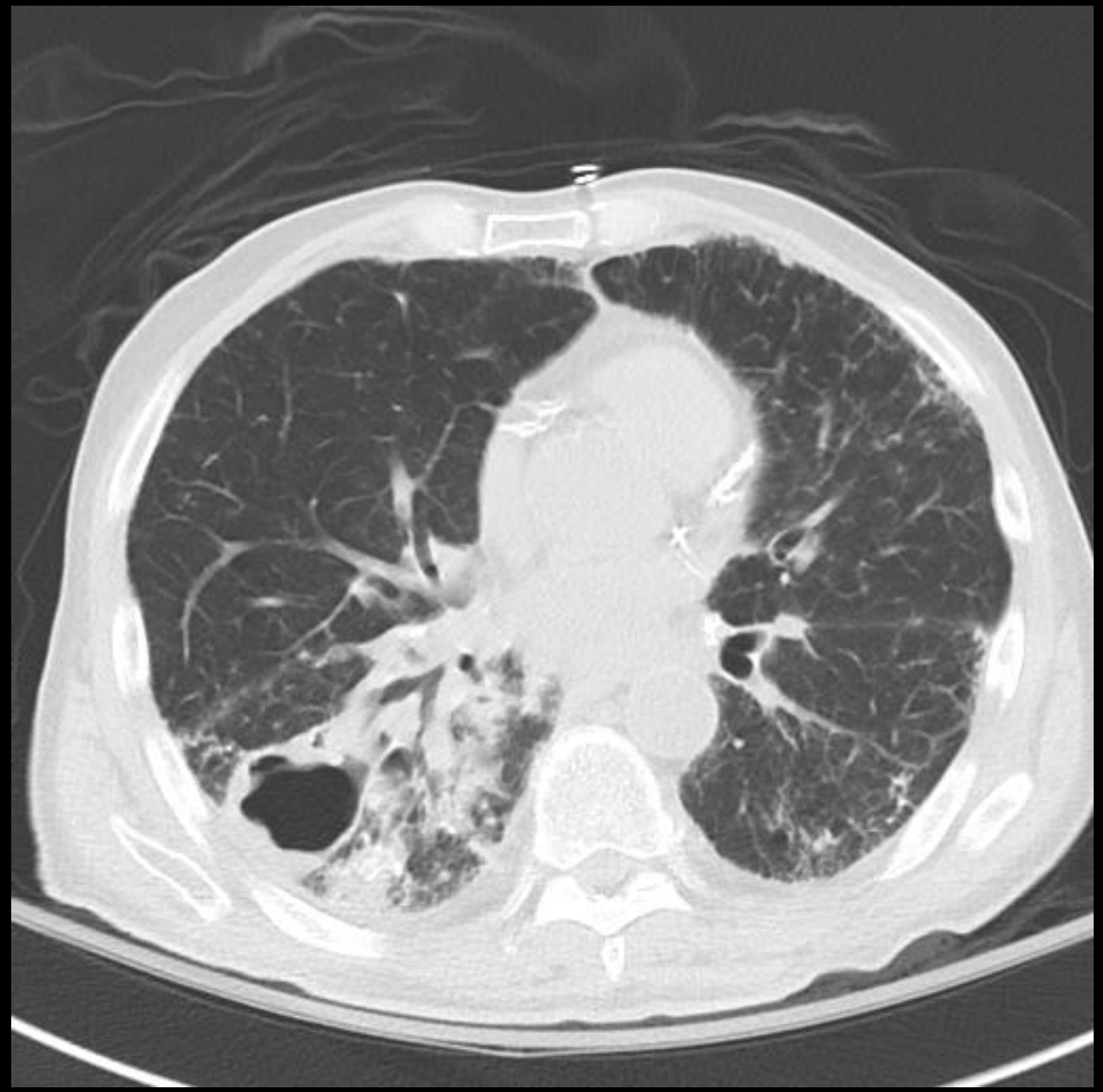
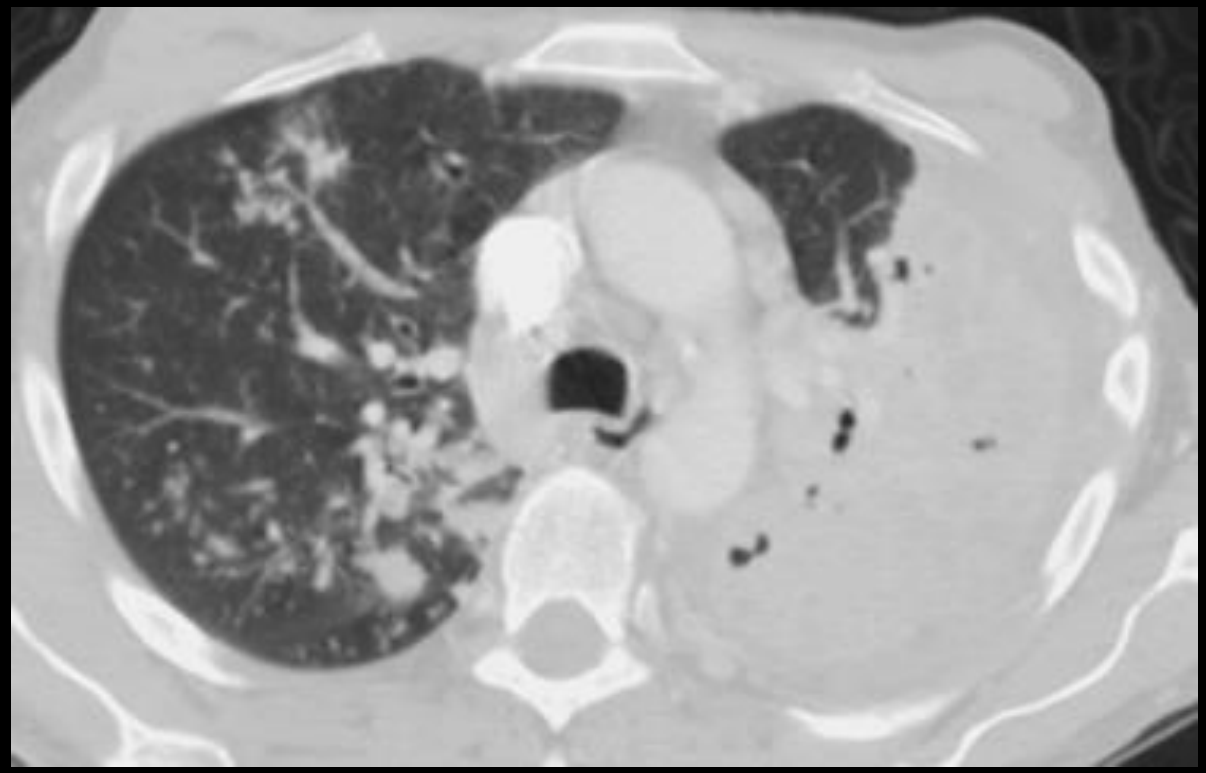
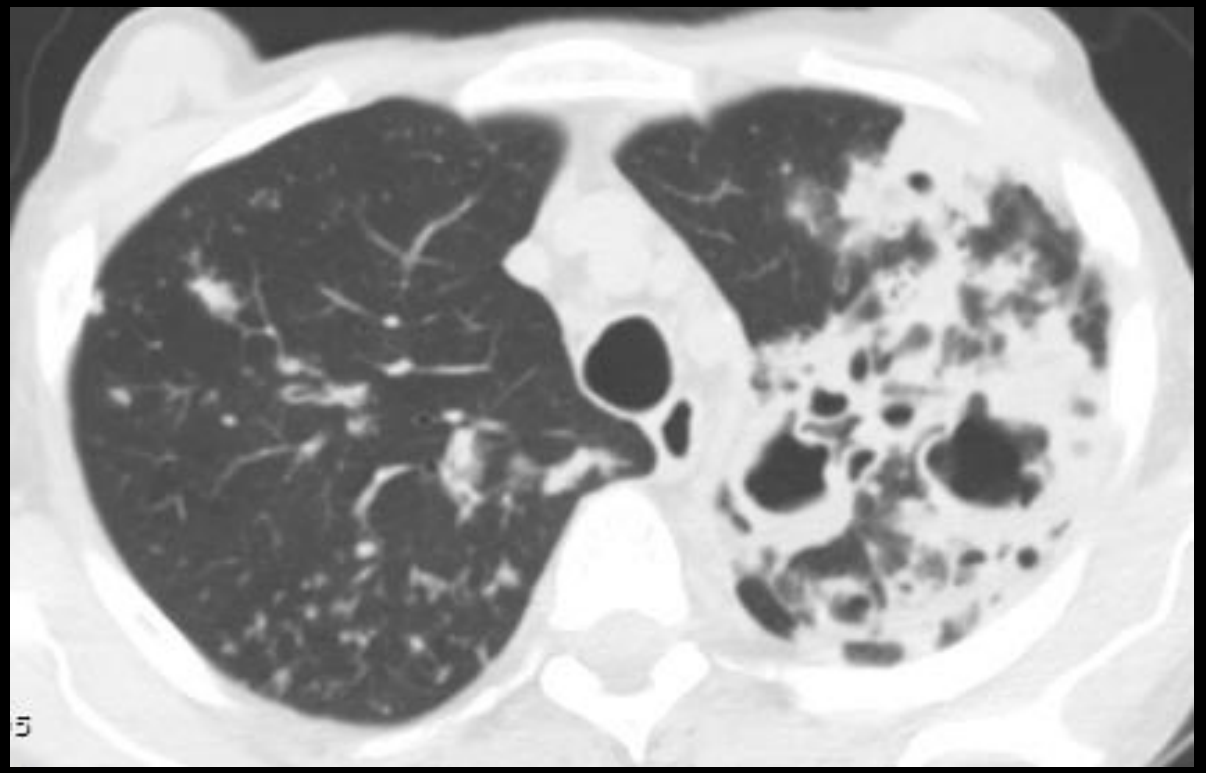


Cavitary Consolidation





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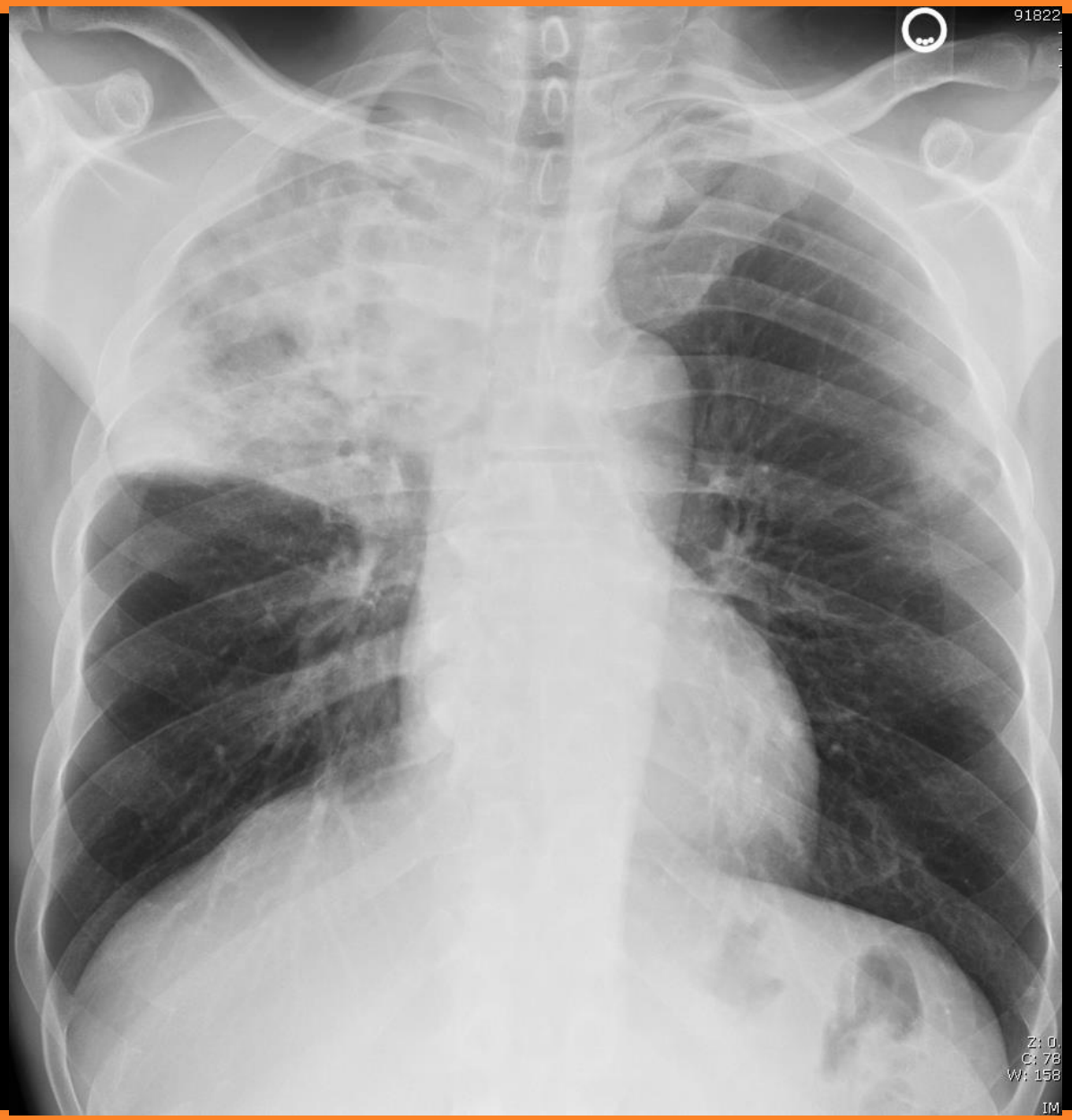
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Tree in Bud……

