Pediatric Chest Emergencies

Dr. Michael R Aquino

Clinical Associate Professor
Cleveland Clinic Lerner College of Medicine
of Case Western Reserve University

Section Head, Pediatric Imaging
Director, Overnight Pediatric Imaging
Cleveland Clinic Imaging Institute

Cleveland Clinic Children's

PRESENTER FINANCIAL DISCLOSURE

I have no financial relationships relevant to this presentation

Objectives

- Describe imaging findings of pediatric chest emergencies
- Know differential diagnosis of common clinical and imaging presentations relating to the pediatric chest
- Identify distinguishing clinical and imaging features of emergent pediatric chest pathologies

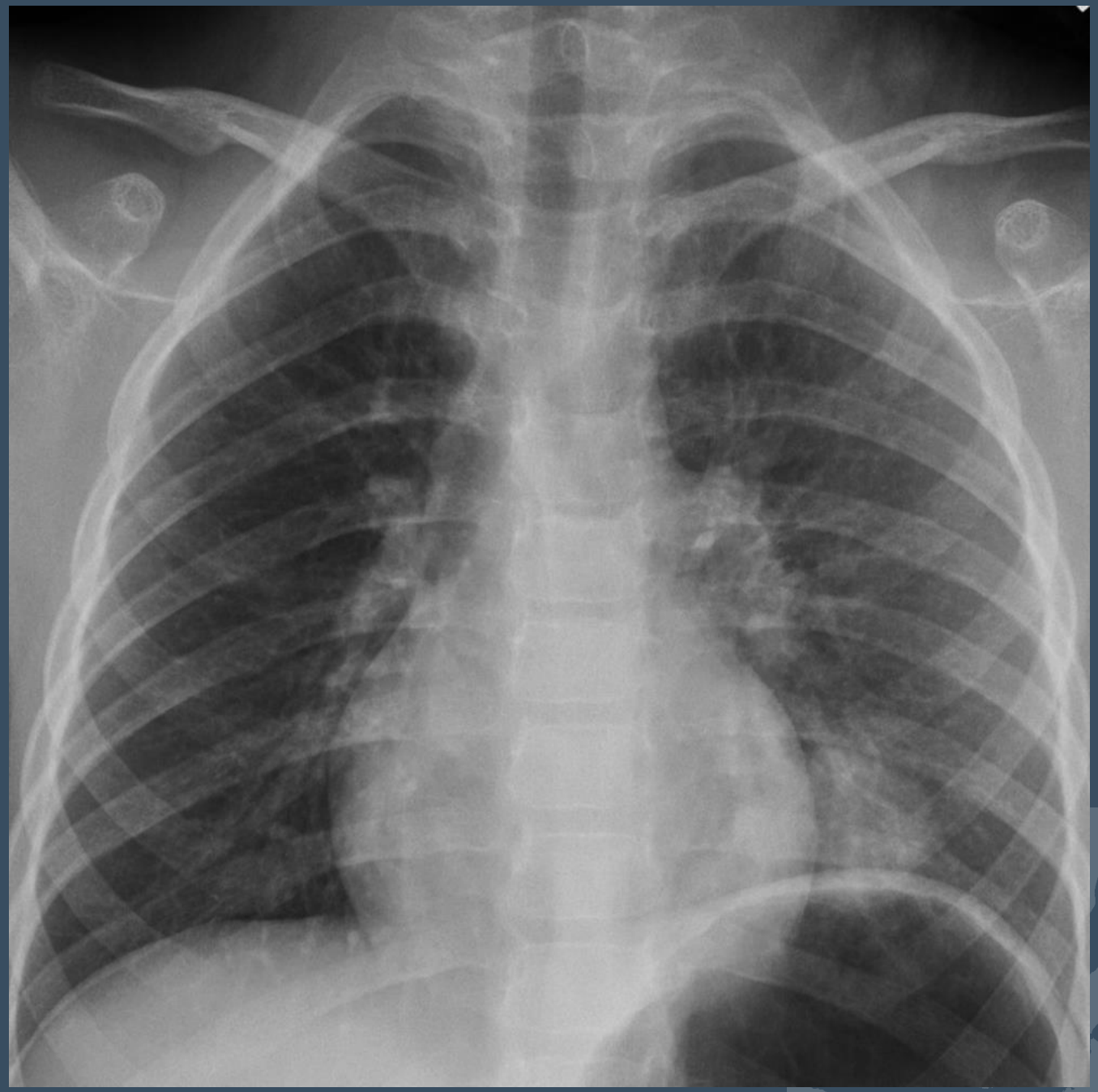
CASE 1

History: 7-year-old with cough and fever

Findings:

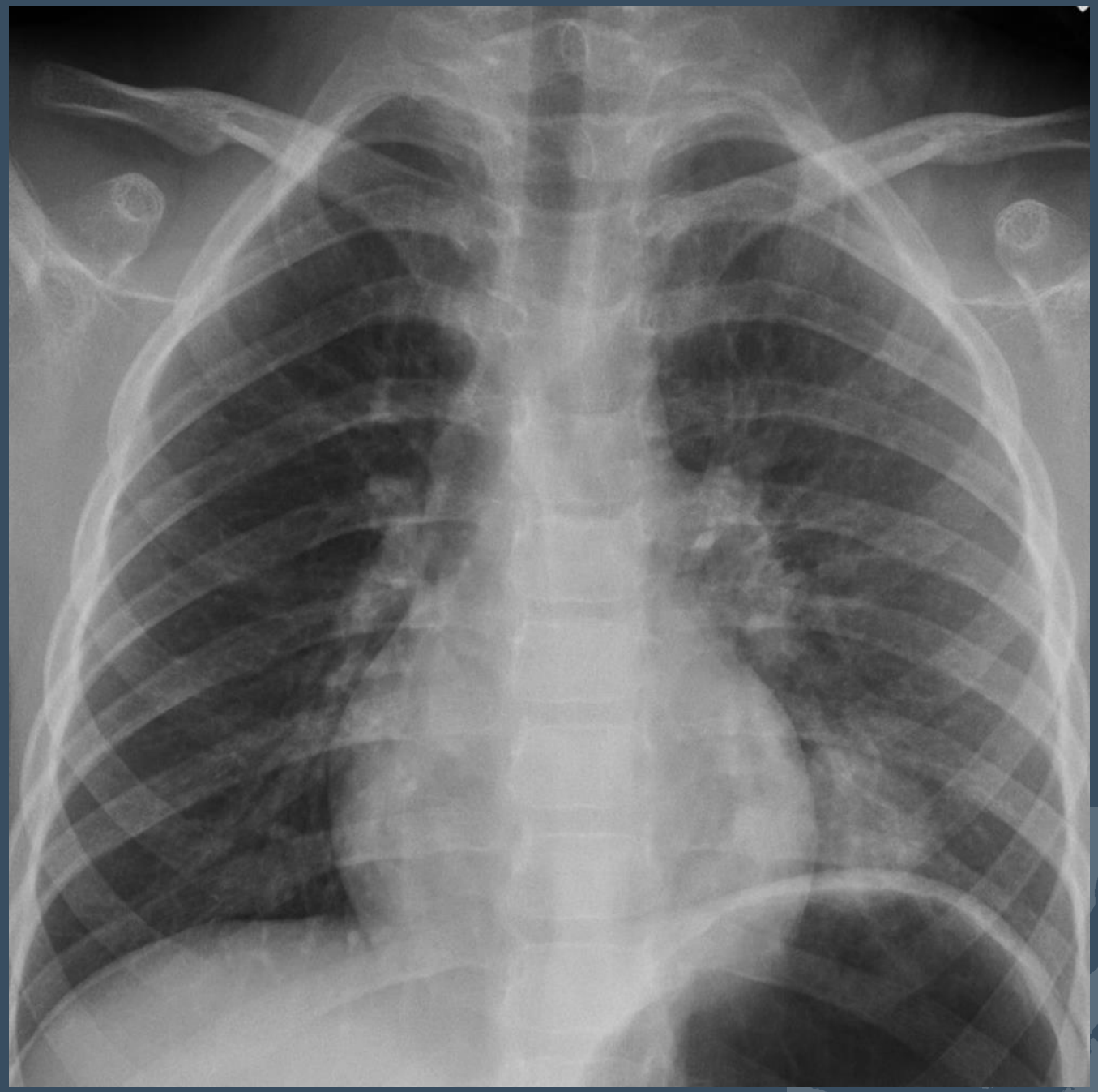
- Circumscribed round left lower lobe opacity
- No mass effect
- Normal bones

Diagnosis:
Round pneumonia



Round Pneumonia

- Age < 8 years with symptoms compatible with pneumonia
- If not typical presentation or other imaging findings, follow-up cross-sectional imaging or radiograph upon completion of antibiotics



CASE 2

History: 17-year-old with fever and loss of appetite. Diagnosed with round pneumonia. Follow-up radiographs after completion of antibiotics.

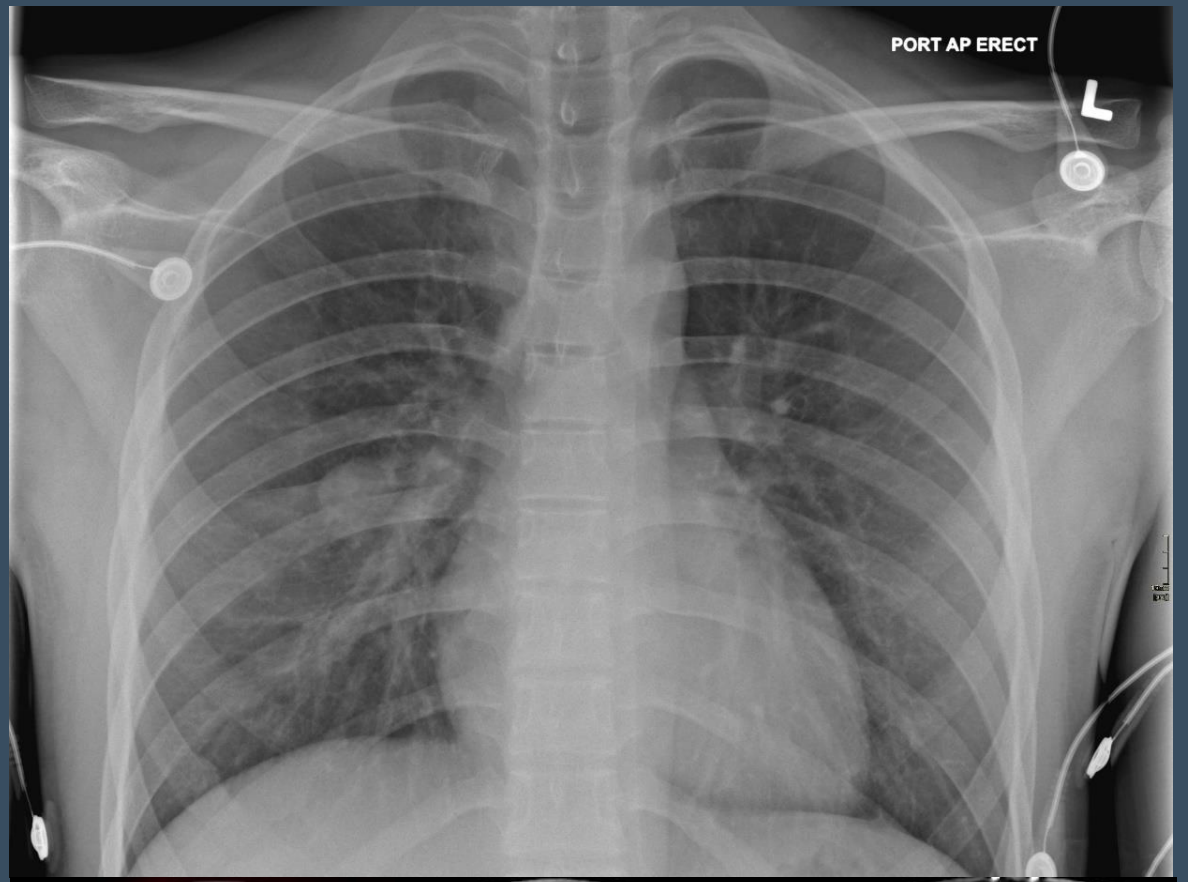
Findings:

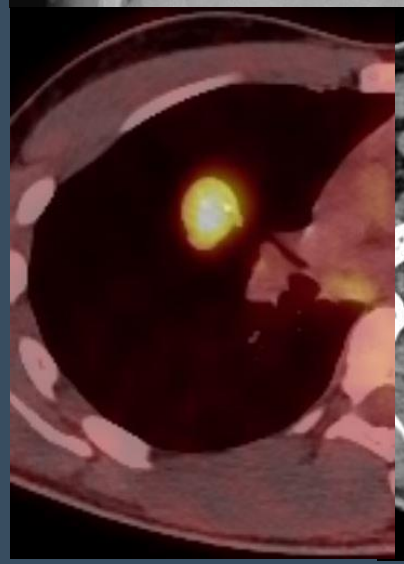
- Right middle lobe pulmonary nodule with calcifications
- ↑ Metabolic activity on PET

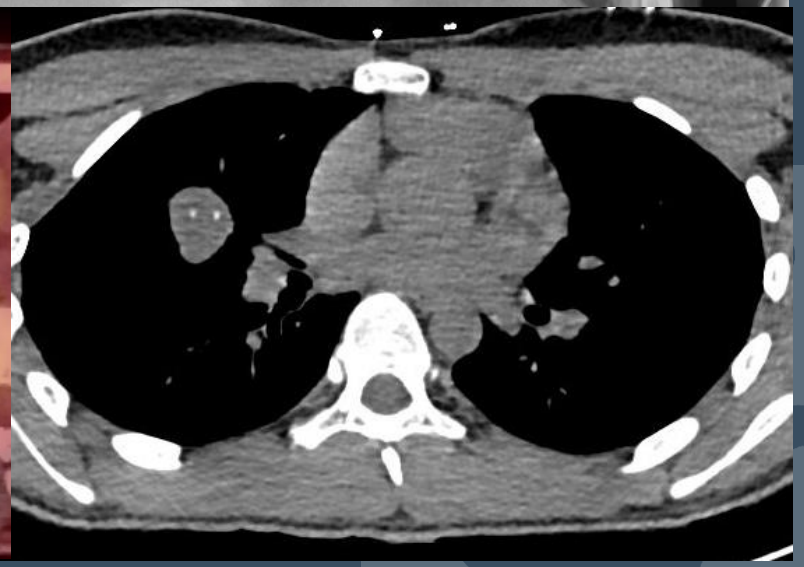
Diagnosis:

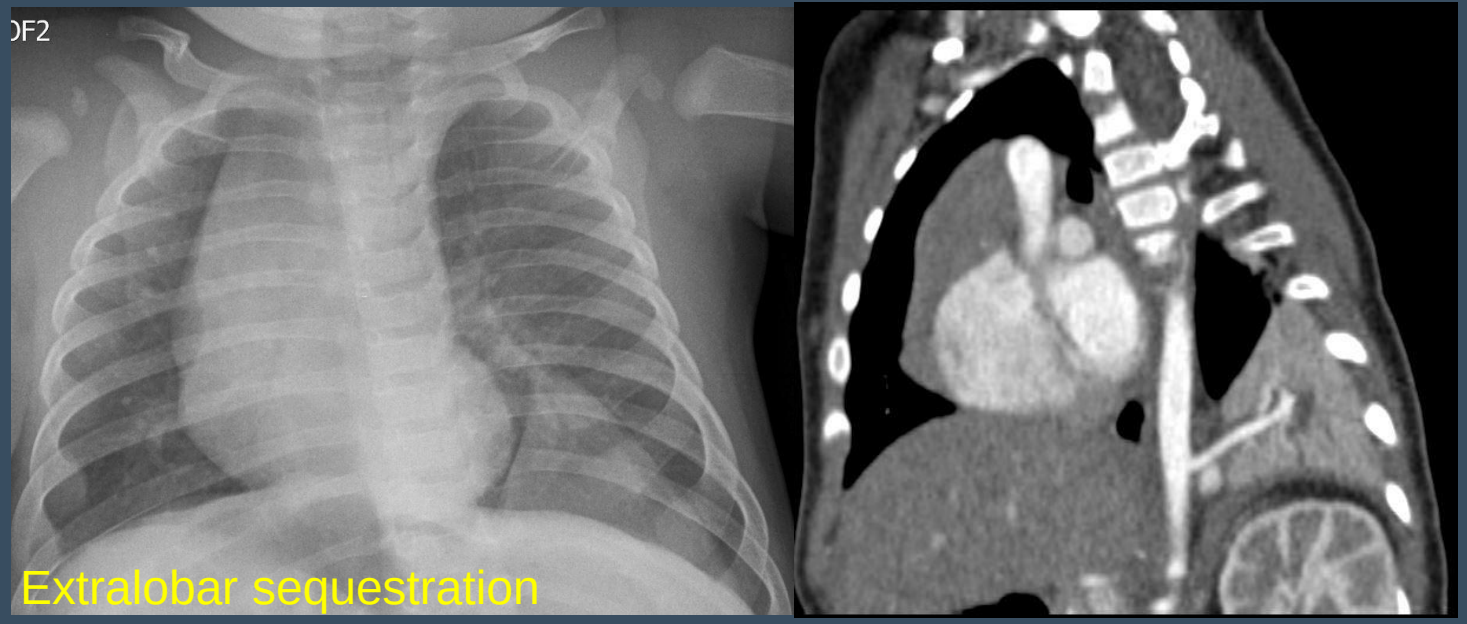
Inflammatory myofibroblastic tumor

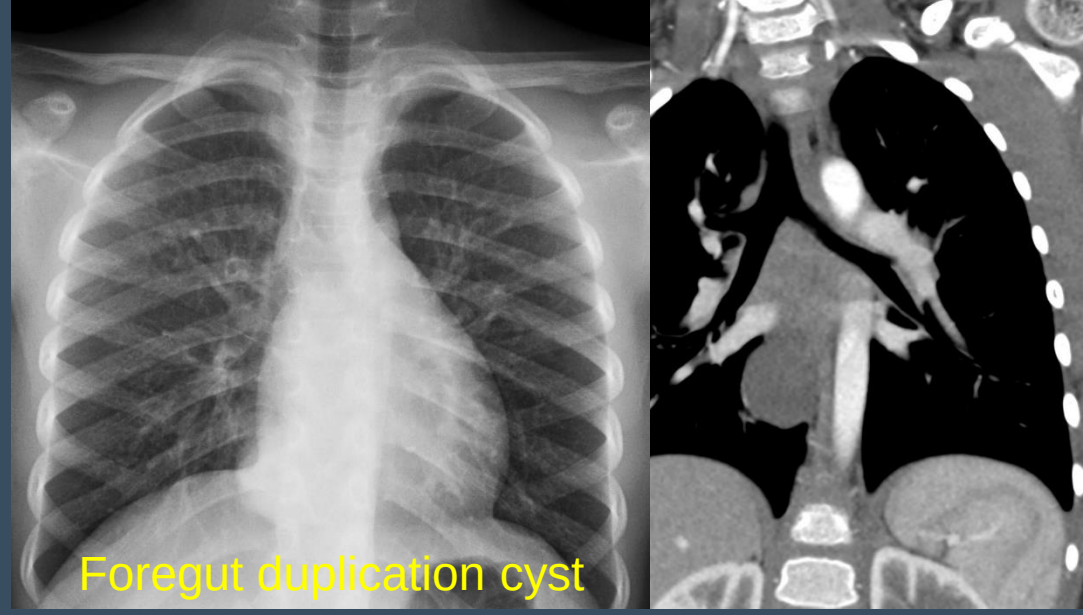
- One of the most common primary lung neoplasm in children
- Circumscribed, solitary mass ± central calcifications
- Nonspecific constitutional symptoms

