



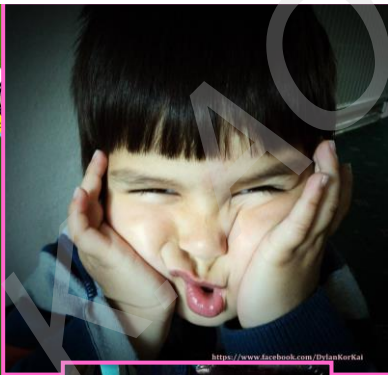
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Normal and Pitfalls in Pediatric Chest Radiographs

Supika Kritsaneepaiboon, M.D.
Sep, 15th 2013

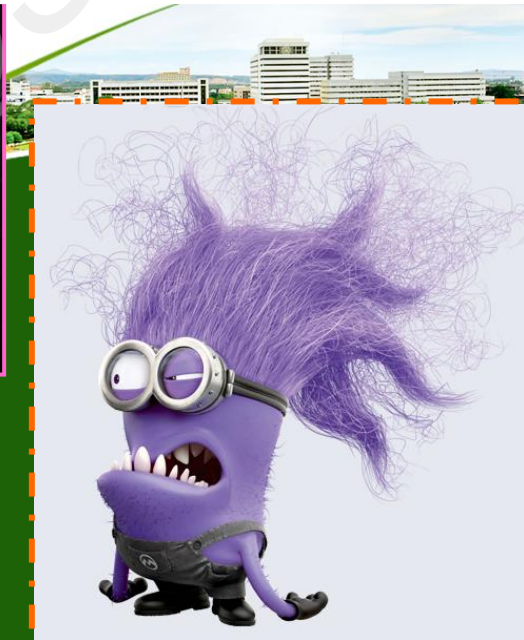
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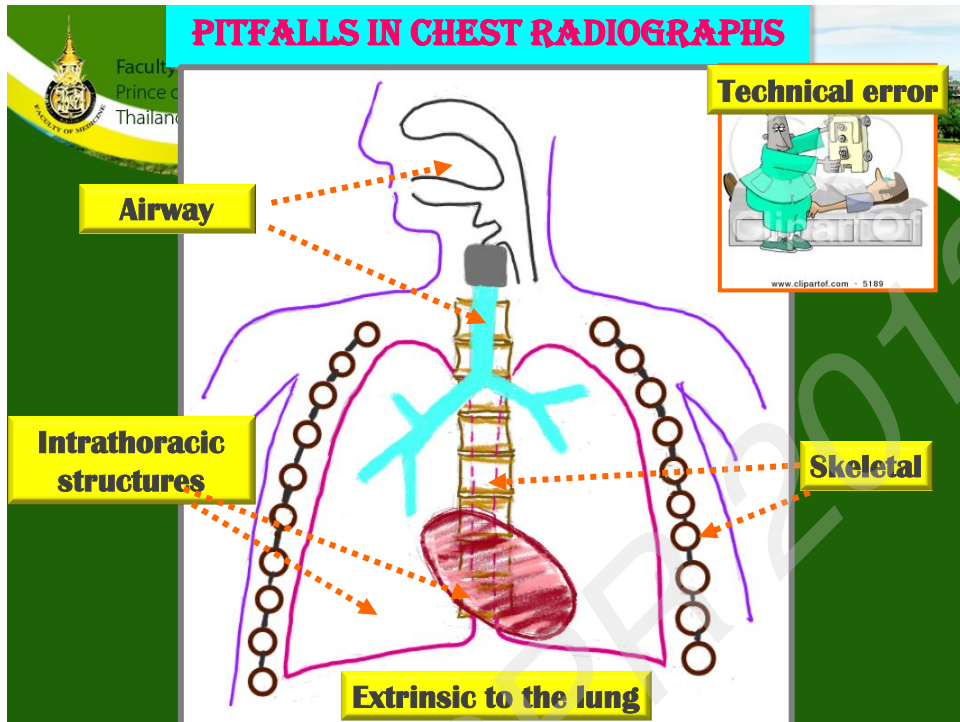


<https://www.facebook.com/DylanKorKai>

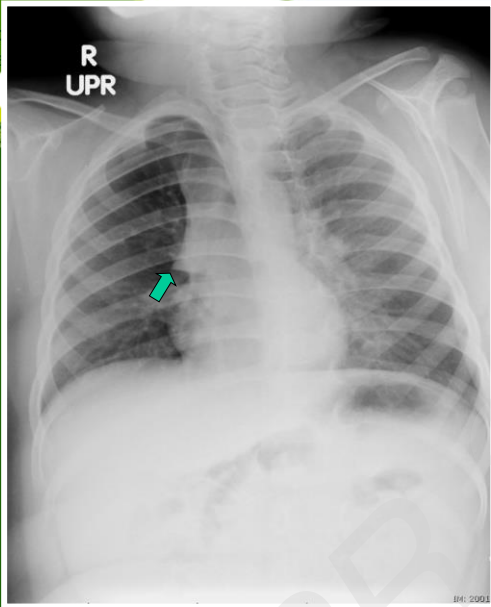


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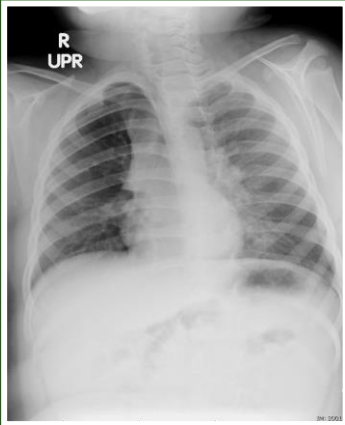


A 3 year old boy with acute dyspnea 1 day

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Hyperlucency One Lung

- Pneumothorax ?
- Emphysema ?
- Lung hypoplasia ?
- Foreign body obstruction ?





