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Chest Radiograph Interpretation in Tuberculosis

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Disclosures

None

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Goals

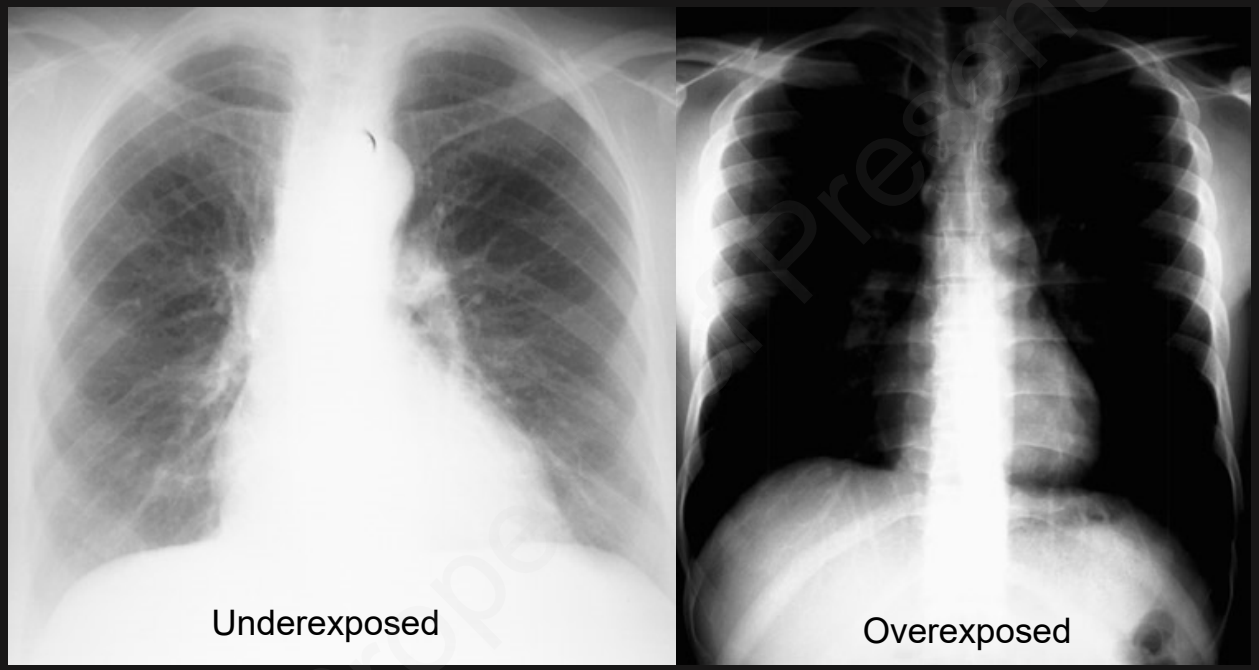
- Understand importance of adequate radiographic technique
- **Basics of CXR interpretation**
- Identify features of tuberculosis
  - Adults
  - Children
  - HIV
  - Healed/inactive
- Role of CT

Approach to chest radiograph

- Technical
  - Exposure
  - Inclusion
  - Rotation
  - Inspiration
- Initial "Gestalt"
- Systematic survey
  - Lungs/ribs - *Symmetry*
  - Mediastinum/heart
  - Soft tissues/abdomen
- Miss/ "Hidden" areas

Technical adequacy of chest X-ray

Exposure



Patient positioning (not rotated, etc)
Inclusion (entire lungs)
Inspiration

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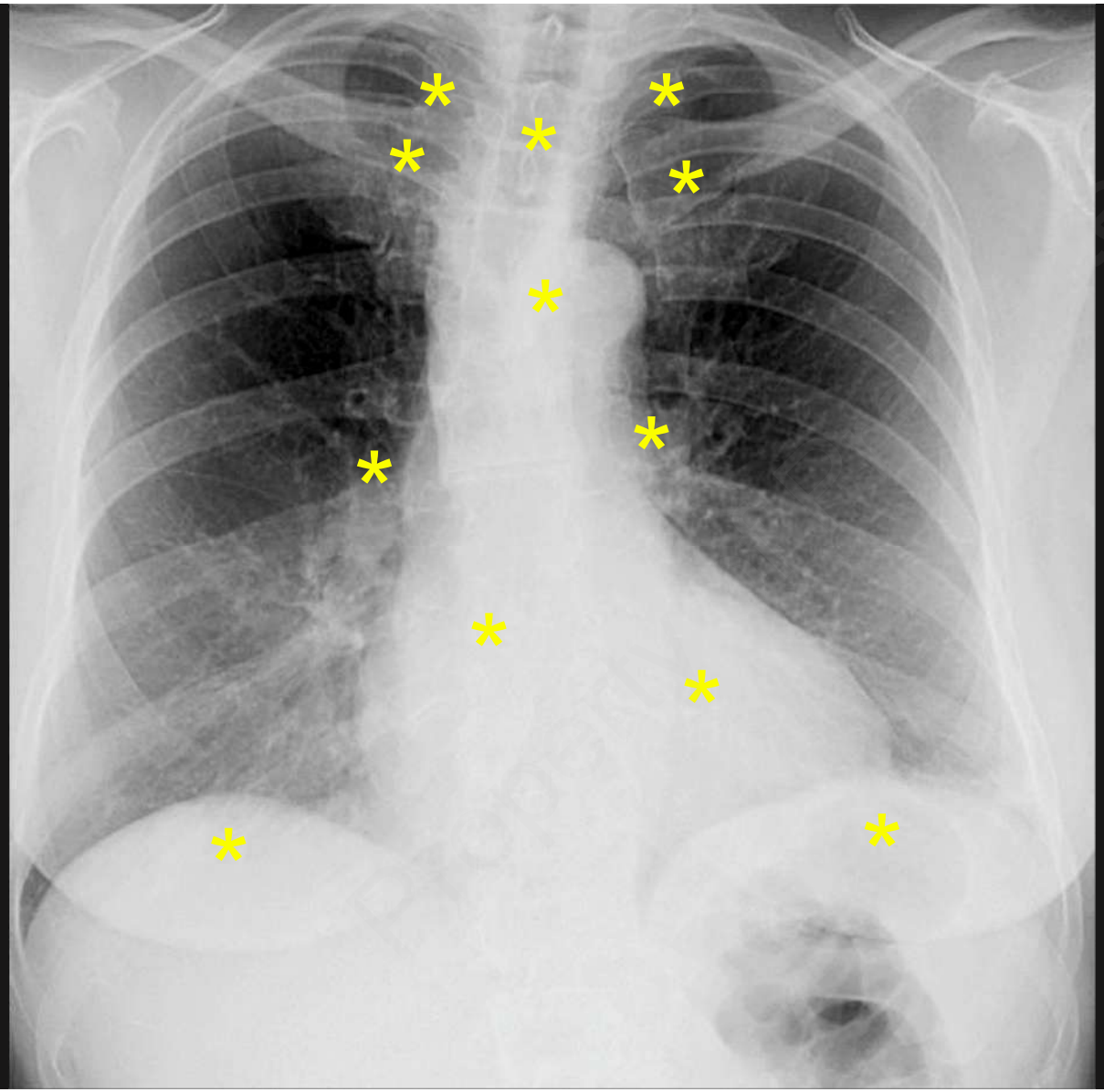
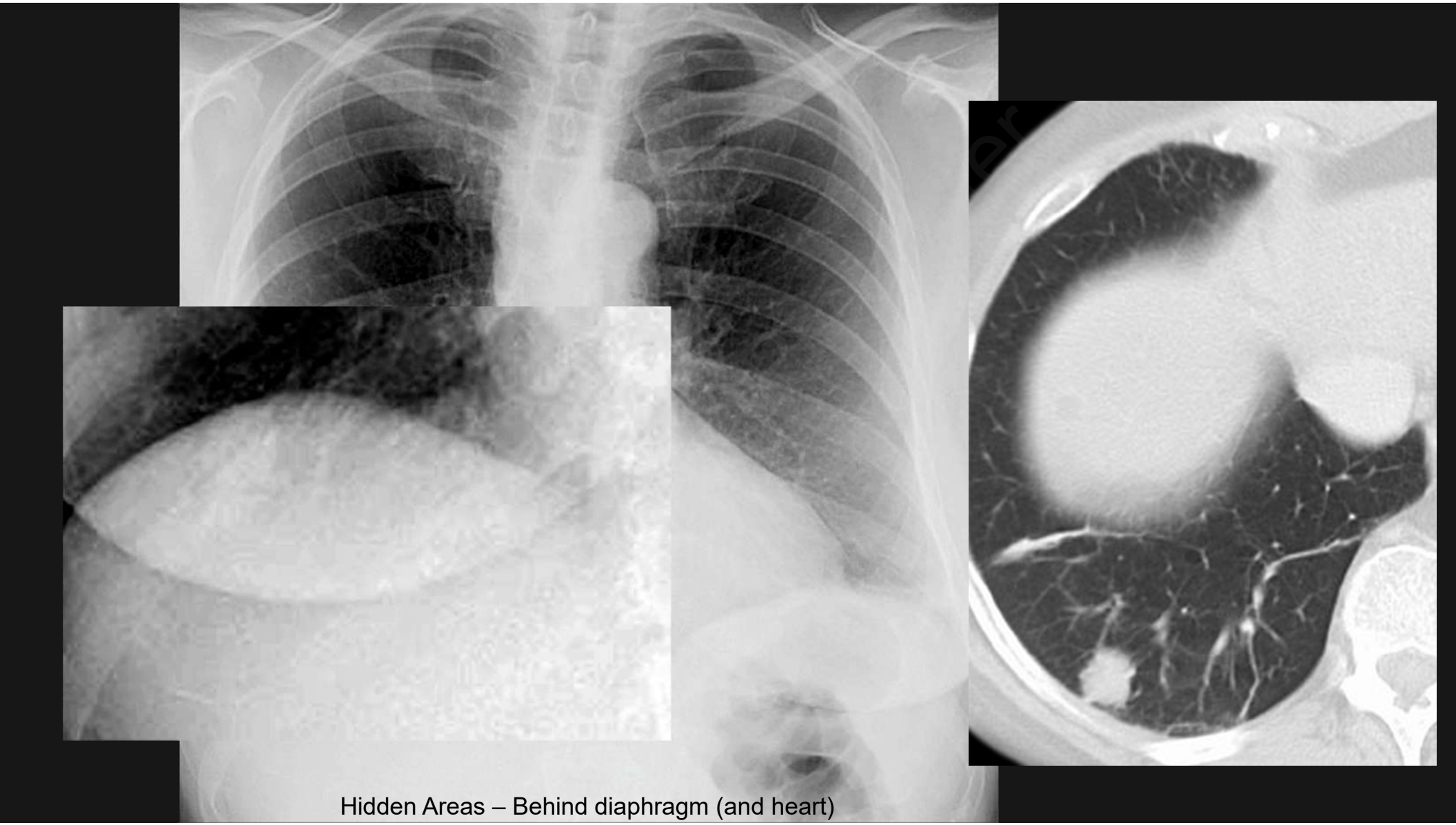
Quality of this Chest X-ray?



- <u>Miss/"Hidden" areas</u>
  - Apices
  - Hila/suprahilar
  - Trachea/bronchi
  - Retrocardiac
  - Retrodiaphragmatic

Hidden Areas – Apices



Hidden Areas – Behind diaphragm (and heart)

Outline

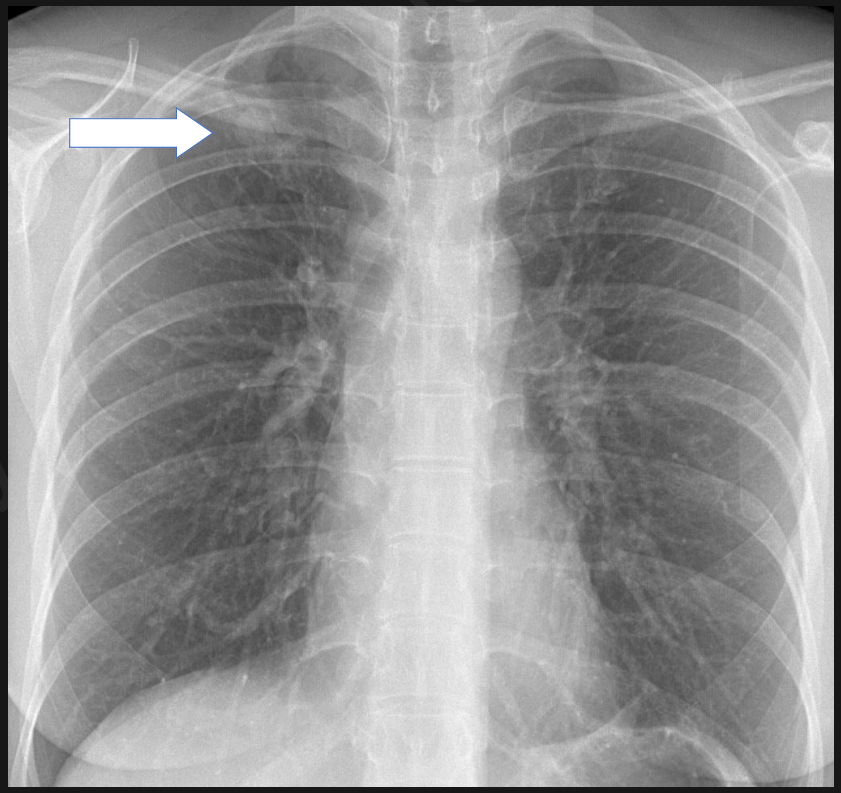
- Lung in TB
- Mediastinum
- Putting it Together – Typical and Atypical TB
  - Kids and HIV Pts.
- “Often Overlooked” – Pleura and Airways
- CT

Common **LUNG** X-ray findings in tuberculosis

- Opacity
  - Nodule
  - Nodular pattern
  - Consolidation
  - Atelectasis
  - Pleural effusion
- Lucency
  - Cavity
  - Bronchiectasis

Nodule

Rounded opacity, well or poorly defined, measuring up to 3 cm in diameter.



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Nodular pattern

Innumerable small rounded opacities that are discrete and range in diameter from 2 to 10 mm

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Miliary pattern

Profuse, discrete, rounded pulmonary opacities 2-3 mm in diameter generally uniform in size diffusely distributed throughout the lungs- sometimes lower lung predominant

Millet Seeds

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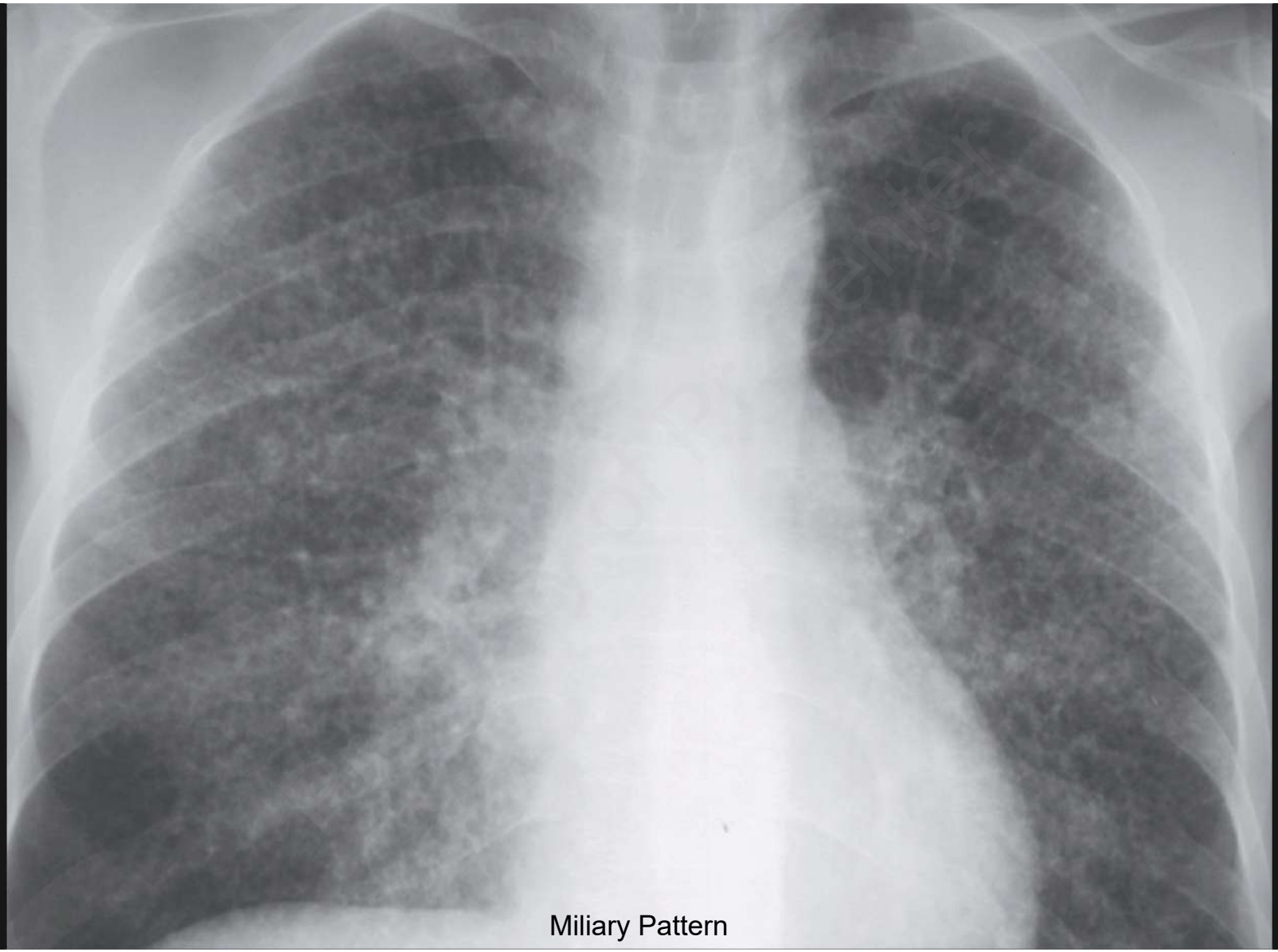
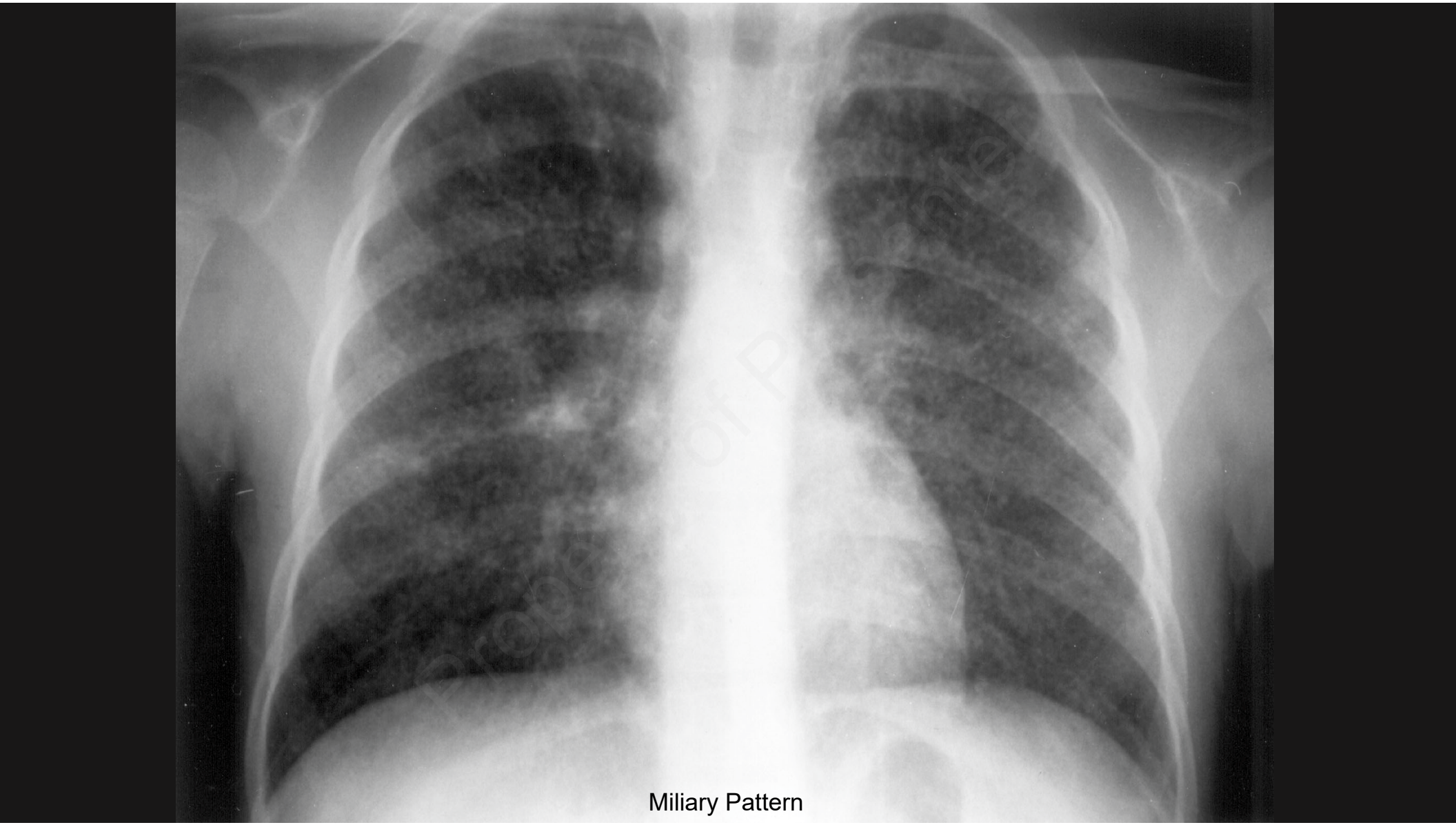