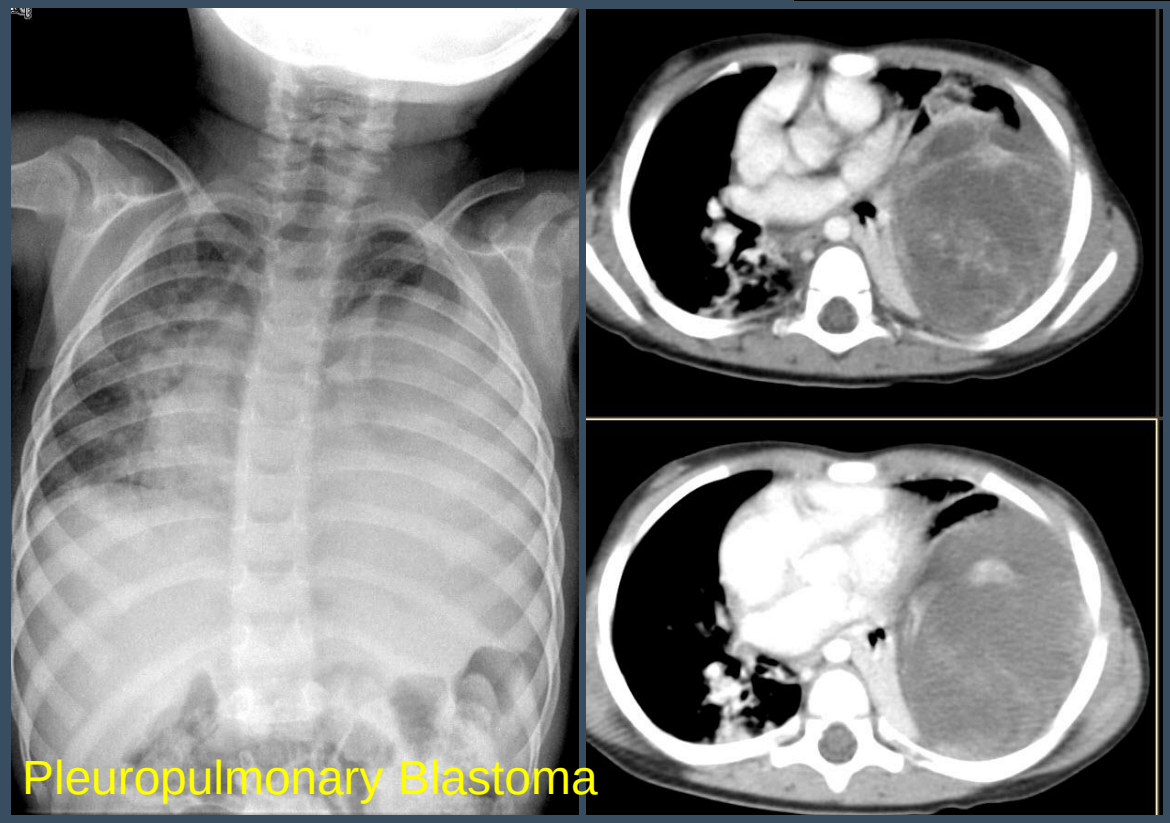












DDx for Lung Consolidation or Nodule/Mass

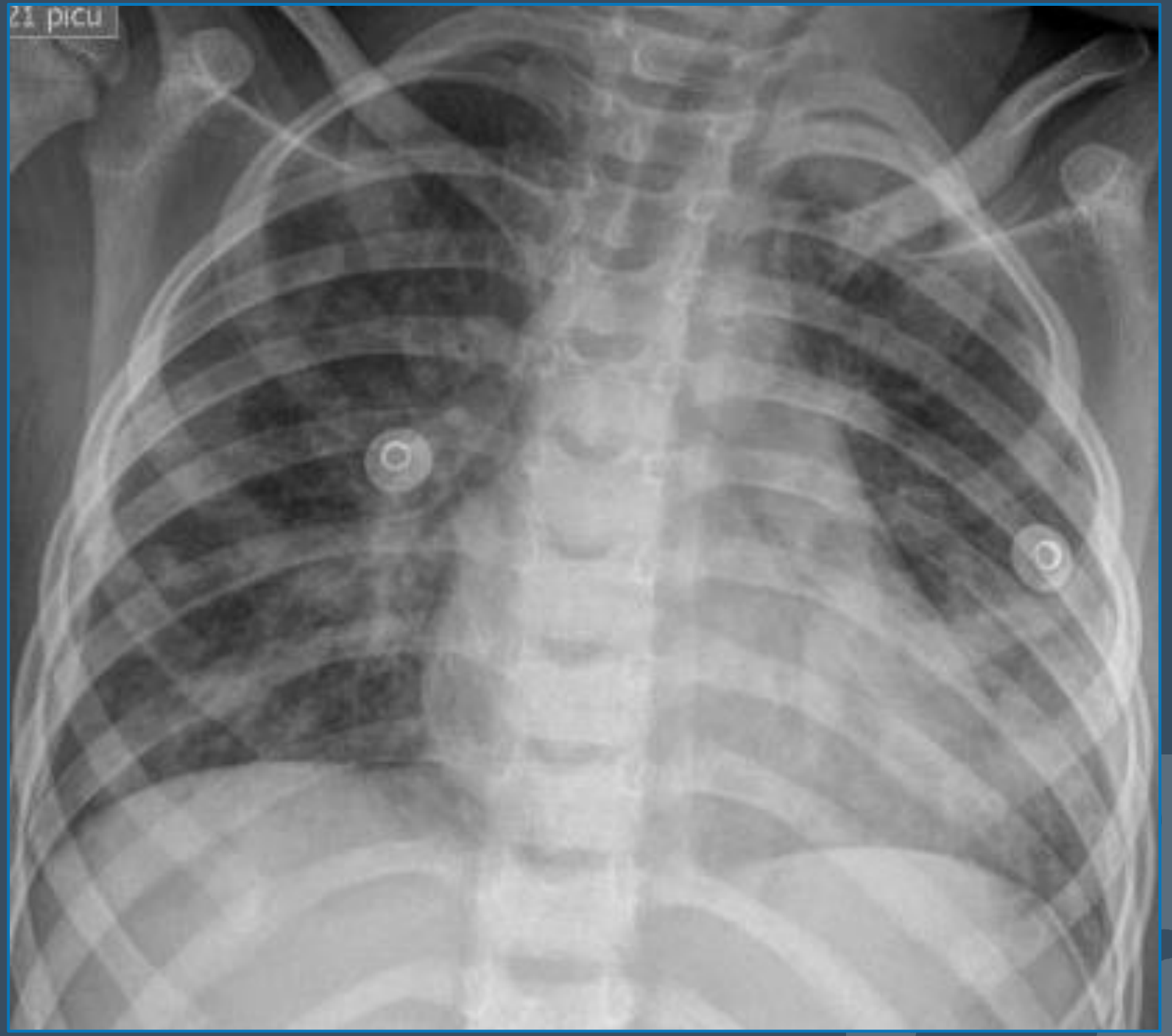
- Infection
  - Pneumonia ± abscess
  - Fungal
- Hemorrhage
- Congenital lung malformation
- Foregut duplication cyst
- Chest wall lesion
- Metastasis
- Primary lung neoplasm

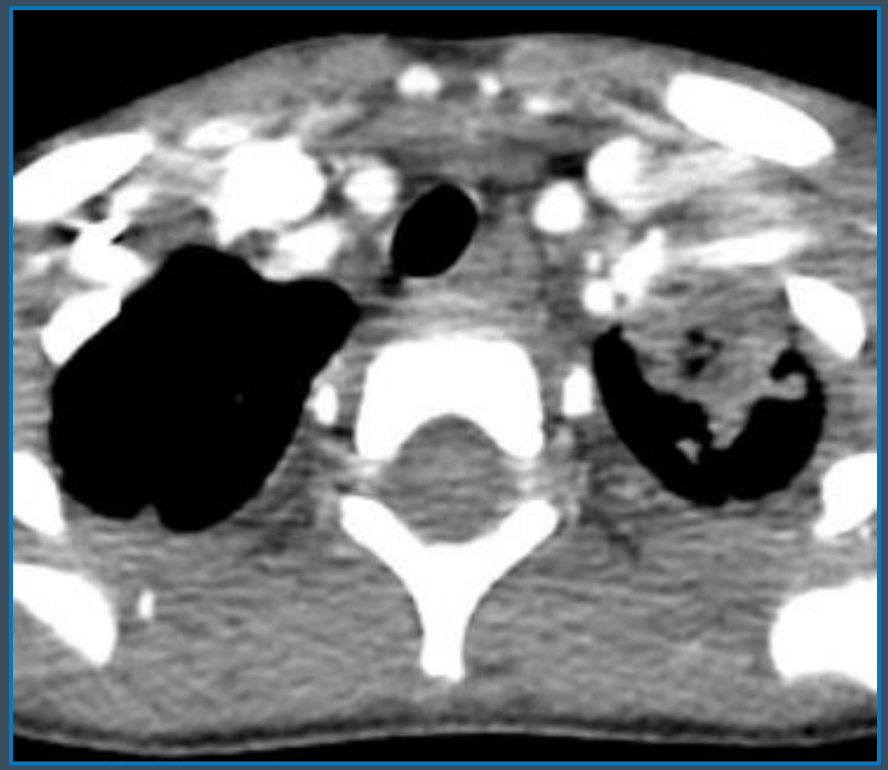
CASE 3

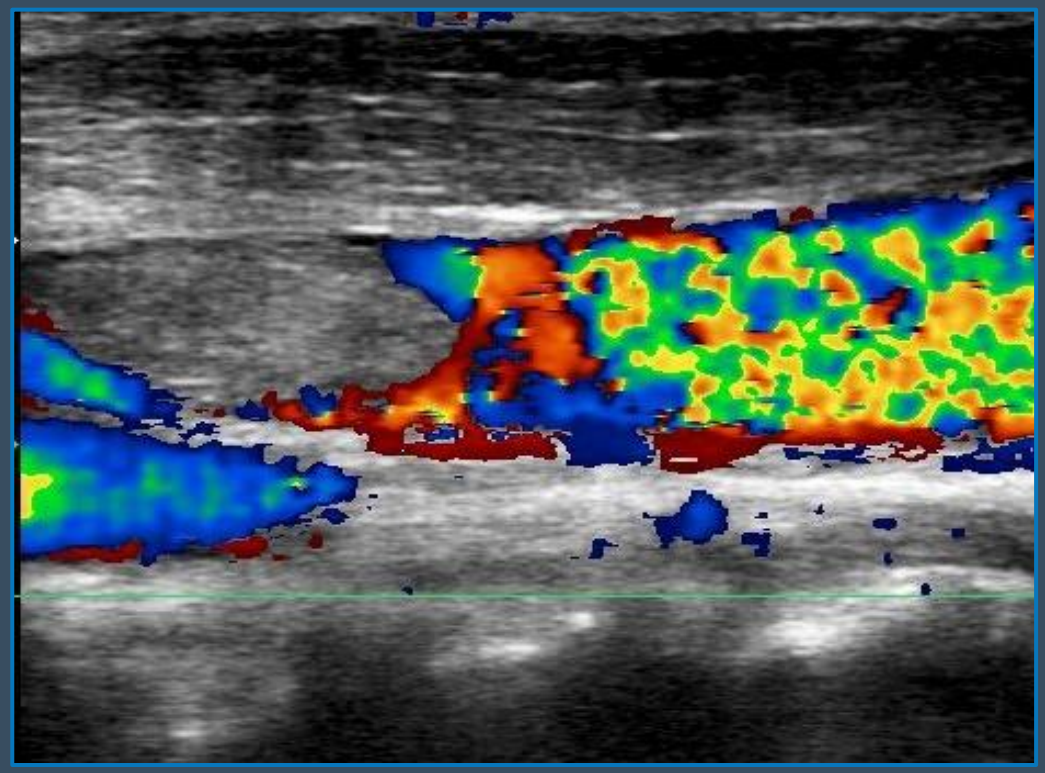
History: 4-year-old with fever and submandibular swelling

Findings:

- Multifocal patchy, nodular, consolodative opacities bilaterally







CASE 3

Findings:

- Nonocclusive thrombus in the right internal jugular vein
- Cavitary pulmonary nodule

Diagnosis:

Lemierre Syndrome

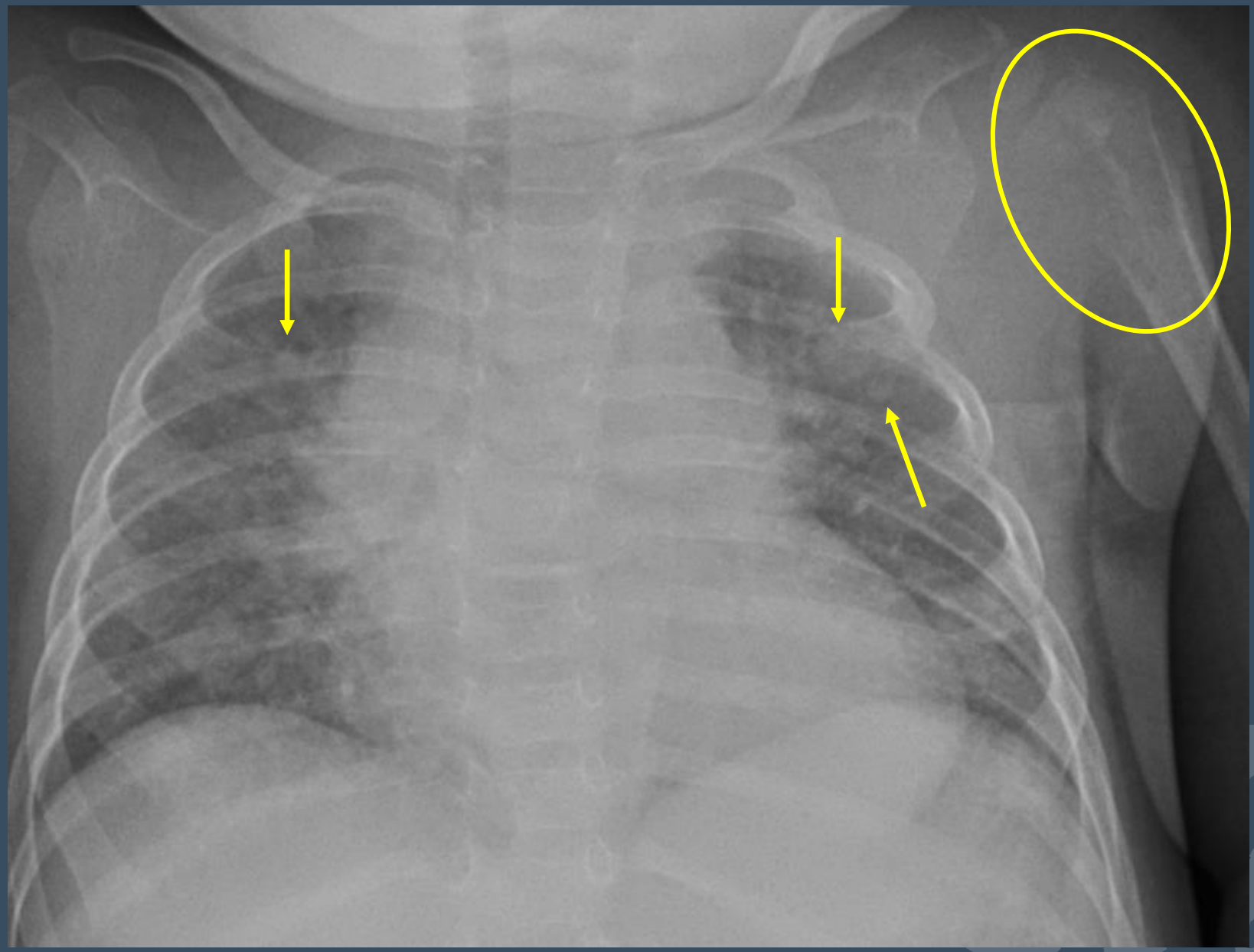
- Extension of pharyngitis/tonsilitis to lateral pharyngeal space with subsequent thrombophelebitis and septic emboli

CASE 4

History: Child with cough and chest pain

Findings:

- Bilateral nodular opacities
- Lytic lesion at left proximal humerus



CASE 4

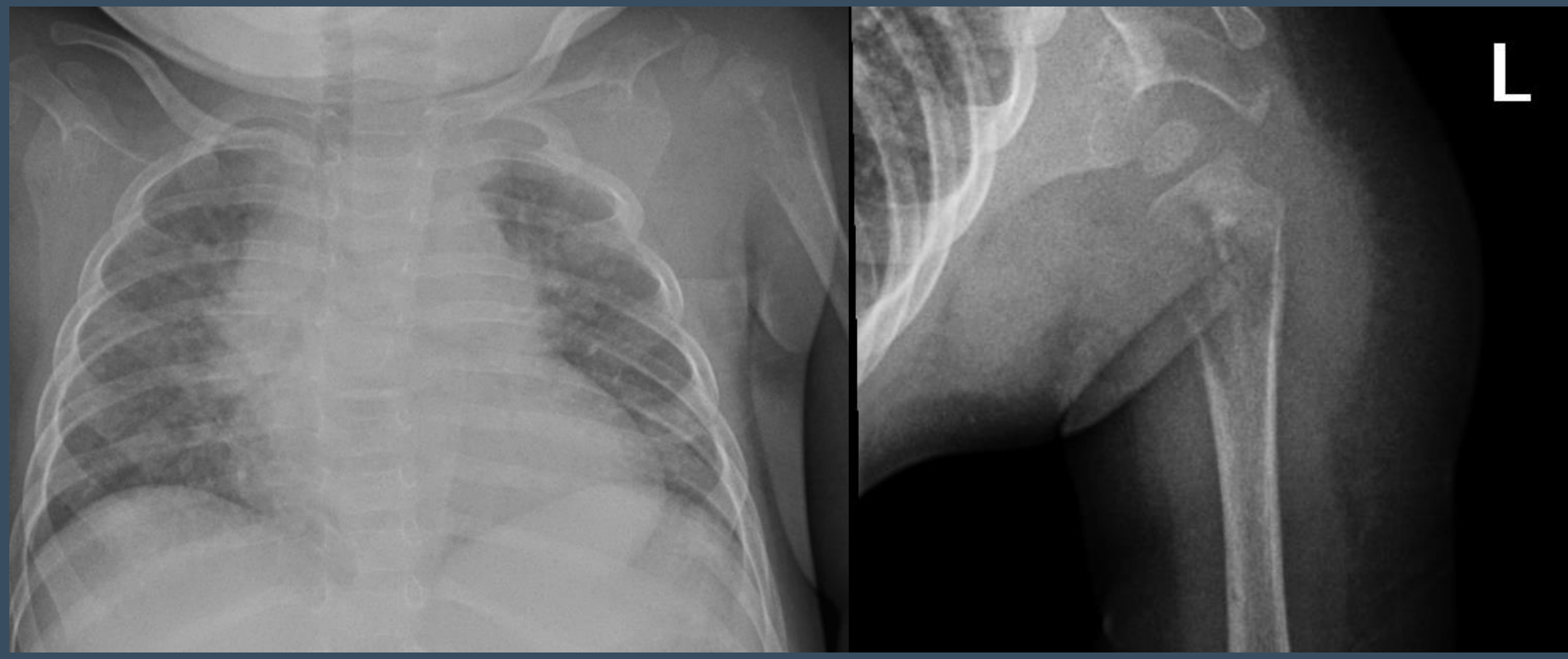
History: Child with cough and chest pain

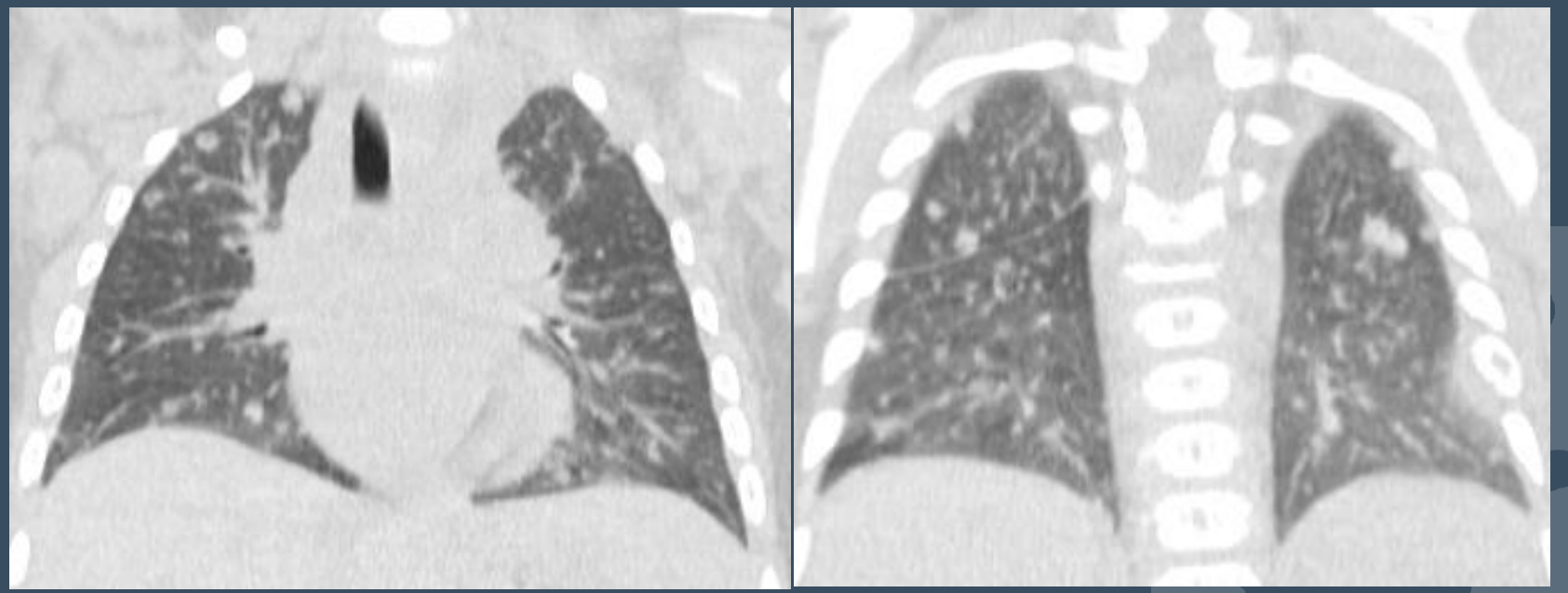
Findings:

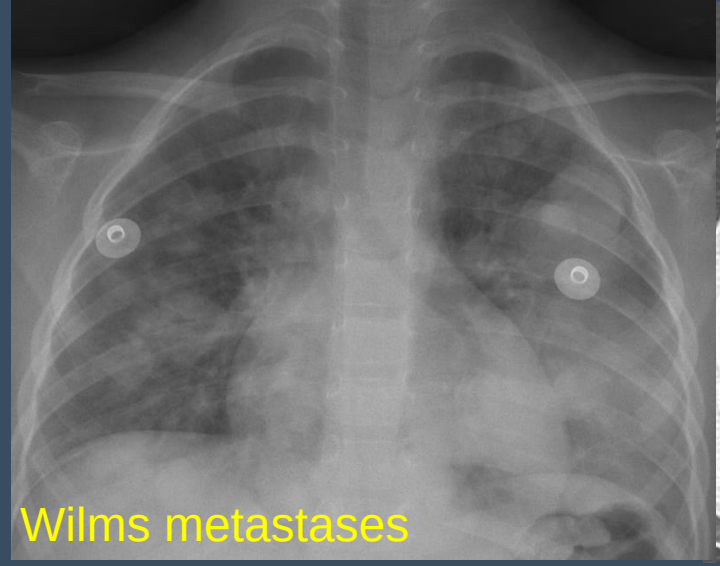
- Mid to upper lung zone predominant nodules, some cavitary
- Lytic lesion at left proximal humerus

Diagnosis:

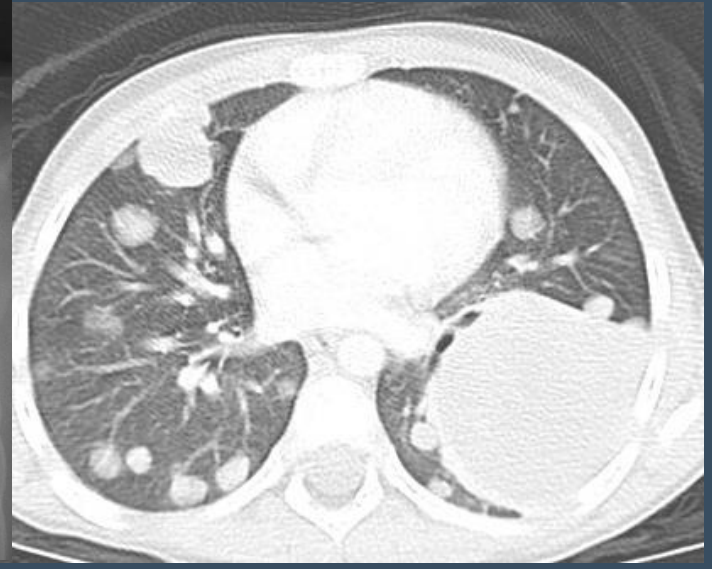
Langerhan’s cell histiocytosis

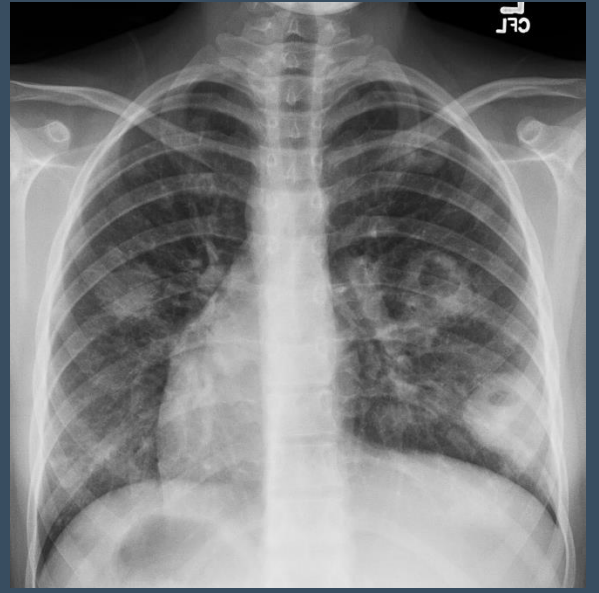






Wilms metastases





Granulomatosis with polyangiitis

Posttransplant lymphoproliferative disease (PTLD)

Hypersensitivity pneumonitis

DDx for Multiple Nodules/Mass

- Infection
- Septic Emboli
- Metastases
- Lymphoproliferative disease
- Langerhan's cell histiocytosis
- Granulomatosis with polyangiitis
- Sarcoidosis
- Hypersensitivity pneumonitis

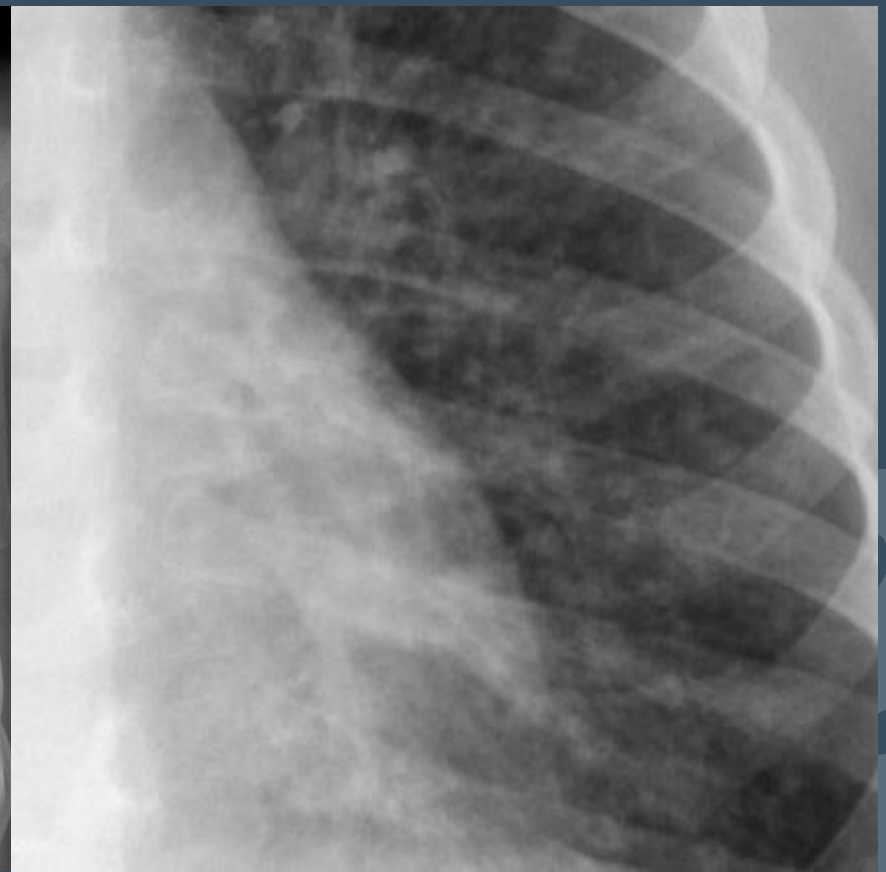
Case 5

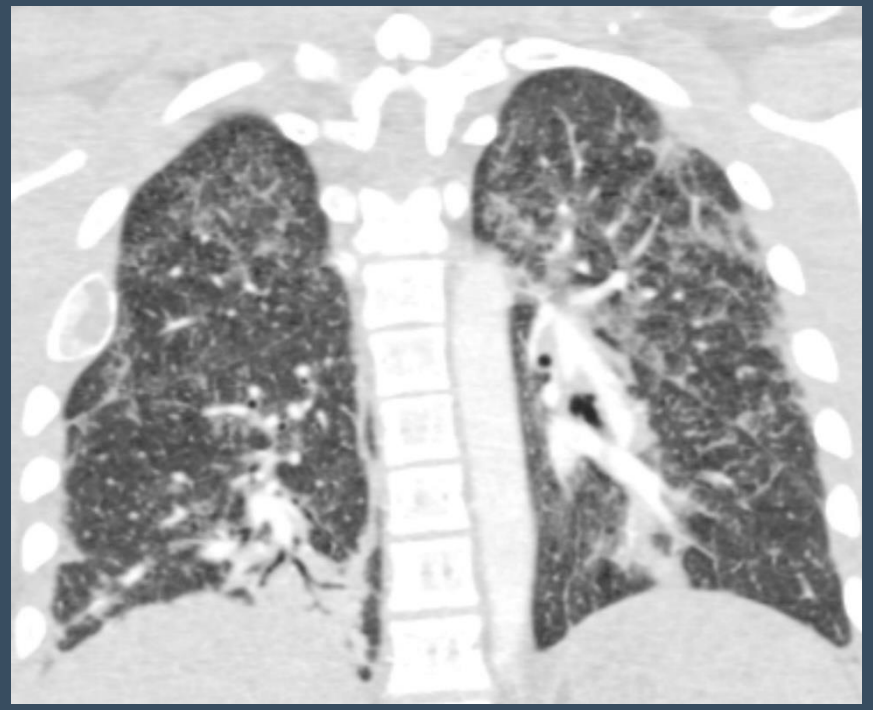
History: 3-week-old and 2-year-old with respiratory distress

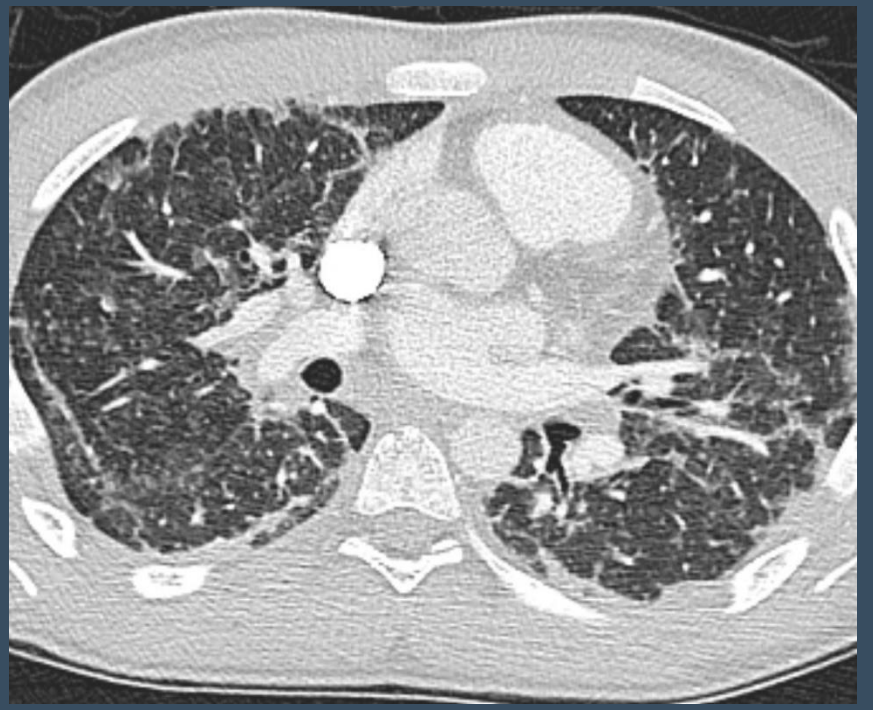
Findings:

- Hyperinflated lungs
- ↑ Parahilar peribronchial opacities

Diagnosis:
Viral chest infection, bronchiolitis







CASE 6

History: 15-year-old with shortness of breath

Findings:

- Radiograph: bibasilar and increased interstitial opacities
- CT: bilateral ground-glass density, centrilobular nodules, interlobular septal thickening and basilar consolidation

Diagnosis:

- E-cigarette or vaping associated lung injury (EVALI)
- Acute, organizing lung injury
- Tetrahydrocannabinol and vitamin-E acetate linked to outbreaks
- Most improve with cessation of e-cigarettes or vaping

CASE 7

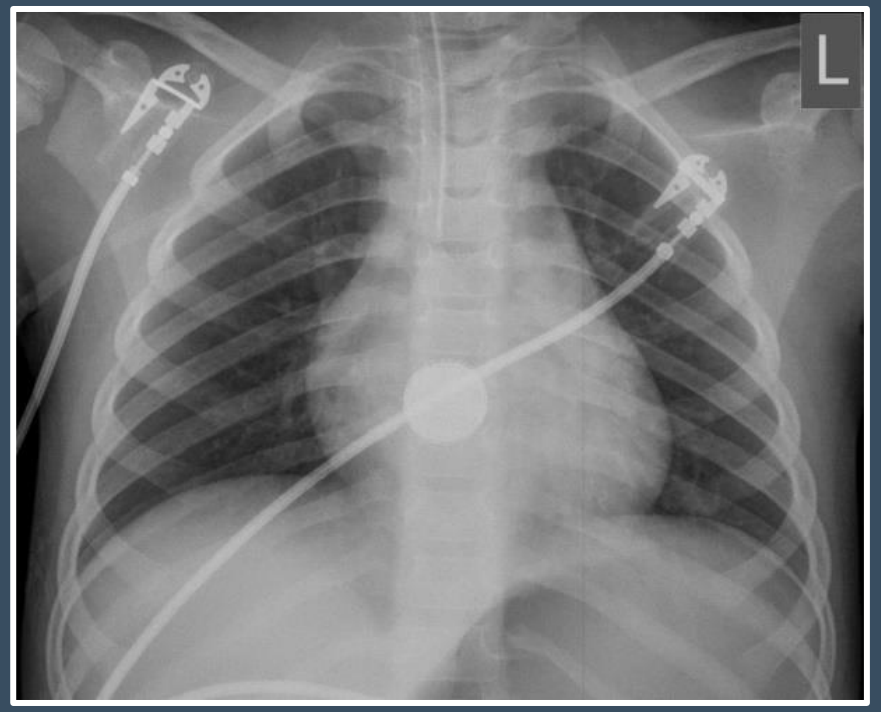
History: Child found down without pulse. Query unwitnessed trauma.