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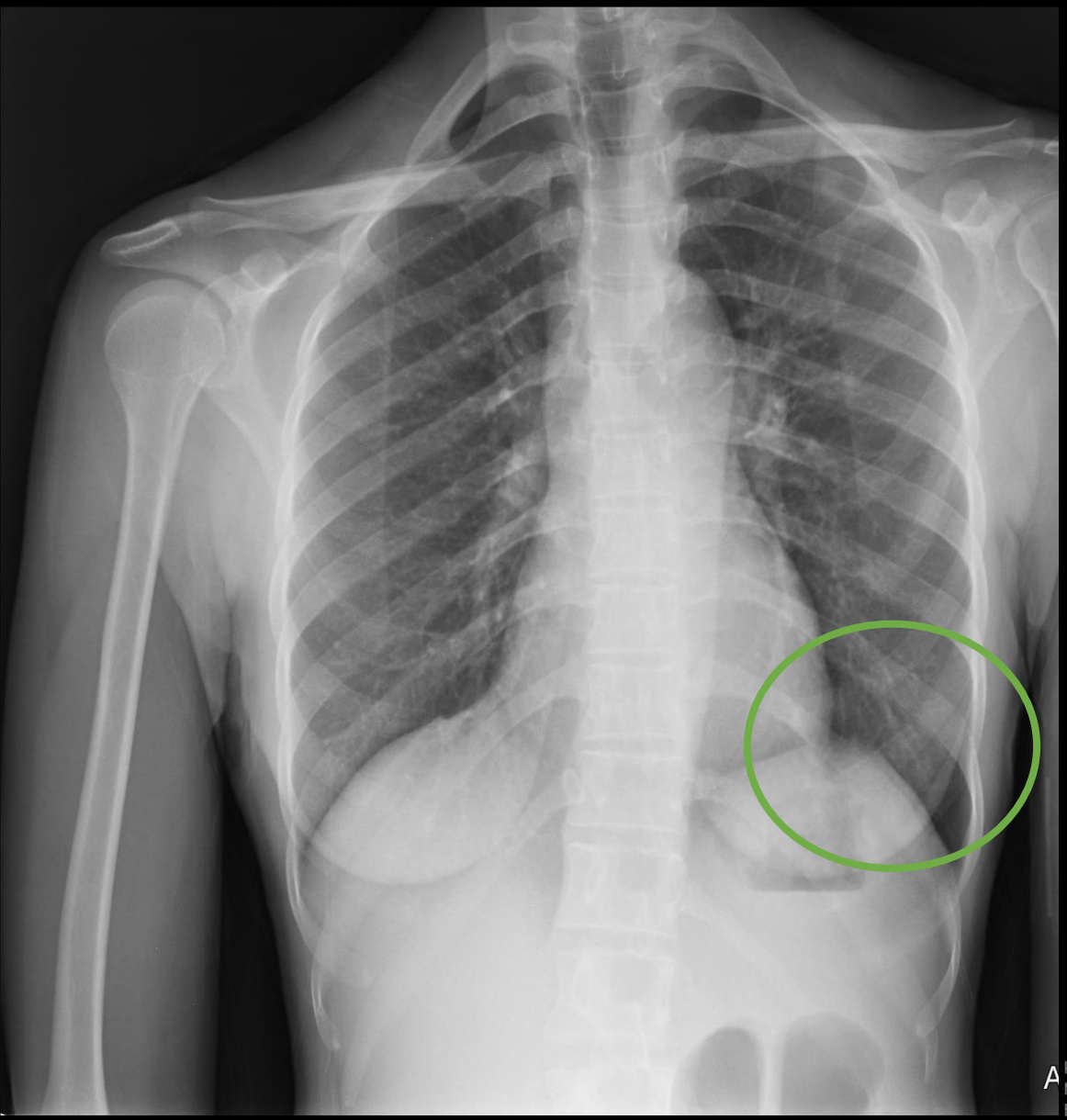
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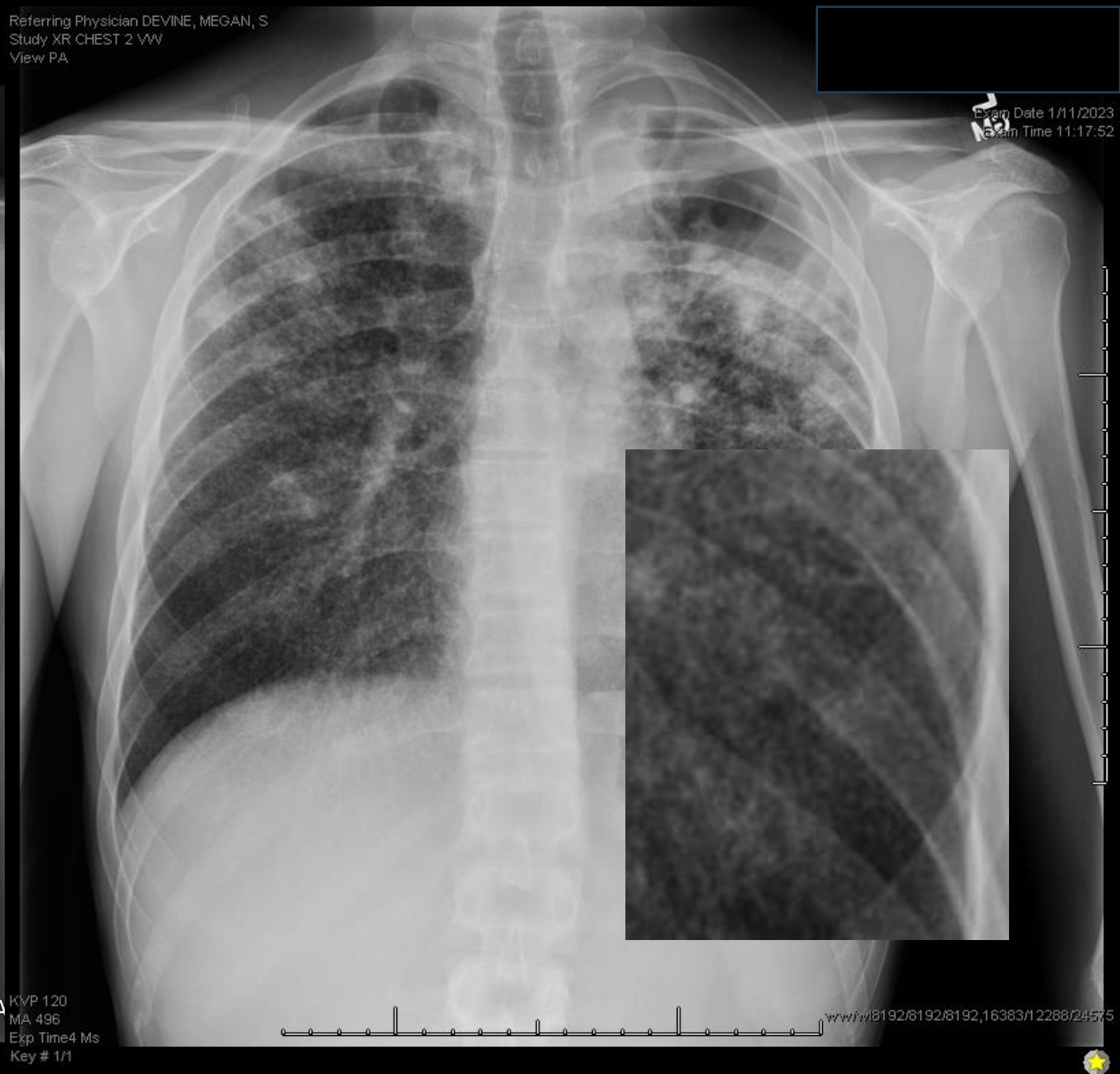
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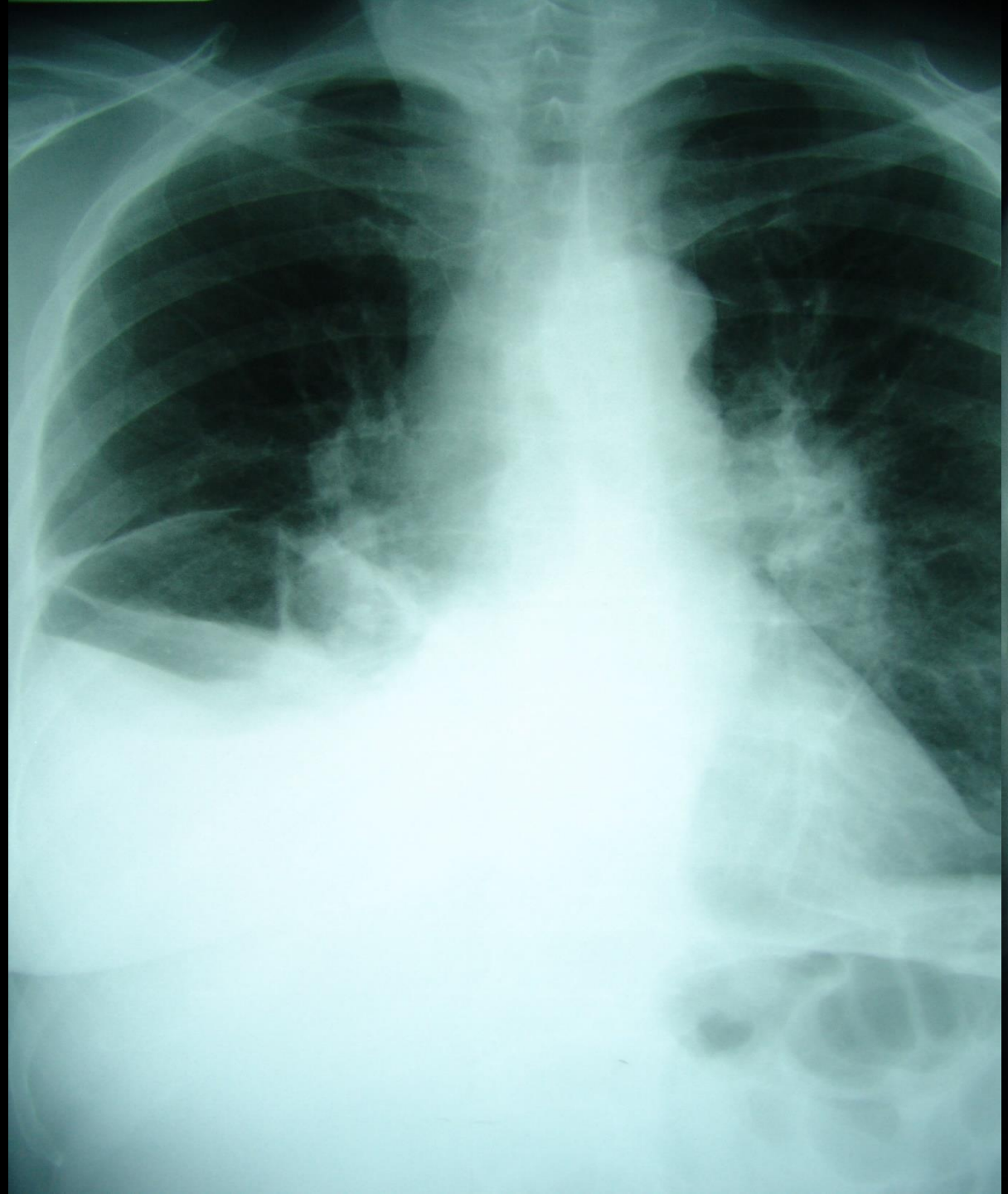
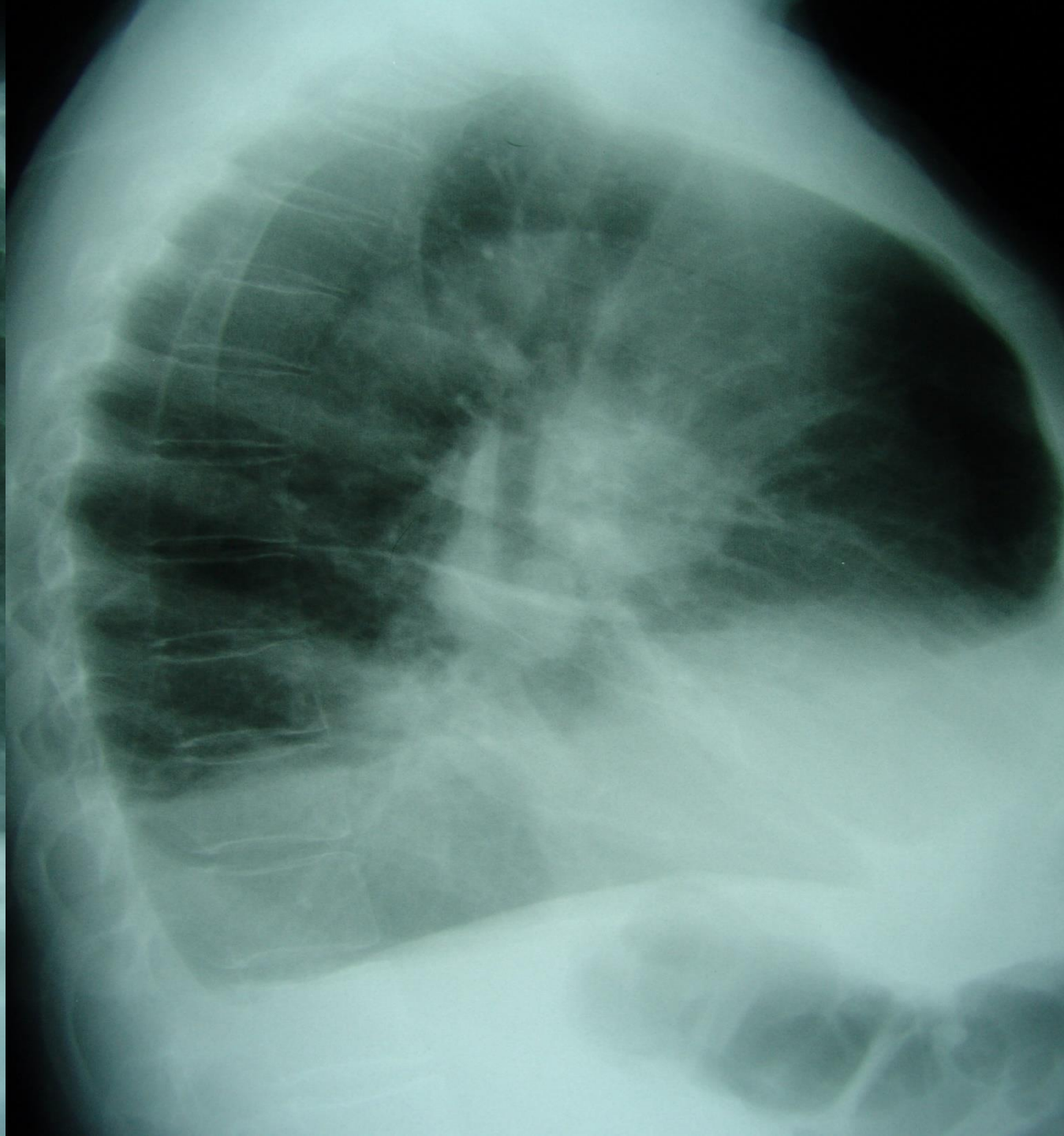
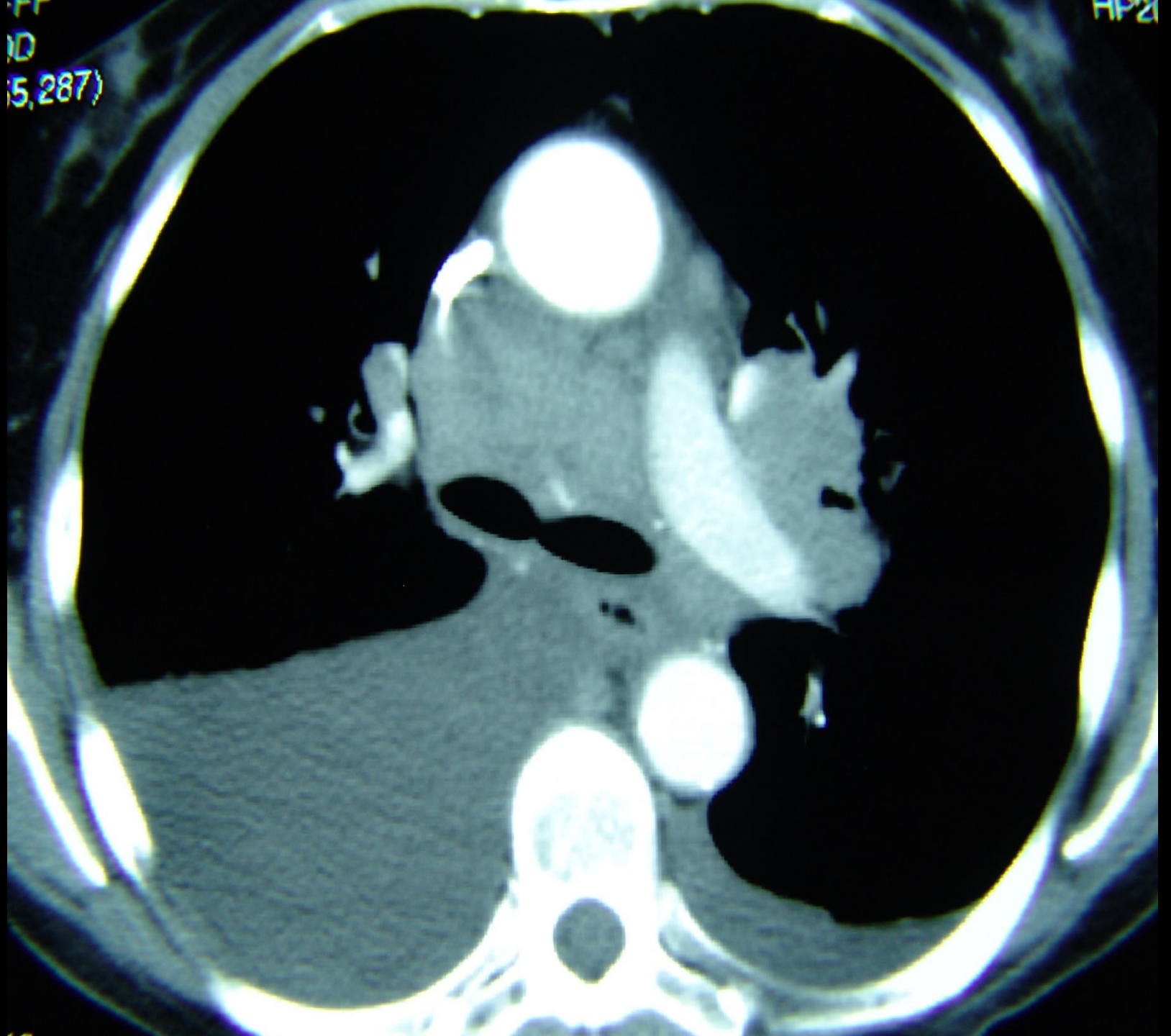
Pleural Effusions