Miliary Pattern



Miliary Pattern

Miliary Pattern

Consolidation

Homogenous increase in lung opacity

Often poorly defined and confluent

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Atelectasis

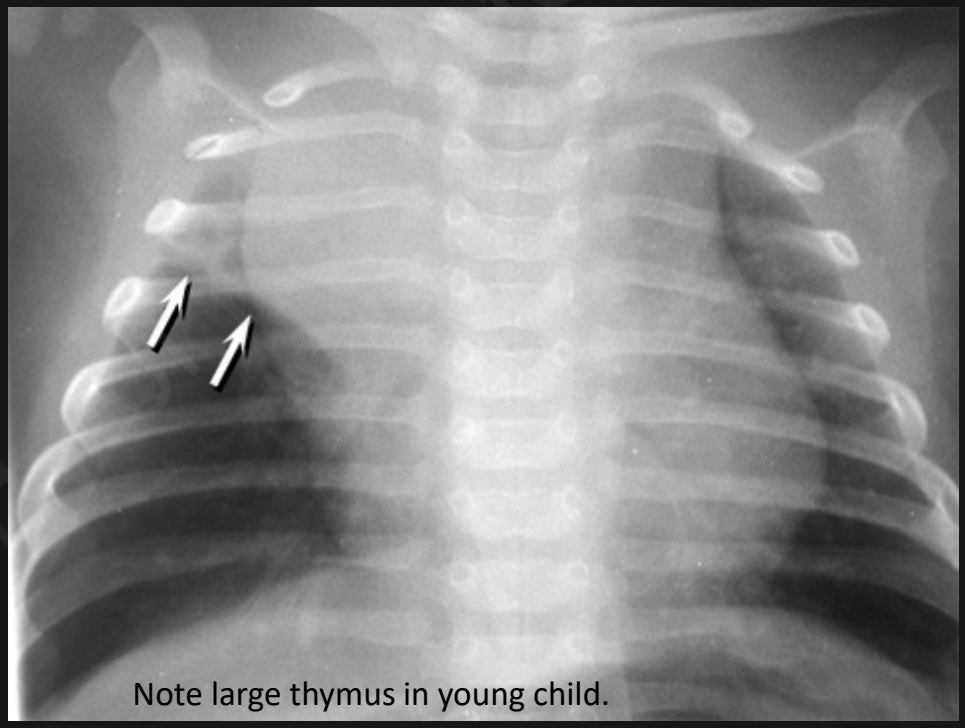
Reduced volume of a lobe or lung, with increased opacity

Displacement of mediastinum, hila, bronchi, or fissures

Not talking about mild atelectasis

2nd Signs helpful

Elevated Minor Fissure



Note large thymus in young child.

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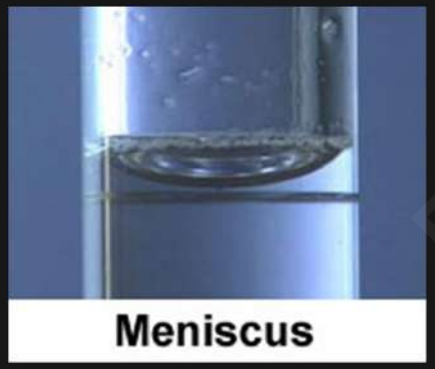
Pleural effusion

Fluid in the pleural space

On erect chest radiograph, characterized by blunting of costophrenic angle and meniscus sign



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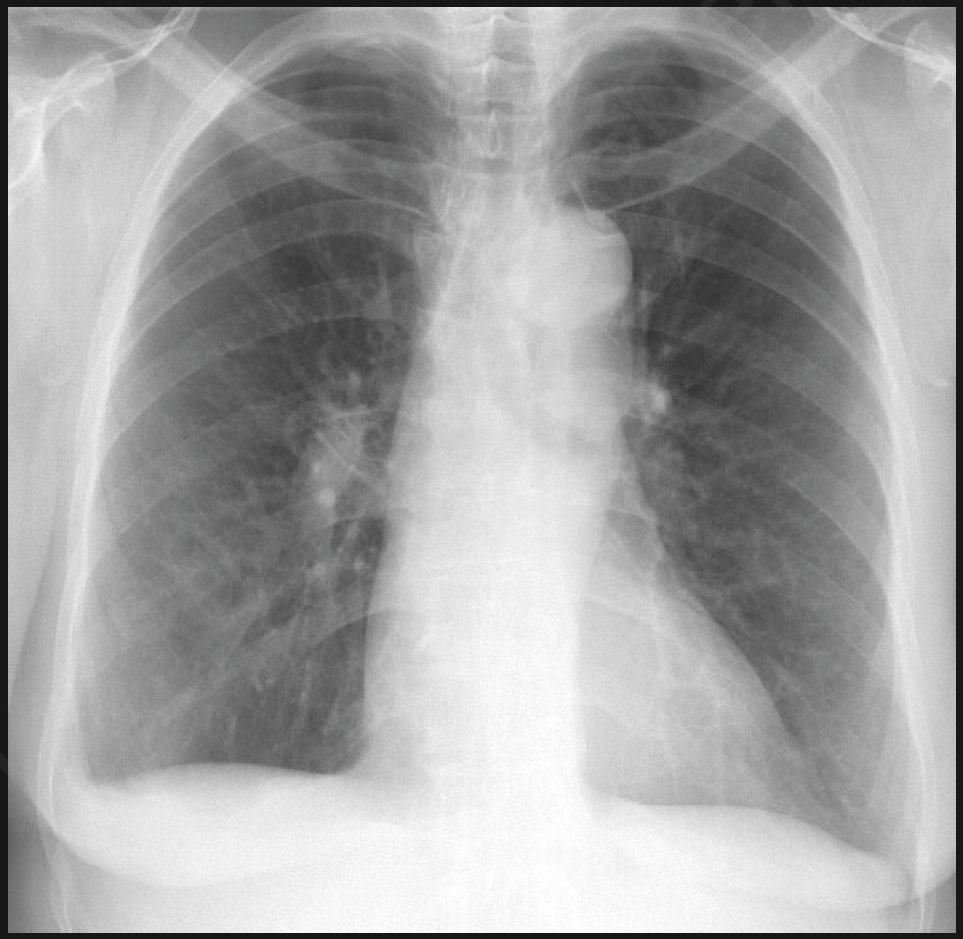
Pleural thickening (vs effusion)

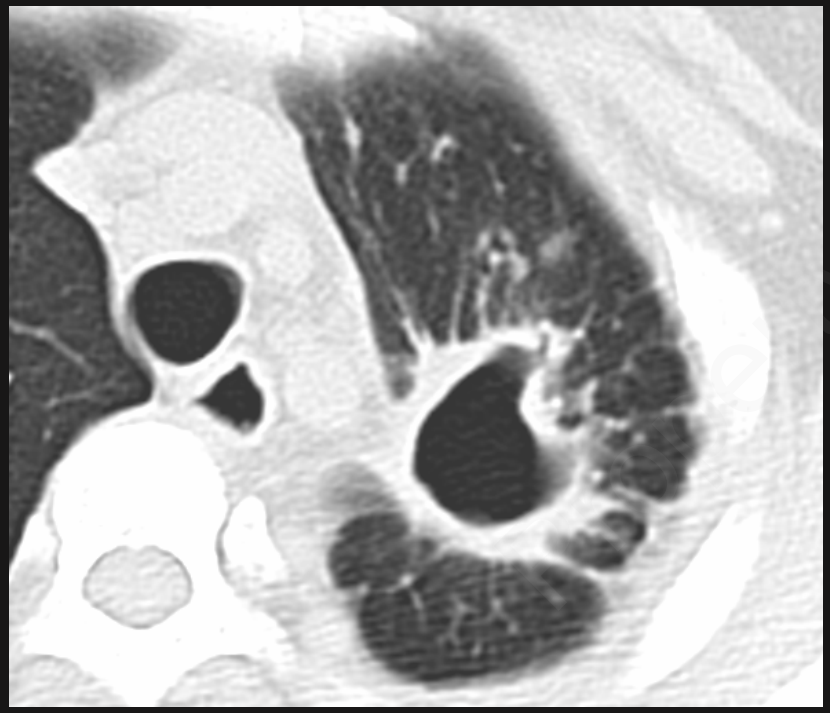
Blunted CP angle is not curved

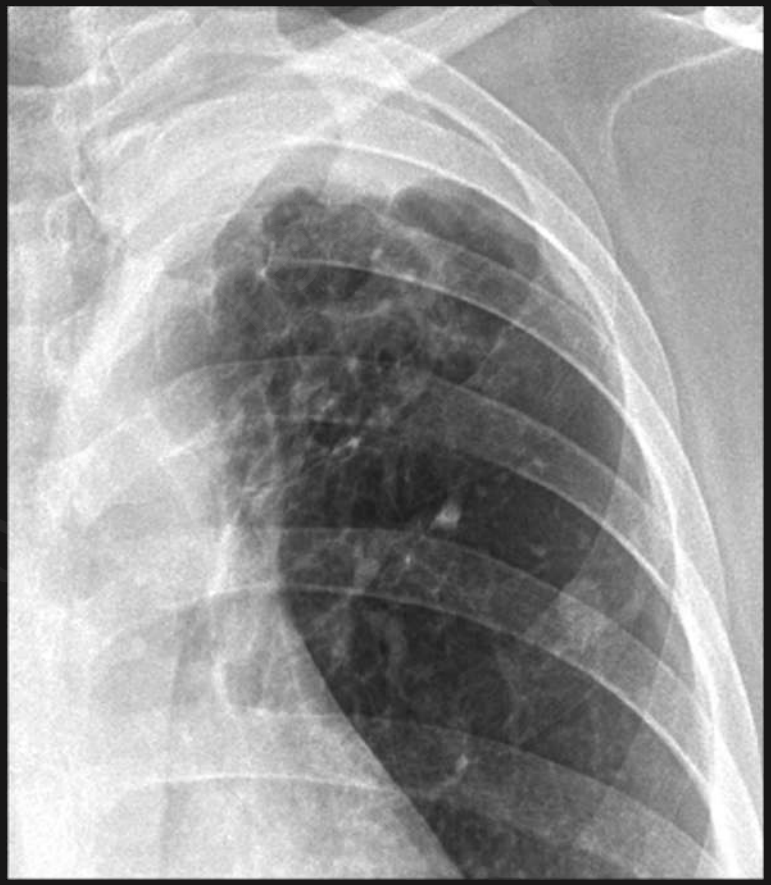
Thickening usually extends up the chest wall



Cavity

Gas-filled space within consolidation, mass, or nodule





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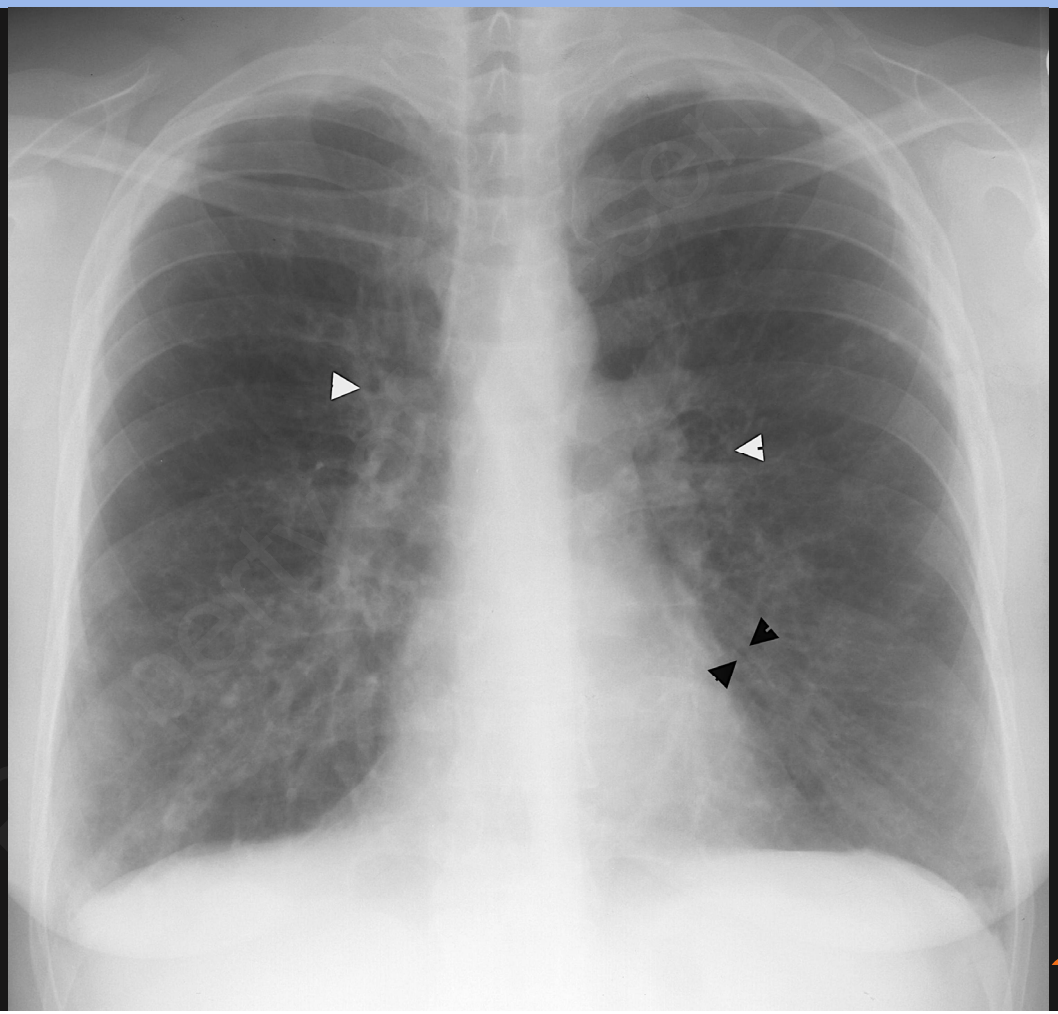
Bronchiectasis

Ring shadows

Train tracks



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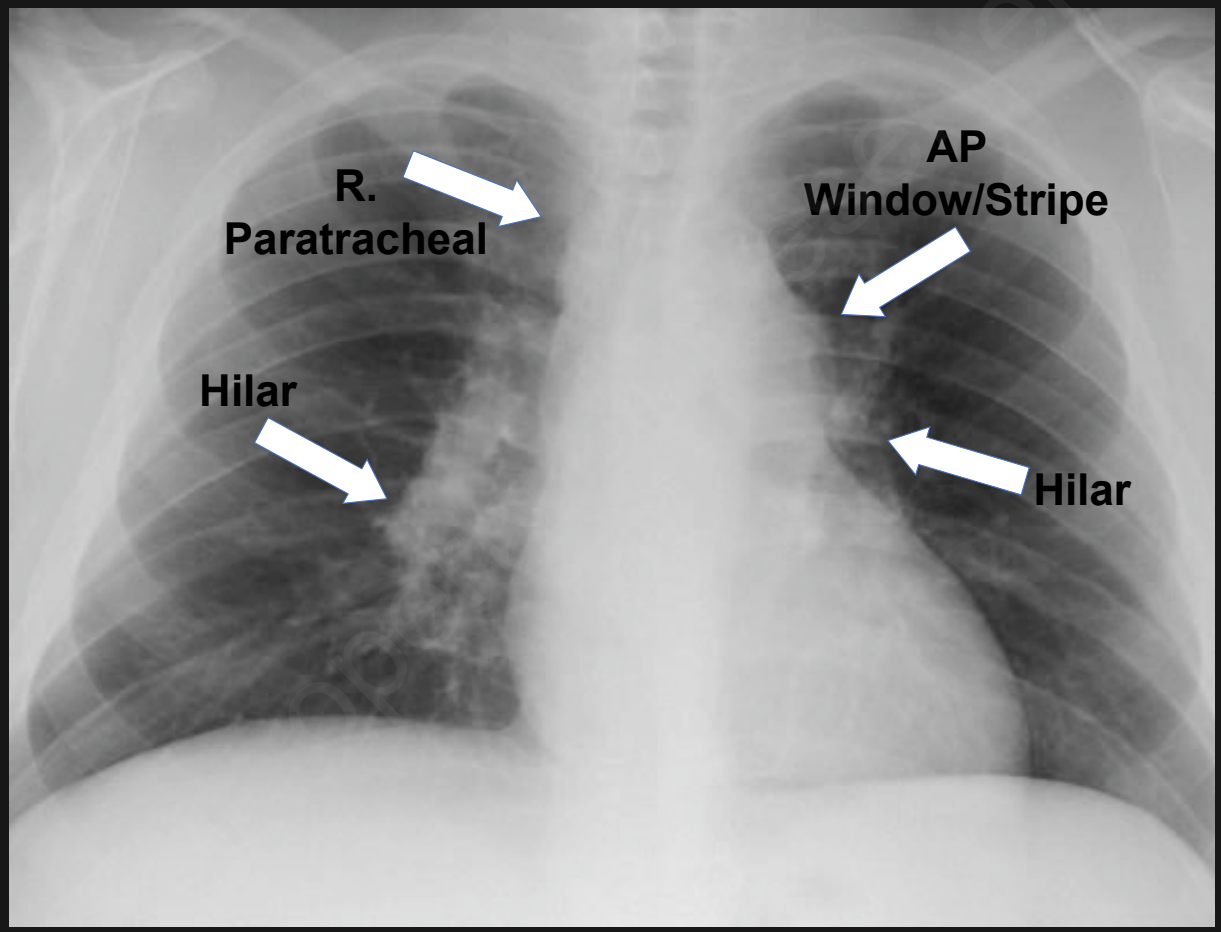
Adenopathy