Findings:

- Ingested button battery at distal esophagus

Diagnosis:

Ingested button battery with esophago-aortic fistula



CASE 7
Companion Case 1

History: Button battery ingestion

Findings:

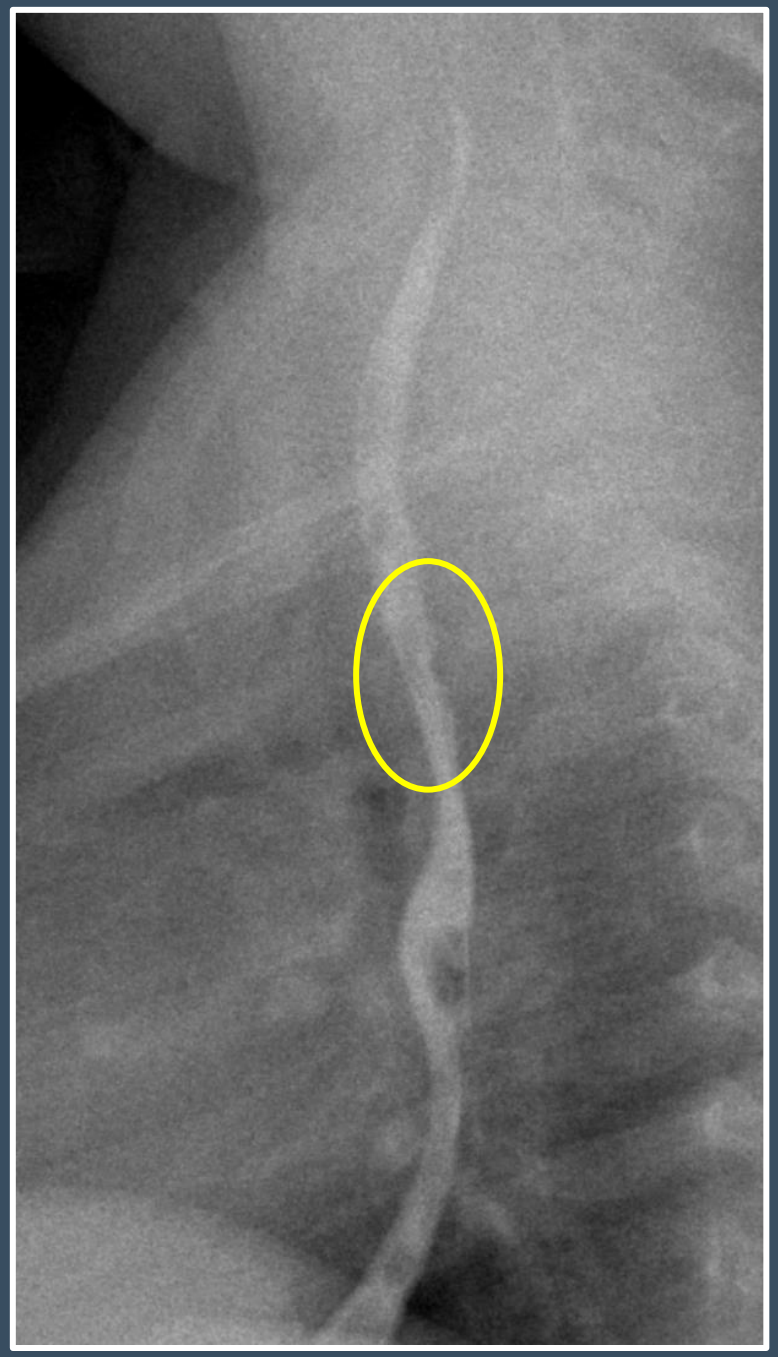
- Button battery impacted at level of aortic arch
- Anode posterior
- Soft-tissue swelling with mass effect on posterior trachea

CASE 7
Companion Case 1

History: Button battery ingestion

Complications:

- Irregular posterior margin of esophagus concerning for leak



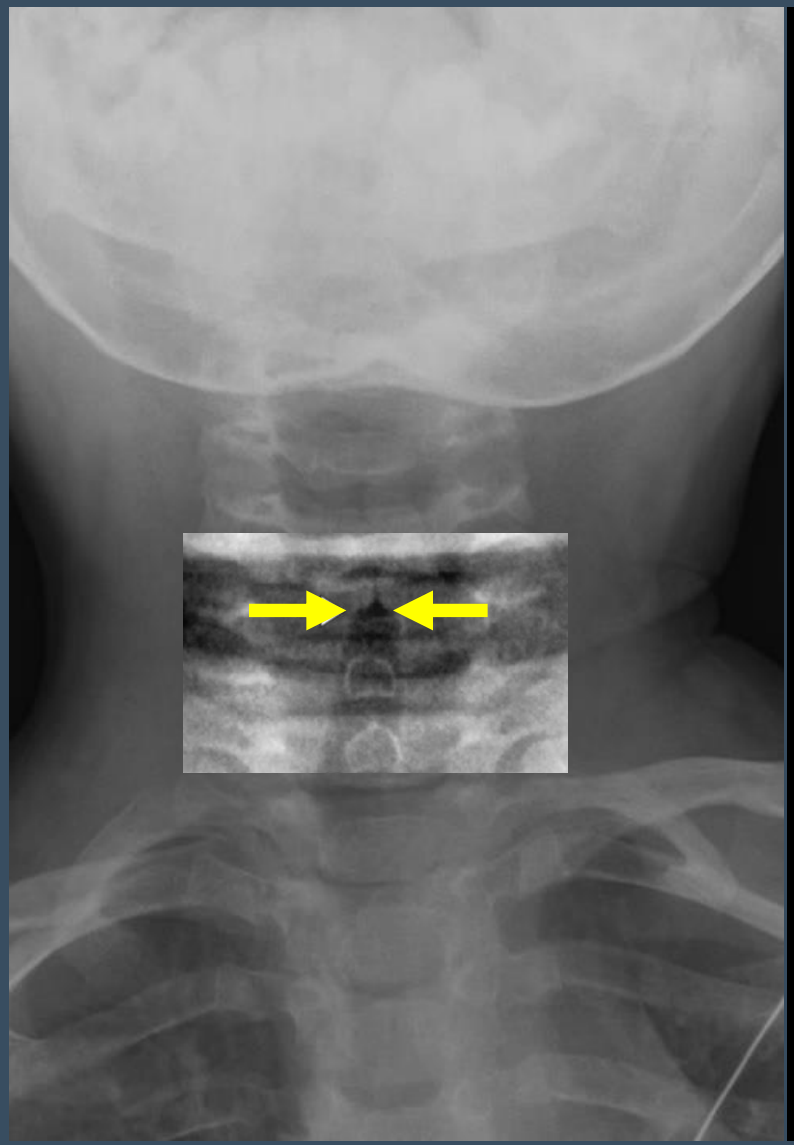
Button Battery Ingestion

- 3 N: Necrosis more likely at the Narrow Negative pole (anode)

- ↑ Risk of complications:
  - Battery diameter >20 mm
  - Unwitnessed ingestion
  - Age <5 years

- Injury continues to evolve weeks after battery removal → delayed complications
- Button battery distal to esophagus DOES NOT exclude esophageal injury
- NASPHGAN recommends CTA/MRA if evidence of esophageal injury at endoscopy

Kramer RE, Lerner DG, Lin T, Manfredi M, Shah M, Stephen TC, Gibbons TE, Pall H, Sahn B, McOmber M, Zacur G. Management of ingested foreign bodies in children: a clinical report of the NASPGHAN Endoscopy Committee. Journal of pediatric gastroenterology and nutrition. 2015 Apr 1;60(4):562-74.



CASE 8

History: 2-year-old with stridor and barking cough

Findings:

- Tapered narrowing of subglottic trachea
- Hyperinflation of hypopharynx

Diagnosis:

Croup

CASE 9

History: 6-month-old with abrupt onset stridor and fever

Findings:

- Thickened epiglottis and aryepiglottic folds

Diagnosis:
Epiglottitis

CASE 10

History: 14-year-old with rapid onset sore throat, fever, cough, stridor

Findings:

- Plaque-like filling defects in subglottic tracheal air column
- Subglottic airway may appear narrowed

Diagnosis:

Bacterial Trachietis

- 1st and 2nd decades of life, mean age 5 years
- Toxic-appearing → Sepsis
- Laryngoscopy/Bronchoscopy with plaque removal and antibiotics

CASE 11

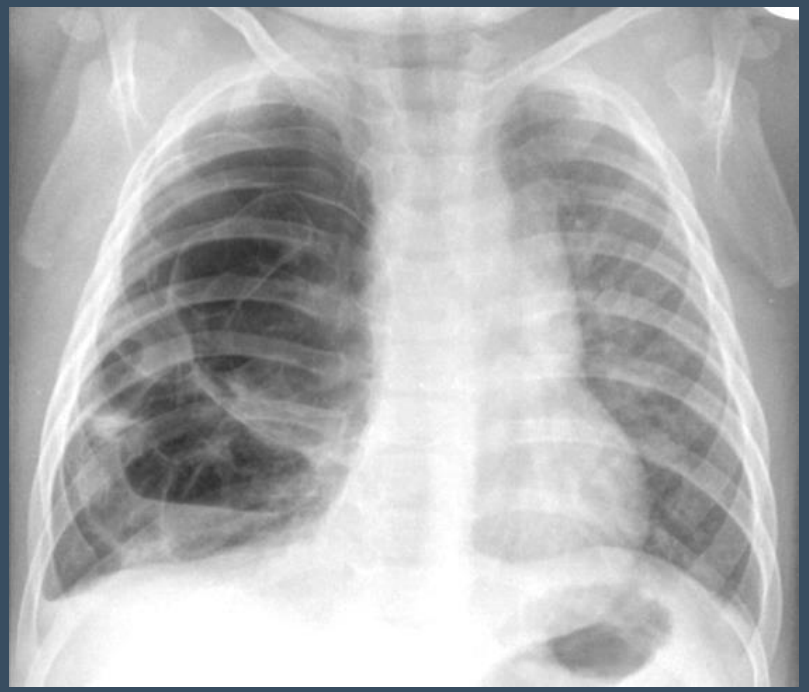
History: Respiratory distress.

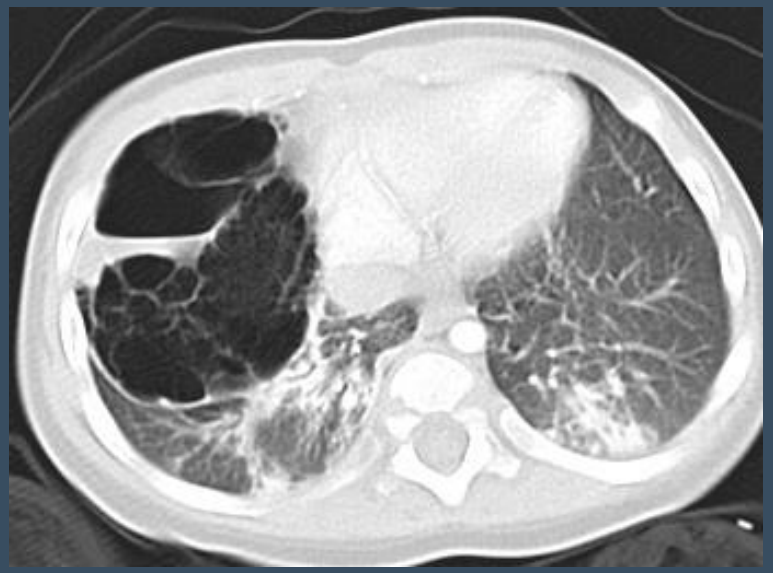
Findings:

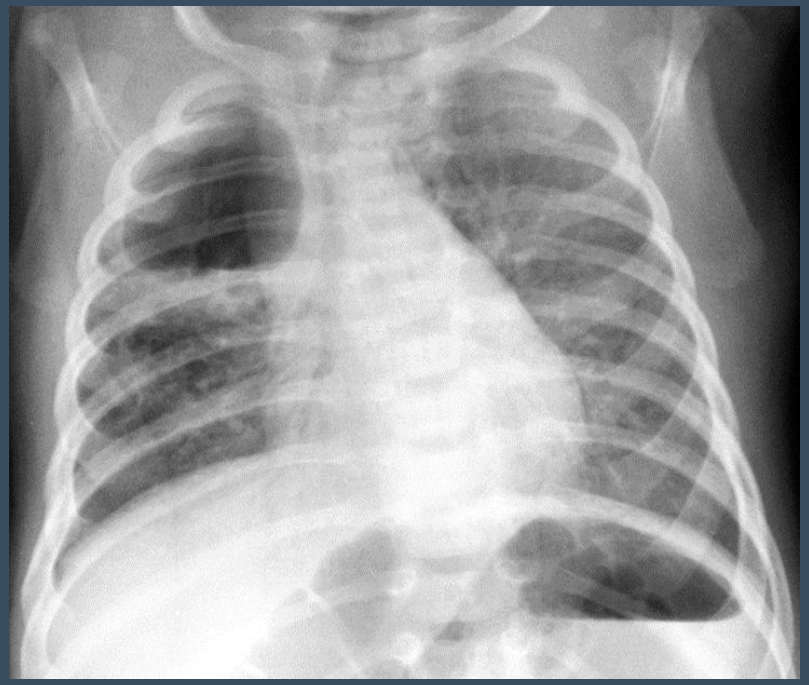
- Multilocular cystic lesion of the right lung

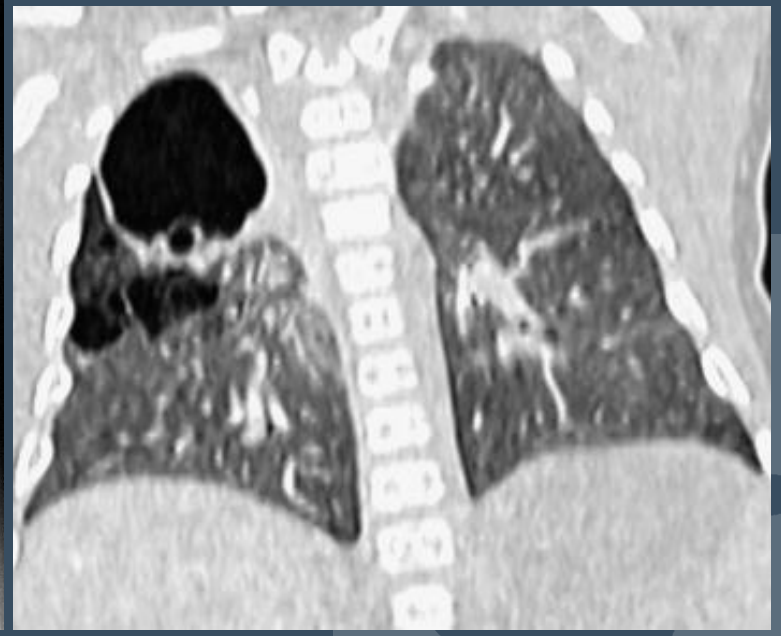
Differential Diagnosis:

- Pleuropulmonary blastoma (PPB)
- Congenital Pulmonary Airway Malformation (CPAM)



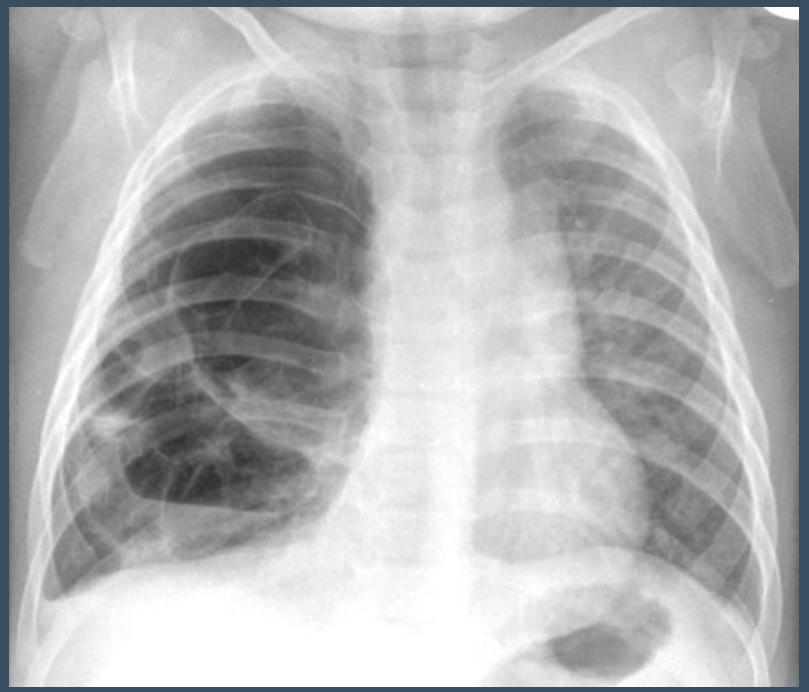


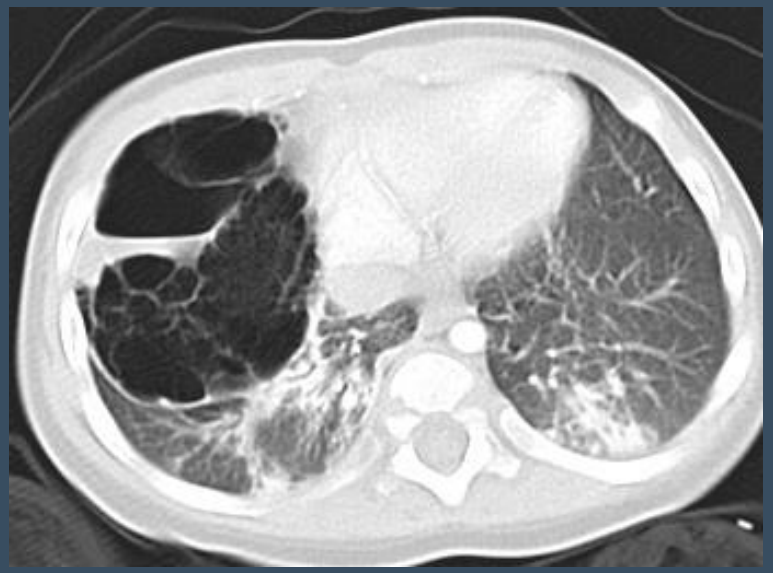




PPB

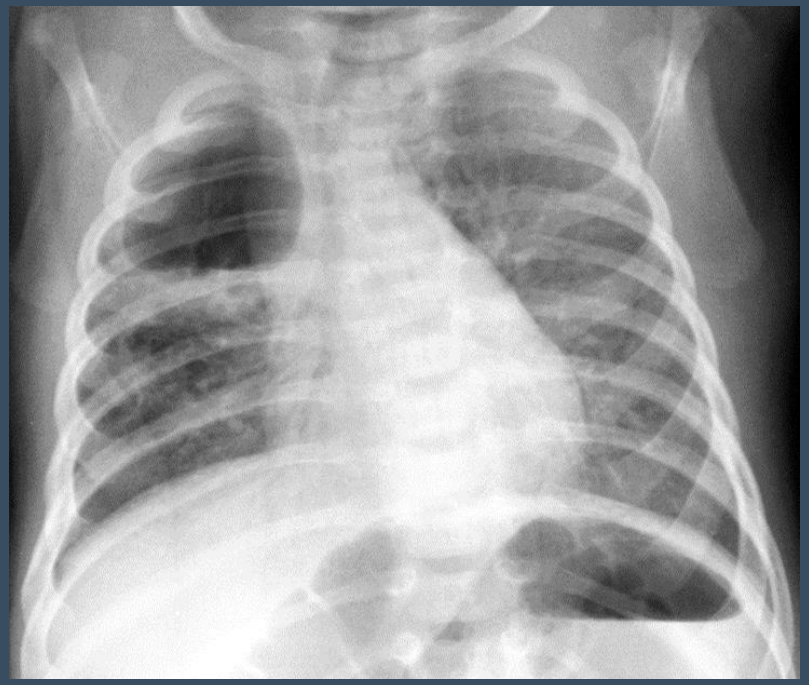
- Most common pulmonary malignancy of childhood
- Appearance depends on type
  - 1: Cystic
  - 2: Cystic and solid
  - 3: Solid
- ↑ Type = Worse prognosis