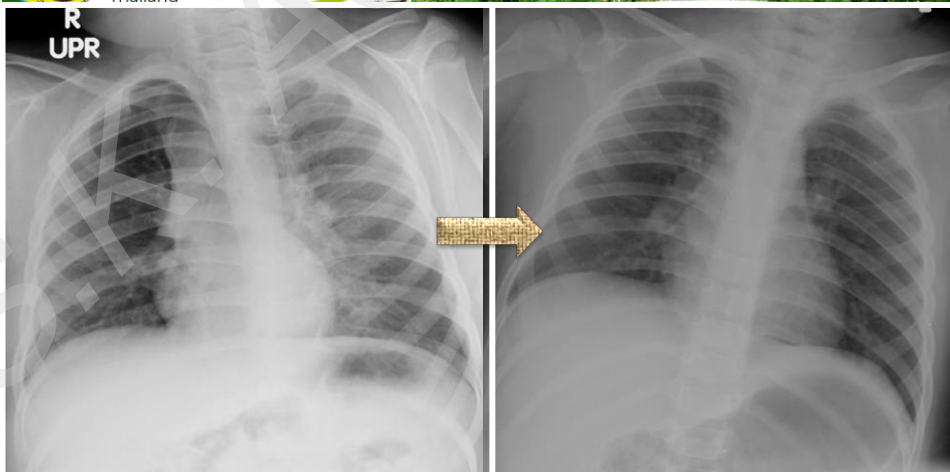
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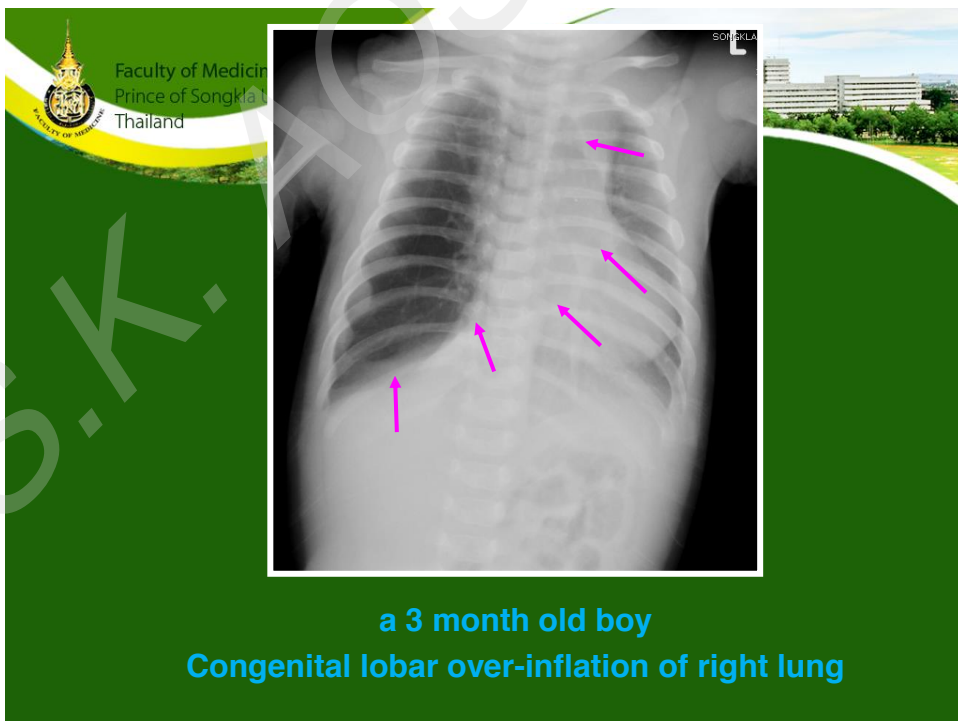
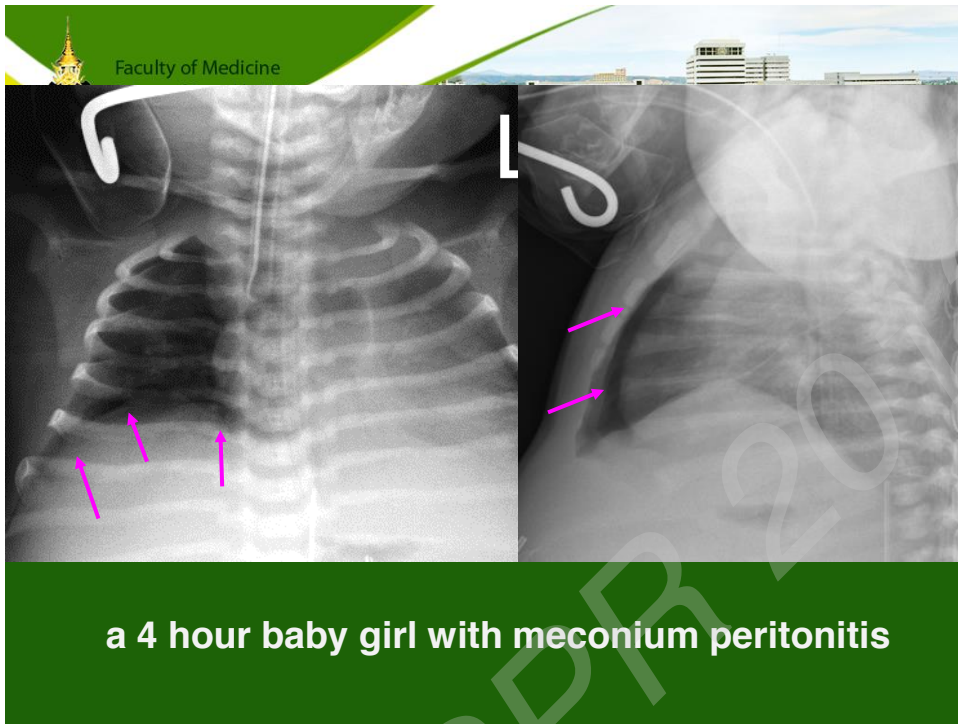
Rotation