Challenging to see on X-ray unless bulky

Luckily TB adenitis tends to be conspicuous
(**AND often important clue of TB**)

Hilar>Mediastinal

Mediastinal Adenopathy



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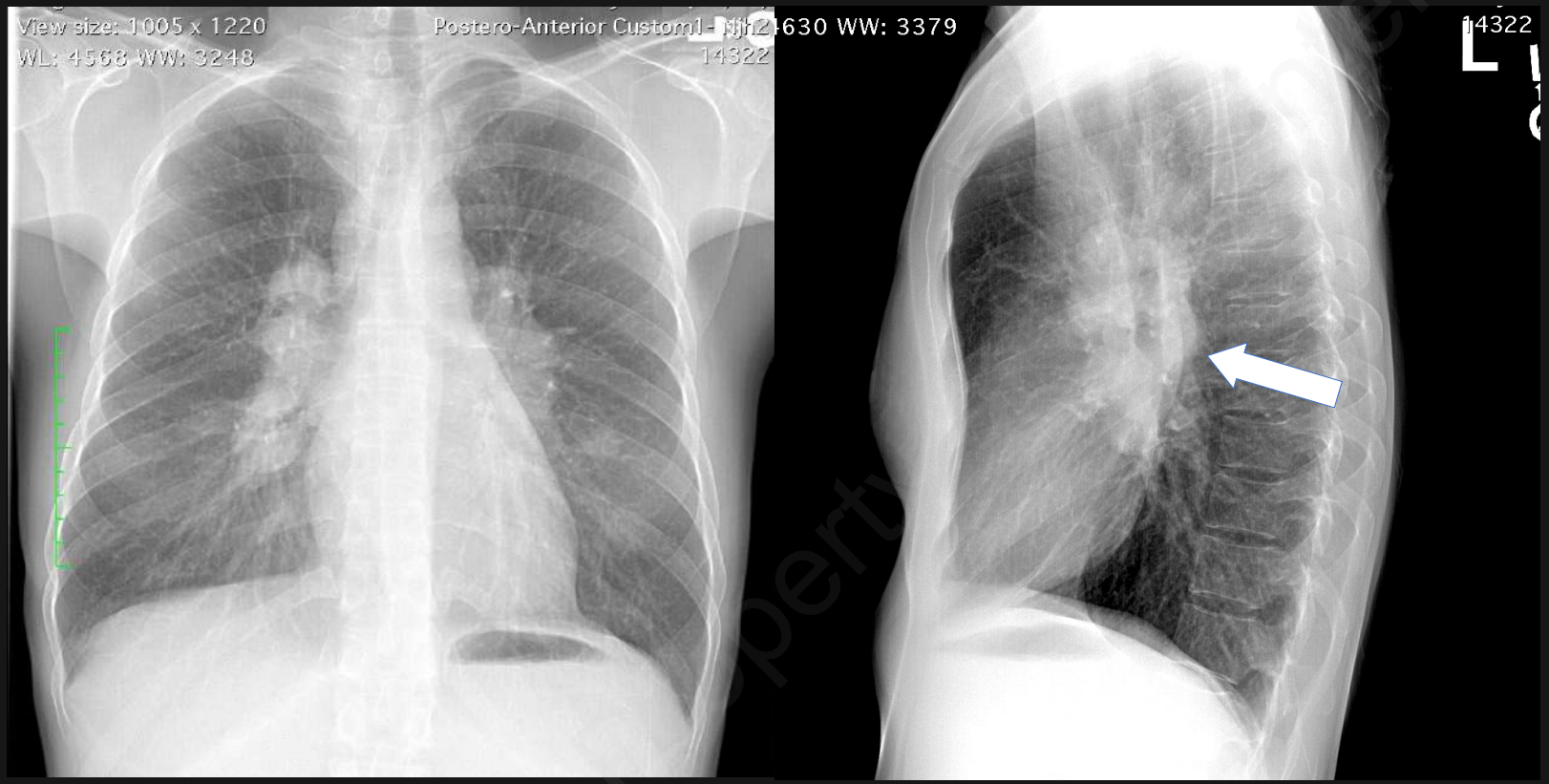
Hilar Adenopathy



Vs. Normal
Lateral Hilum

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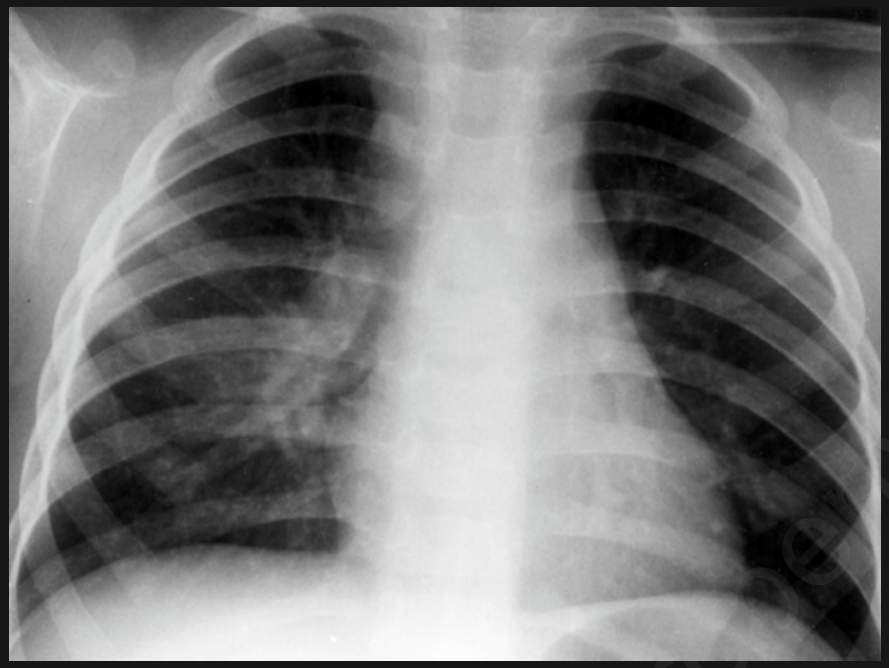
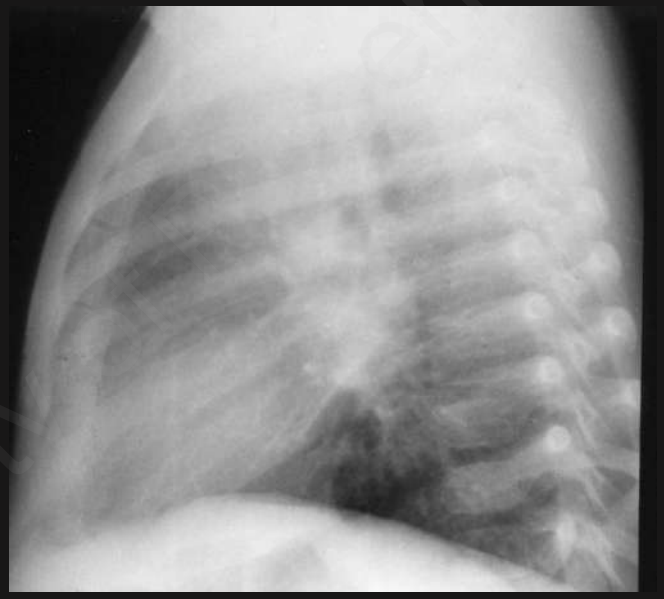
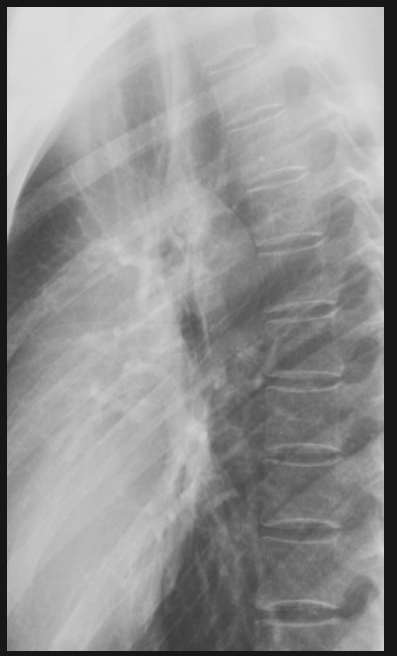
Hilar Adenopathy







Vs. Normal
Lateral Hilum

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AP “Window”

Left lung between aortic arch and the left PA

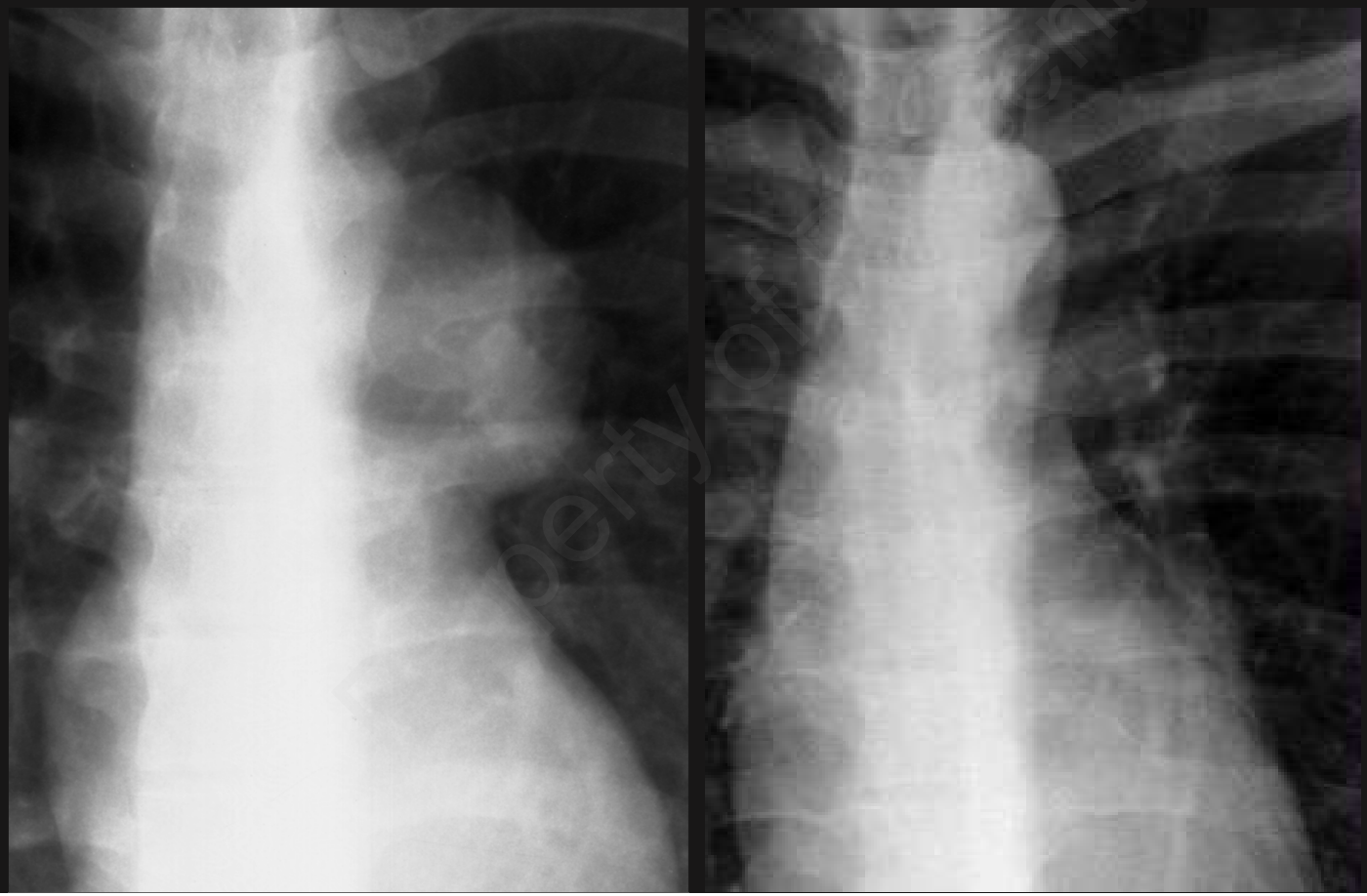
Almost always seen

Usually concave or straight

Abnormal convexity
- Lymph nodes
- Mediastinal mass
- Vascular abnormality

AP “Window” Adenopathy

Abnormal AP Window vs. Normal AP Window



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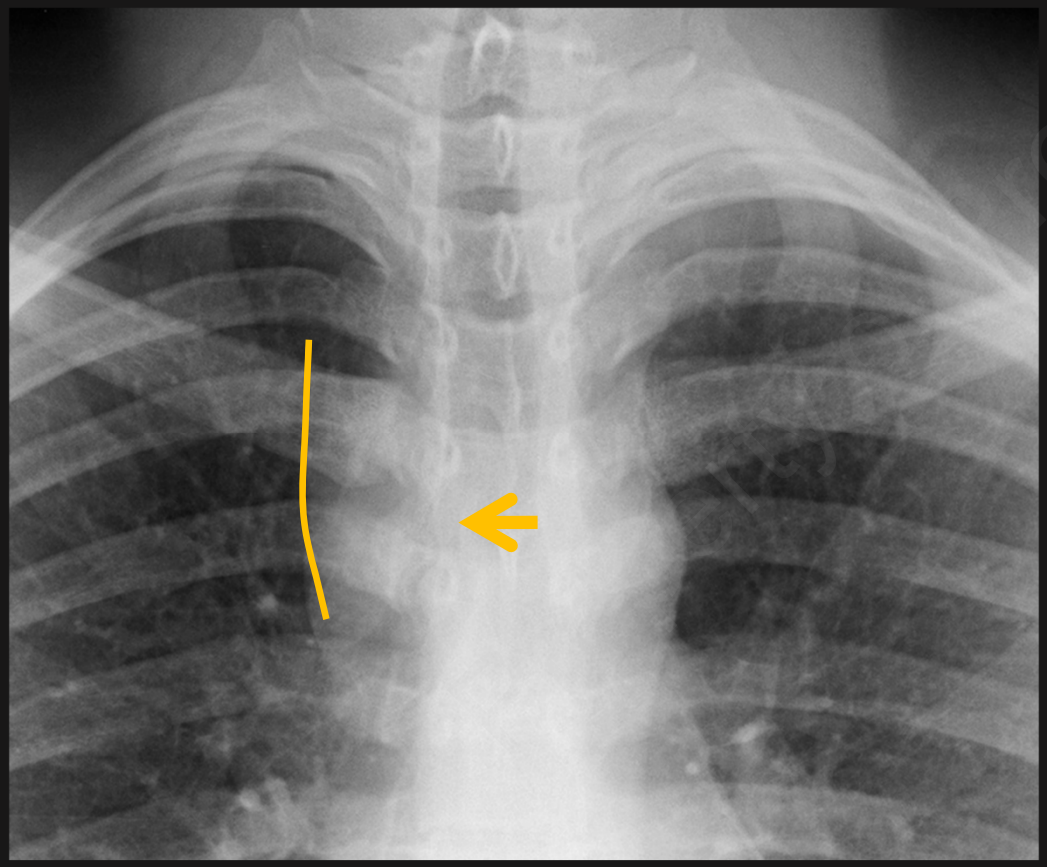
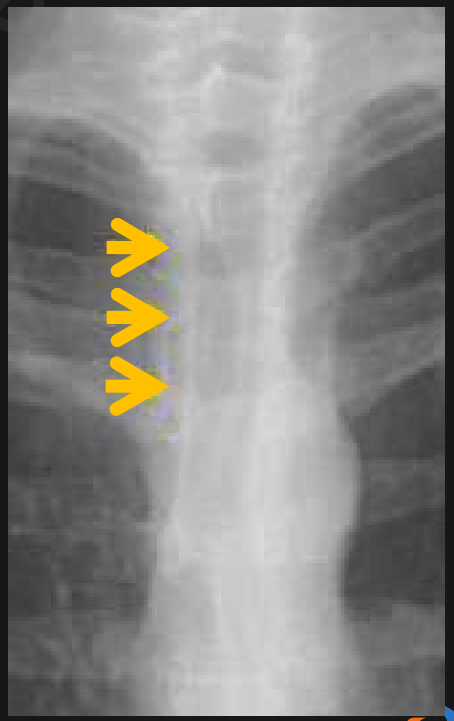
Right Paratracheal Adenopathy

Adenopathy vs. Normal R. Paratracheal Stripe





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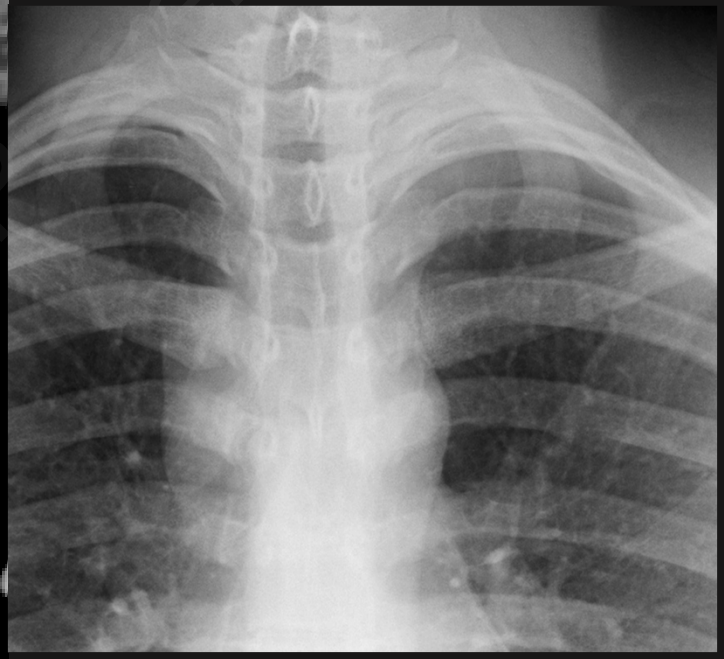
Right Paratracheal Adenopathy



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Primary vs Post-primary Tuberculosis

In adults, there is no significant difference in radiographic features between recently and remotely acquired TB.

Therefore, “post-primary” and “primary” terms inaccurate

Better to use terms “typical” and “atypical”

Rozenshtein A, et al. AJR. 2015 May 204:974-978
Geng E, et al. JAMA. 2005 Jun 8;293(22):2740-5.
Jones BE, et al. AJRCCM. 1997 Oct;156(4 Pt 1):1270-3.

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Typical tuberculosis

- *Upper lobe* “infiltrate”
- *Upper lobe* cavities

Geng E et al. JAMA. 2005 Jun 8;293(22):2740-5.