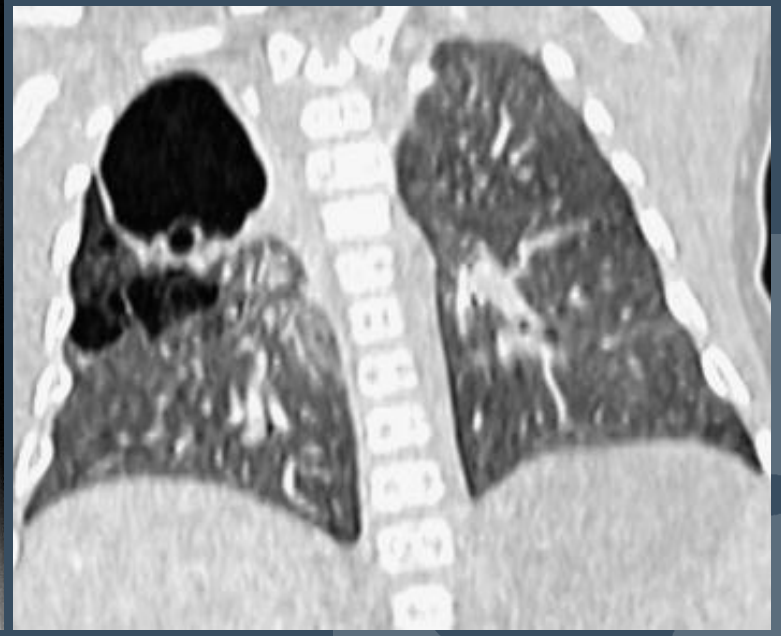




CPAM

- Developmental pulmonary lesion resulting from in-utero obstruction
- Type
  - 1: Large cysts
  - 2: Small-Medium cysts
  - 3: Microcysts
  - 4: Large peripheral cysts



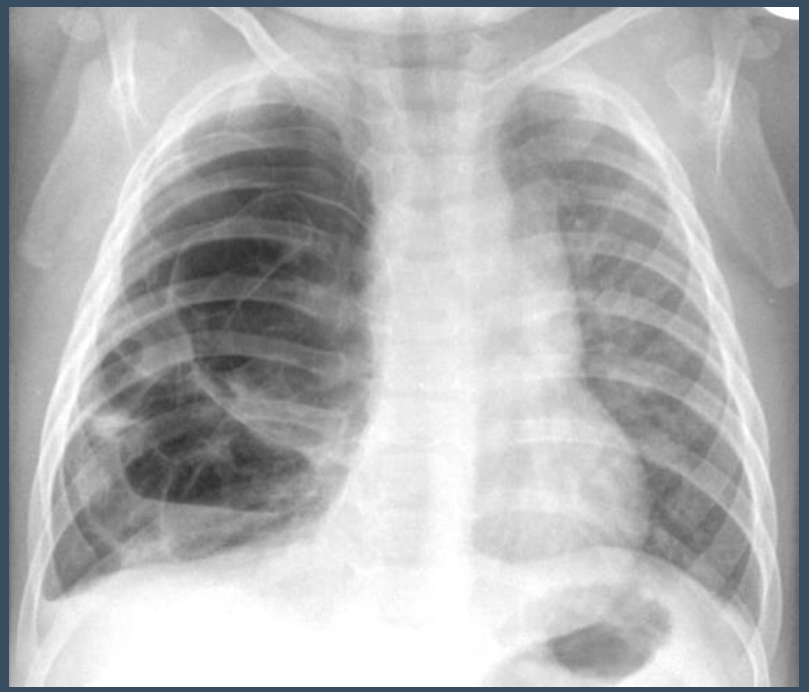


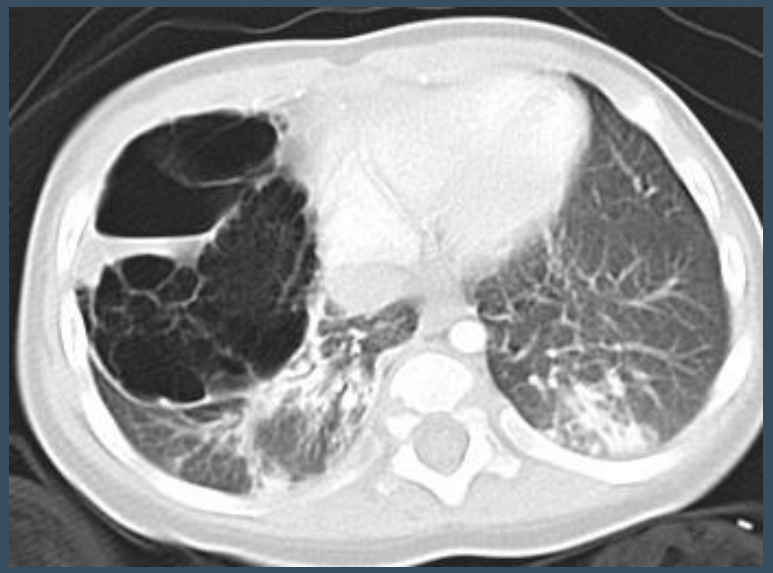
PPB vs CPAM

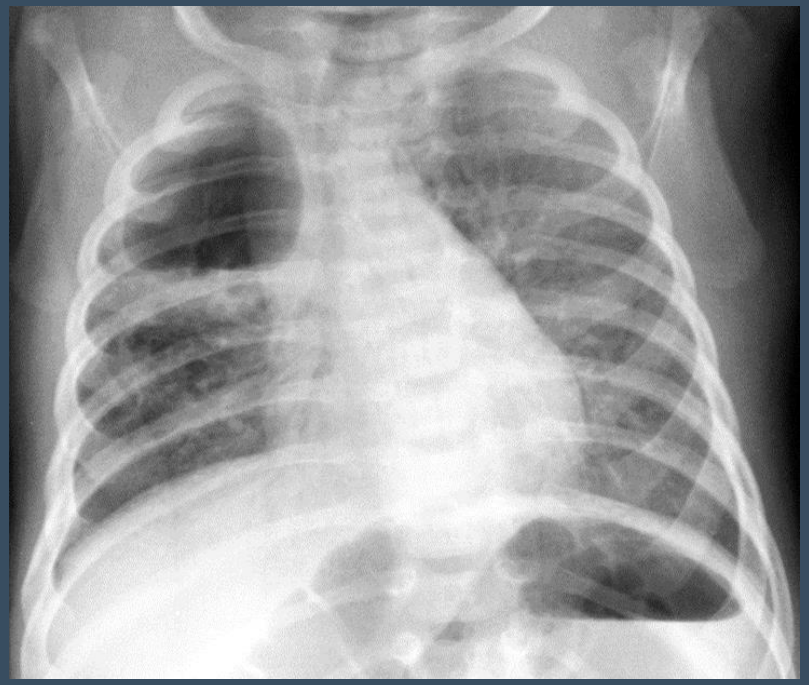
- Type 1 PPB indistinguishable from Type 1 and 4 CPAM

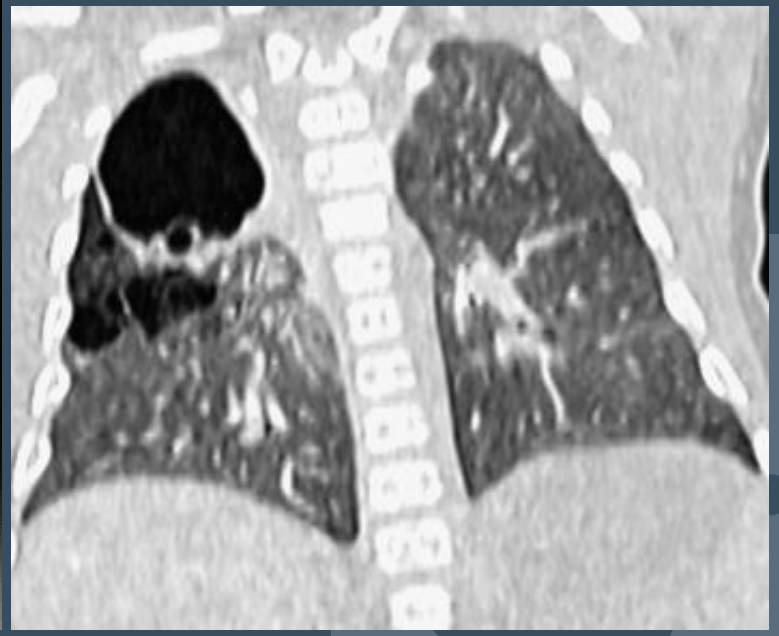
- Findings that favor PPB
  - Bilateral or multi-segment involvement
  - Pneumothorax
  - DICER1 gene mutation
  - Presence of symptoms

- Findings that favor CPAM
  - Prenatal detection
  - Systemic feeding vessel
  - Lack of symptoms
  - Lung hyperinflation









CASE 12

History: 12-month-old with wheezing after choking episode

Findings:

- Asymmetric hyperinflation and lucency of the left lung

CASE 12

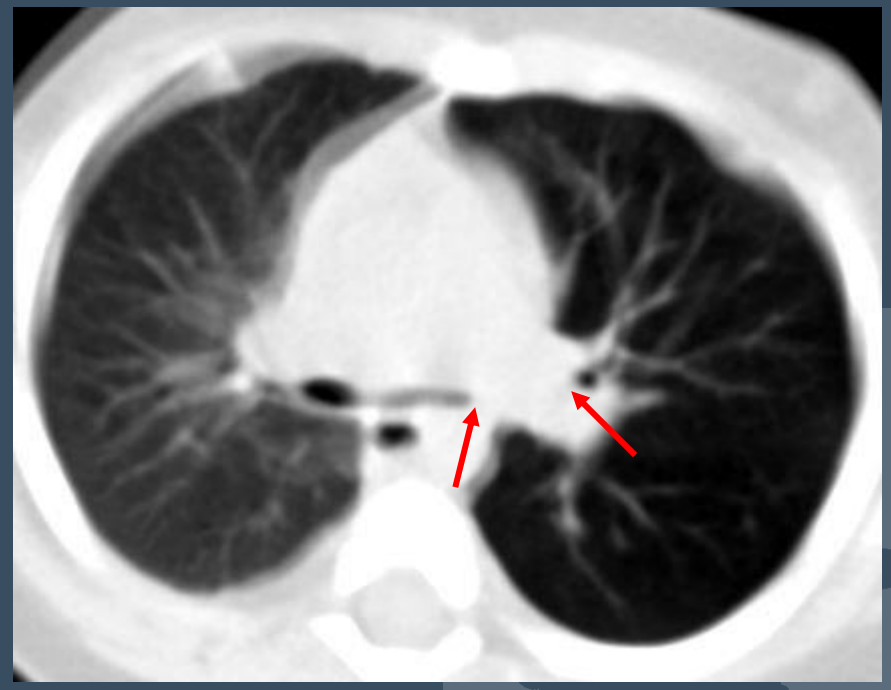
History: 12-month-old with wheezing after choking episode

Findings:

- Asymmetric hyperinflation and lucency of the left lung
- Occlusion of left mainstem bronchus

Diagnosis:

Aspiration of foreign body with left mainstem bronchus obstruction

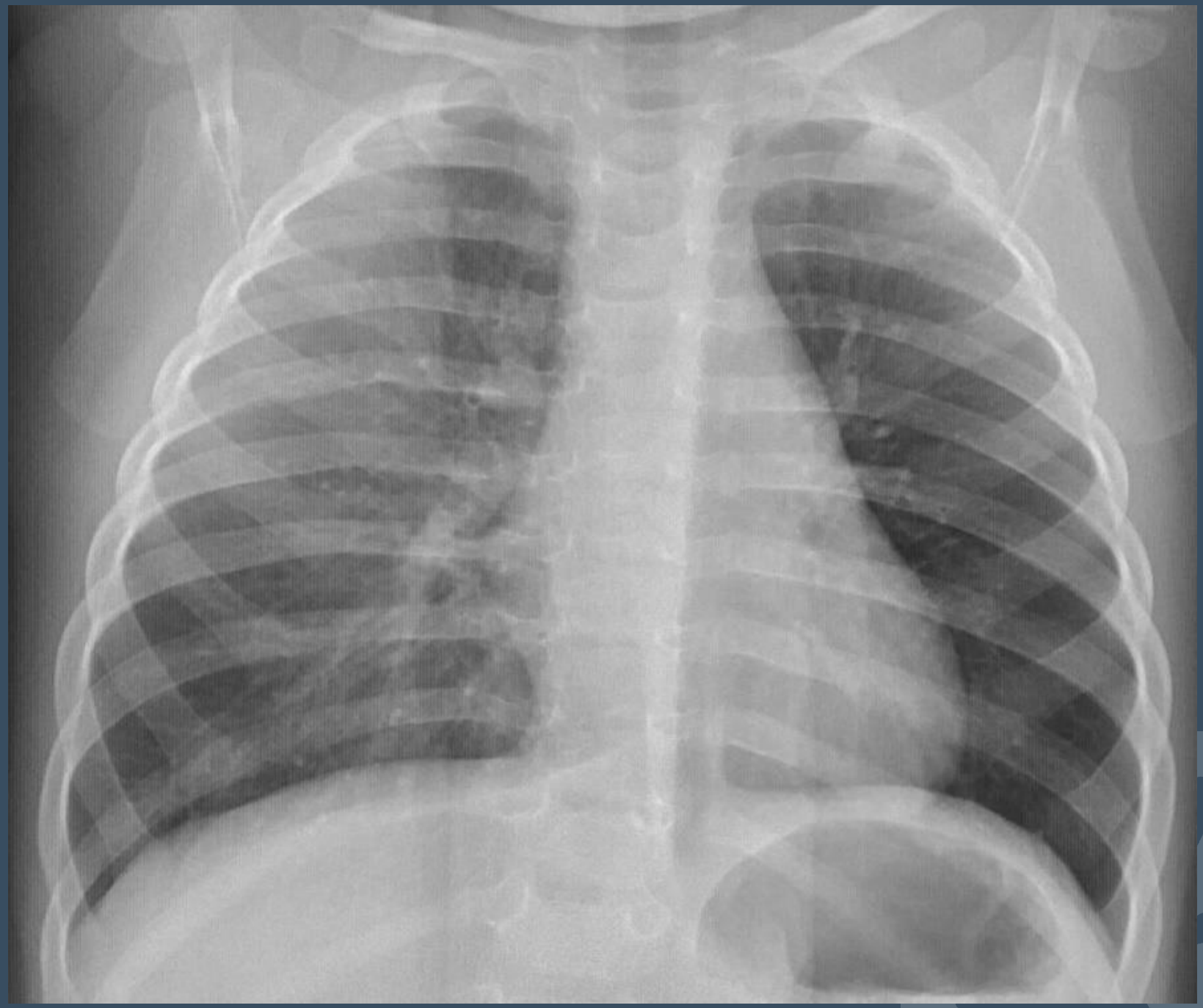


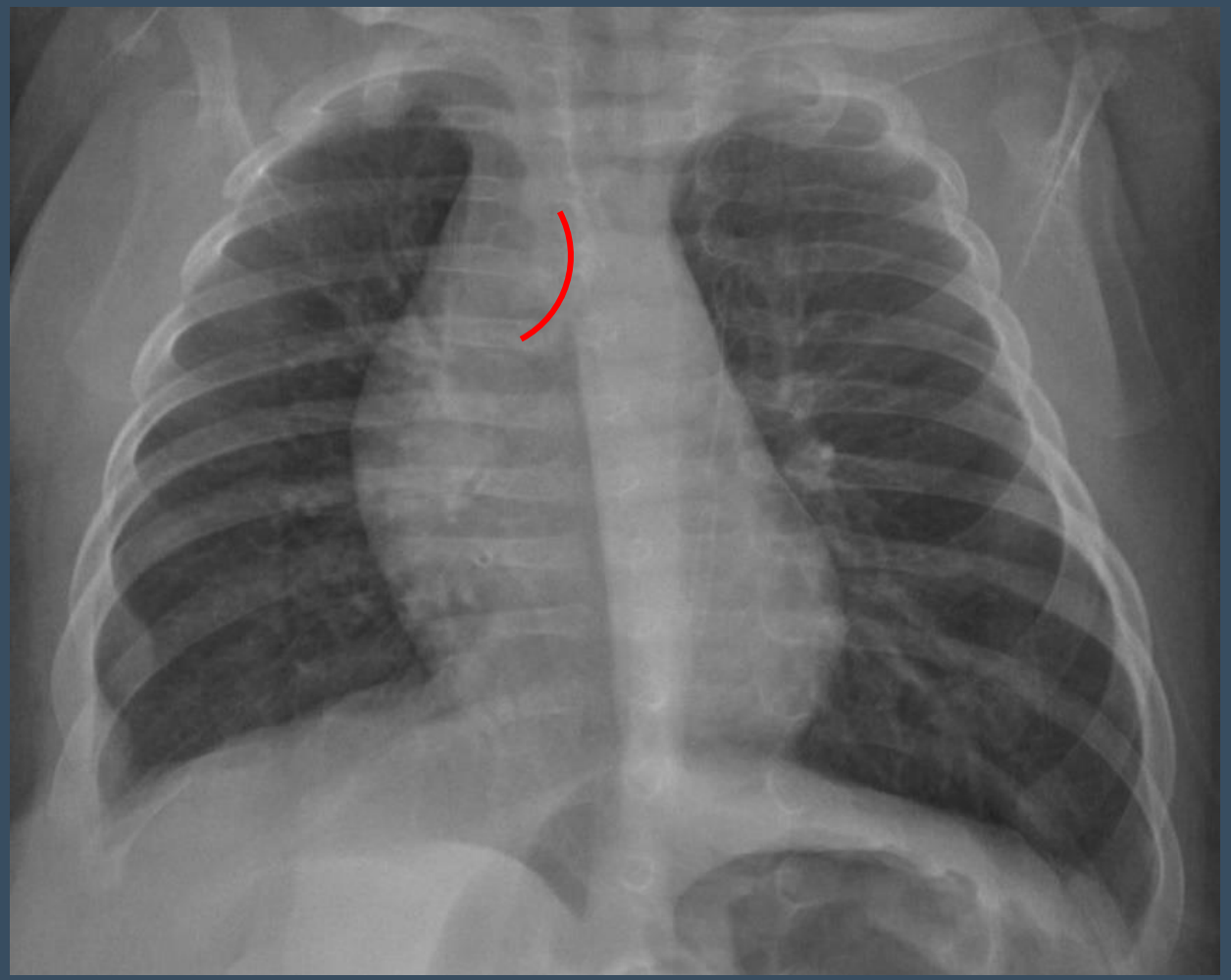
CASE 13

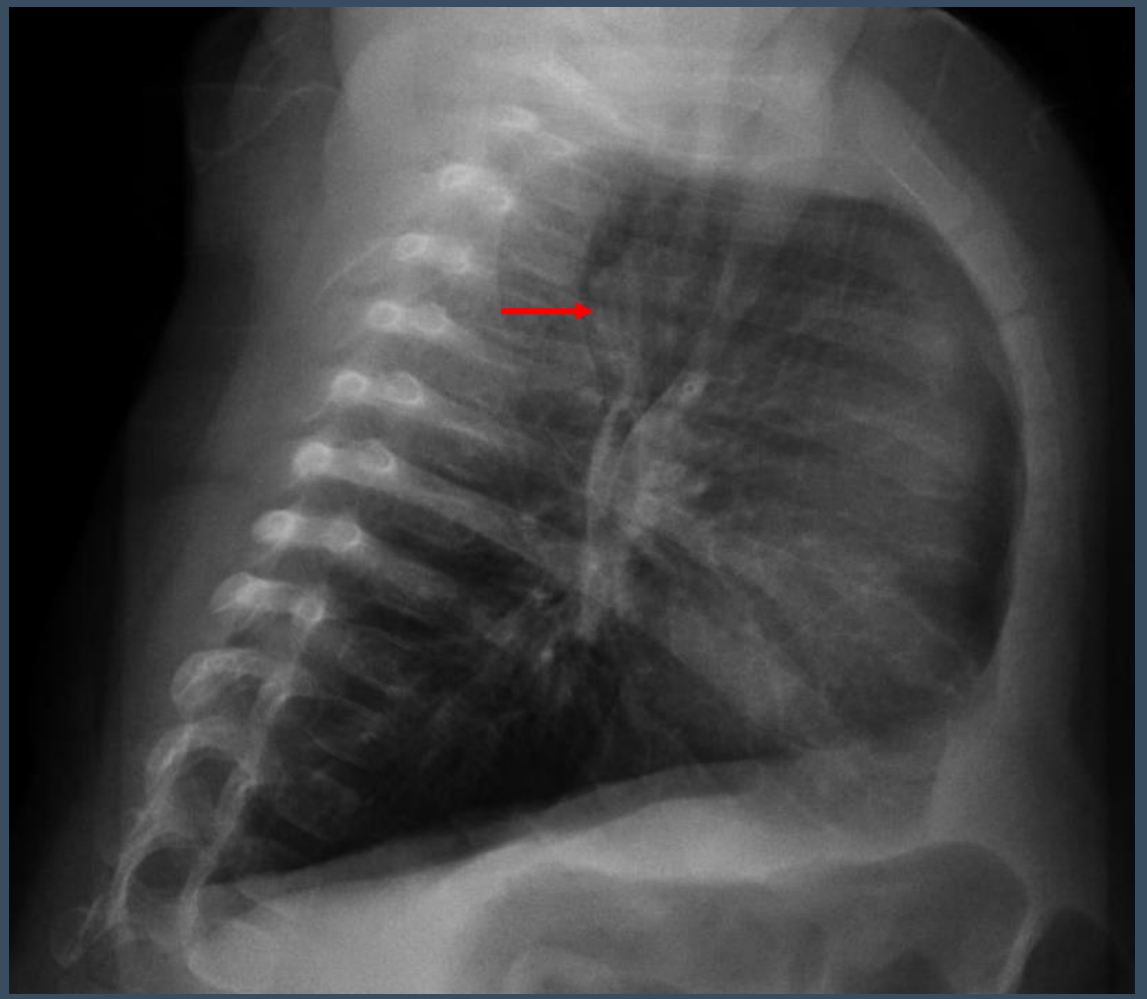
History: 21-month-old with chronic wheezing

Findings:

- Subtle asymmetric lucency of the left lung







CASE 13 continued

History: 21-month-old with chronic wheezing

Findings:

- Right aortic arch
- Aberrant left subclavian
- Hyperinflated lungs

CASE 13

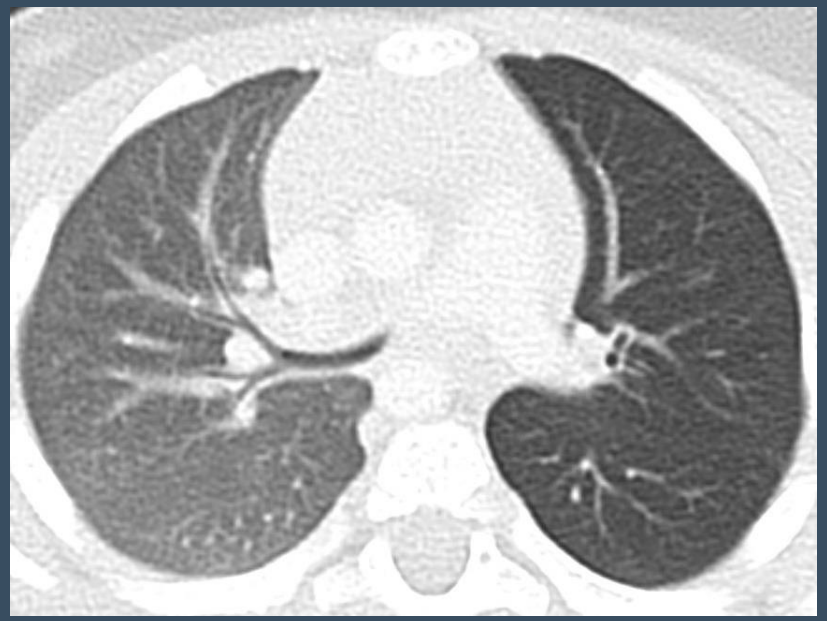
History: 21-month-old with chronic wheezing

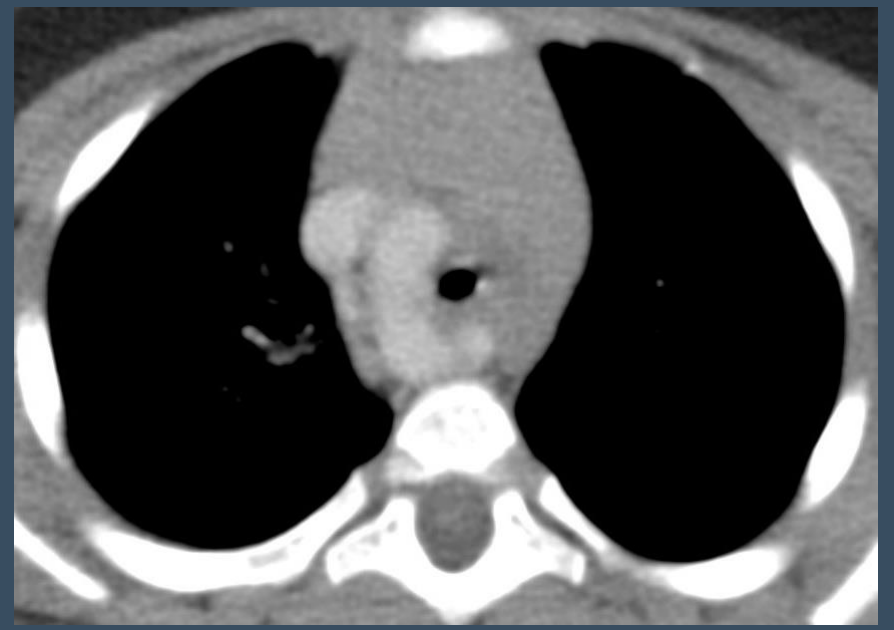
Findings:

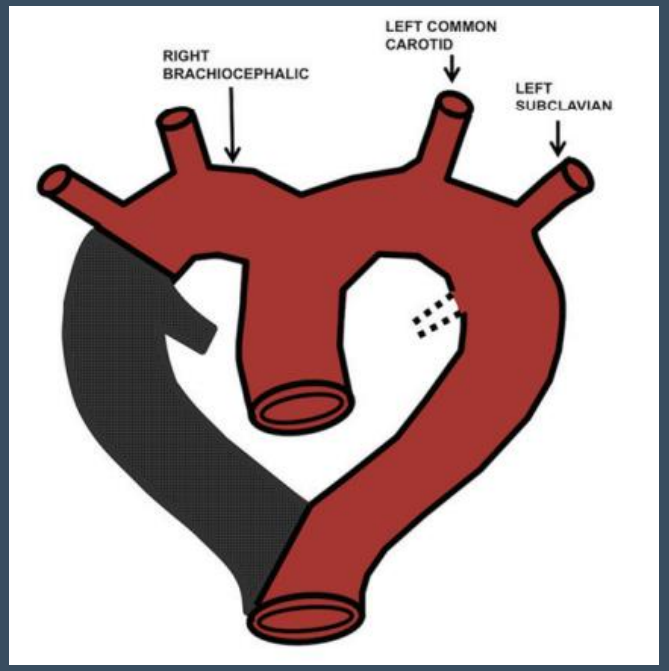
- Asymmetric lucency of the left lung
- Right aortic arch with aberrant left subclavian artery

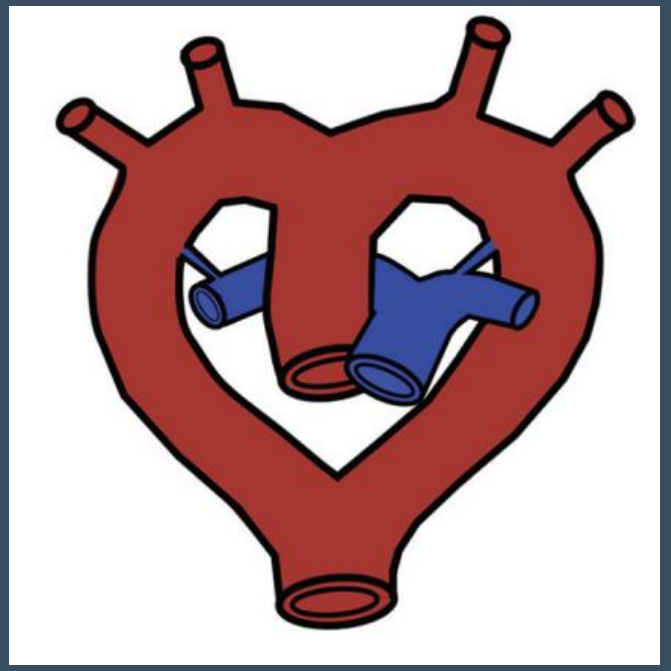
Diagnosis:

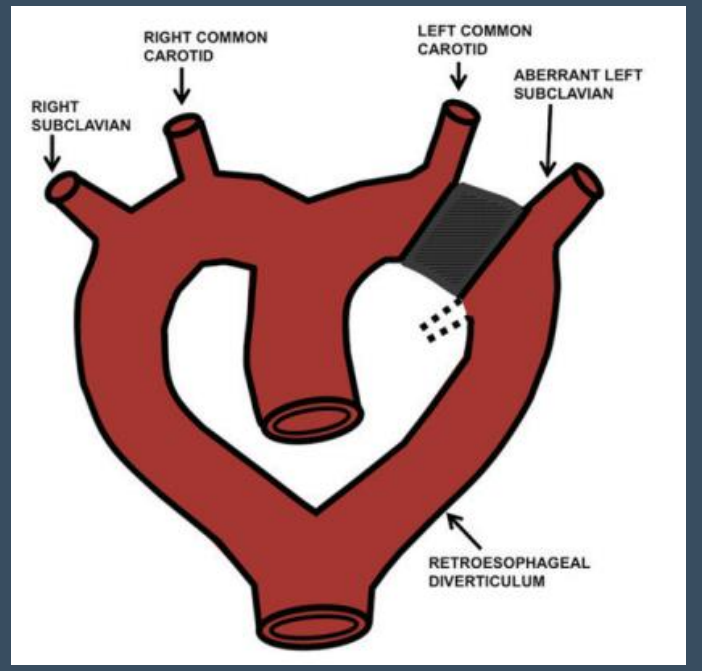
Vascular ring (right aortic arch, aberrant left subclavian artery, ligamentum arteriosum) with compression of distal trachea and left mainstem bronchus

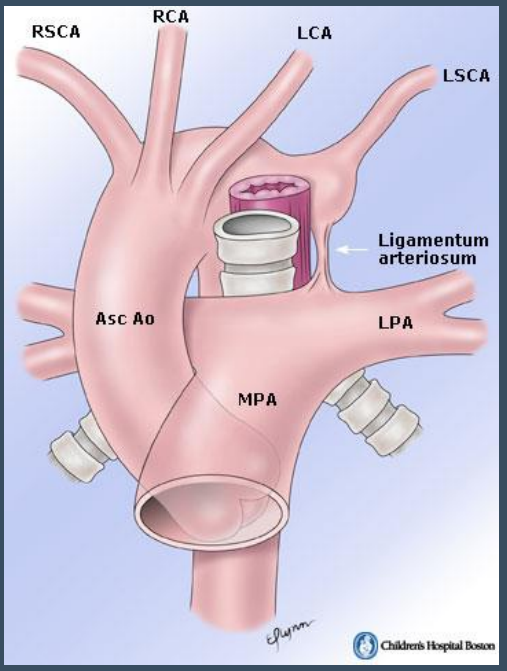






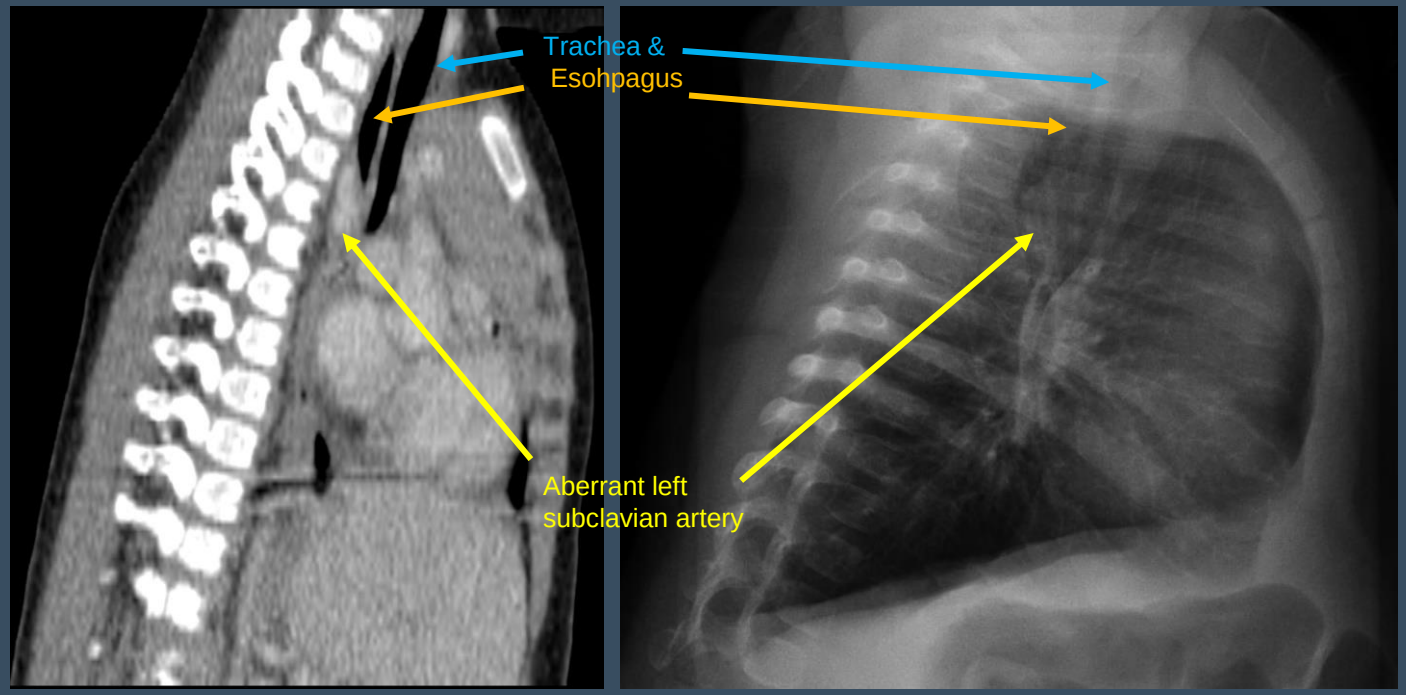


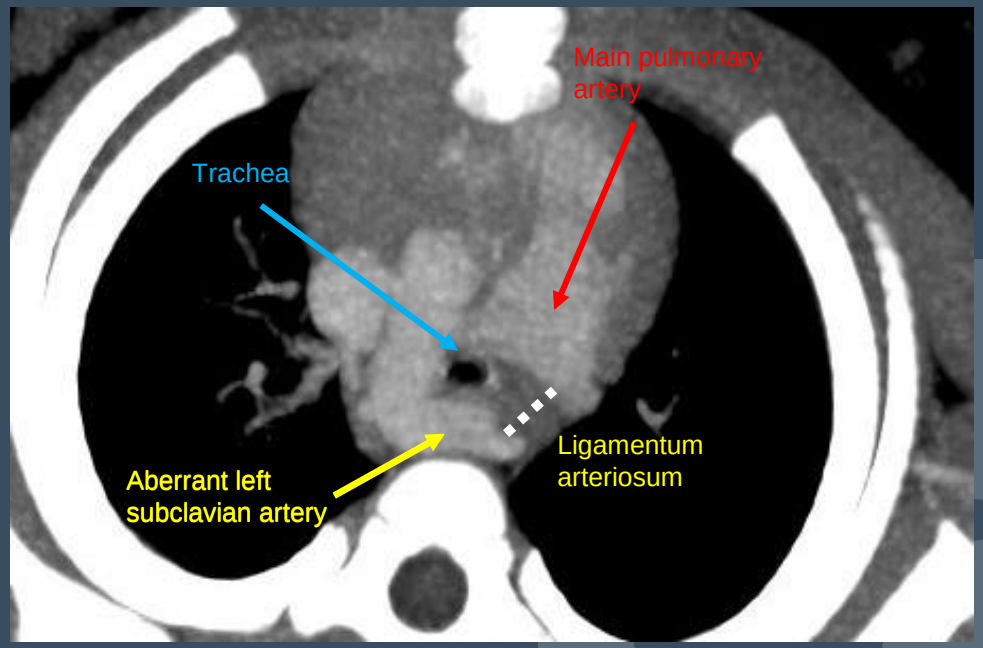




Source: Hanneman K, Newman B, Chan F. Congenital variants and anomalies of the aortic arch. Radiographics. 2017 Jan;37(1):32-51.