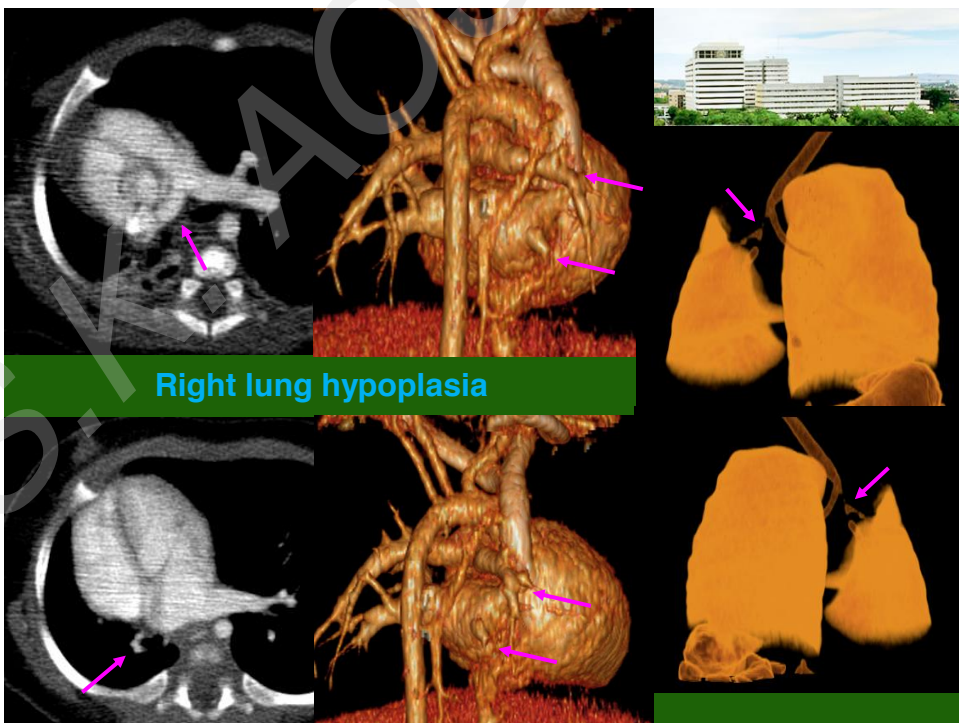
- Symmetrical ribs and the medial border of the clavicles
- Longer posterior ribs

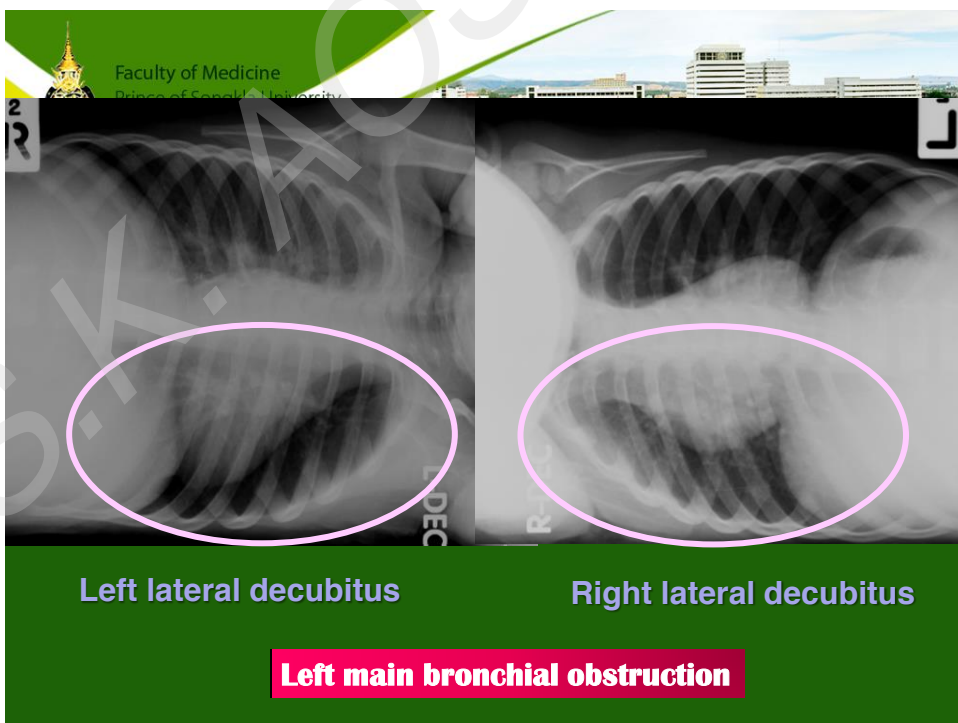
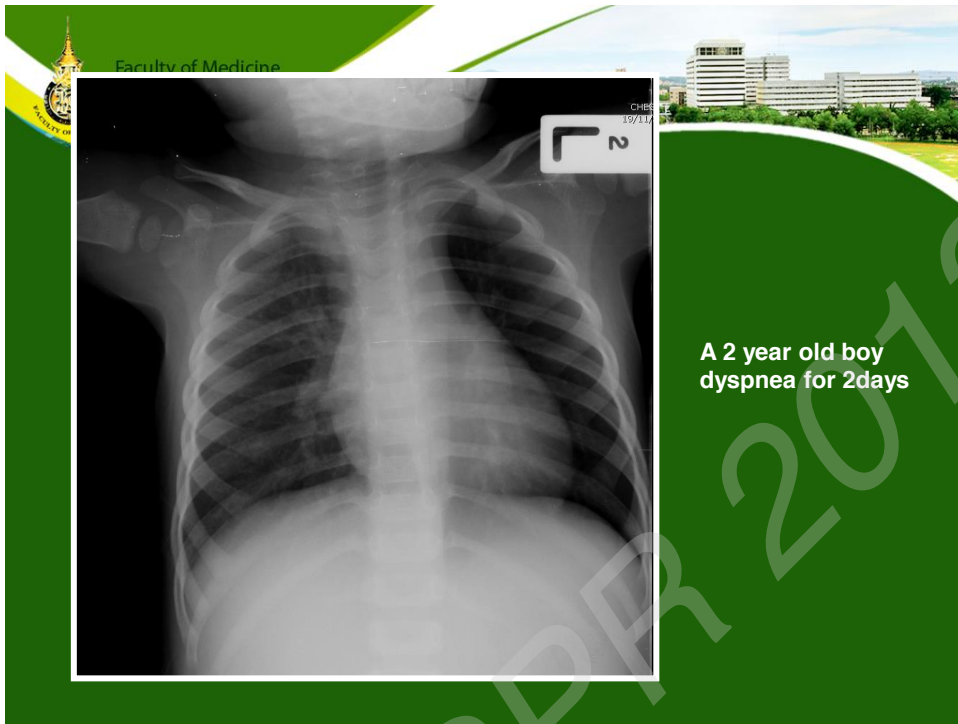