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Typical tuberculosis

- Apical/Posterior Segments Upper Lobe - & Superior Segment Lower Lobes

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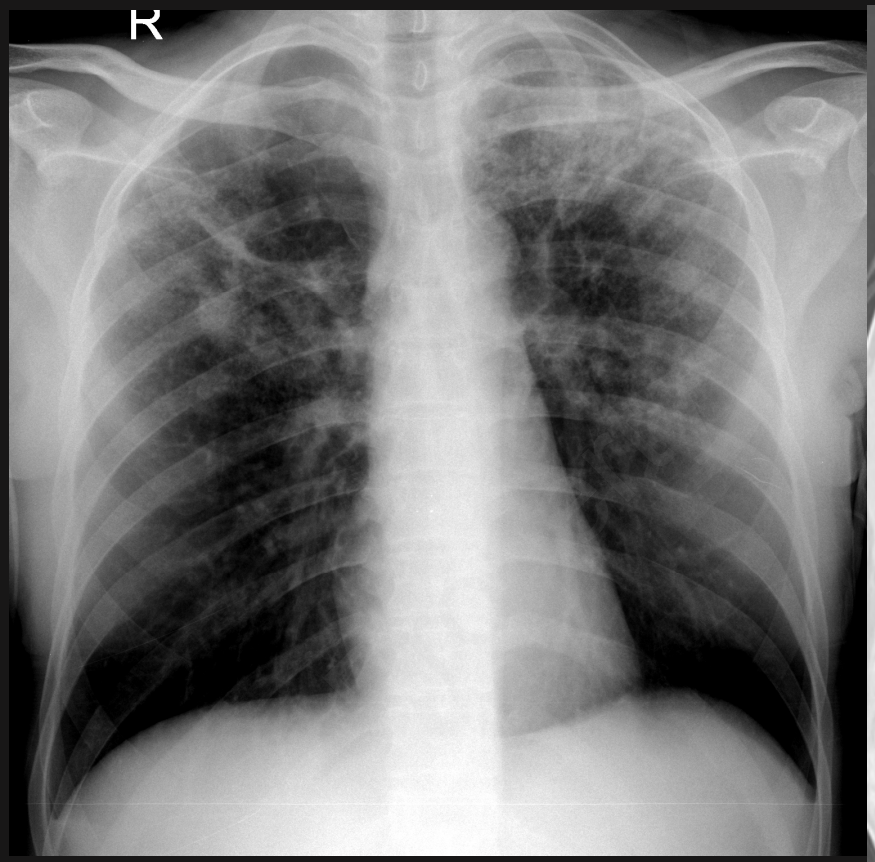
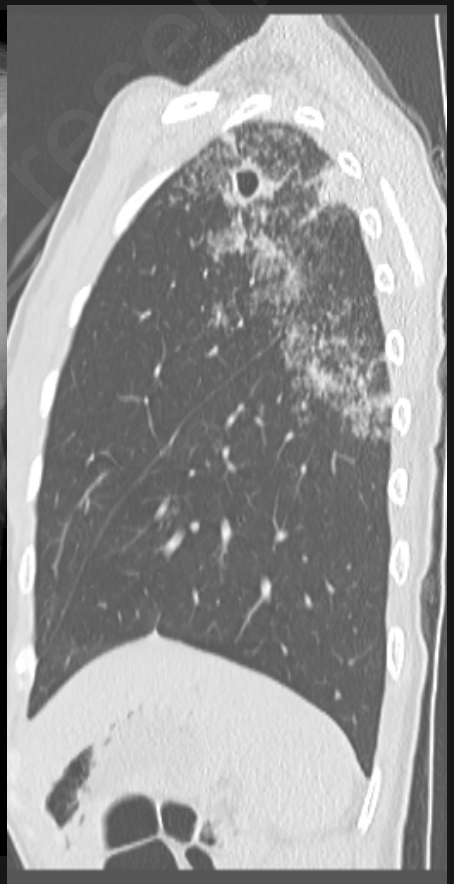
Typical tuberculosis

- Apical/Posterior Segments Upper Lobe - & Superior Segment Lower Lobes





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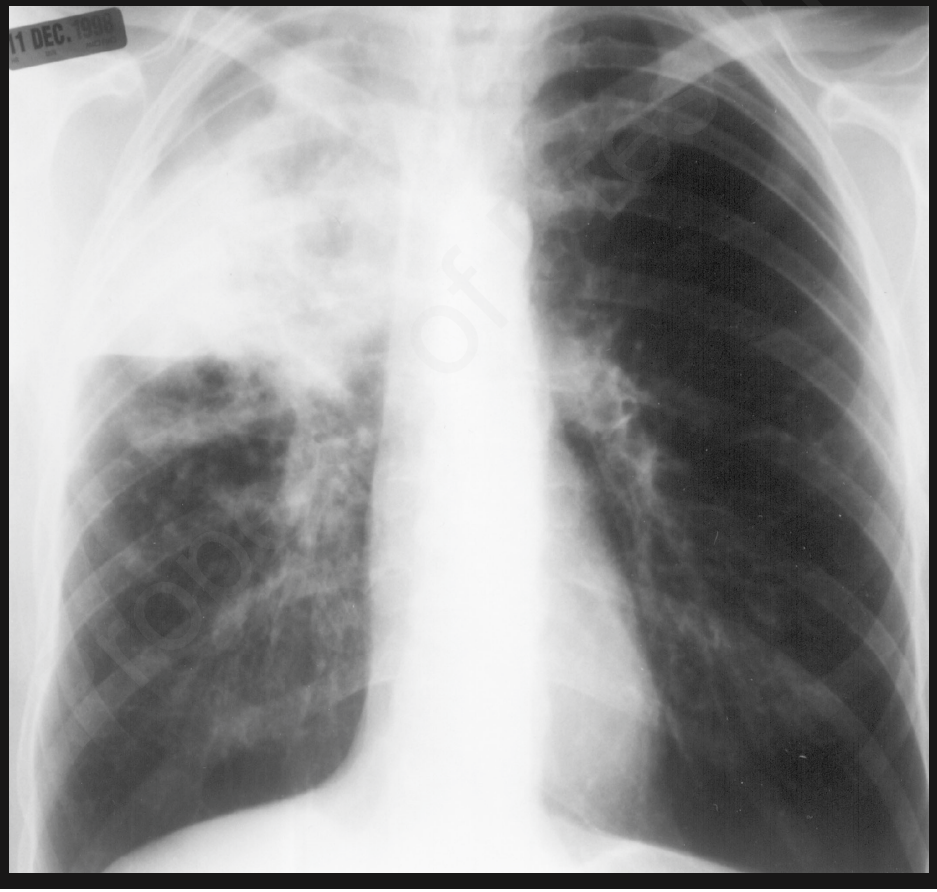
Typical tuberculosis

- Consolidation with Cavitation



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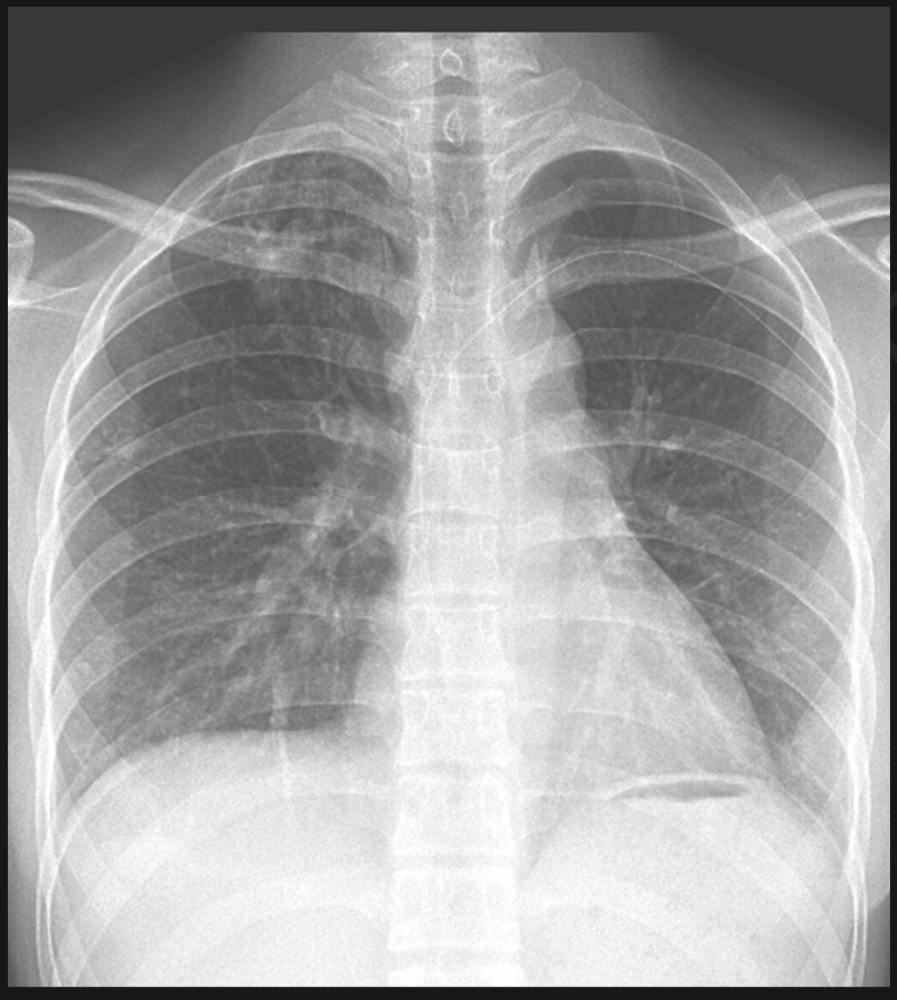
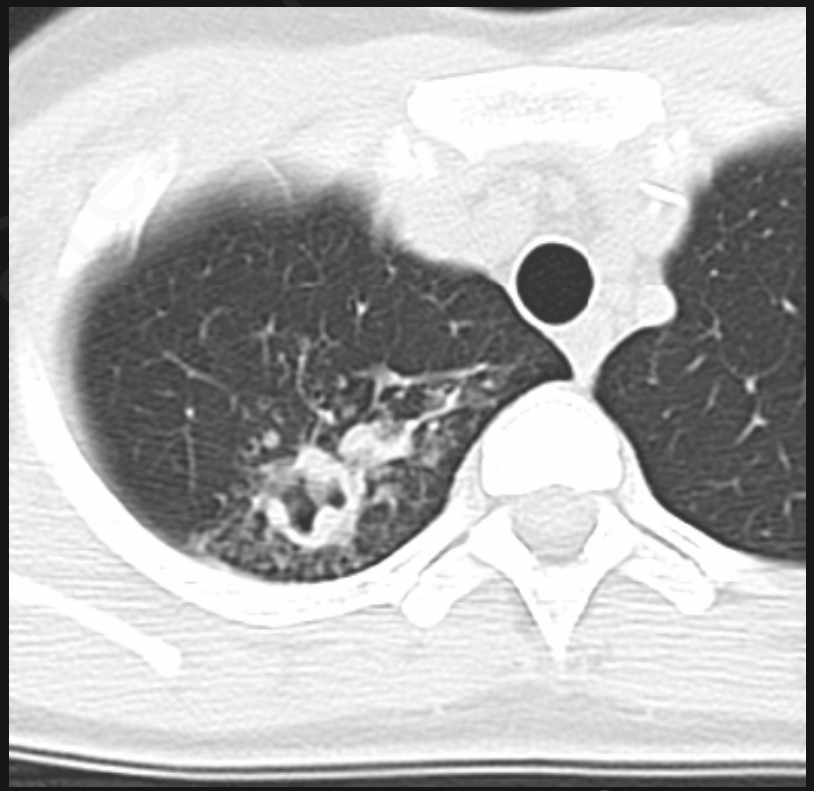
Typical tuberculosis





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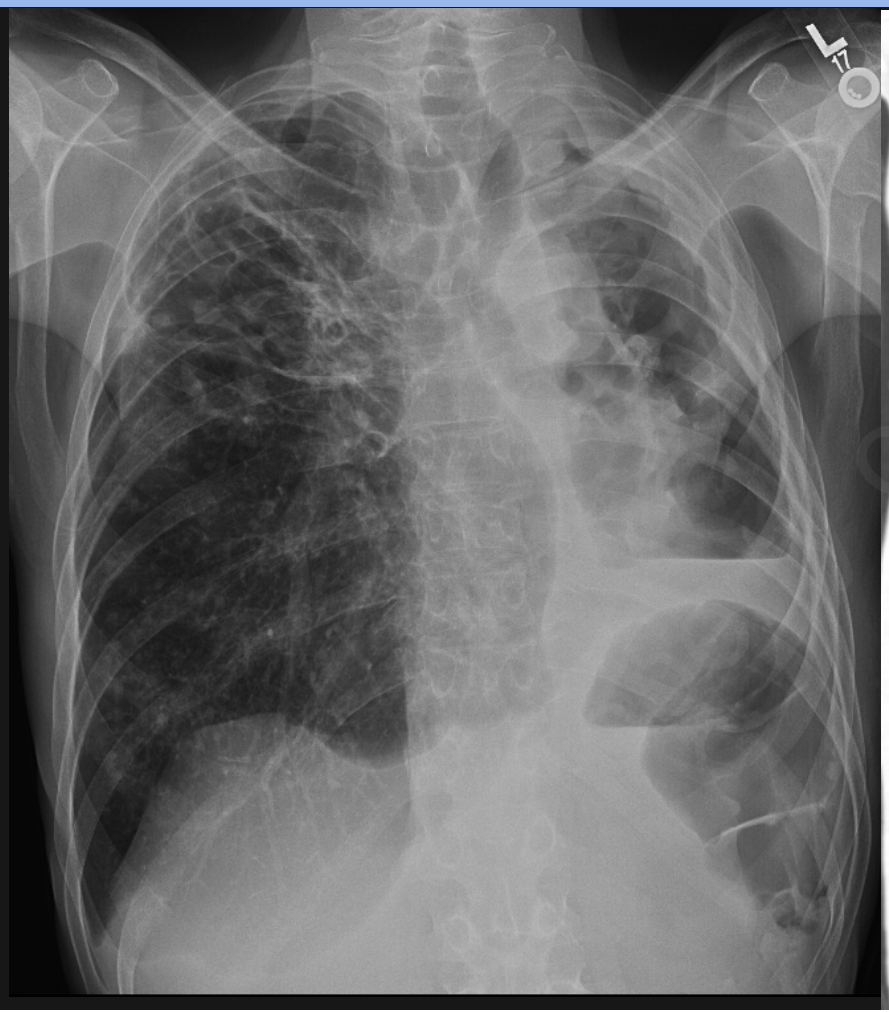
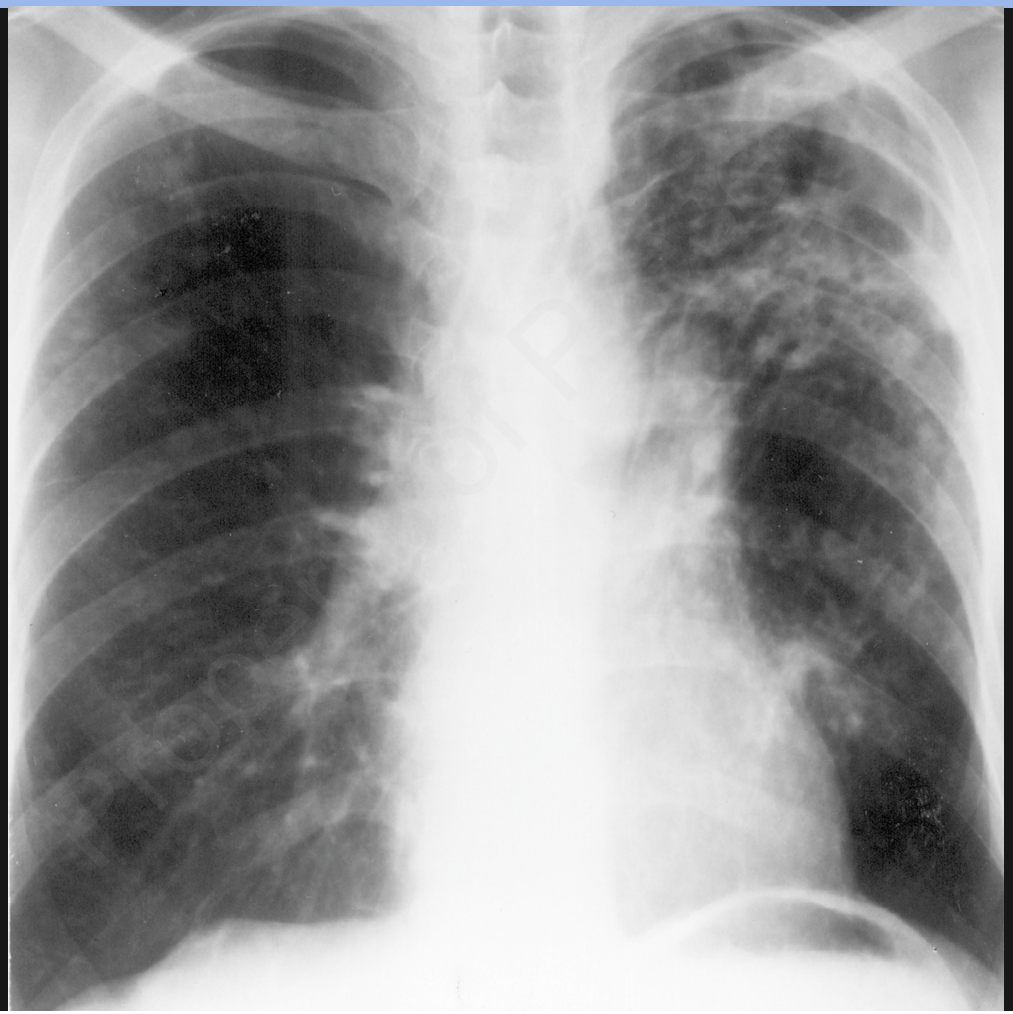
Typical tuberculosis



Typical Tuberculosis - Endobronchial spread



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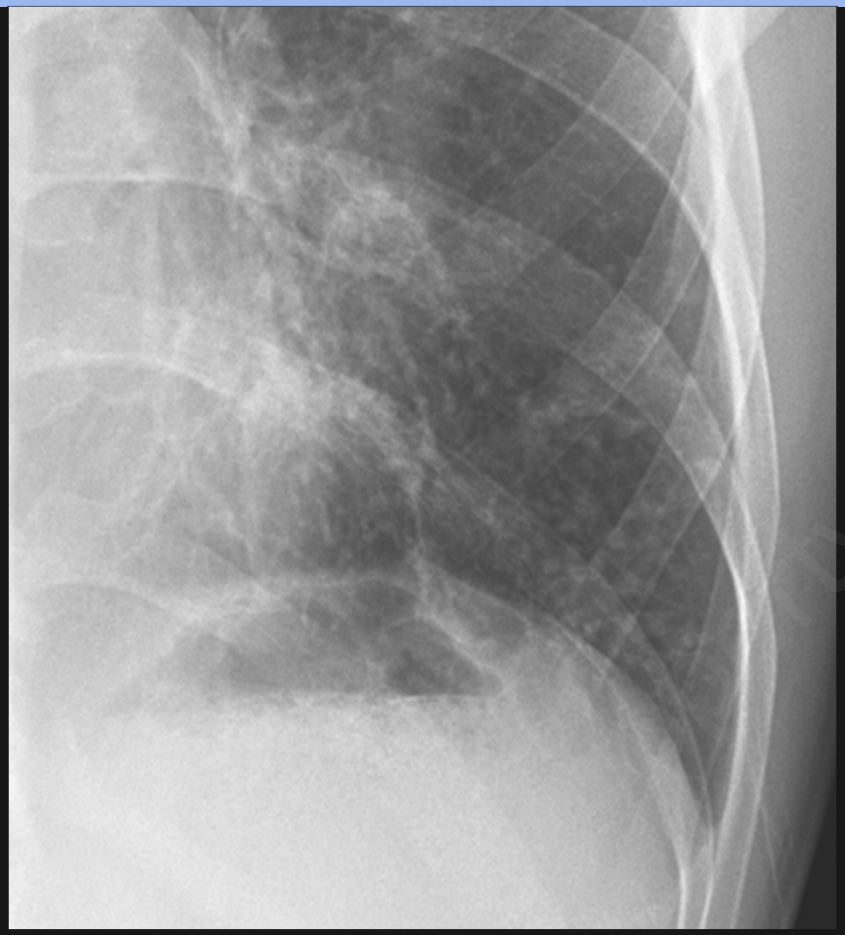
Typical Tuberculosis - Endobronchial spread



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Atypical tuberculosis

- *"Atypical" is more common in children & HIV*

- Lower or mid-lung opacity
- Lymphadenopathy *Only*

- Effusions, without cavity or upper lung opacity
  - In kids, simple effusions more common with older age, as "hypersensitivity reaction" to TB.