Source: https://apps.childrenshospital.org/MML/index.cfm?CAT=media&MEDIA_ID=2019





CASE 14

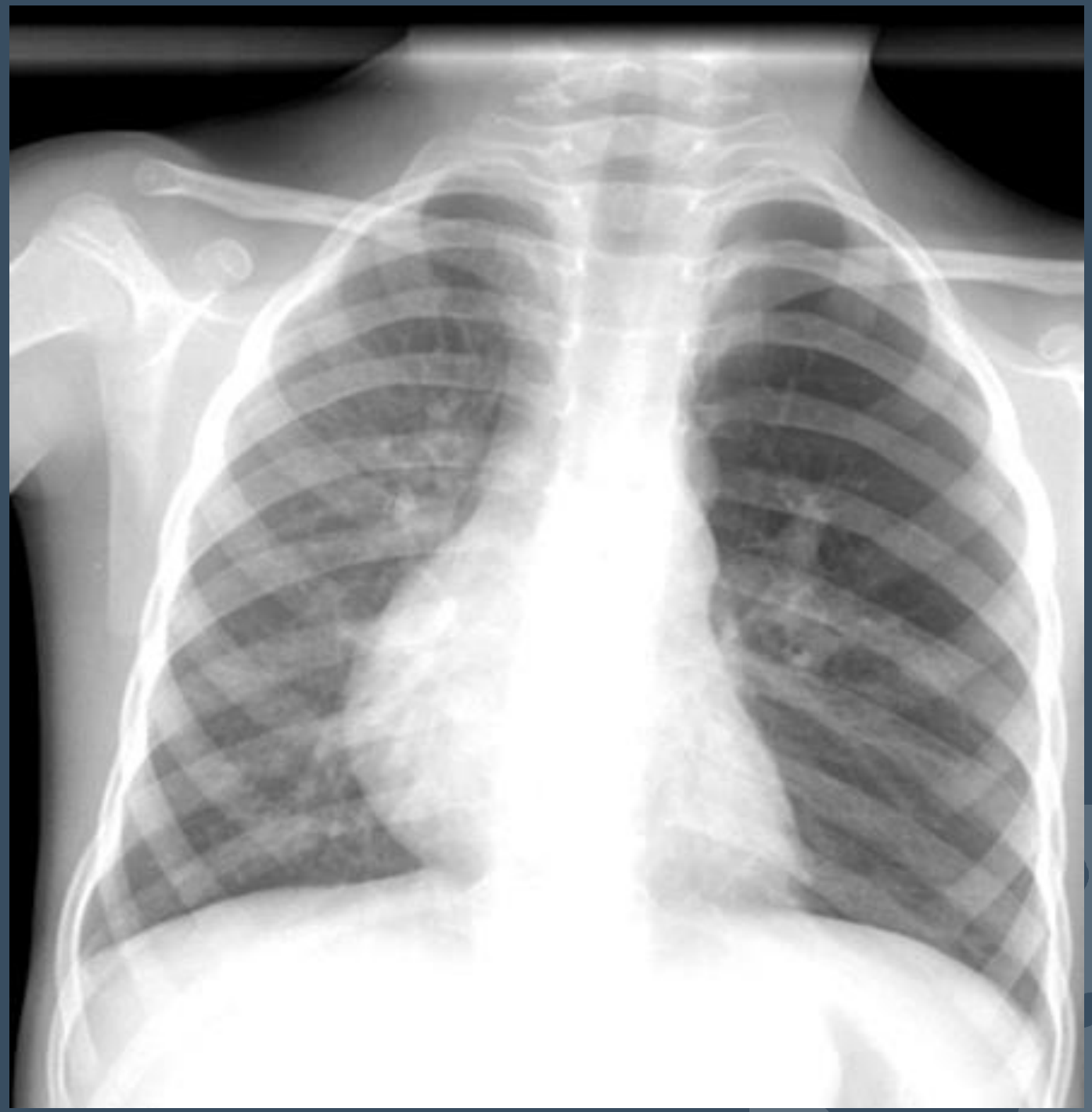
History: 3-year-old with recurrent respiratory infection

Findings:

- Hyperlucent left upper lobe
- Atretic bronchus with mucocele
- No bronchiectasis

Diagnosis:

Bronchial Atresia



CASE 14

History: 3-year-old with recurrent respiratory infection

Findings:
- Hyperlucent left upper lobe
- Branching low attenuation mucocele

Diagnosis:
Bronchial Atresia

Teaching Point

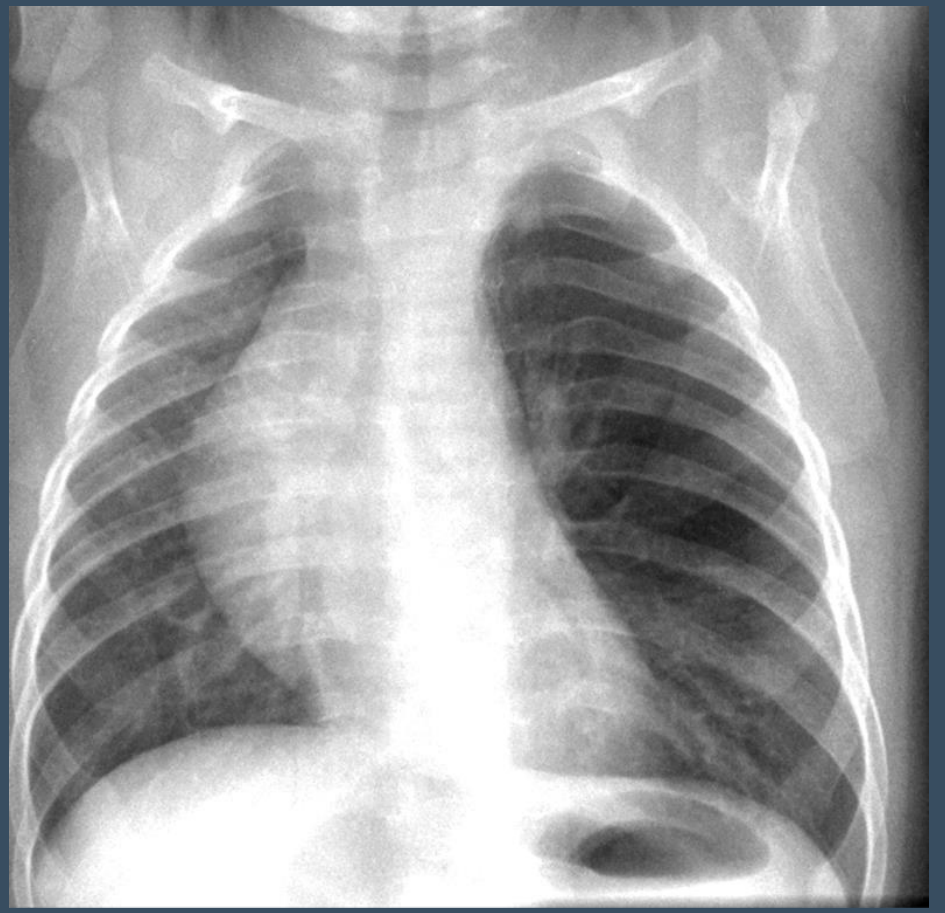
- Differentiate from allergic bronchopulmonary aspergillosis
  - No bronchiectasis with bronchial atresia
  - “Finger in glove” may be high attenuation in ABPA

CASE 14
Companion Case

History: Neonate with recurrent respiratory infection

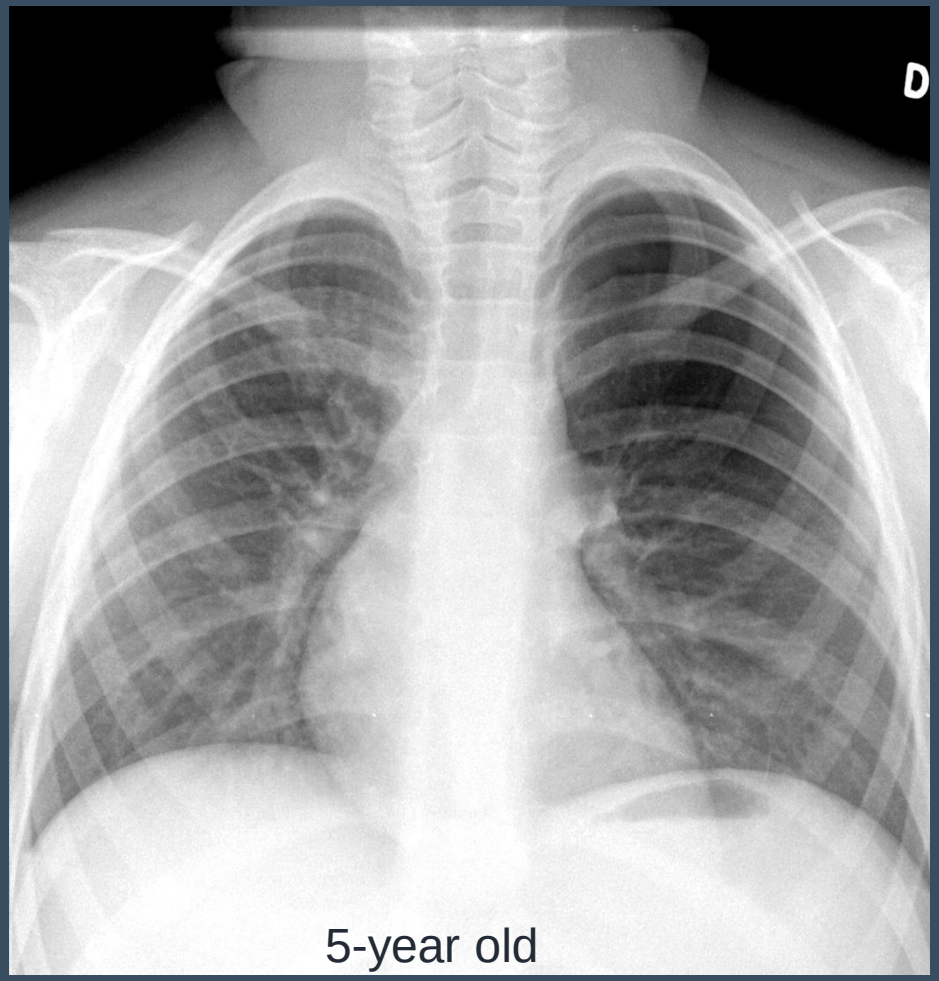
Findings:
- Hyperlucent left upper lobe
- Mass effect with rightward mediastinal shift

Diagnosis:
Congenital lobar overinflation



CASE 14
Companion Case

History: Congenital lobar overinflation



5-year old

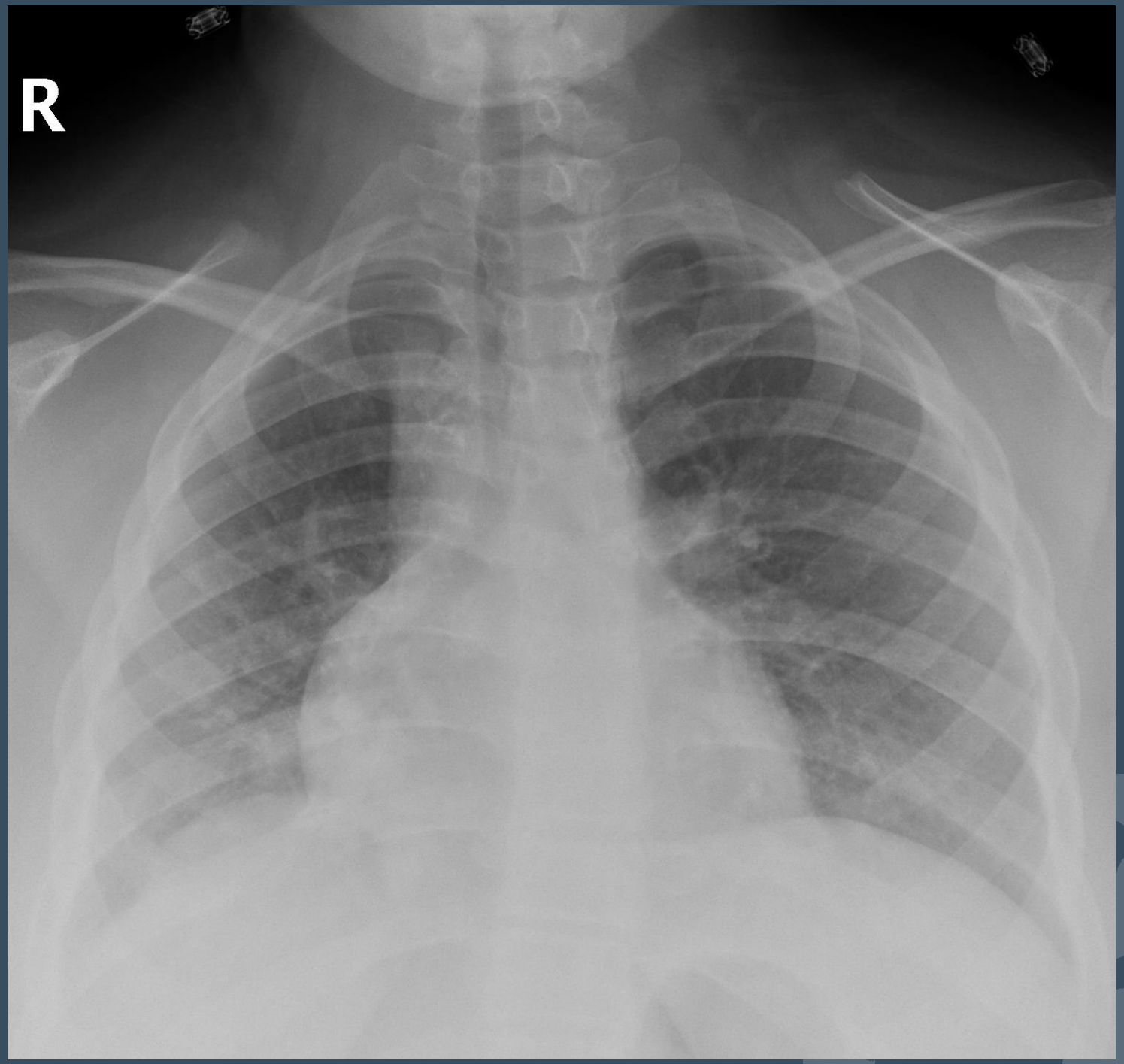
8-year old

CASE 15

History: 15-year-old with cough.
History of asthma.

Findings:

- Retrocardiac opacity
- Asymmetric lung volume, R<L



CASE 15

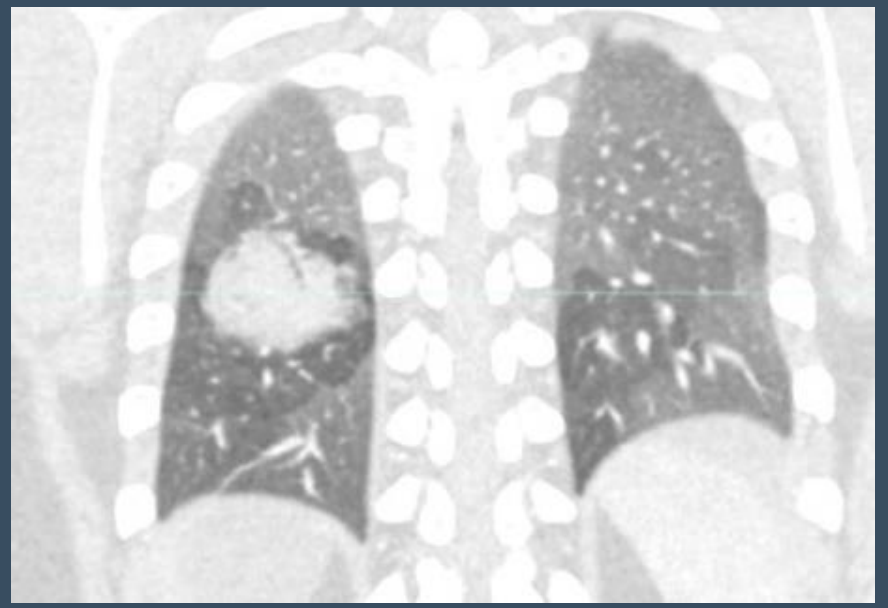
History: 16-year-old with cough. History of asthma.