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Abstract

In our series of 400 Chinese children with foreign body aspiration (FBA), 343 cases were evaluated by fluoroscopy and/or plain chest X-rays before endoscopic removal of the foreign bodies. The majority of the foreign bodies (FBs) were organic (378/400, 94.5 per cent). The results showed that mainstem bronchial foreign bodies were diagnosed correctly in 68 per cent of cases compared with 65 per cent correct diagnoses with segmental bronchial foreign bodies, but only 22 per cent correct diagnoses with tracheal, and 0 per cent correct diagnosis in those with laryngeal foreign bodies. Eighty per cent (32/40) of the children with laryngotracheal FBs had normal X-ray findings, whereas 67.7 per cent (205/303) of the children with bronchial FBs had abnormal chest X-ray findings. The most common positive radiological signs in the children with tracheobronchial FBs were obstructive emphysema (131/213, 62 per cent) and mediastinal shift (117/213, 55 per cent). The incidence of major complications was related not only to the size of the foreign body and its location but also the duration since aspiration. The most common types of bronchial obstructions by airway FBs are discussed.

The Journal of Laryngology and Otology
October 1990, Vol. 104, pp. 778-782



TABLE V
POSITIVE X-RAY FINDINGS IN 213 CASES WITH FOREIGN BODY ASPIRATION

X-ray findings	Site of foreign bodies							
	Trachea (N=8)		Main bronchi (N=160)		Segmental bronchi (N=45)		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Obstructive emphysema	4	(2)	106	(50)	21	(10)	131	(62)
Mediastinal shift	4	(2)	94	(44)	19	(9)	117	(55)
Pneumonia	2	(1)	35	(16)	19	(9)	56	(26)
Atelectasis	0	(0)	24	(11)	15	(7)	39	(18)
Radiopaque object	0	(0)	5	(2)	2	(1)	7	(3)

*More than one of these positive findings were present in some cases.

The Journal of Laryngology and Otology
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TABLE VII
RELATIONSHIP BETWEEN X-RAY FINDINGS AND DURATION OF FOREIGN BODY ASPIRATION IN 343 CASES

X-ray findings	24 hrs (N=63)	1-3 days (N=94)	4-7 days (N=75)	8-14 days (N=34)	15-30 days (N=56)	31-365 days (N=21)
Negative (N=130, 38%)	35	38	27	12	17	1
Positive (N=213, 62%)						
obstructive emphysema	19	35	26	18	23	10
mediastinal shift	20	34	25	12	18	8
pneumonia	3	10	11	8	16	8
atelectasis	2	4	11	5	9	8
Complication rate	44%	60%	64%	65%	70%	95%


*More than one of these positive X-ray findings was present in some cases.

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Poor Inspiration


- Interstitial pneumonia
- Pulmonary edema
- Cardiomegaly
- Mediastinal mass



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CHEST, PED.-1
8/23/2013 12:29:47 PM
22855946



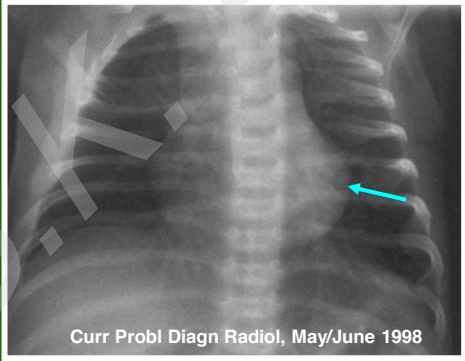


Courtesy of Edward Y Lee
Children's Hospital Boston

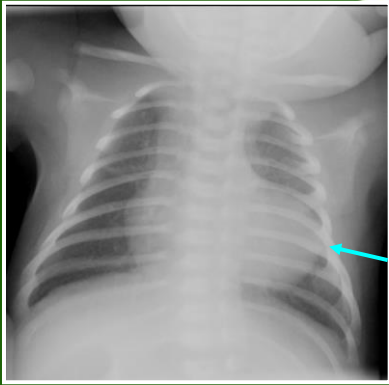
**A 3 month old boy post operative CHD
worsening pulmonary edema ??**



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Curr Probl Diagn Radiol, May/June 1998



Tetralogy of Fallot ?