Geng E et al. JAMA. 2005 Jun 8;293(22):2740-5.

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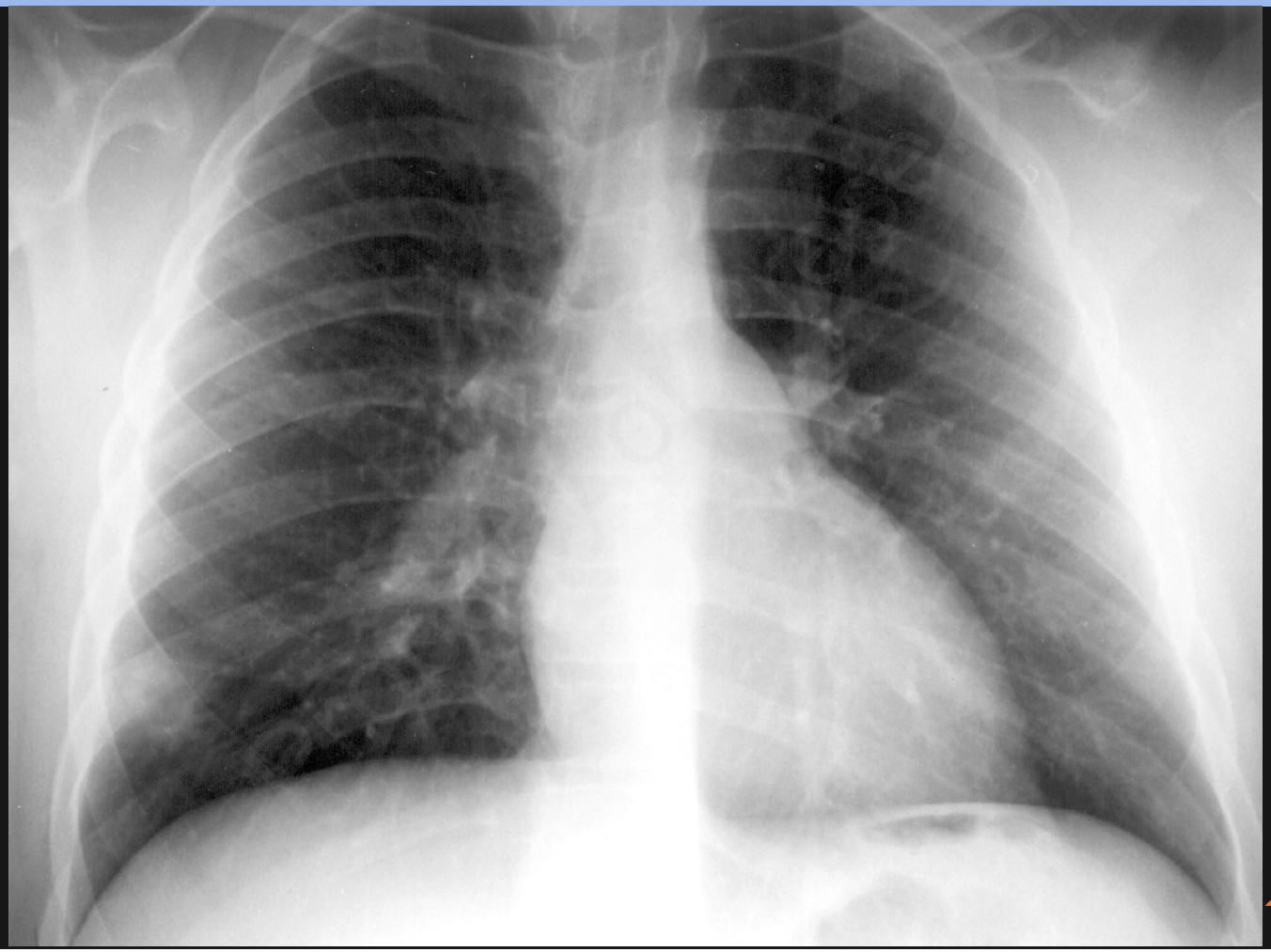
Atypical Tuberculosis- RLL cavity/hilar adenopathy



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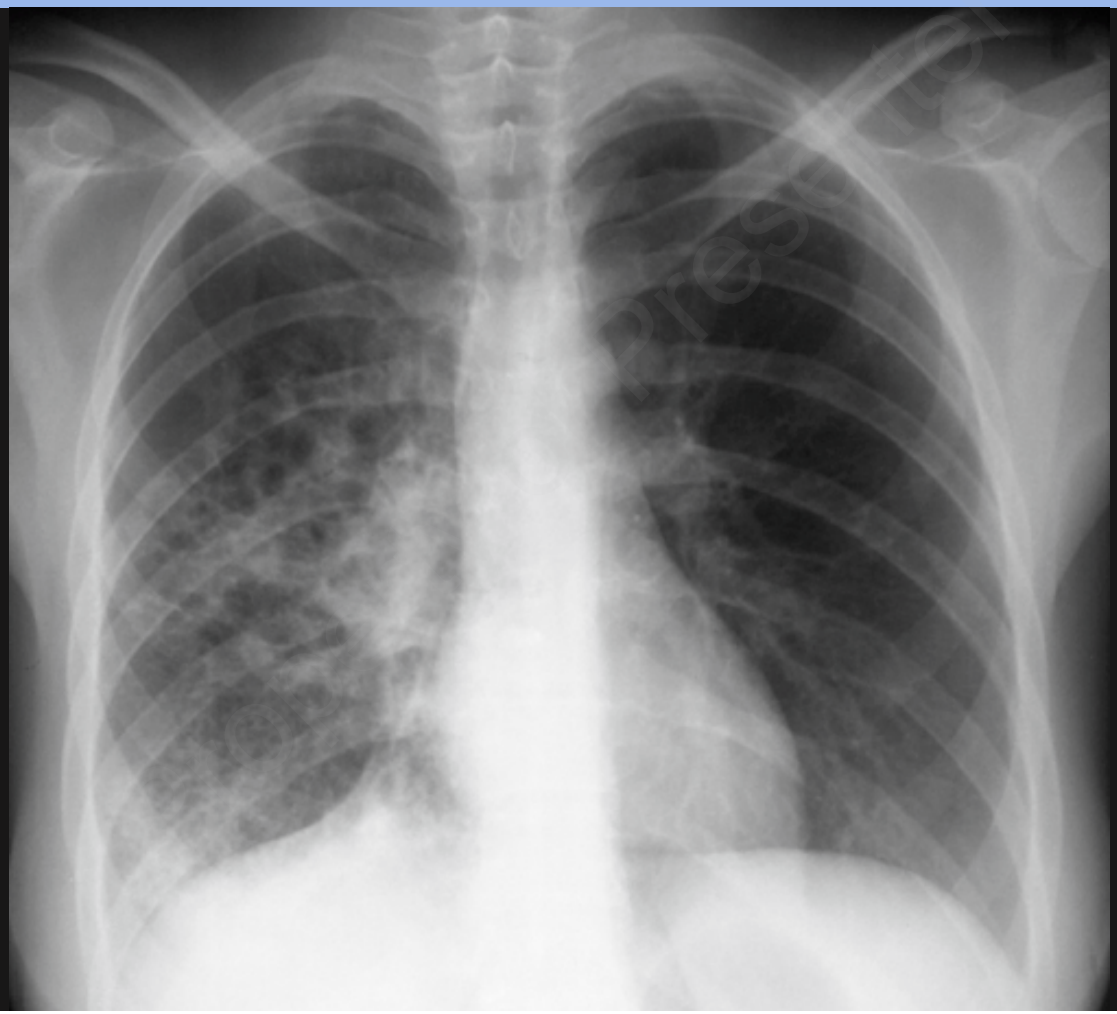
Atypical Tuberculosis



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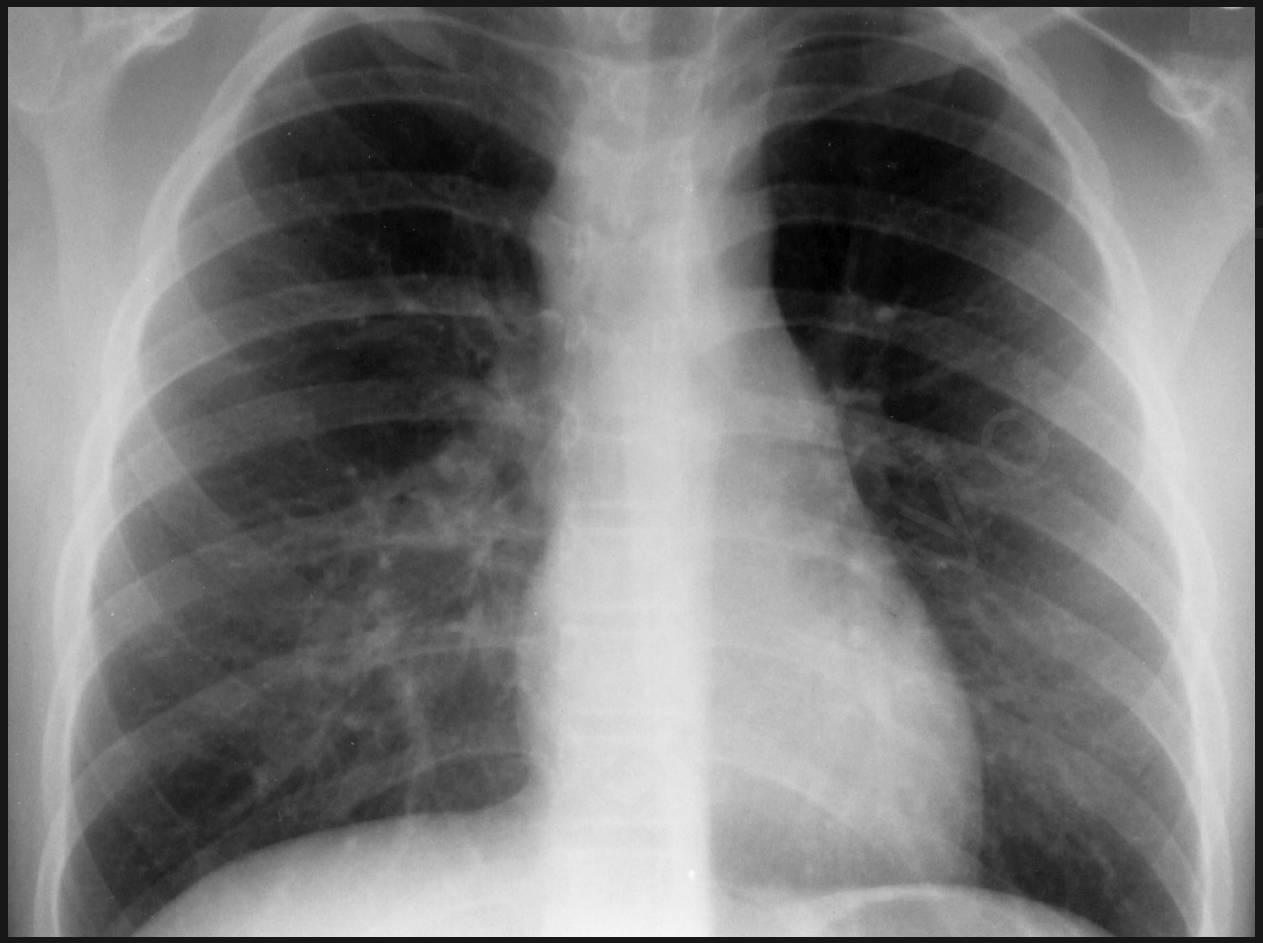
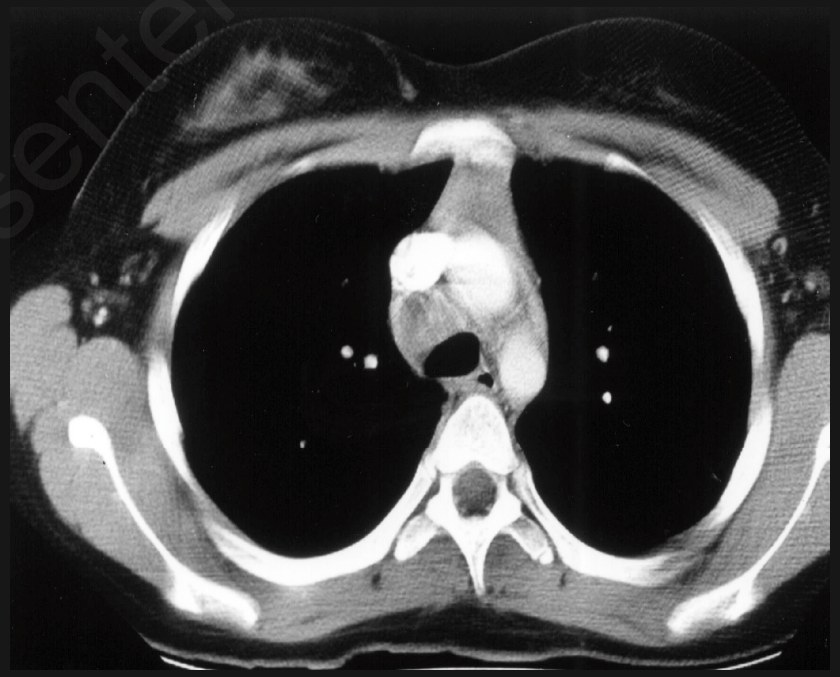
Atypical TB- Hilar/Mediastinal Lymphadenopathy





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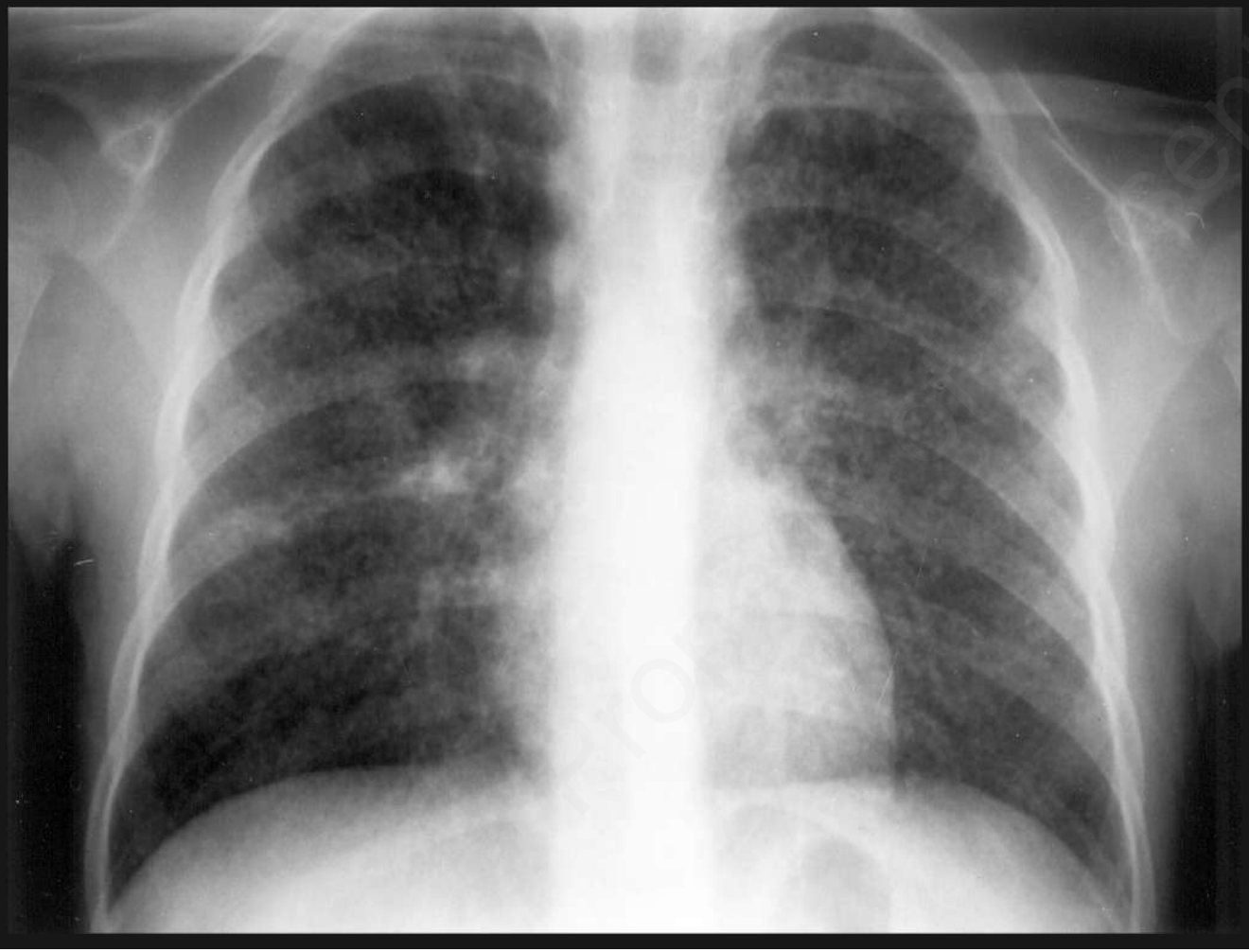
Atypical Tuberculosis - Miliary Pattern



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Childhood Tuberculosis - Lymphadenopathy

Finding		
Any adenopathy	175	92%
Right hilar	83	43%
With mediastinal nodes	43	23%
Left hilar	37	19%
With mediastinal nodes	16	8%
Bilateral hilar	49	26%
With mediastinal nodes	44	23%
Mediastinal only	6	3%

(n=191)

Leung AN. Radiology. 1992 Jan;182(1):87-91.

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Parenchymal abnormality in childhood TB

Finding		
Parenchymal abnormality with adenopathy	130	68%
Parenchymal abnormality without adenopathy	2	1%
Right lung consolidation	78	41%
Left lung consolidation	21	11%
Bilateral consolidation	33	17%
Lobar atelectasis	16	8%
Effusion	11	6%
Normal CXR	14	7%

Leung AN. Radiology. 1992 Jan;182(1):87-91.