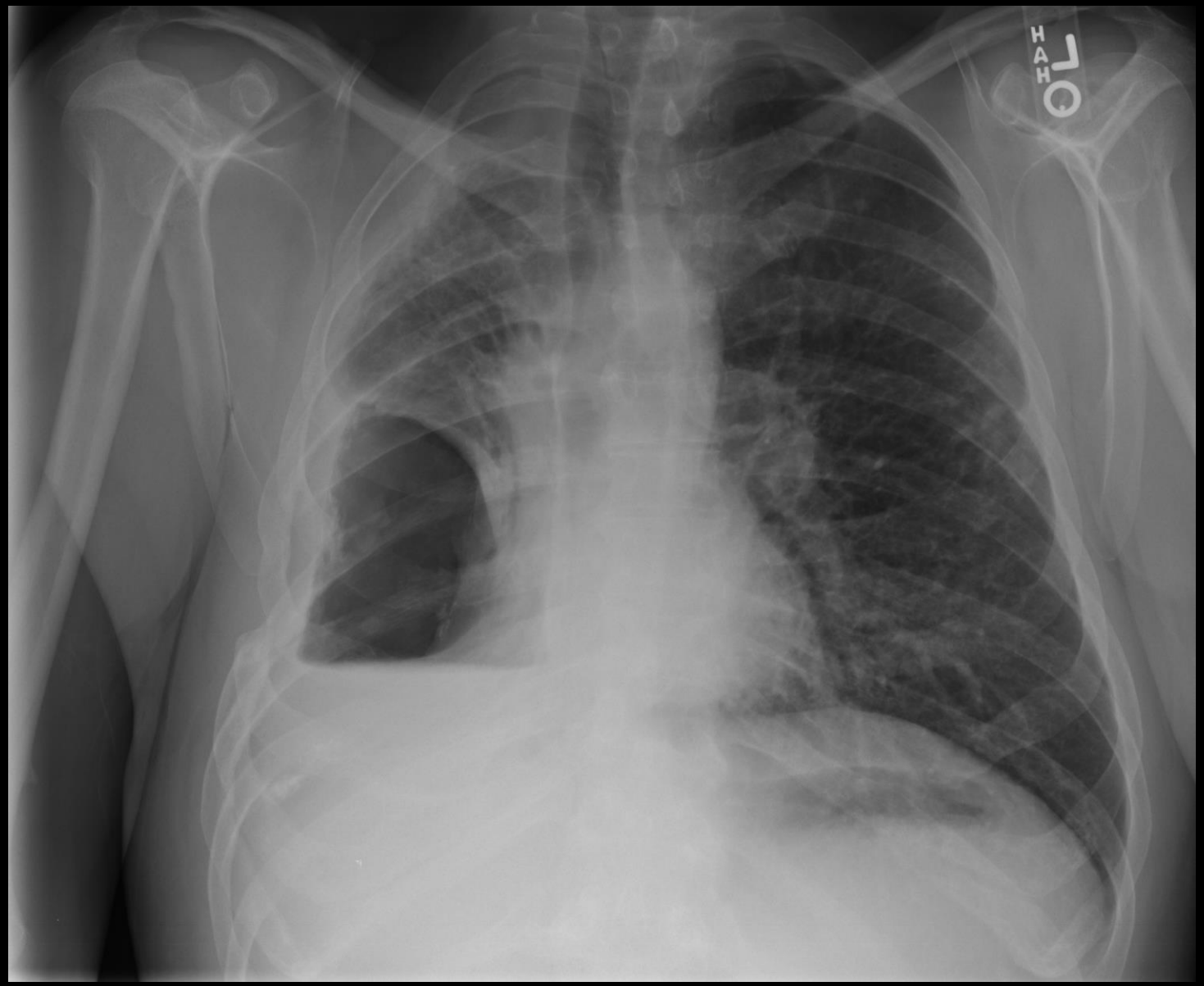
- Primary TB (25%)
- Hypersensitivity reaction to TB proteins
- Organisms uncommonly isolated from fluid
- May not be associated with obvious parenchymal disease on CXR