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Lordosis

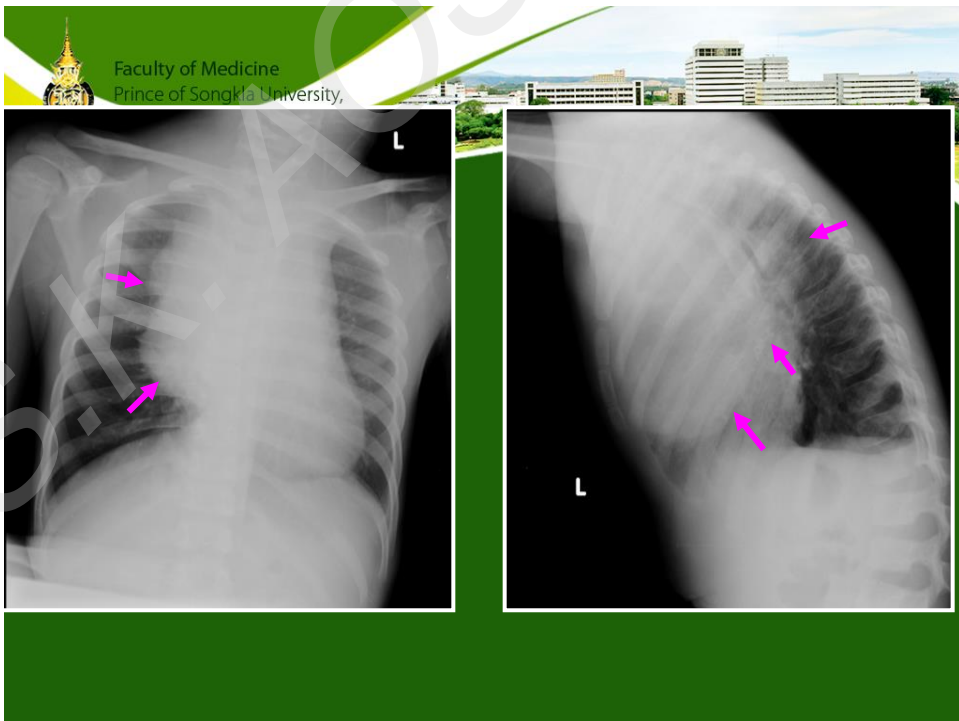
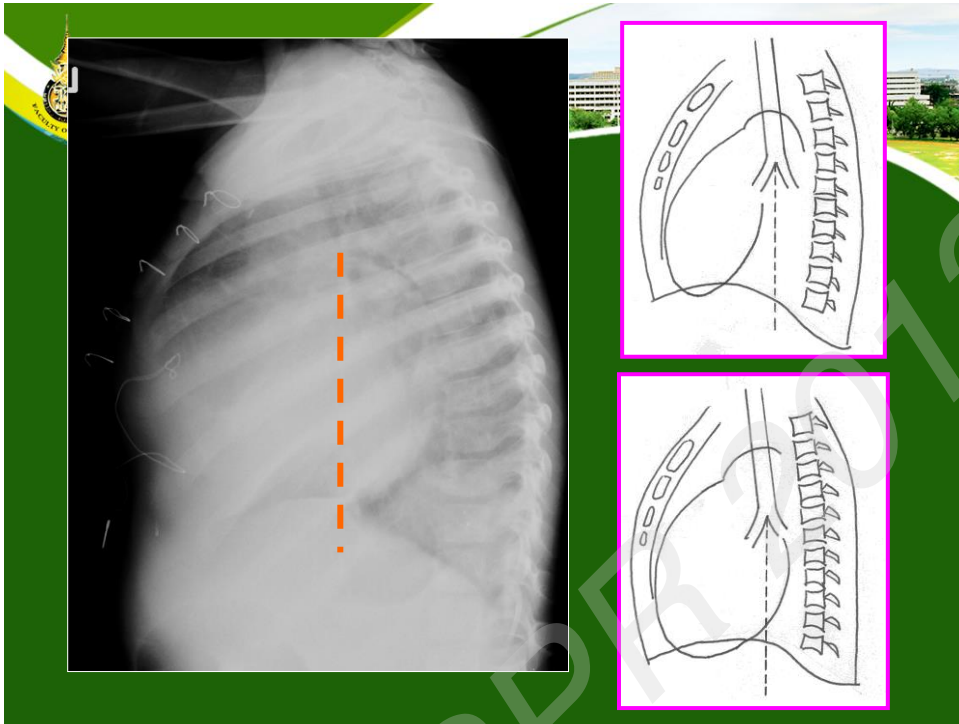
- Round cardiac apex → RVH
- Prominent perihilar bronchovascular markings
- Horizontal or upturned anterior ribs