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“Primary” tuberculosis in childhood: Pearls

- Parenchymal abnormality is more common in children older than 3 years
- Adolescents with recent infection usually have typical features of tuberculosis with upper lobe nodules or cavity

- *Leung AN, et al. Radiology. 1992 Jan;182(1):87-91.*
- *Koh WJ, et al. Korean J Radiol. 2010 Nov-Dec;11(6):612-7.*

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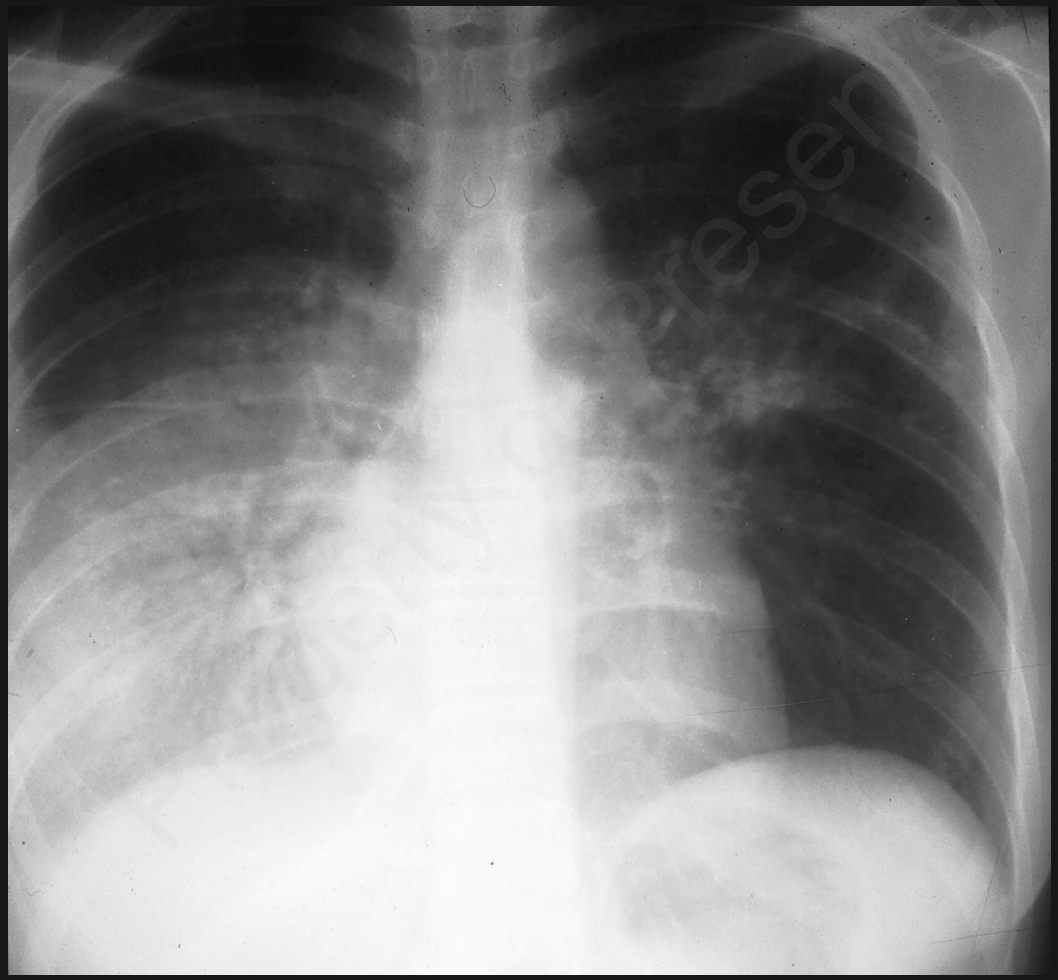
Childhood TB - Mid/lower lung Consolidation



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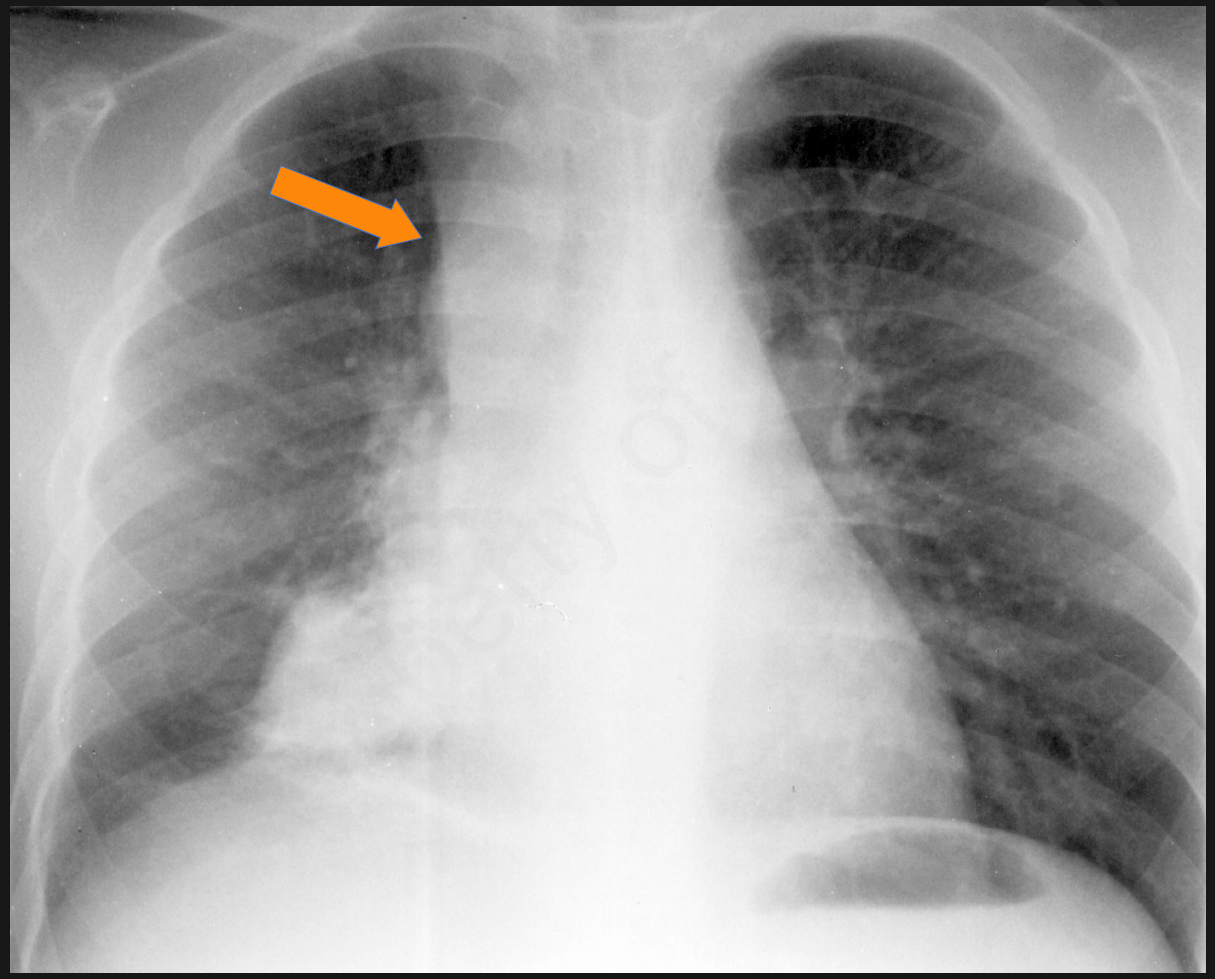
Childhood TB - Hilar/Mediast. Lymphadenopathy



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Chest Radiograph - TB and HIV

- Chest radiograph often looks like "atypical" ("primary") disease – in more advanced TB
- Adenopathy is common and highly predictive of tuberculosis
- *Radiograph may be normal in up to 10% of cases*

Geng E et al. JAMA. 2005 Jun 8;293(22):2740-5.

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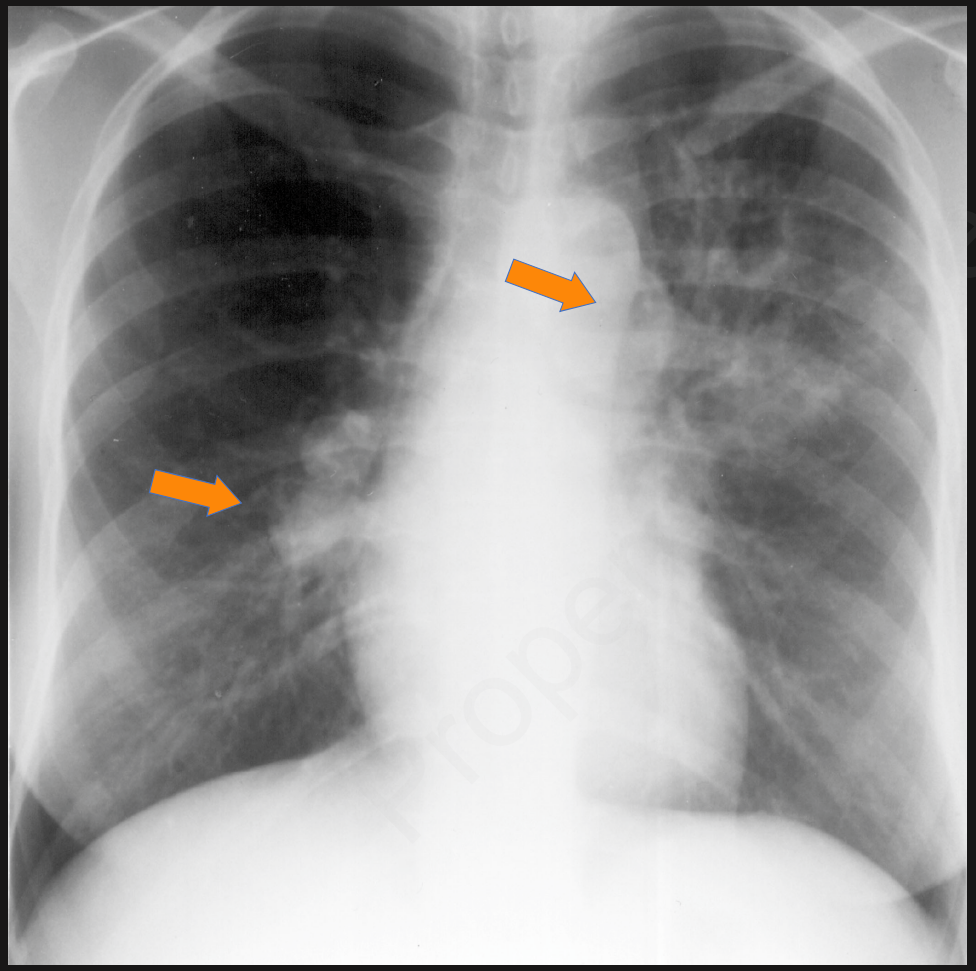
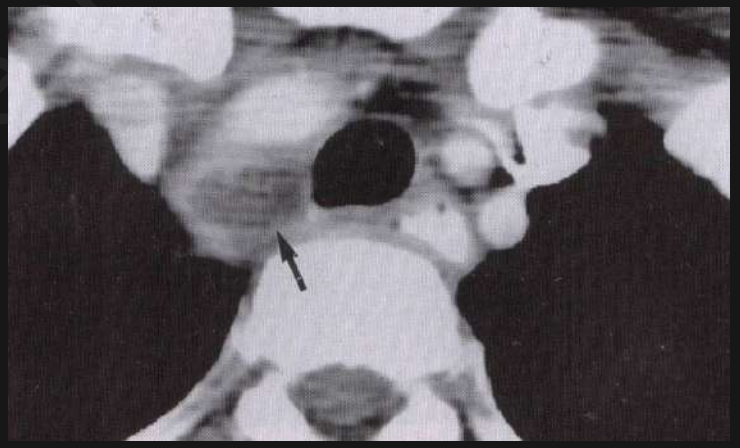
Chest Radiograph - TB and HIV





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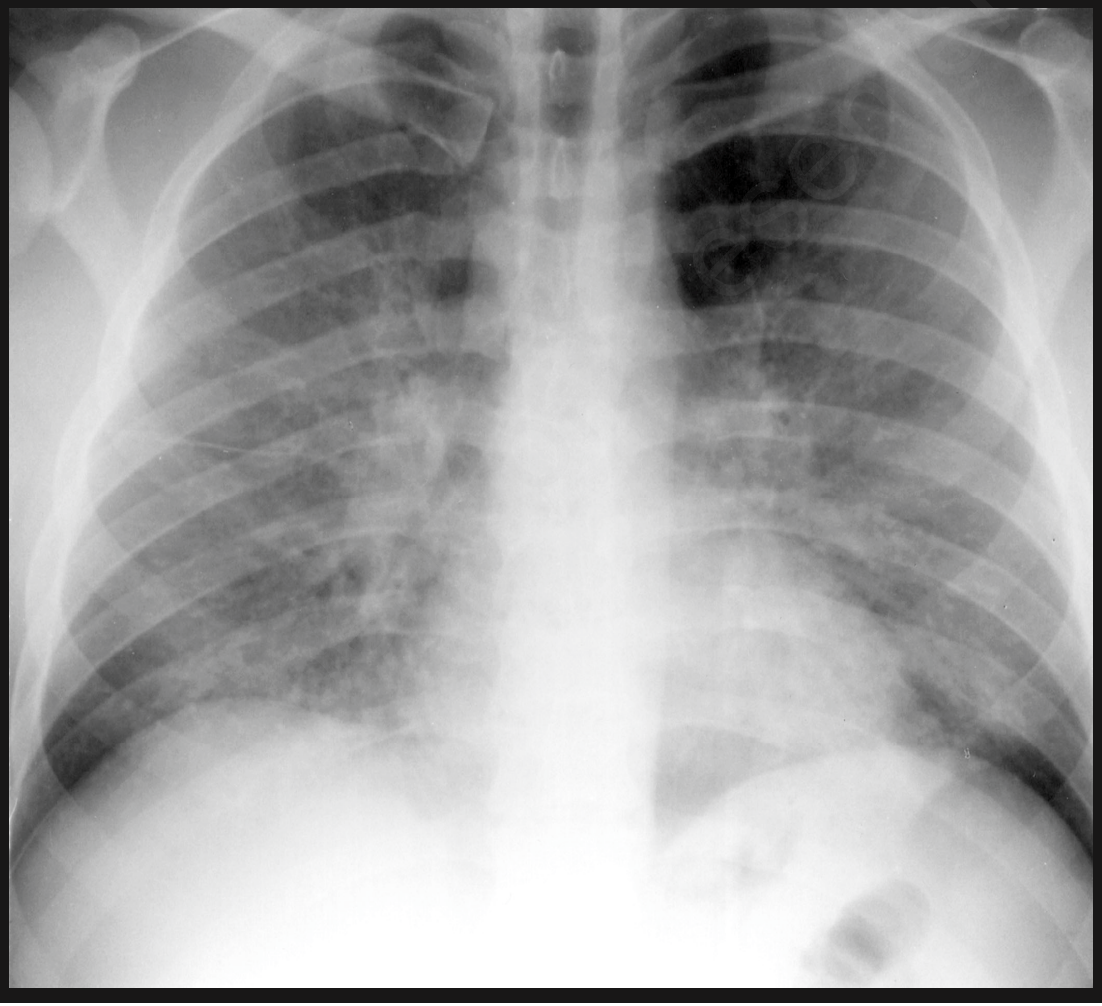
Chest Radiograph - TB and HIV



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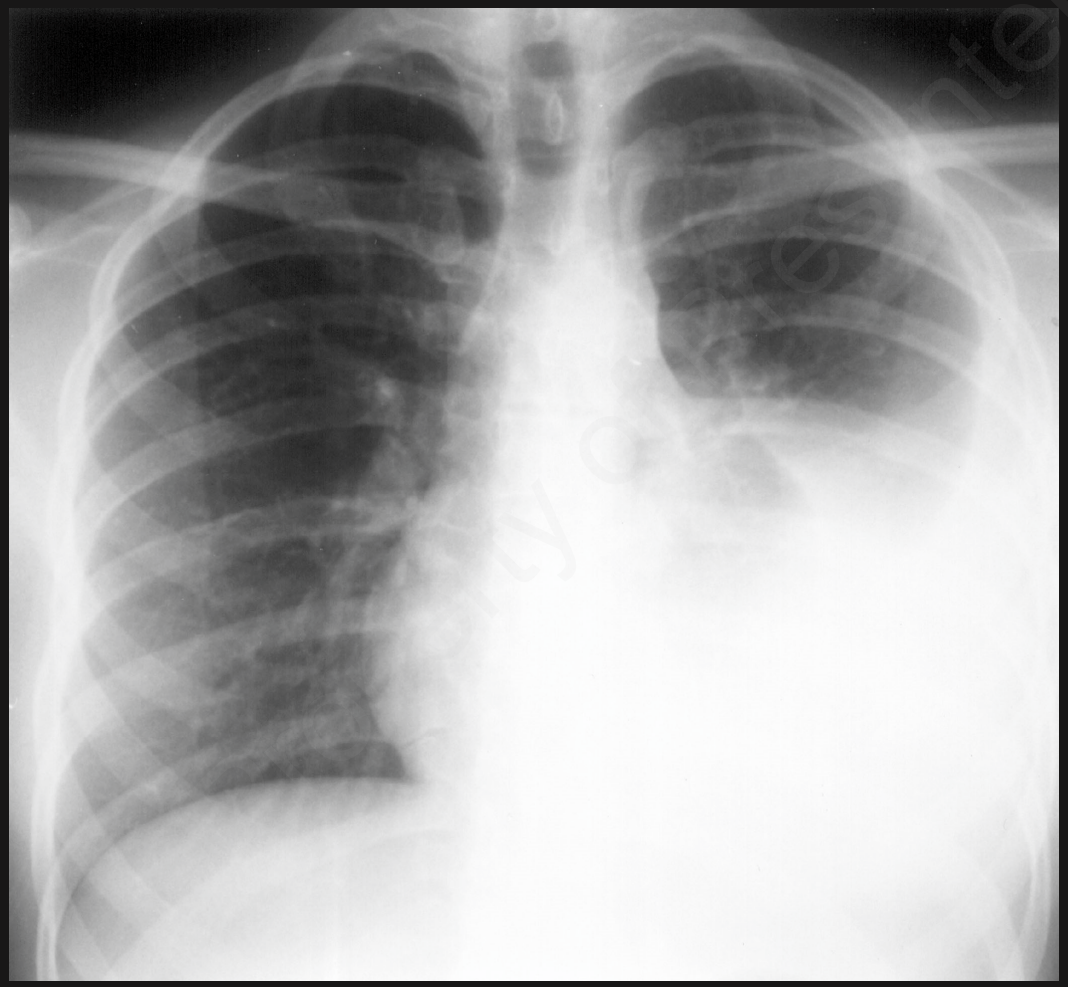
Pleural Tuberculosis

- Effusions common in adults (6-15%)

- Less common in children
- Very uncommon finding in infants
- But, may be sole finding in kids

- Air fluid level may indicate bronchopleural fistula

Pleural Effusion



Meniscus

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Post-Primary Tuberculosis - Empyema