Pleural Effusions

- Post primary TB (20%)
- Caused by rupture of a tuberculous cavity into the pleural space, causing empyema
- May cause bronchopleural fistula with air fluid levels
- Often results in irreversible pleural thickening and calcification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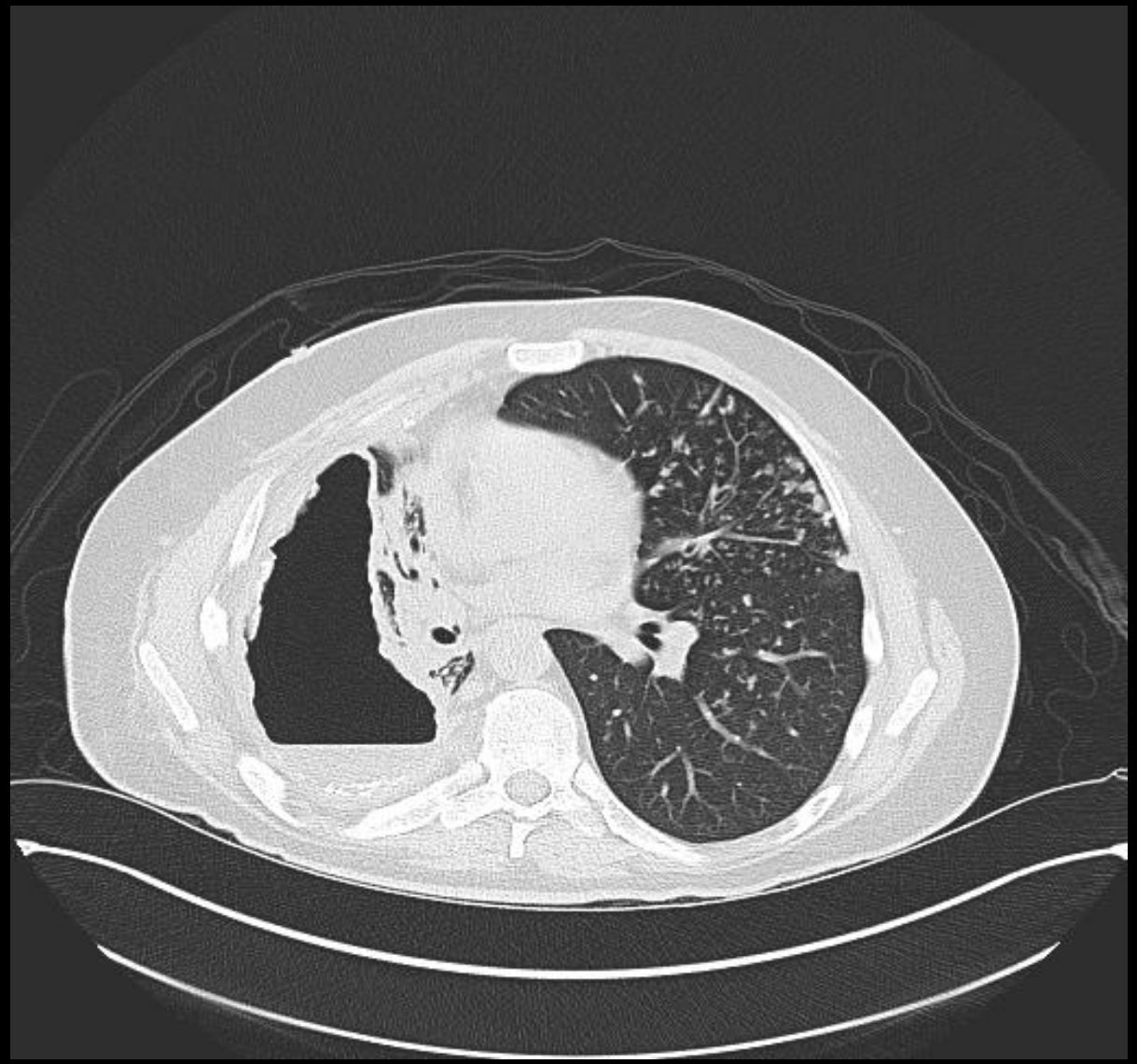

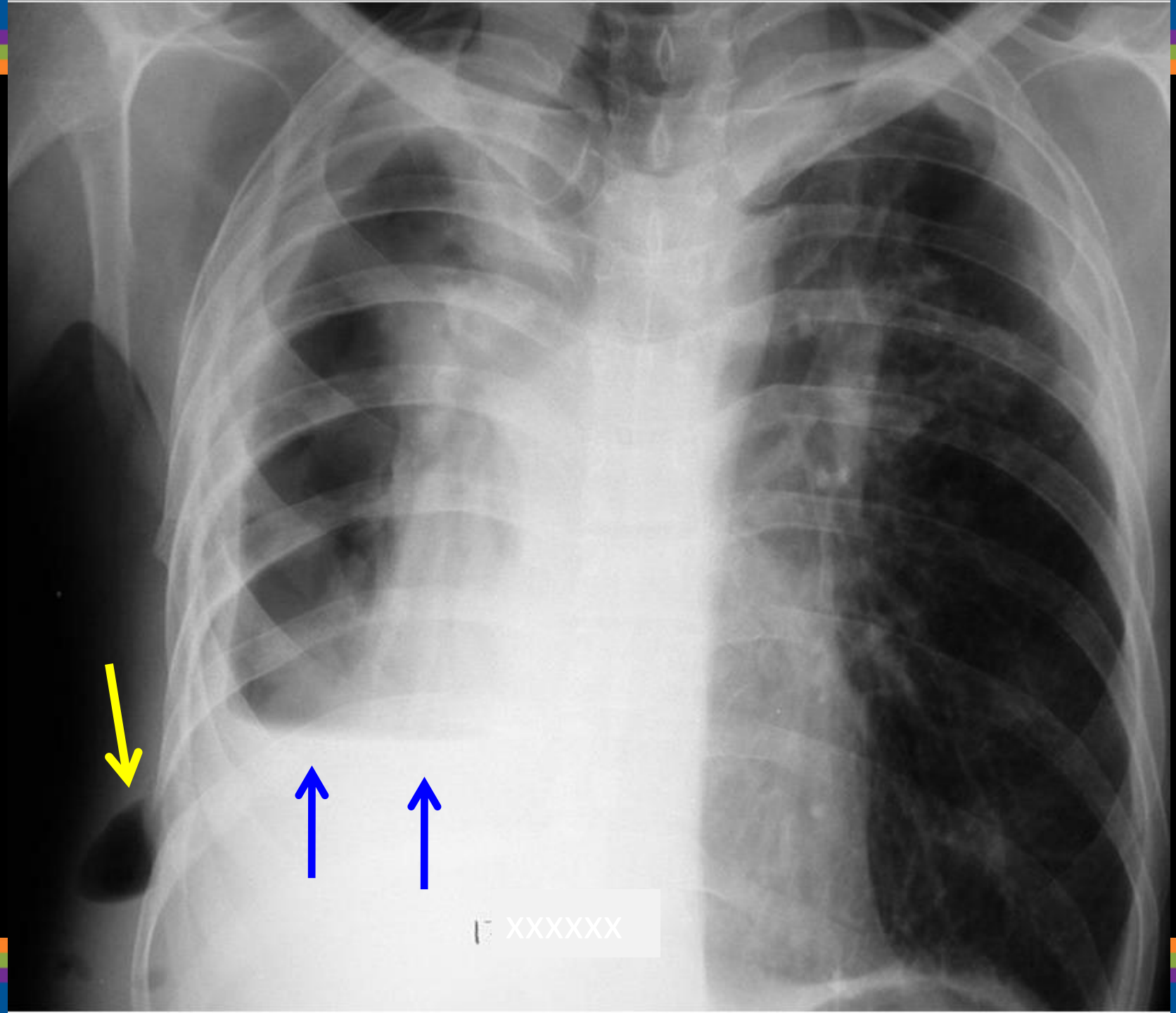
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Tracheobronchial TB

- TB is the most common cause of inflammatory stricture of a bronchus
- 10% - 20% of TB patients
- Circumferential wall thickening
- Luminal narrowing
- Long segment involvement
- Left > Right

Moon WK, et al. AJR 1997;16

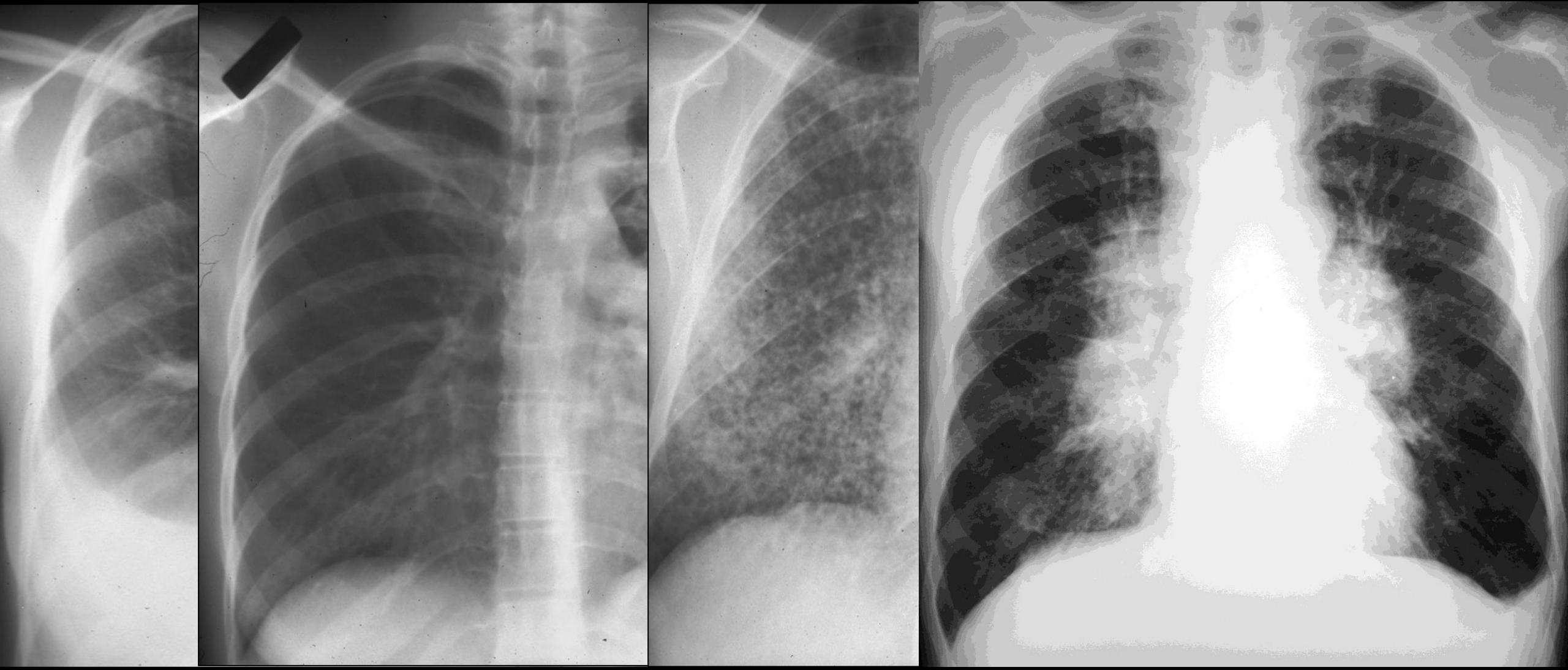
Courtesy: Dr. Santiago Res

Tuberculosis and Immunocompromised Persons

- Higher prevalence of extra-pulmonary involvement
- 38% of immunocompromised patients with TB have pulmonary involvement only, but up to 30% have only extrapulmonary involvement
- May have a normal chest radiograph due to limited immune response