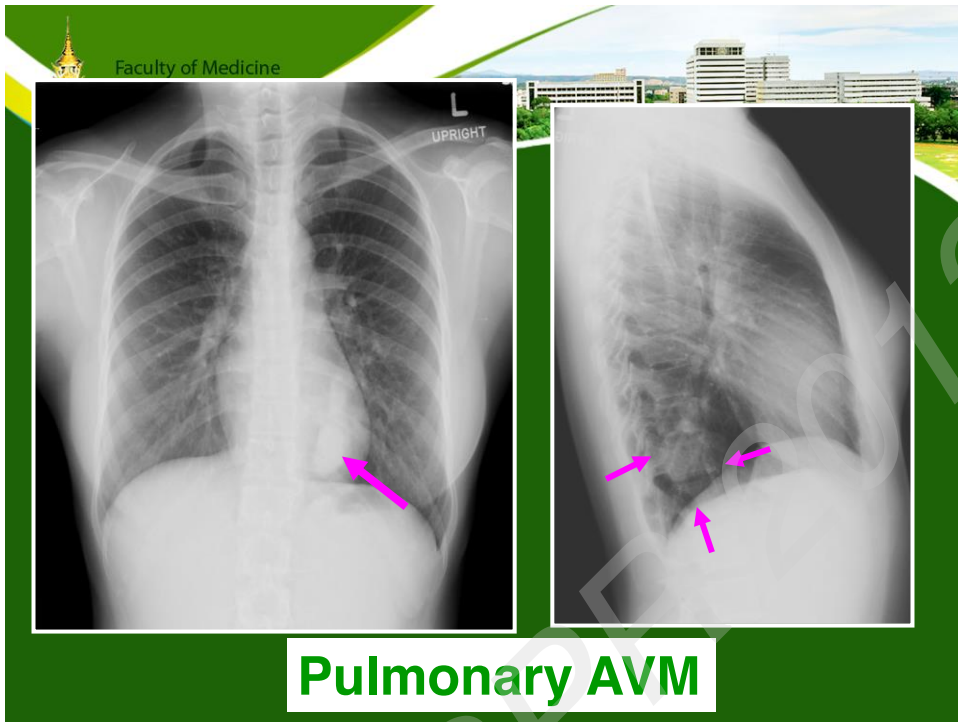


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Additional Lateral View

- Assess cardiomegaly
- Determine location and confirm pulmonary nodule on frontal view
- Clarify number & position of FB
- Evaluate LN and pulmonary hilum







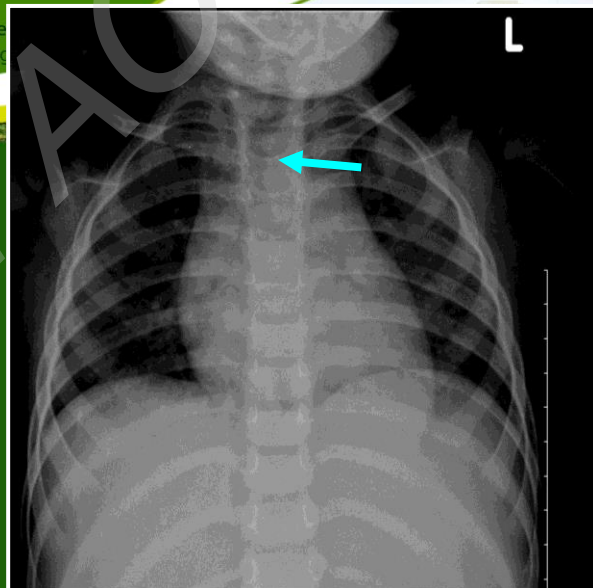
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Airways