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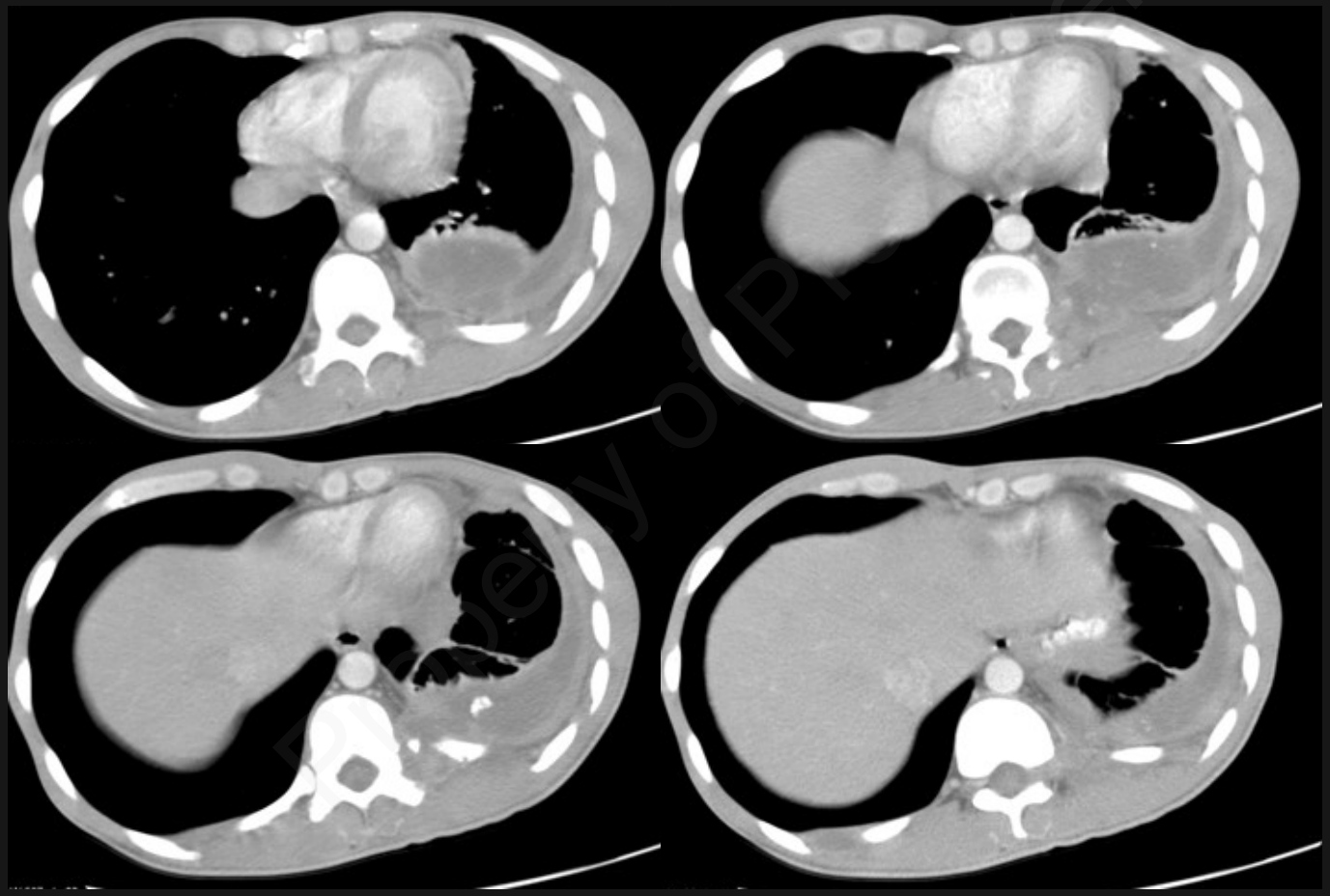
Post-Primary Tuberculosis - Empyema



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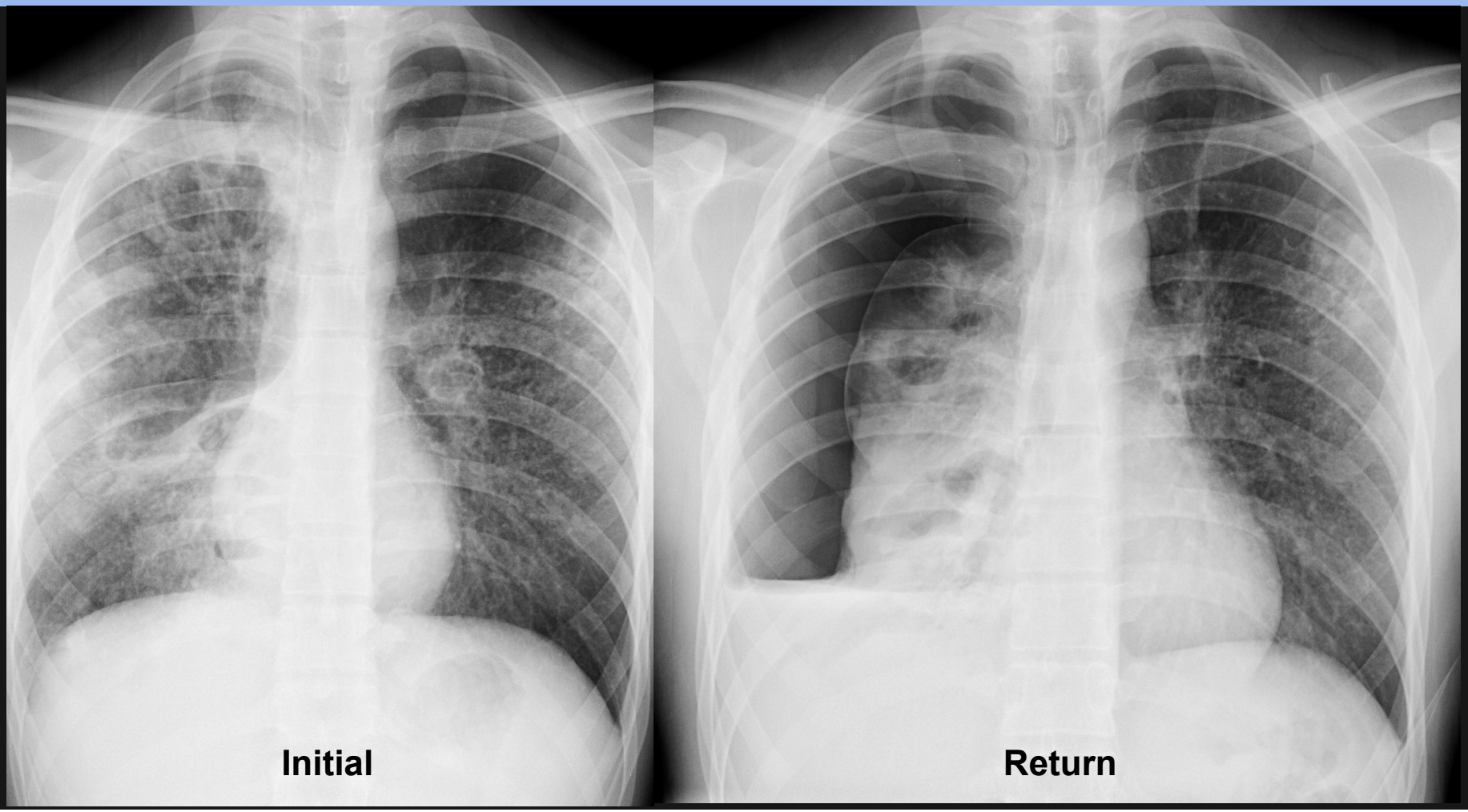
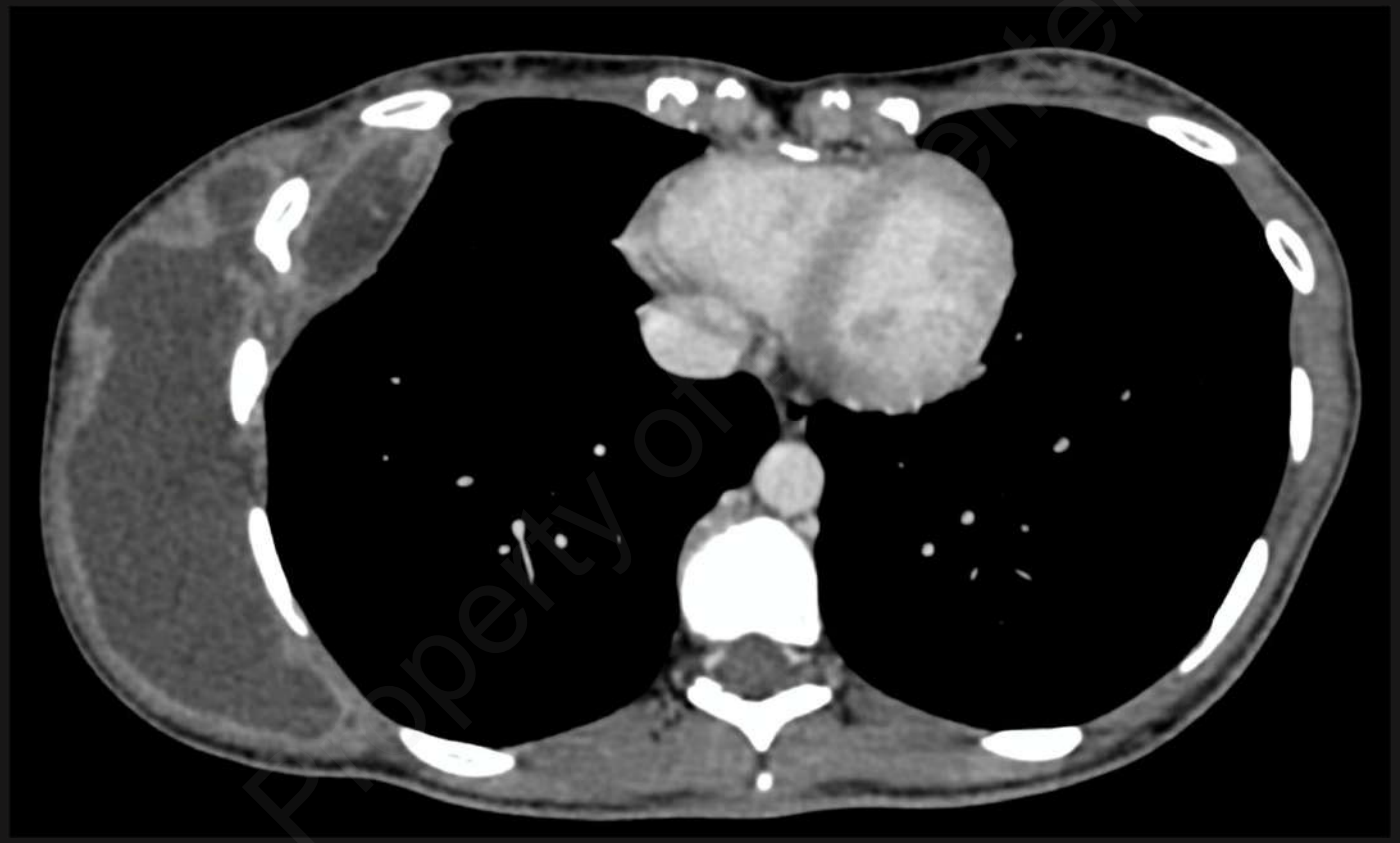
Bronchopleural Fistula



Empyema Necessitans



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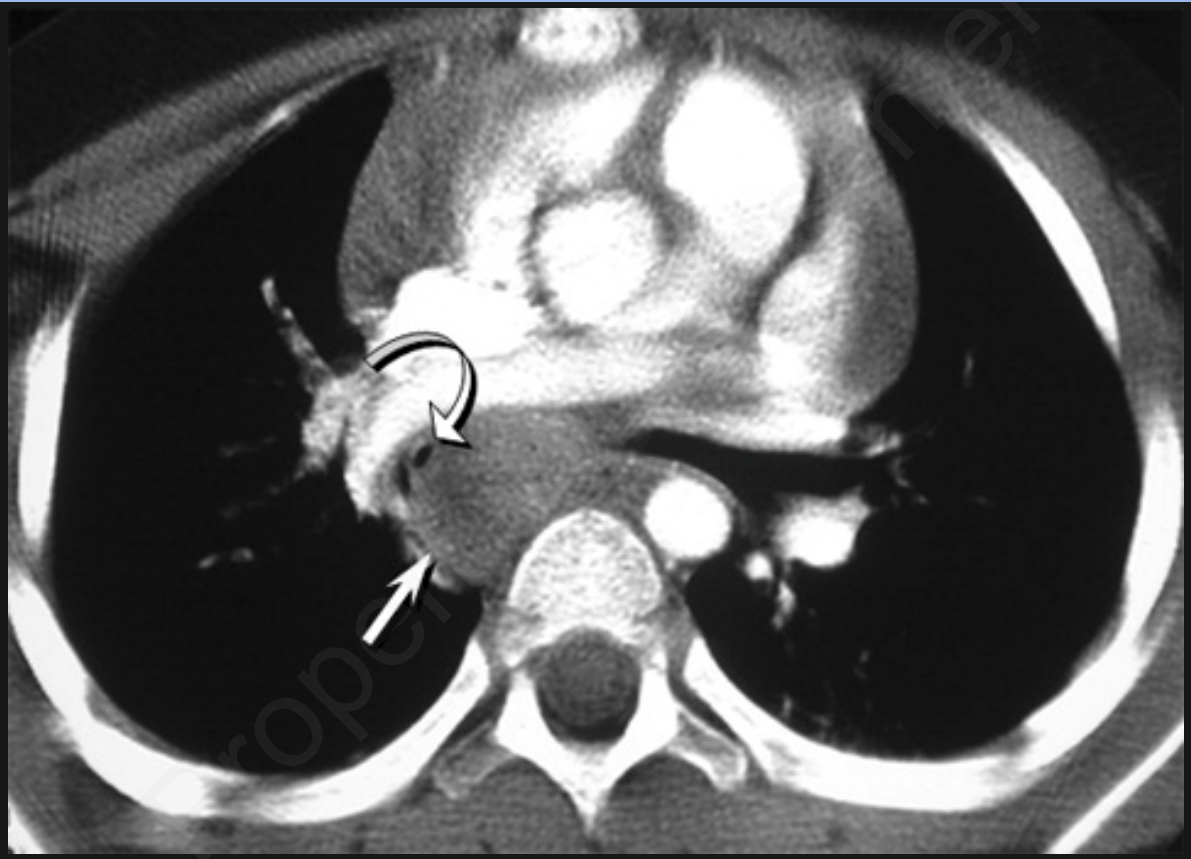
Tuberculosis and Airways

Atelectasis due to

1) Nodal enlargement - compressing airway
2) Endobronchial abnormality - obstructing airway

May never resolve

Airway narrowing due to nodal enlargement



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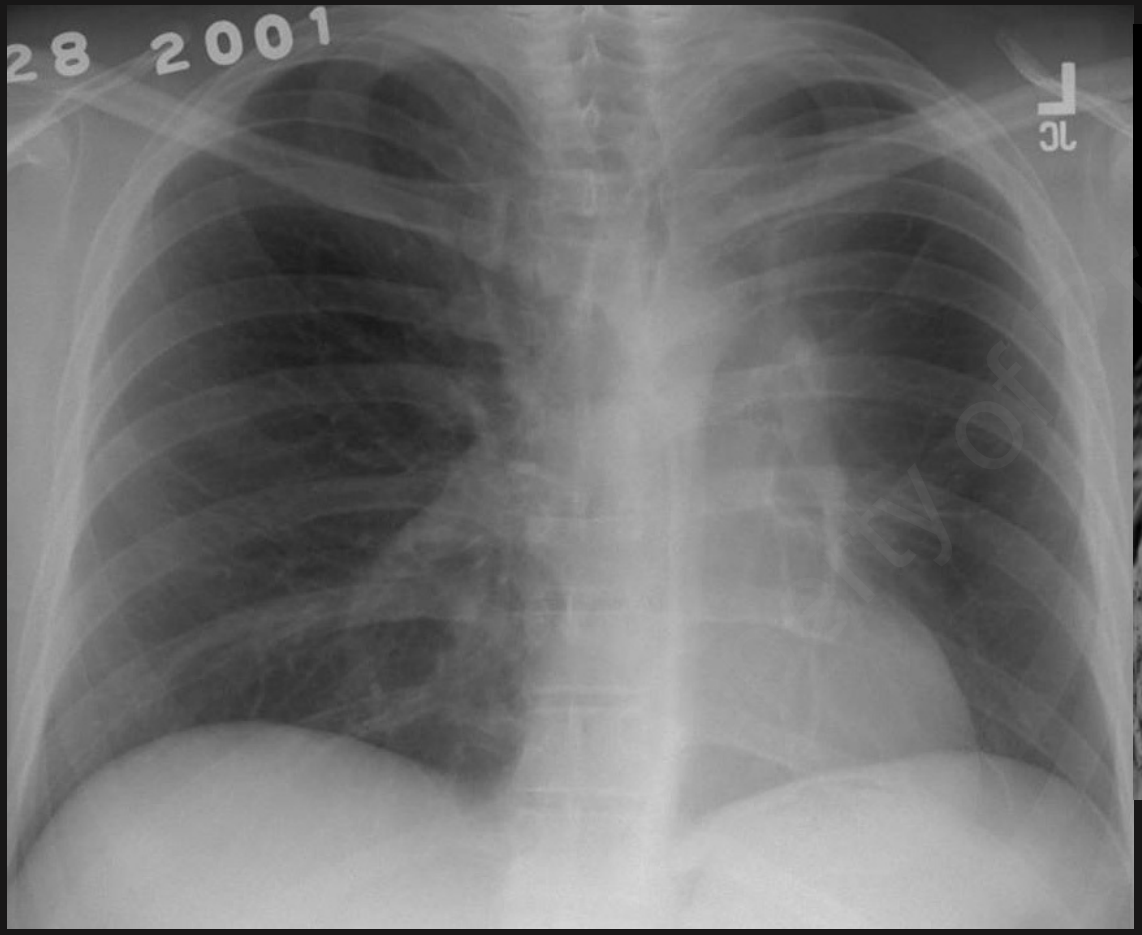
Bronchostenosis



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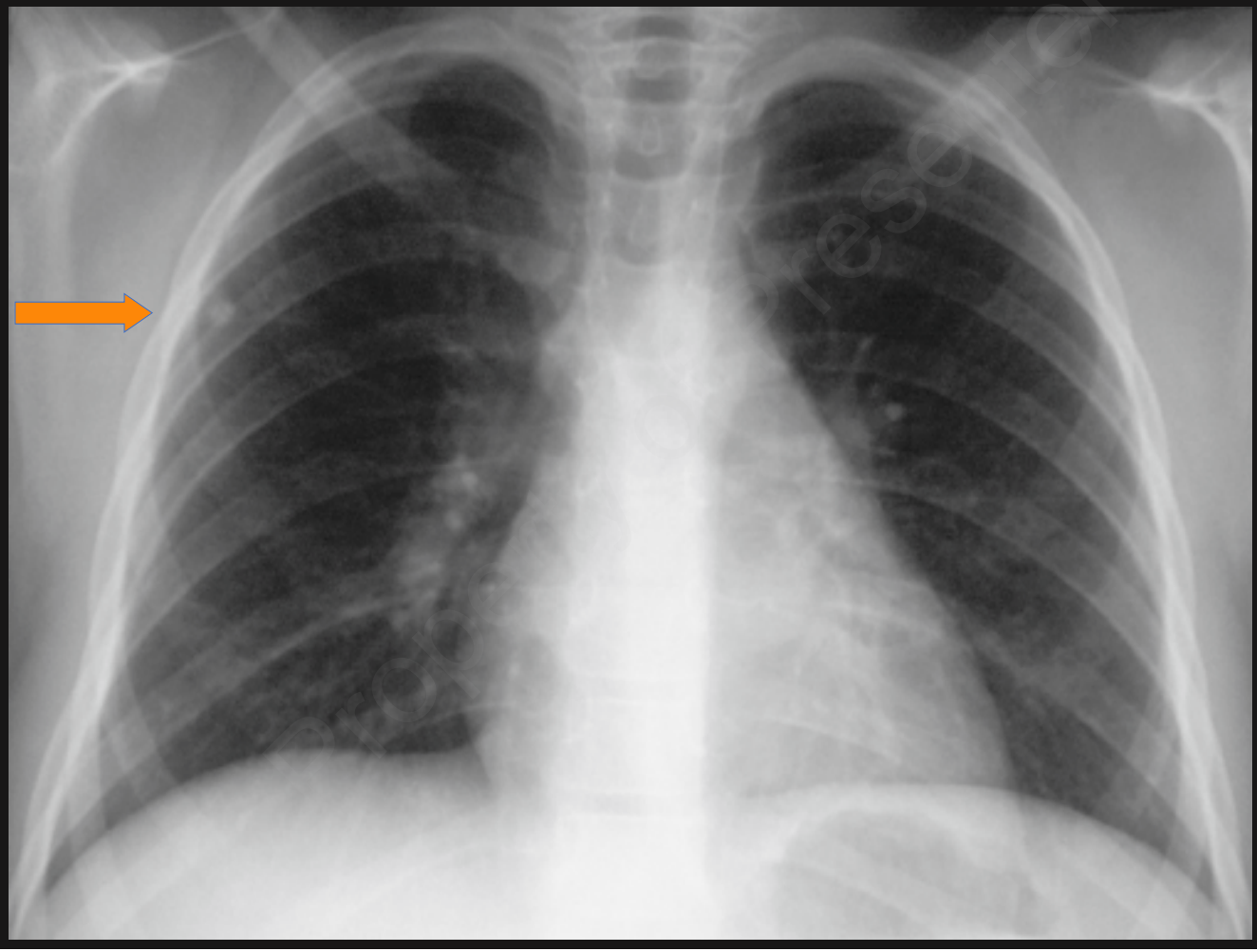
The Chest Radiograph - Healed Tuberculosis

- Calcified granuloma - *Ghon lesion*
- Calcified granuloma & hilar calcification - *Ranke complex*
- Apical pleural thickening
- Fibrosis and volume loss

Healed Tuberculosis - Ghon Lesion



Note – Calcified nodule is more dense than rib.