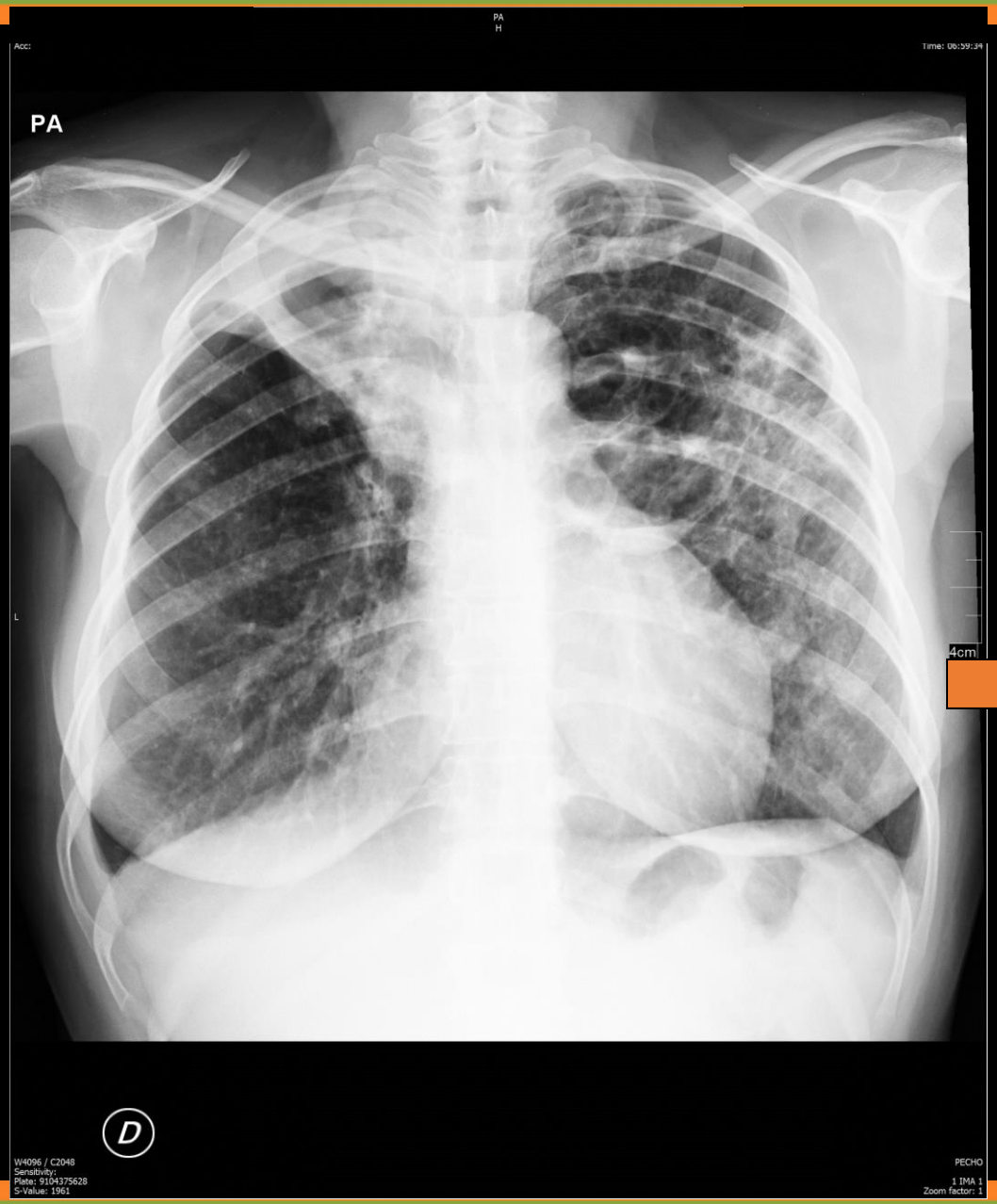
Tuberculosis and HIV ….

Any combination of the previously mentioned patterns!



Complications of Pulmonary Tuberculosis

- Bronchiectasis
- Broncholithiasis
- Extensive pulmonary destruction
- Non-tuberculous mycobacterial disease
- Chronic pulmonary aspergillosis
- Venous thromboembolism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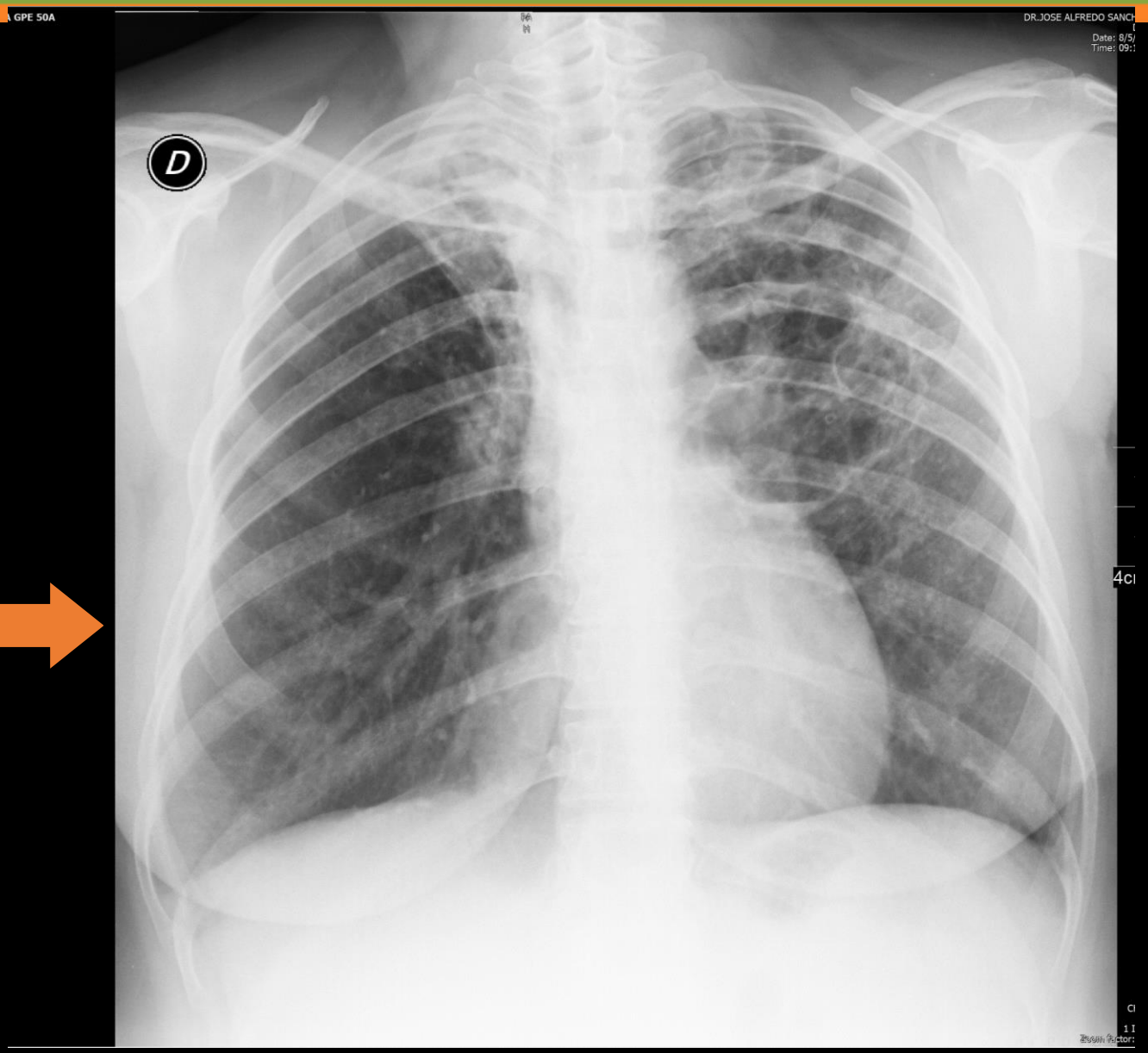
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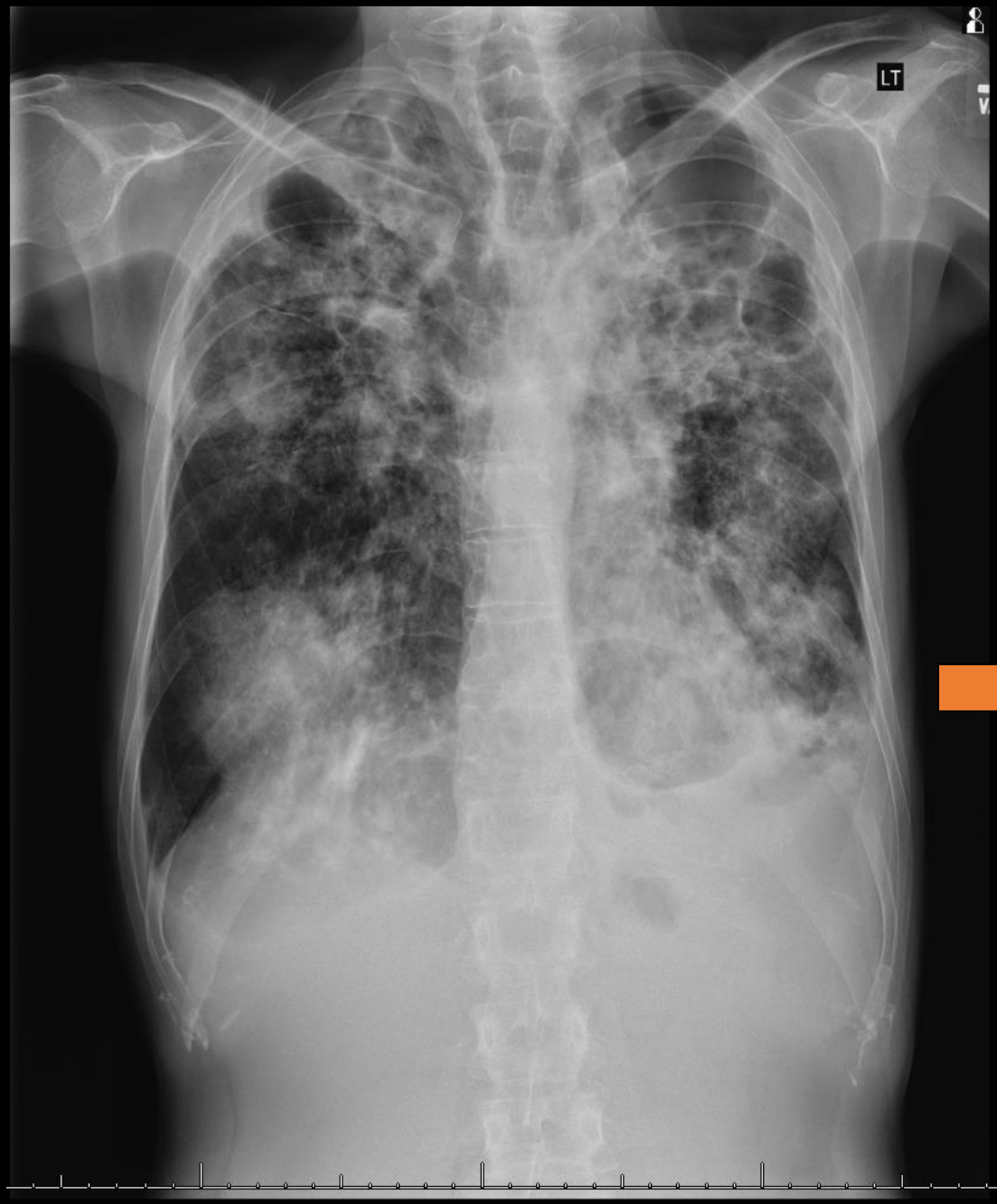
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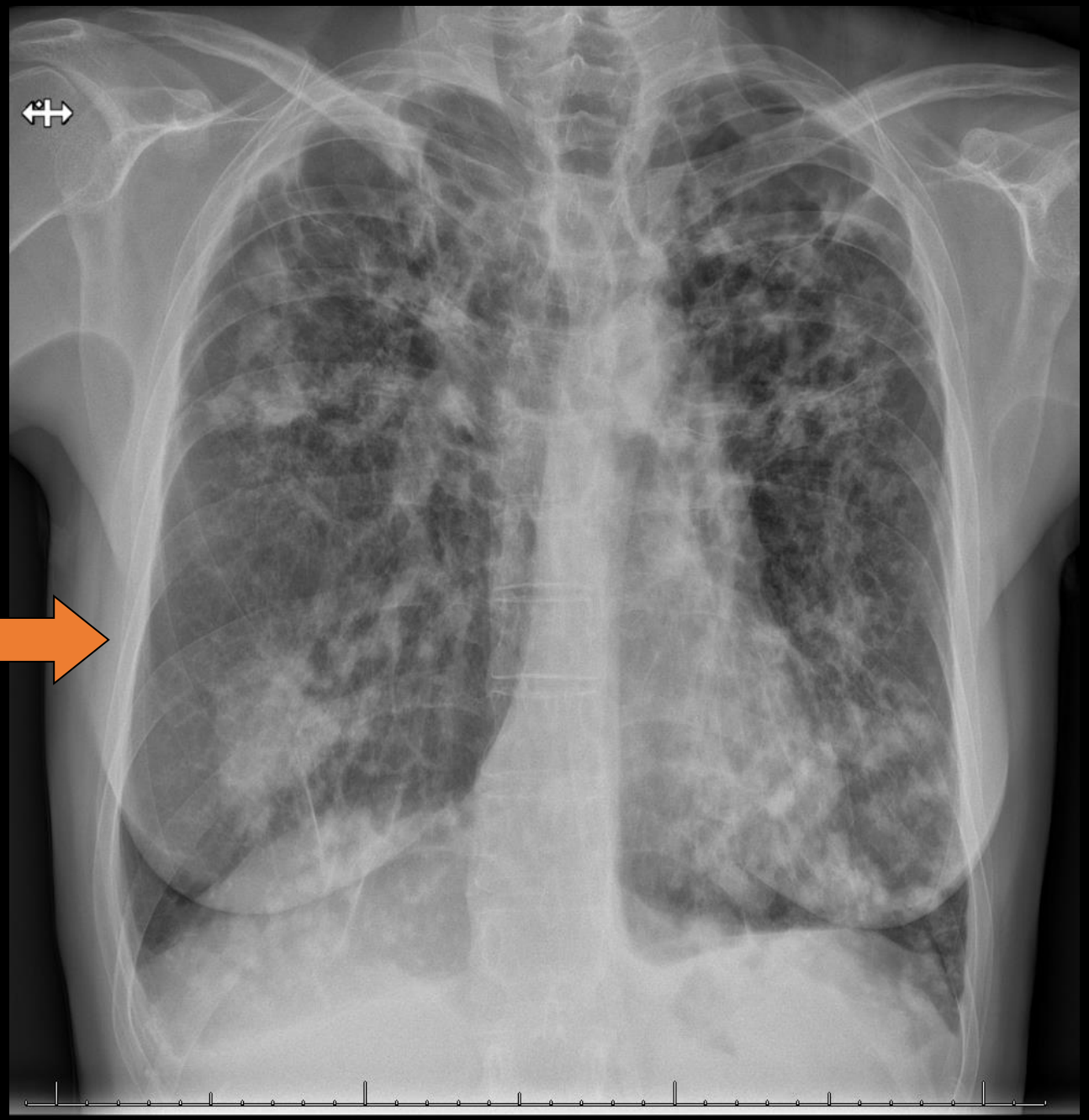
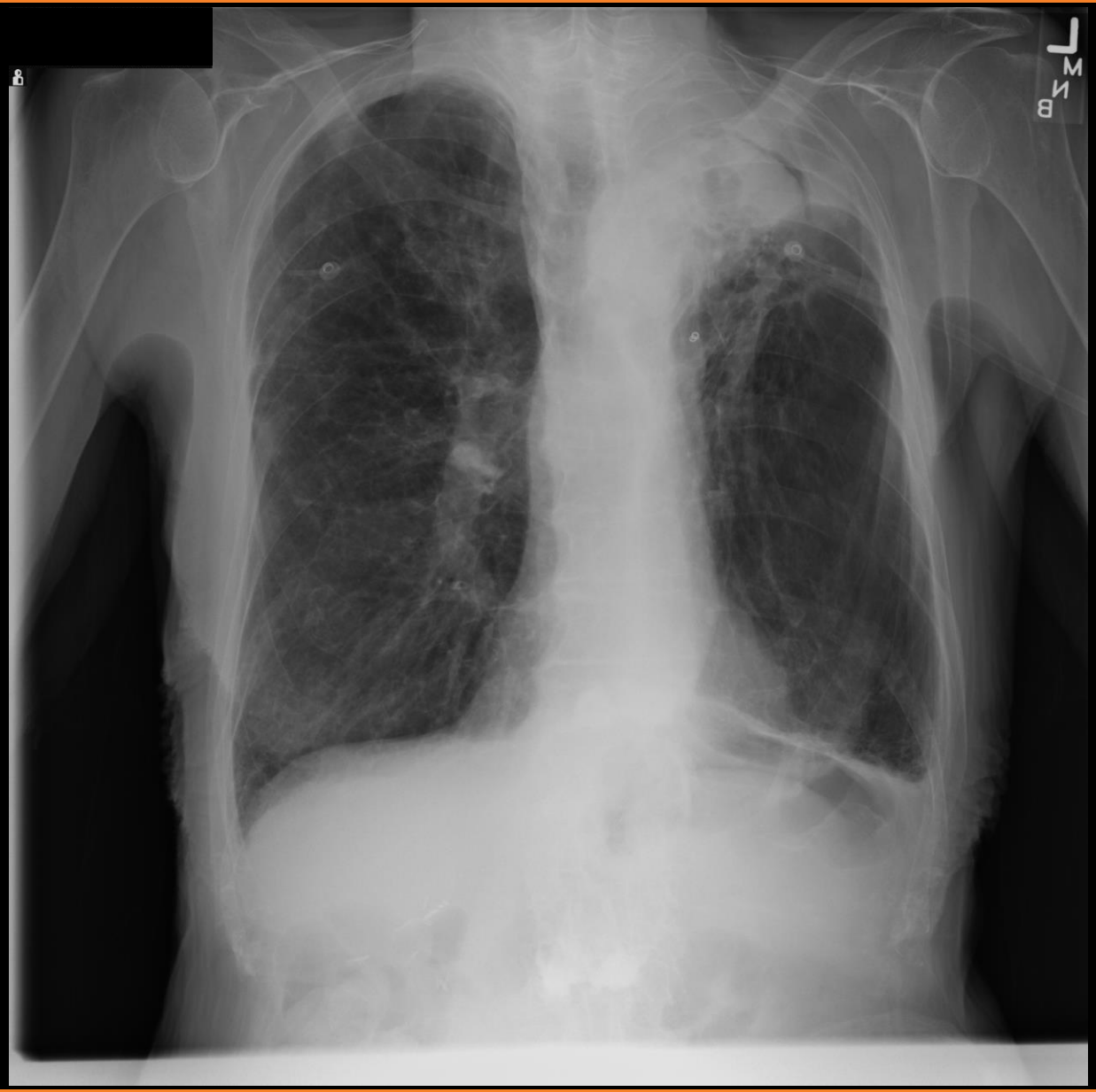