Findings:

- Anomalous pulmonary venous drainage to IVC
- Right lung hypoplasia
- Atretic right upper lobe bronchus
- Right lower lobe pneumonia

Diagnosis:

Scimitar syndrome



Case 16

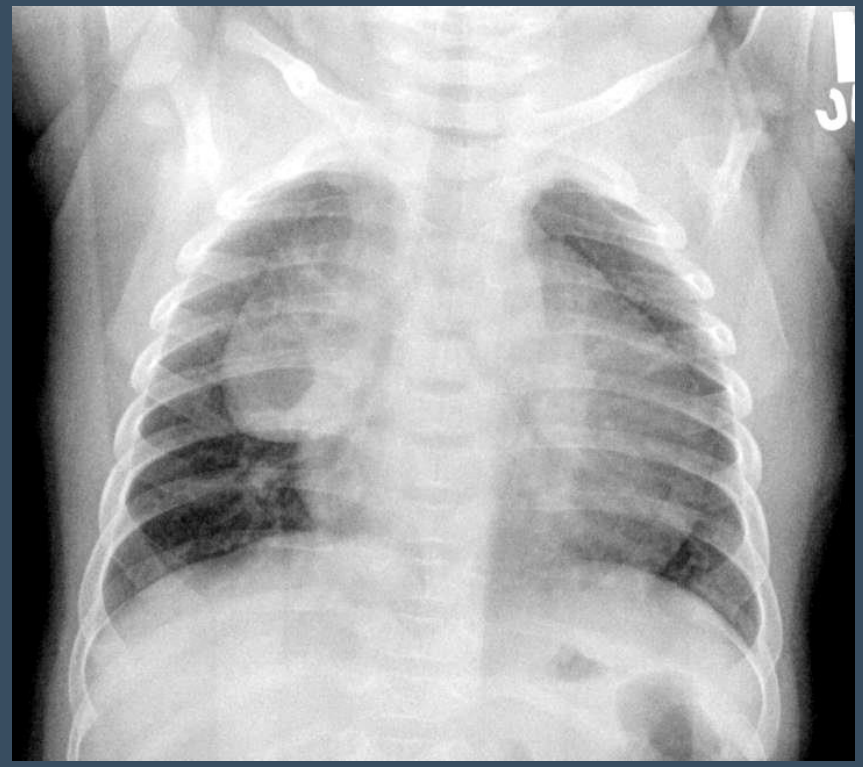
History: 3-month-old referred for anterior mediastinal mass

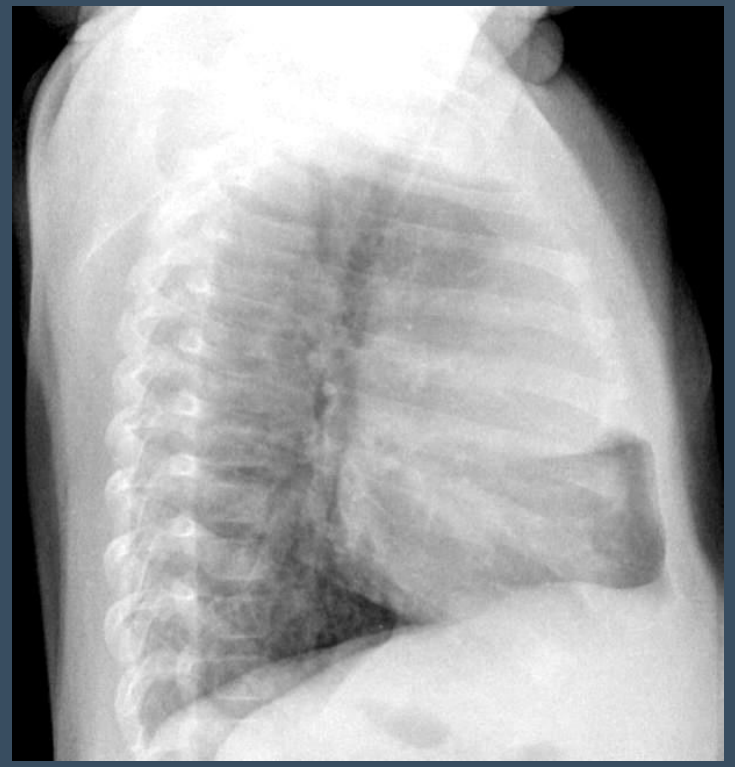
Findings:

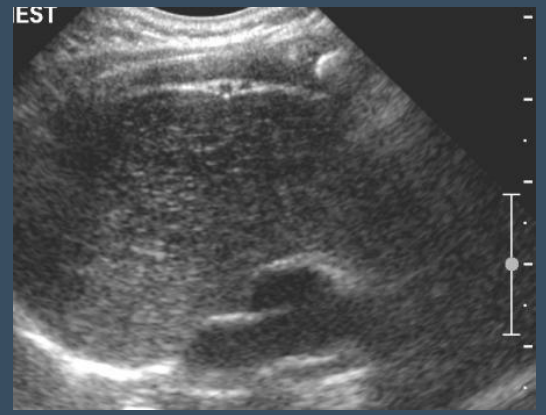
- Lobular anterior mediastinal soft-tissue
- No mass effect
- Hypoechoic with echogenic foci and internal vascularity

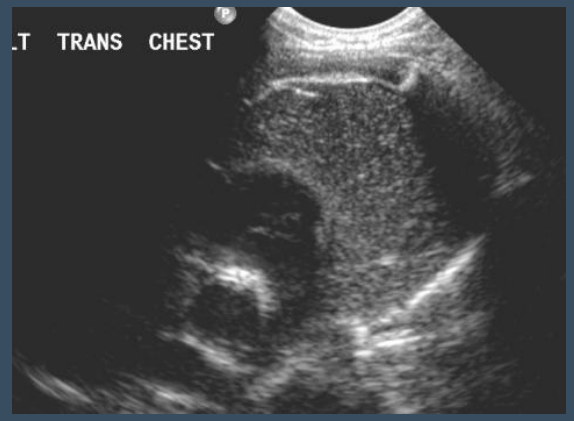
Diagnosis:

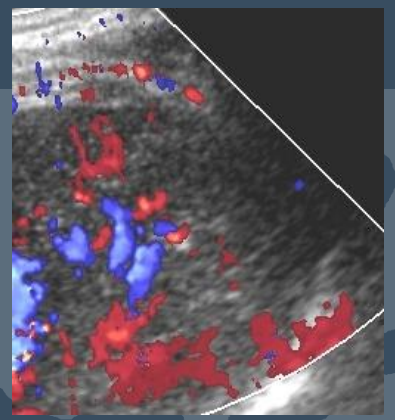
Normal thymus





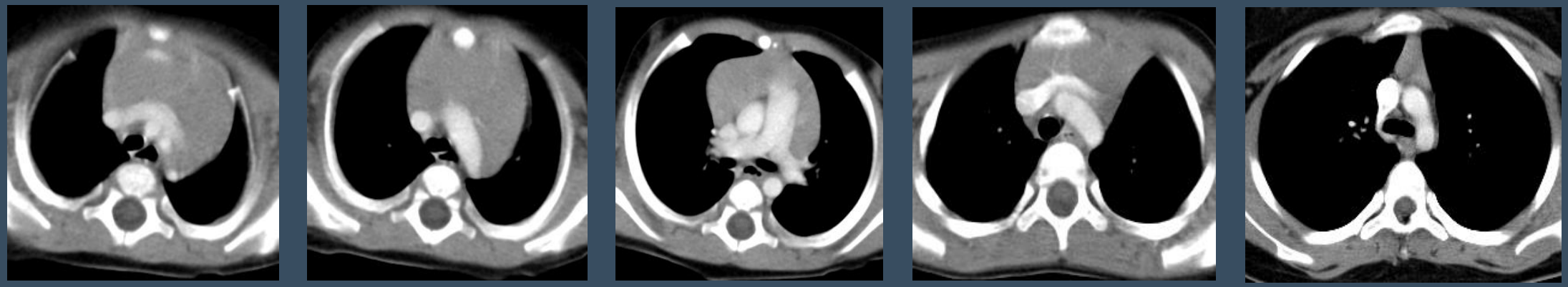




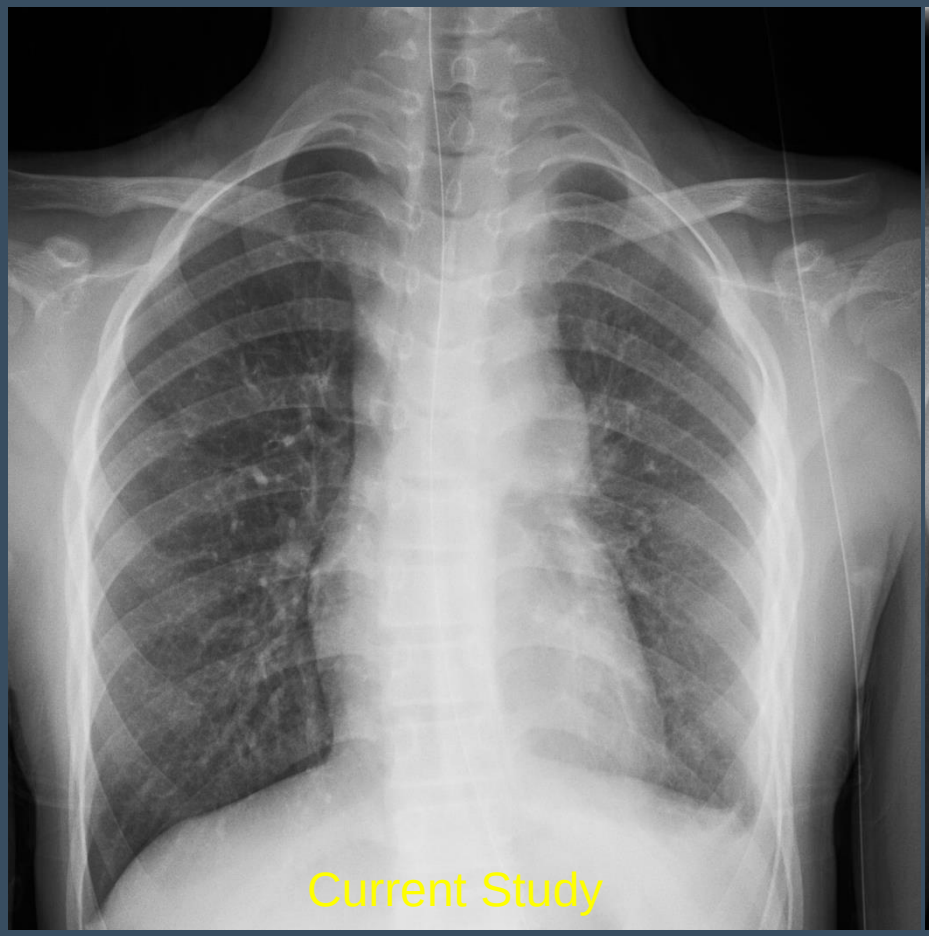


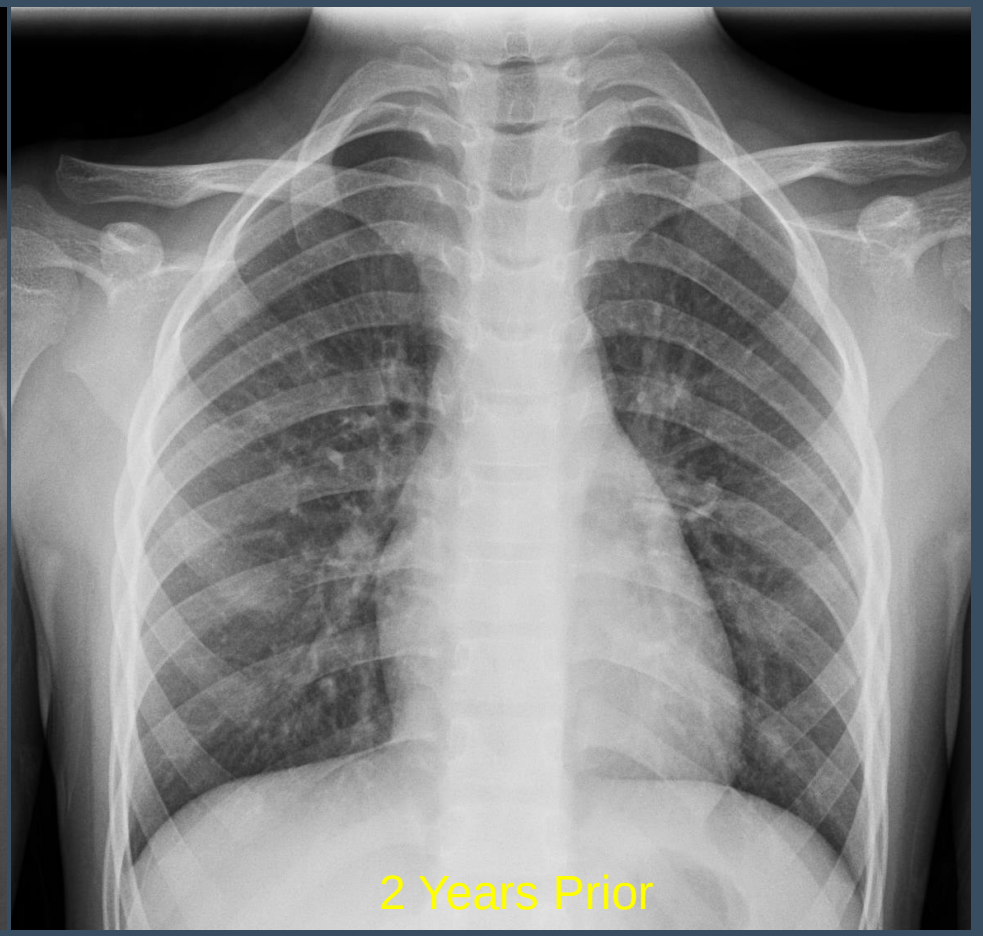
Case courtesy of Dr. David Manson

Normal Thymus



- Large, nearly fully developed at birth
- Soft, no mass effect, small degree of transparency
- Gradually involutes after the age of 2-years, usually difficult to visualize after age of 8-years on radiograph





Case 17

History: 8-year-old with constipation

Findings: Increase in size of mediastinum

Diagnosis: Tuberculosis

CASE 18

History: 3-year-old with chest pain

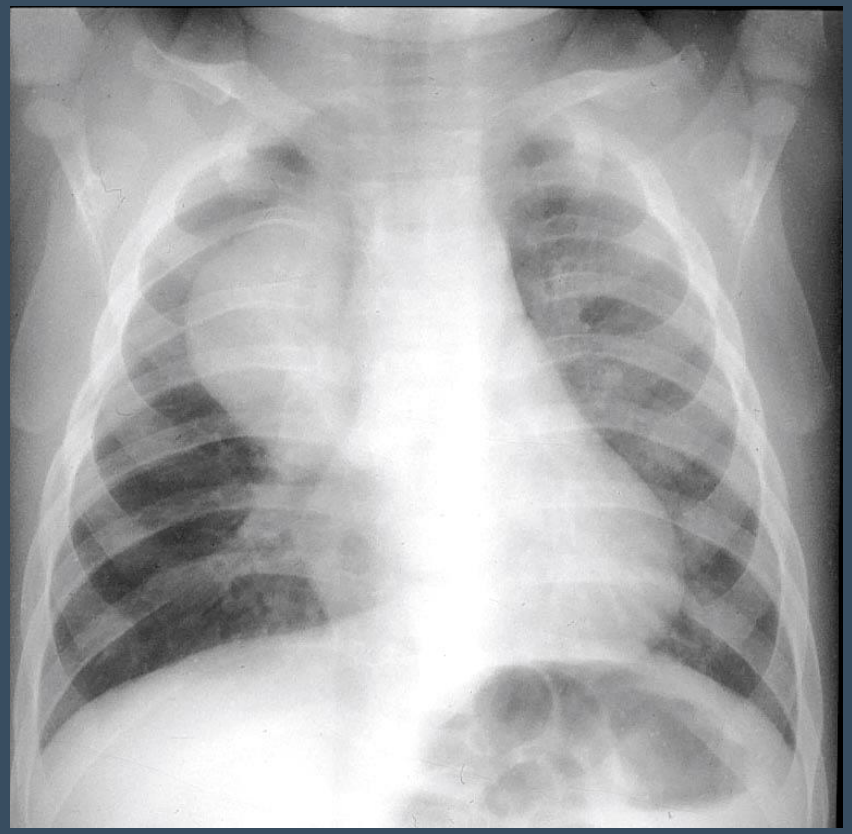
Findings:

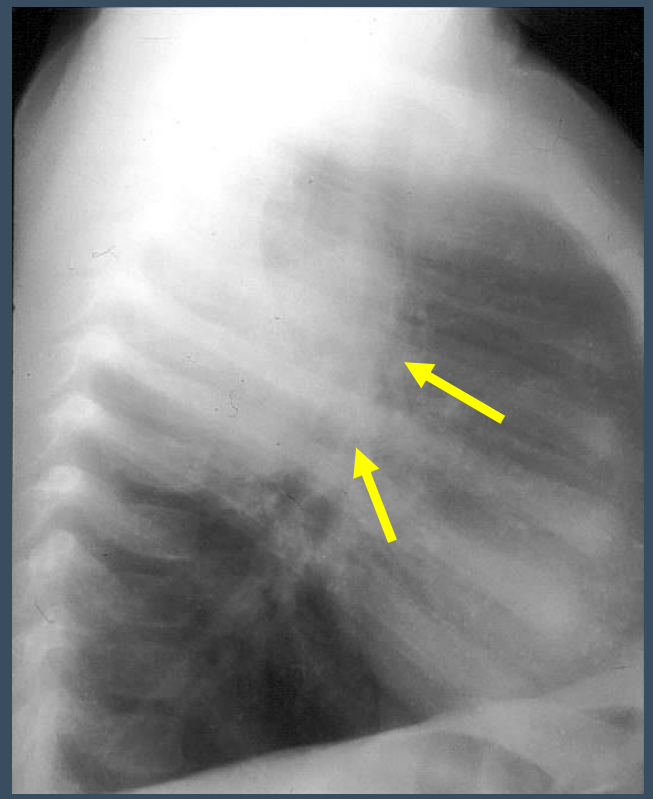
- Lobular right mediastinal soft-tissue
- + Mass effect on trachea
- + Rib splaying

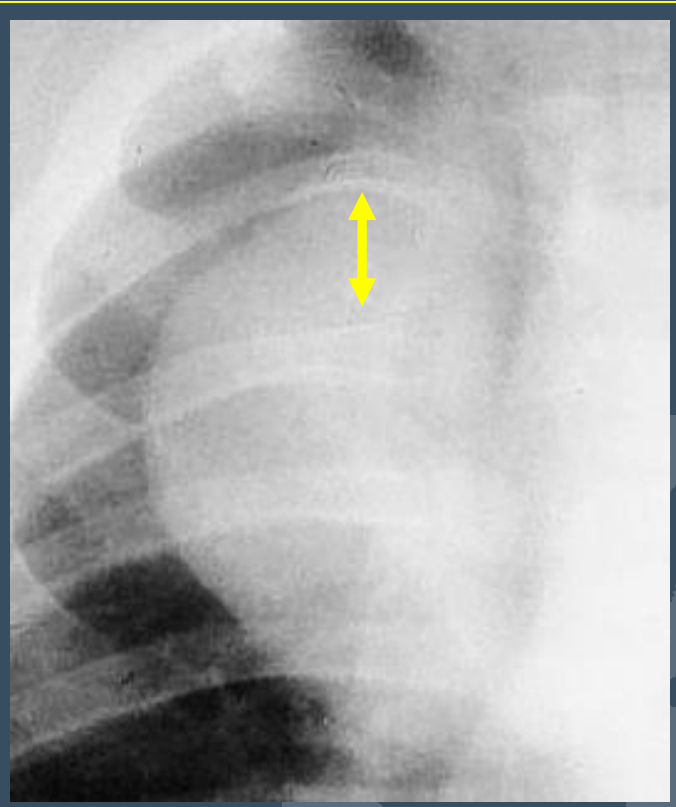
Diagnosis:
Neuroblastoma

Teaching Points

- Normal thymus
  - No mass-effect
  - Normal bones
  - Decreases in size with age
- Characteristic appearance on US
  - Hypoechoic
  - “Feathery” linear echogenic foci







Take Home Points

- Wide differential for consolidation/nodules/masses but clinical history can help narrow the differential diagnosis
- Look at the airway for evidence of obstruction or mass-effect
- Look for subtle hyperlucency and asymmetric lung volumes
- Button battery impactions could cause severe complications
- Be aware of characteristics of the normal thymus

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