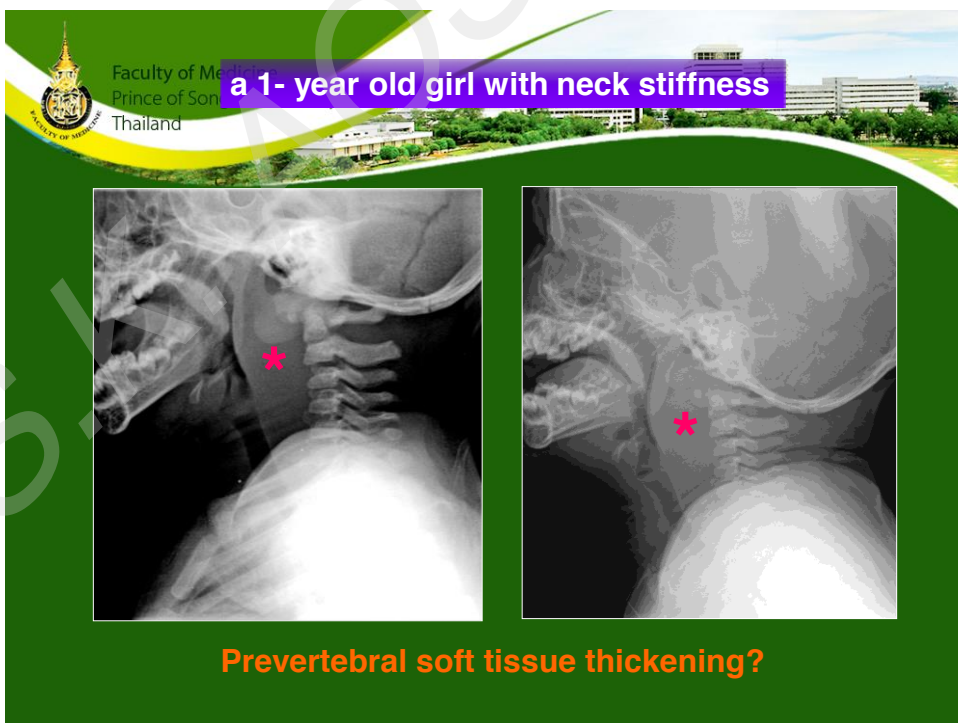
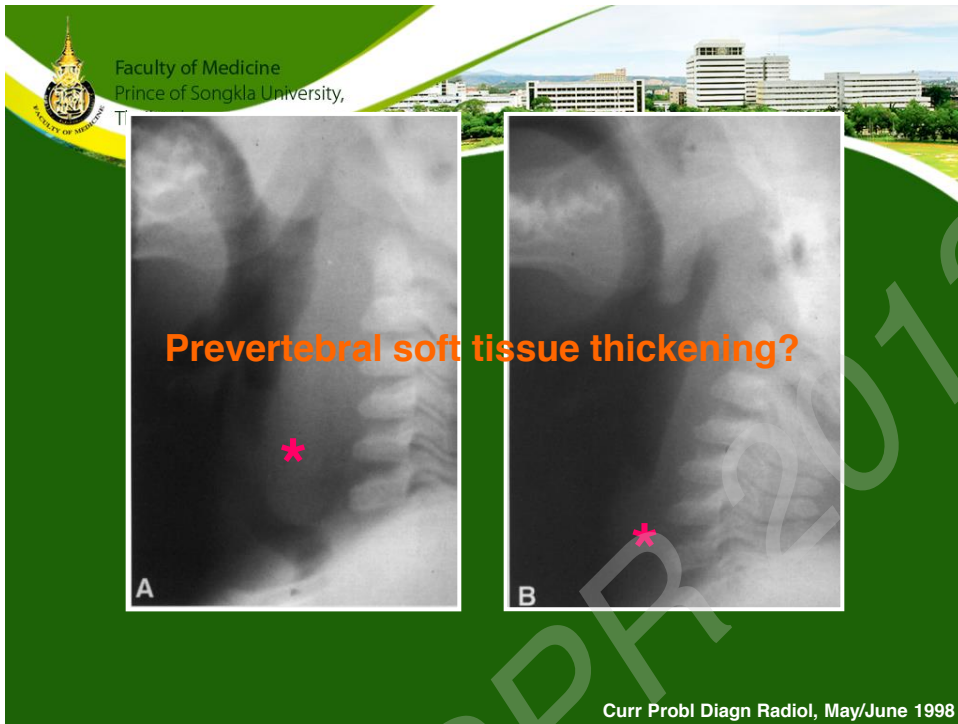
- Tracheal buckling simulating extrinsic compression by a mass
- Neck flexion simulating retropharyngeal soft tissue thickening



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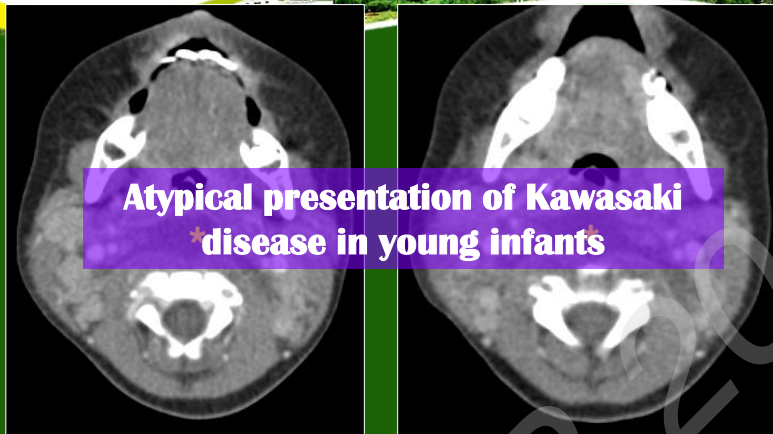


Tracheal buckling





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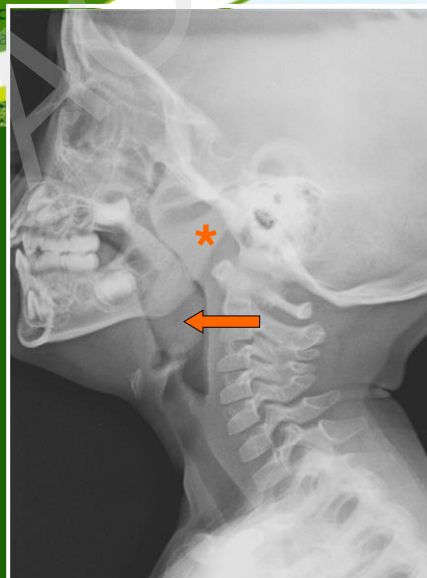
**Atypical presentation of Kawasaki
*disease in young infants**