Extra-pulmonary Tuberculosis can affect ANY ORGAN

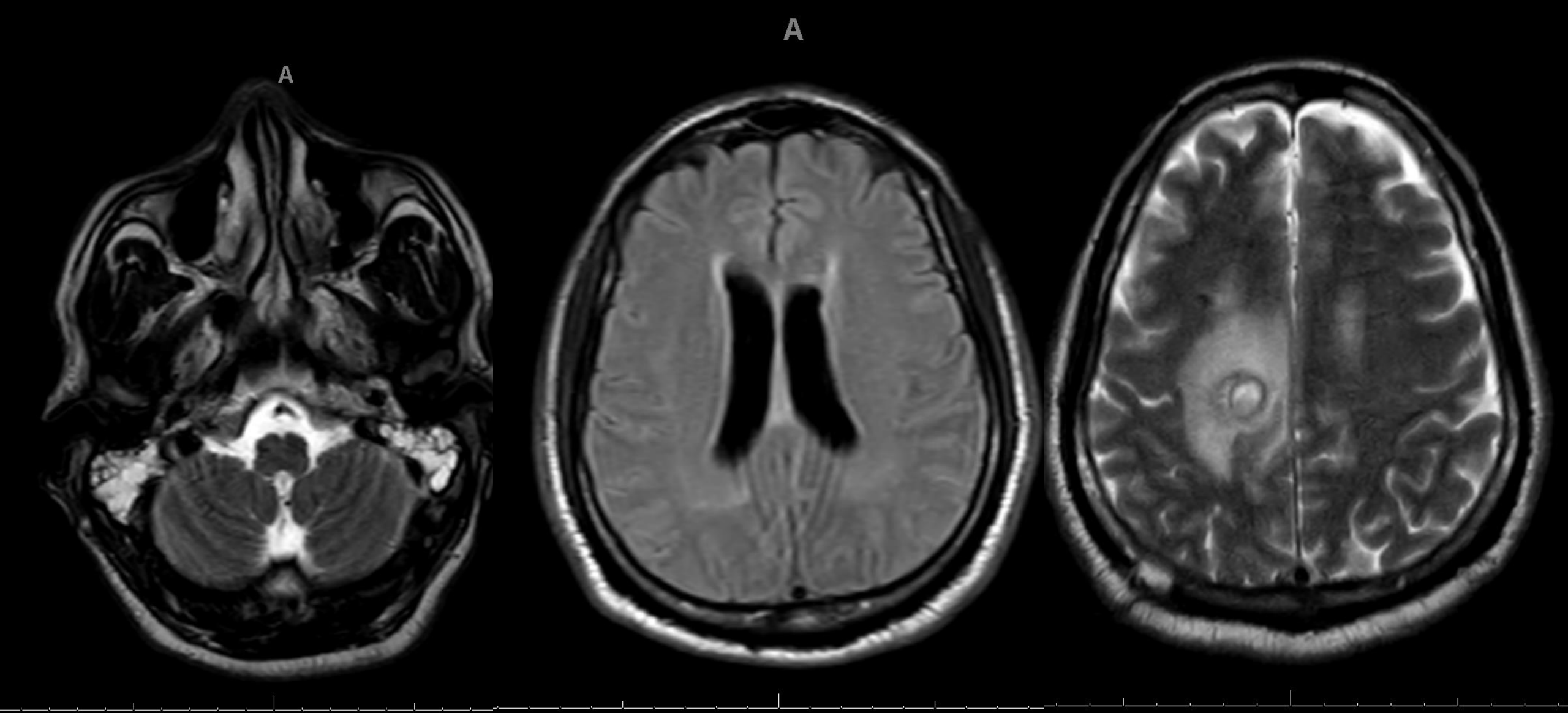
- Cardiac: pericarditis, pericardial effusion, myocarditis
- CNS: meningitis, tuberculomas, tuberculous abscesses, cerebritis, and miliary TB
- Head and neck: lymphadenitis (scrofula), less common sinonasal, thyroid, skull base
- Musculoskeletal: spinal column, pelvis, hip, and knee (spondilytis, osteomyelitis, arthritis)
- Abdominal: lymphadenopathy, peritonitis, ileocecal region, hepatosplenic, adrenal glands
- Genitourinary: renal, ureters, bladder, genital (fallopian tubes in women and seminal vesicles or prostate gland in men)

A Word About MRI…

- Uses non-inozing radiofrequency radiation inside a strong magnetic field to detect the location and chemical environment of protons.
- Achieves greater tissue contrast than CT imaging.
- Particularly helpful in neurologic, bone and soft-tissue imaging.
- Limitations