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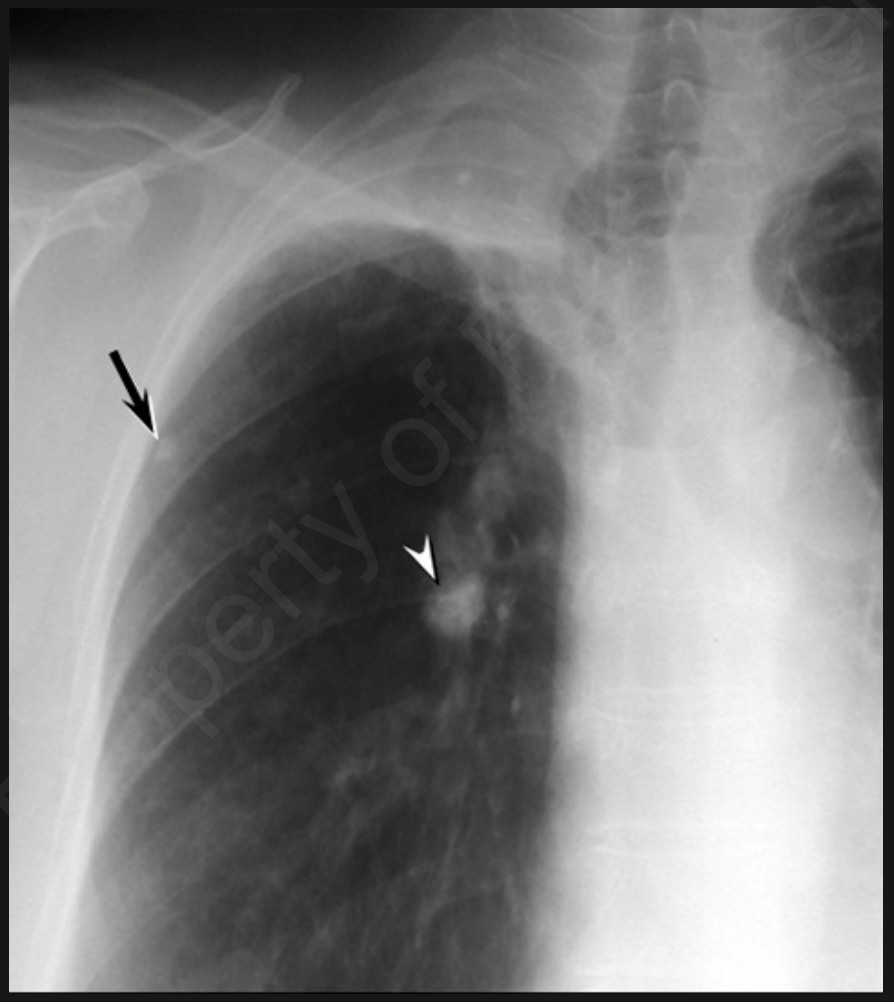
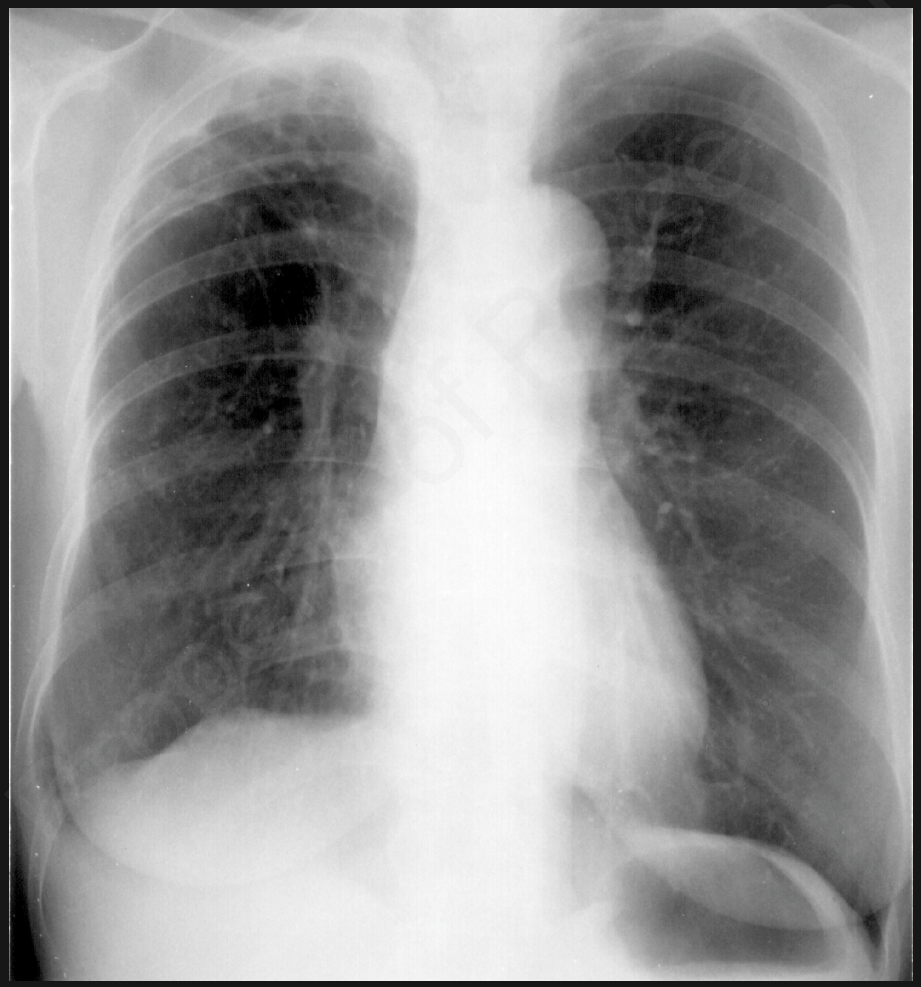
Healed Tuberculosis - Ranke Complex



Healed Tuberculosis - Apical Fibrosis



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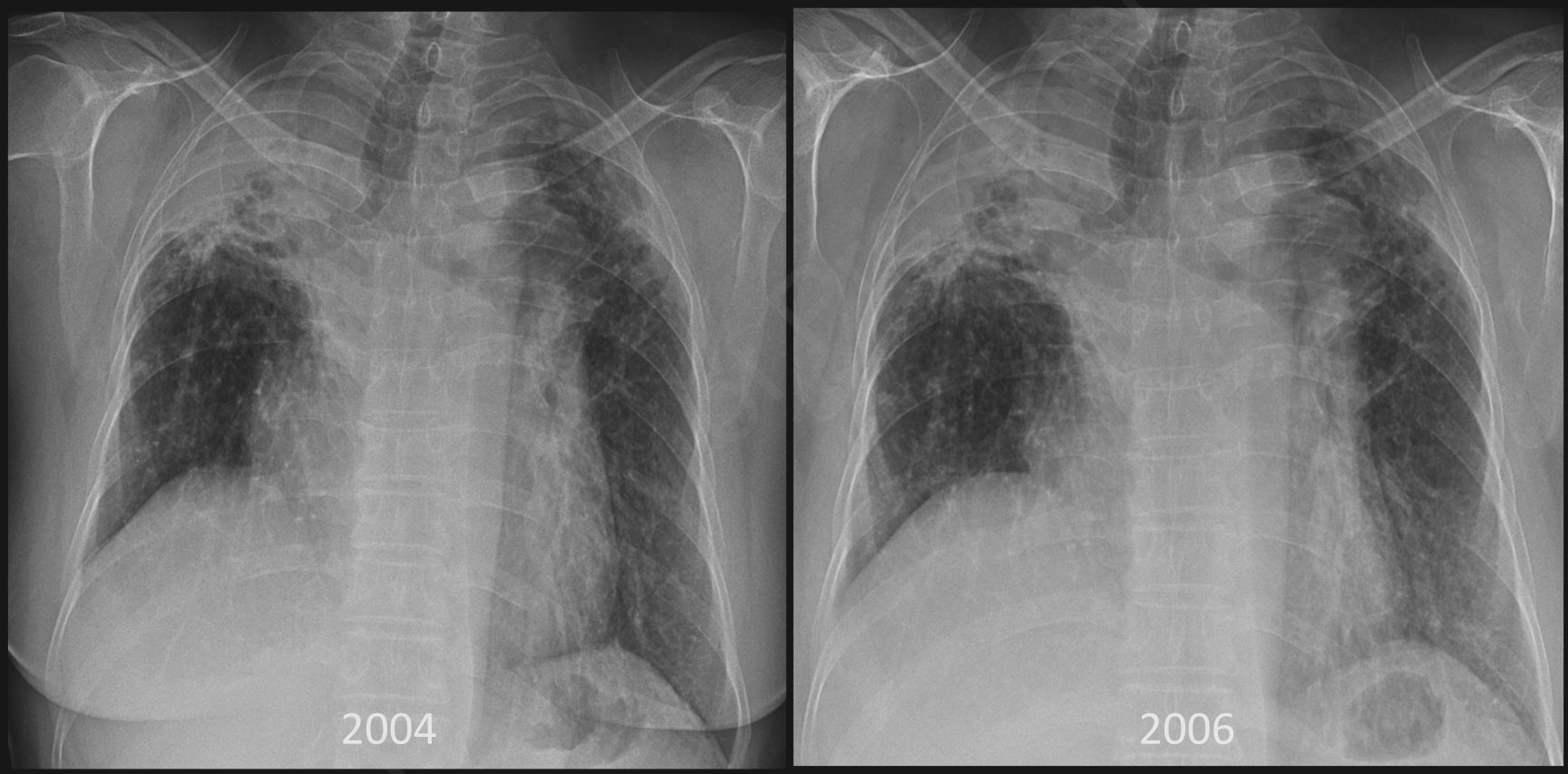
"Activity" of tuberculosis

- ***Activity cannot be determined from single chest radiograph***

- *Progressive disease **indicates** activity*

- Cavitation and bronchogenic spread *suggest* activity

Stable tuberculosis



Old X-rays often helpful (Want 6 months+ stability)

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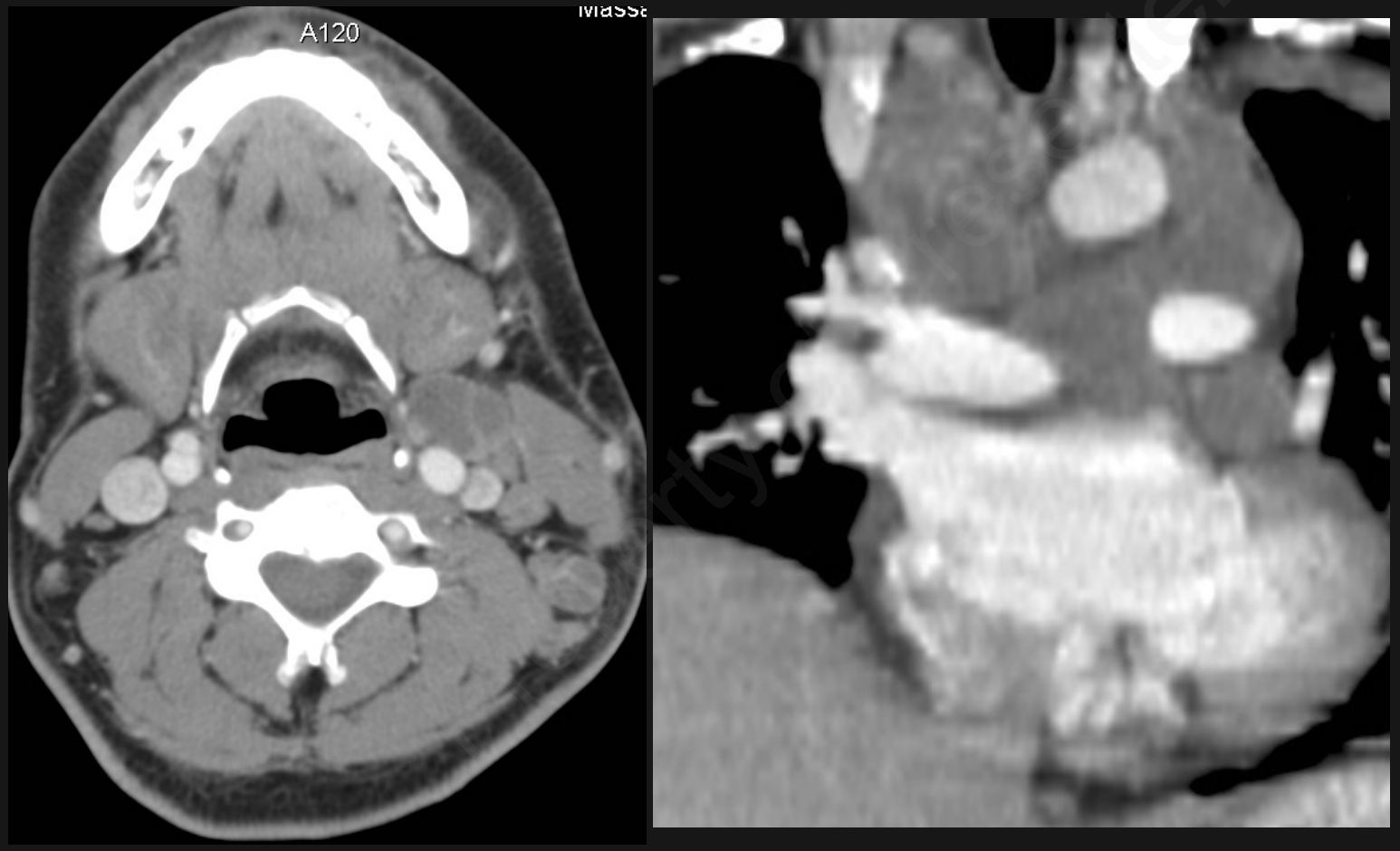
Role of CT in tuberculosis

- Useful in “Equivocal” Chest X-ray
  - *CT increases the specificity of a TB diagnosis*

- Occult miliary disease and cavities
- Necrotizing adenopathy

- Roadmap for bronchoscopist
- Presurgical

CT in TB Adenopathy



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CT in Airway TB

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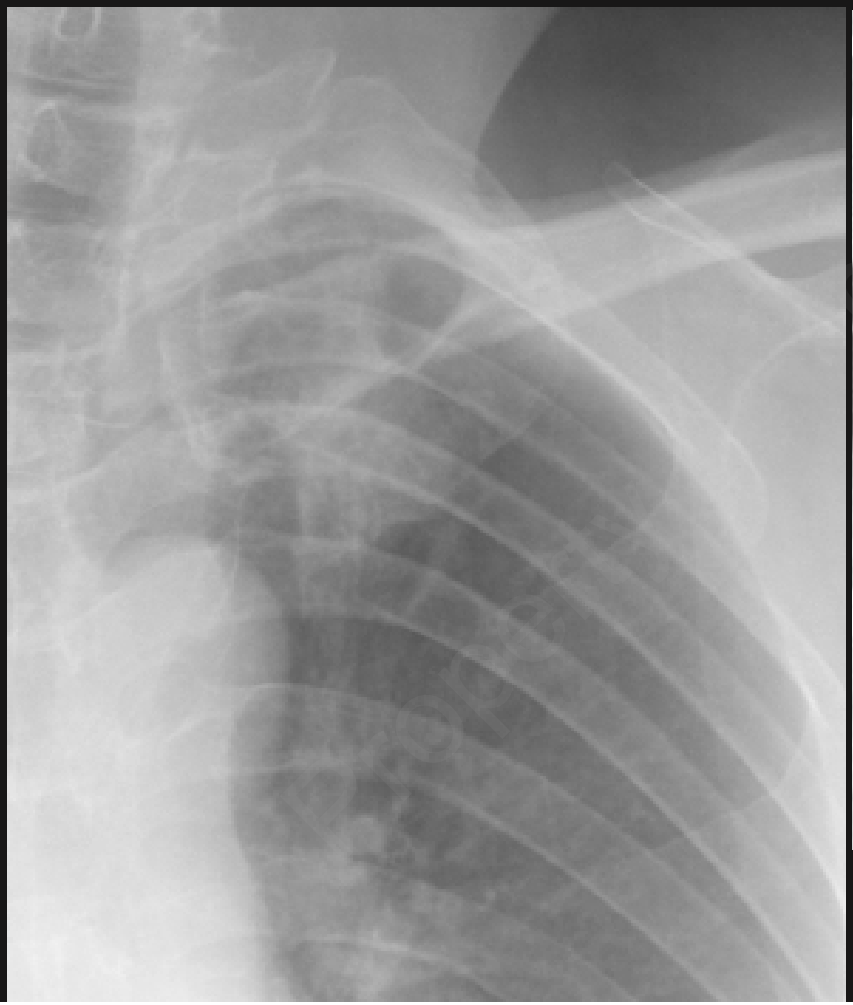
CT in Subtle Findings (i.e. Cavities)



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Summary

- Chest radiograph requires systematic approach
- Typical (Post-primary) TB: Upper lung fibrocavitary disease, “endobronchial spread” nodules
- Atypical (Primary) TB: Usually children, HIV, consolidation with adenopathy
- ***Serial radiographic evaluation important to determine activity***

References

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- *Jeong YJ, et al.* **Pulmonary Tuberculosis: Up-to-Date Imaging and Management.** *AJR 2008; 191:834-844*

- *Burrill J, et al.* **Tuberculosis: A Radiologic Review.** *Radiographics 2007;27:1255-1273.*

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Thank You

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