Tuberculous Meningitis

- Hematogenous dissemination
- TB meningitis thought to occur via rupture of a subependymal tubercle into the subarachnoid space
- Basal meninges most commonly involved
- Secondarily results in cortical and lacunar brain infarction and spinal cord infarction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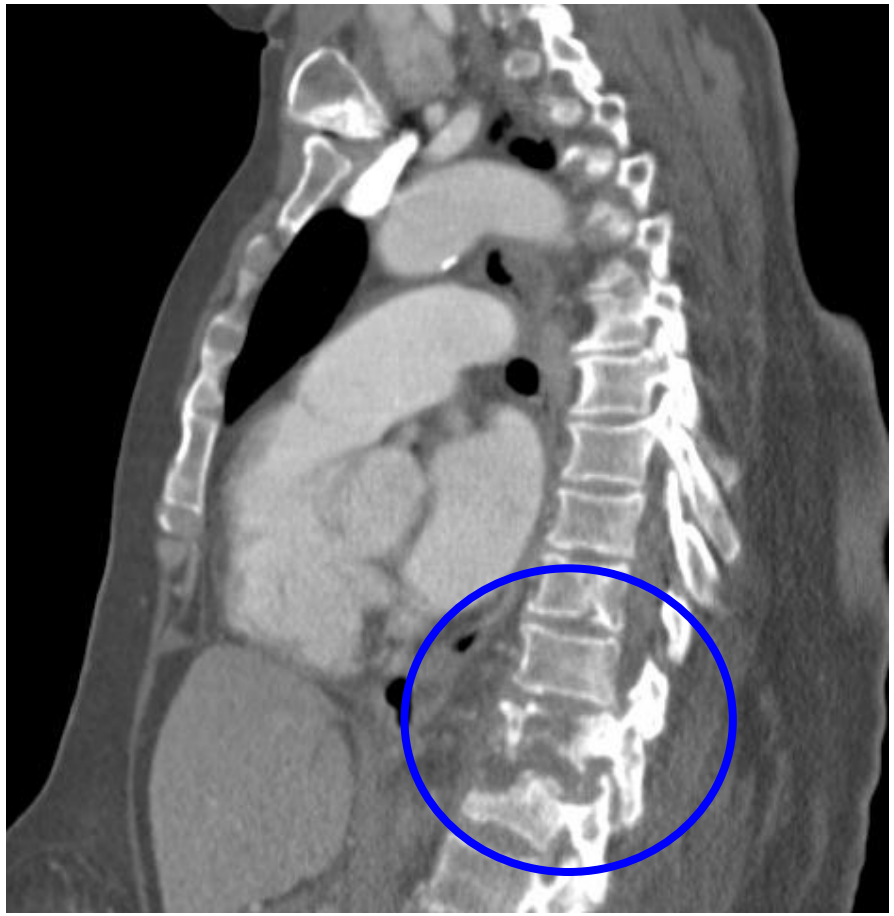
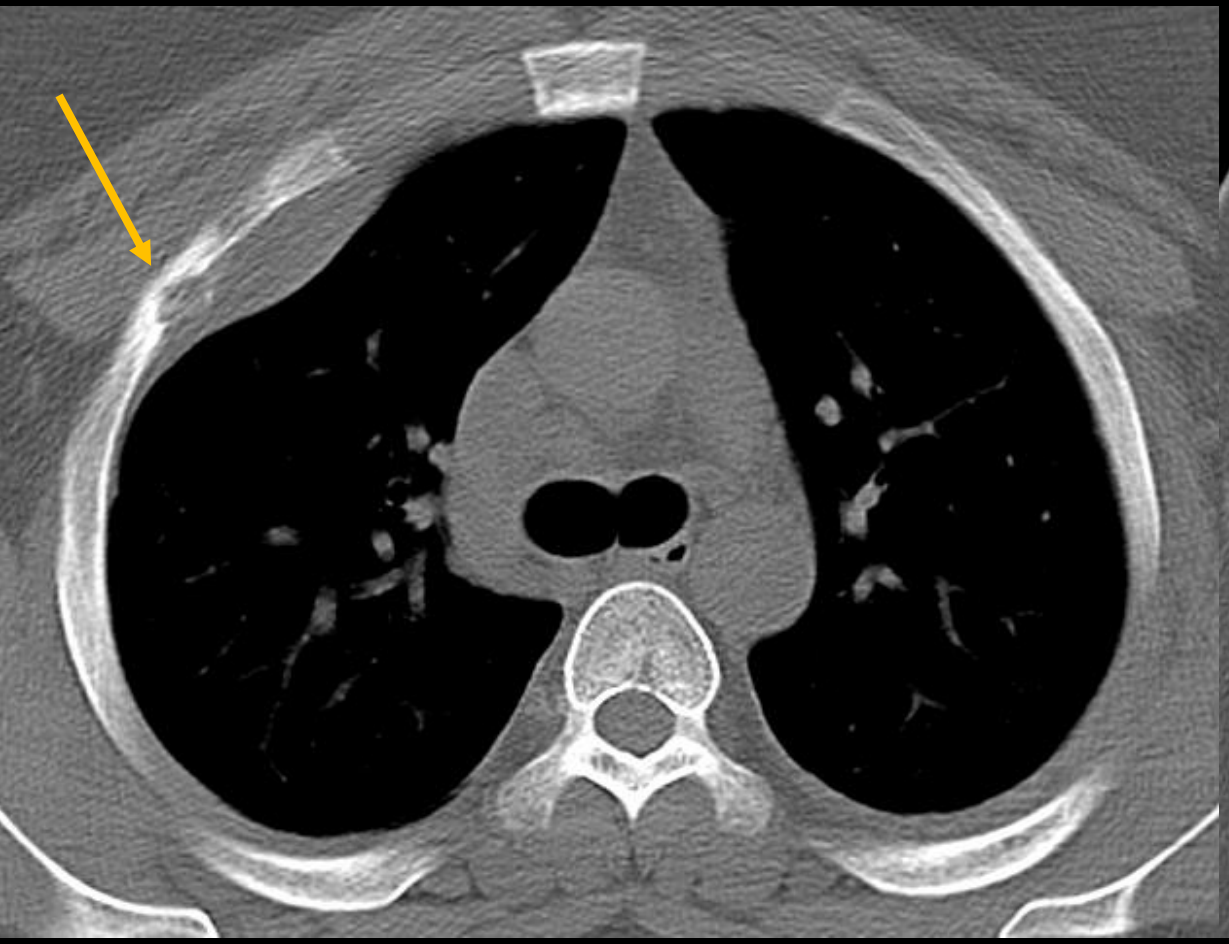
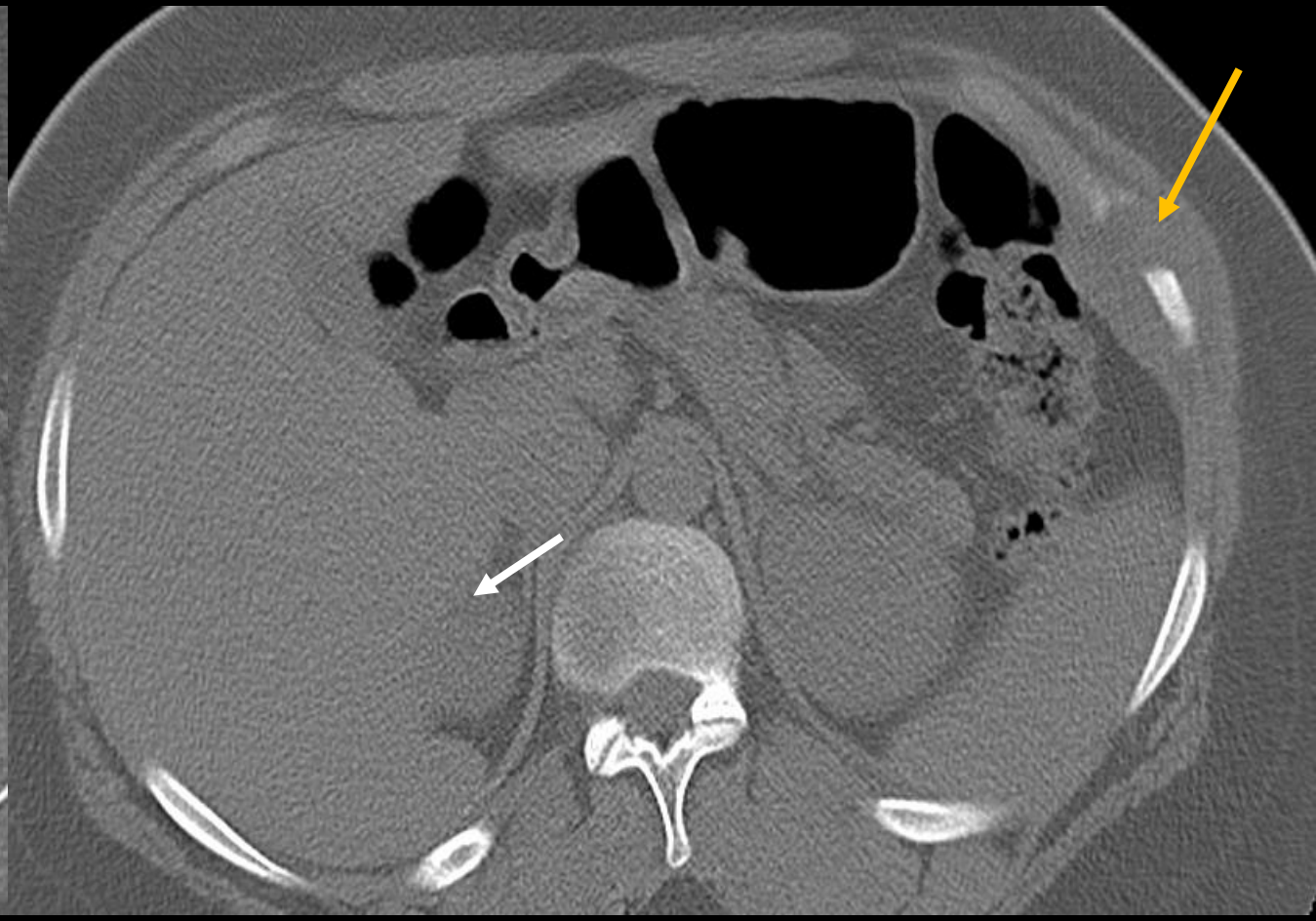
Bone Involvement

- Potts disease – Tuberculous spondylitis
  - Destructive lesions in the spine primarily centered in vertebral discs and secondarily involving vertebral end plates, resulting in kyphosis.
  - May result in paravertebral abscess.
  - Extends under anterior longitudinal ligament, involving multiple vertebra.
- Can involve other joints – hip, knee, tarsal joints

Extrapulmonary Tuberculosis
Pott's Disease







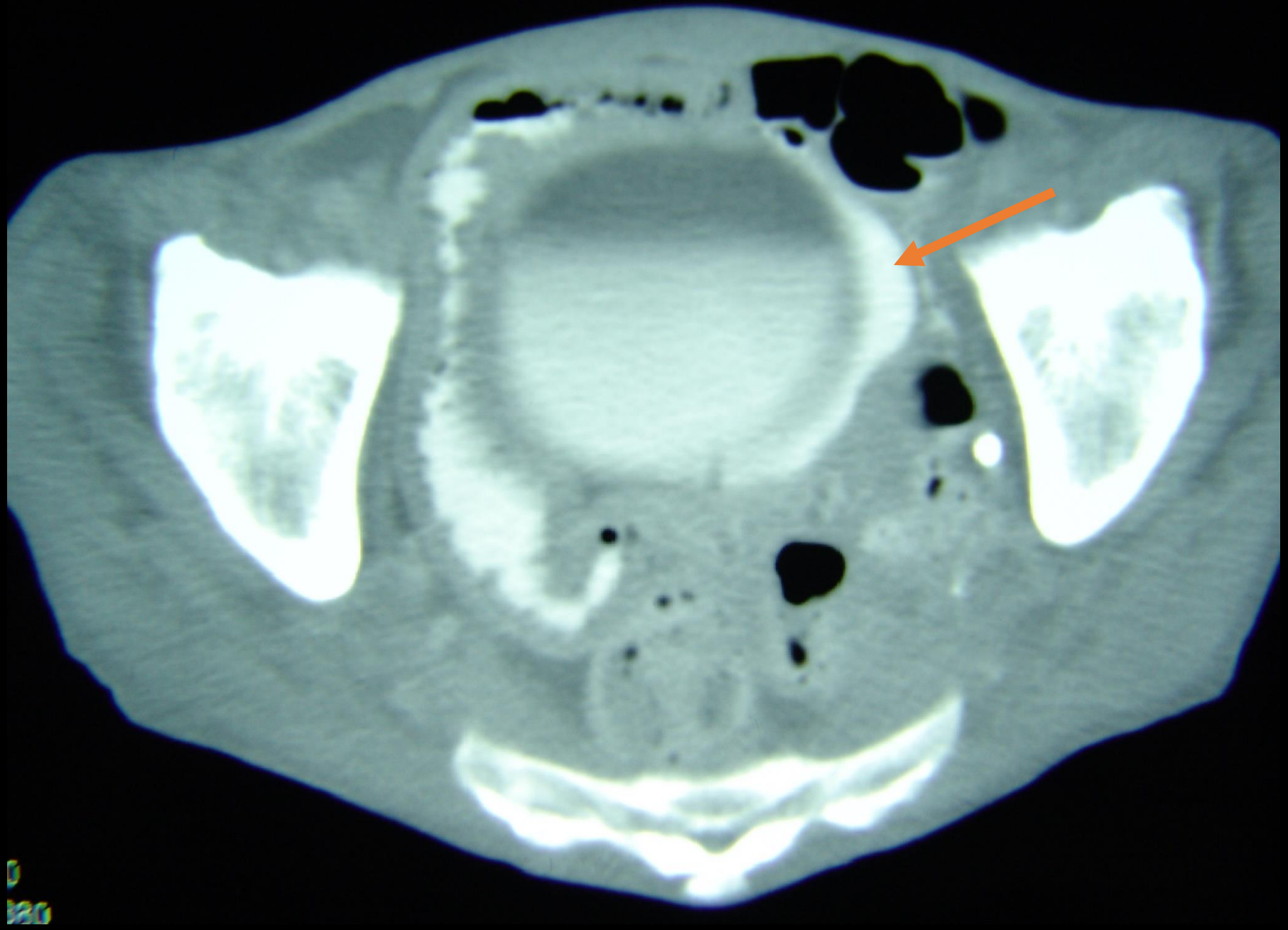
Courtesy: Dr. Santiago Rest

Urinary Tract Involvement

- Hematogenous spread to the kidney
- Tuberculomas form in renal parenchyma
- Hematuria, “sterile” pyuria
- 75% unilateral
- Auto-nephrectomy – shrunken, calcified, scarred, and nonfunctional
- Ureteral involvement develops from direct spread, resulting in stricture and obstruction

Bladder Involvement

- Direct spread
- Interstitial cystitis with thickened bladder wall
- Ulceration

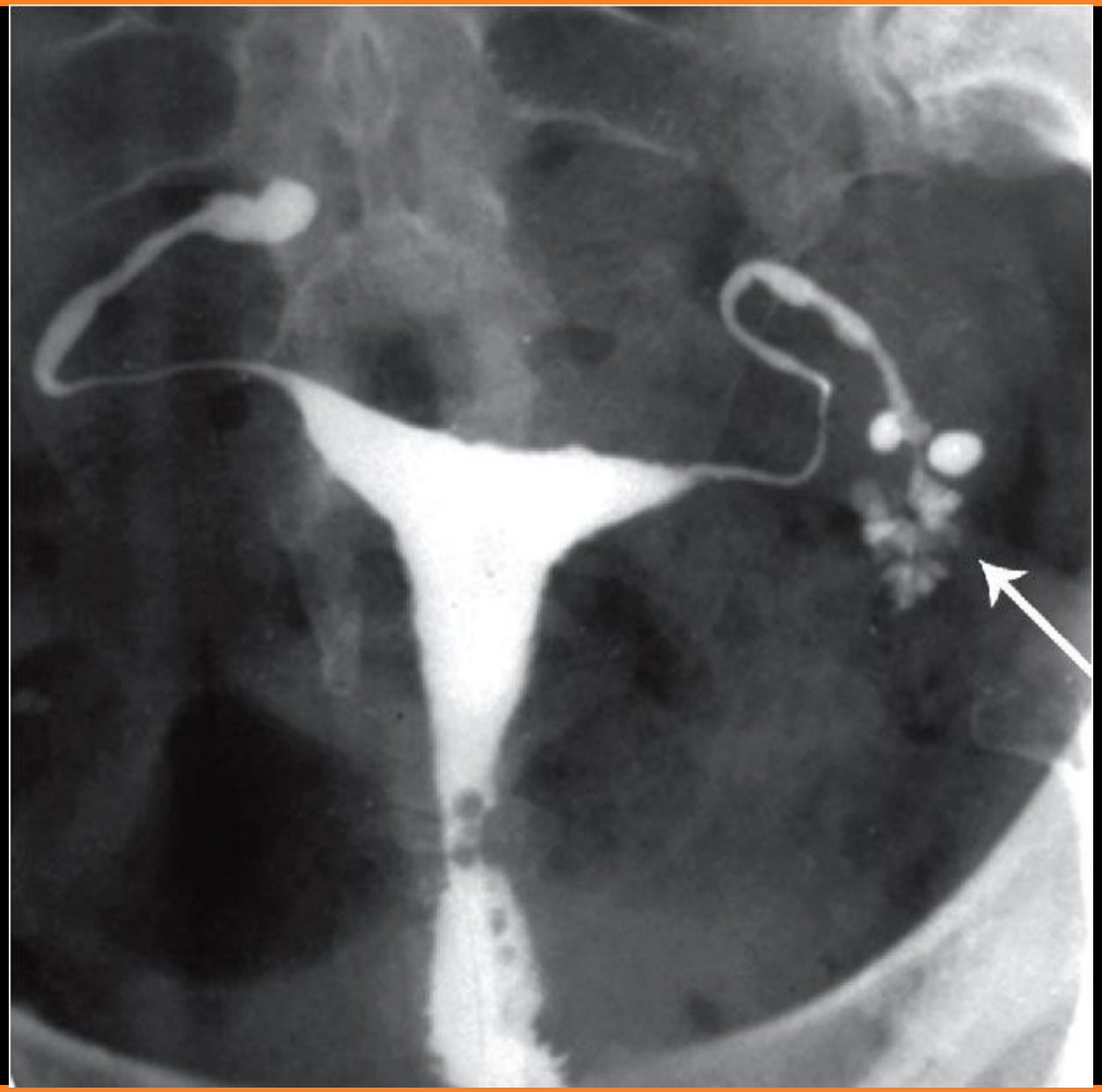


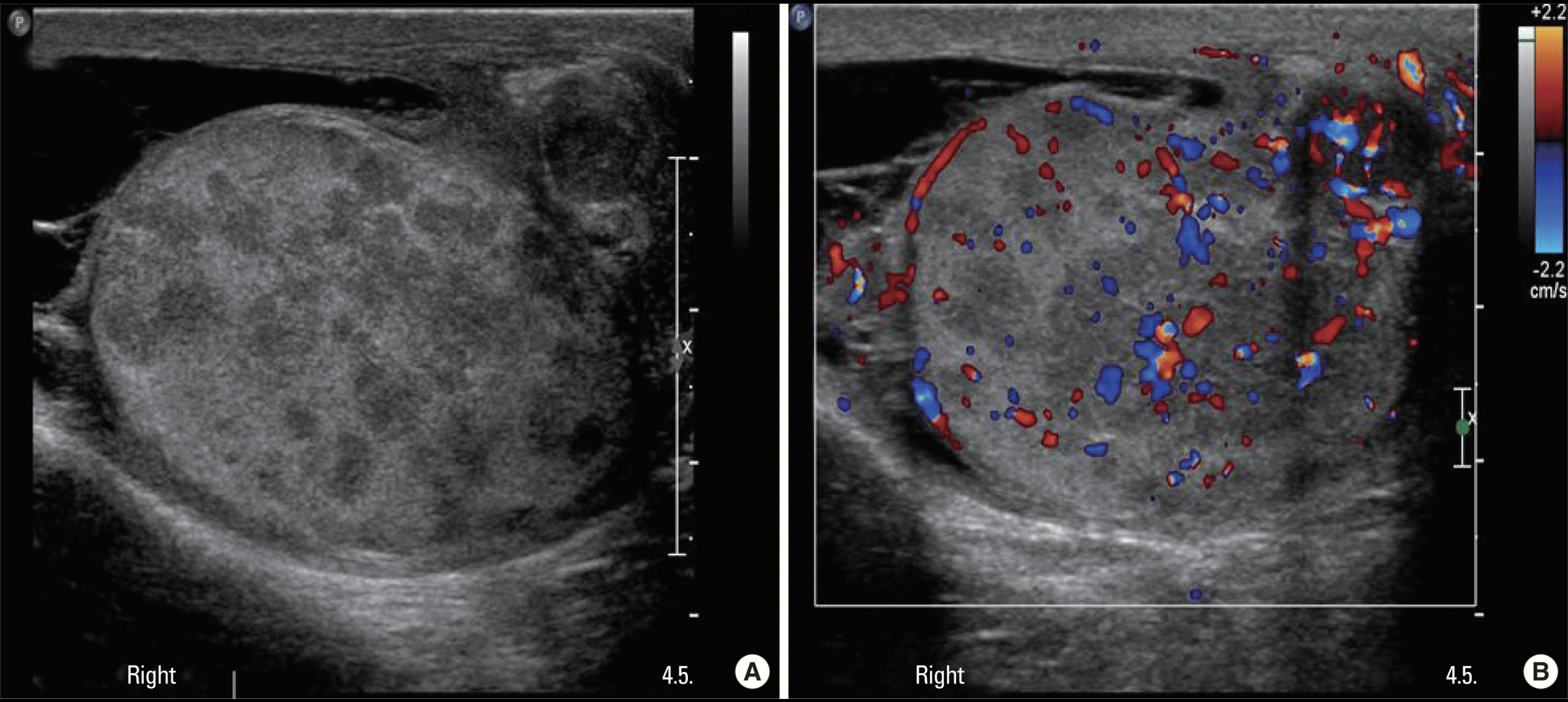
Genital Tuberculosis

- An important and underrecognized cause of infertility.
- 90% from hematogenous spread but can also spread from local extension.

ORGAN	FREQUENCY
Fallopian tubes	90-100%
Endometrium	50-60%
Ovaries	20-30%
Cervix	5-15%
Vulva and Vagina	1%

Schaefer G: Female genital tuberculosis. Clin Obstet Gynecol 19:23, 1976)

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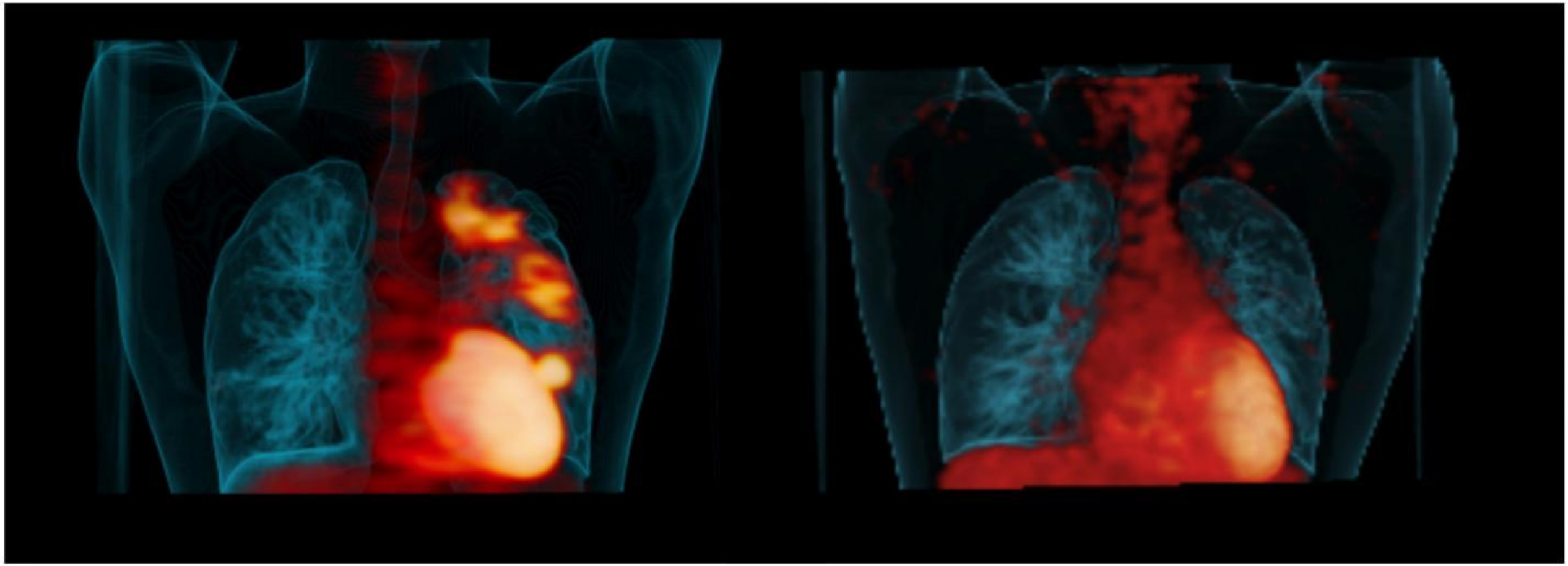
A Word About PET_CT…

- It happens.
- It may be useful in determining if activity is present in old lesions or after treatment.
- Who will pay for it?



Questions ?