Retropharyngeal fluid/abscess

Kritsaneeapaibon S, et al. Emerg
Radiol (2012) 19:159-163



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a 3 - year boy with snoring



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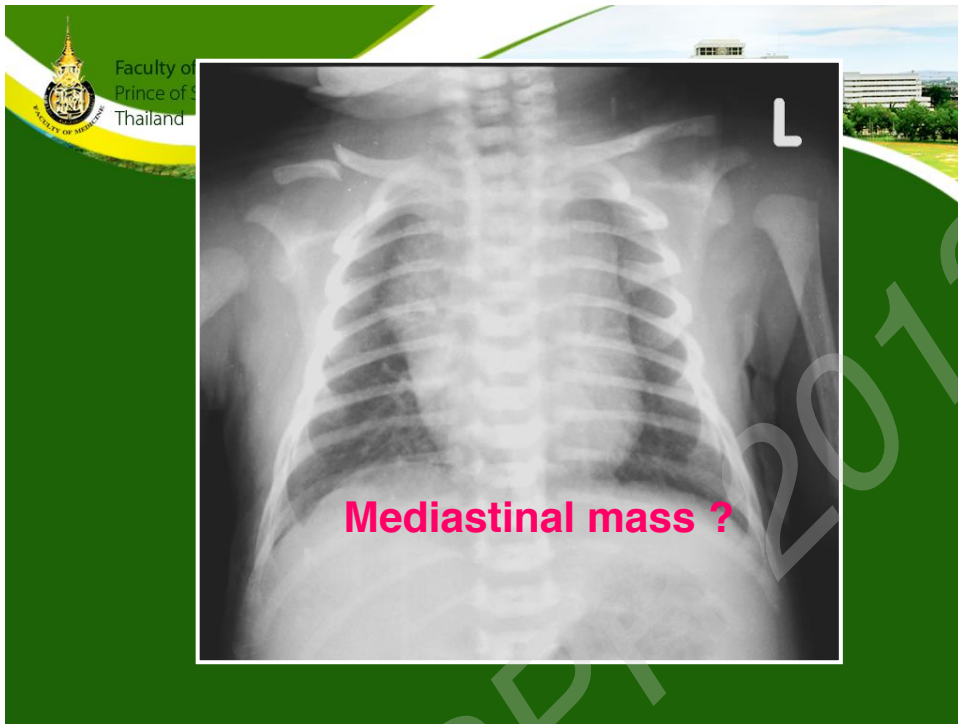
Lateral Neck

- Prominent normal lymphoid tissue
- Over diagnosis of airway masses
- Significant enlargement \leftrightarrow airway obliteration
- Considered immune deficiency > 6 months



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Intrathoracic Structures



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Thymus

- Most frequent pitfall
- Located in prevascular space
- Large at birth
- Less prominent in older children
- Never displace mediastinum



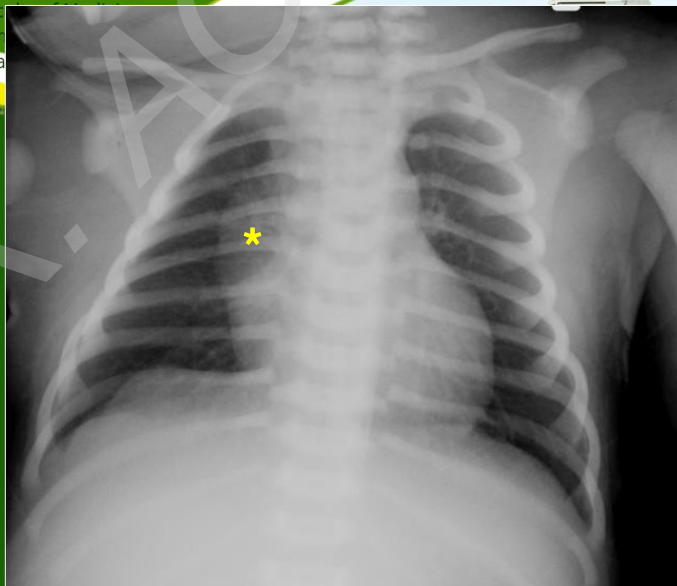
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Thymus

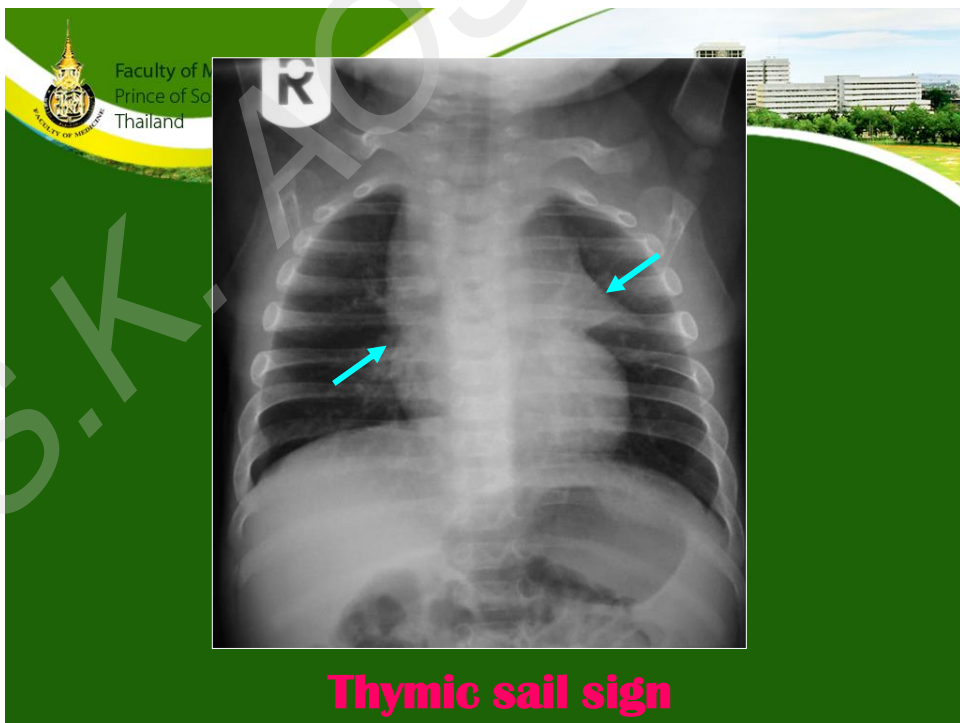
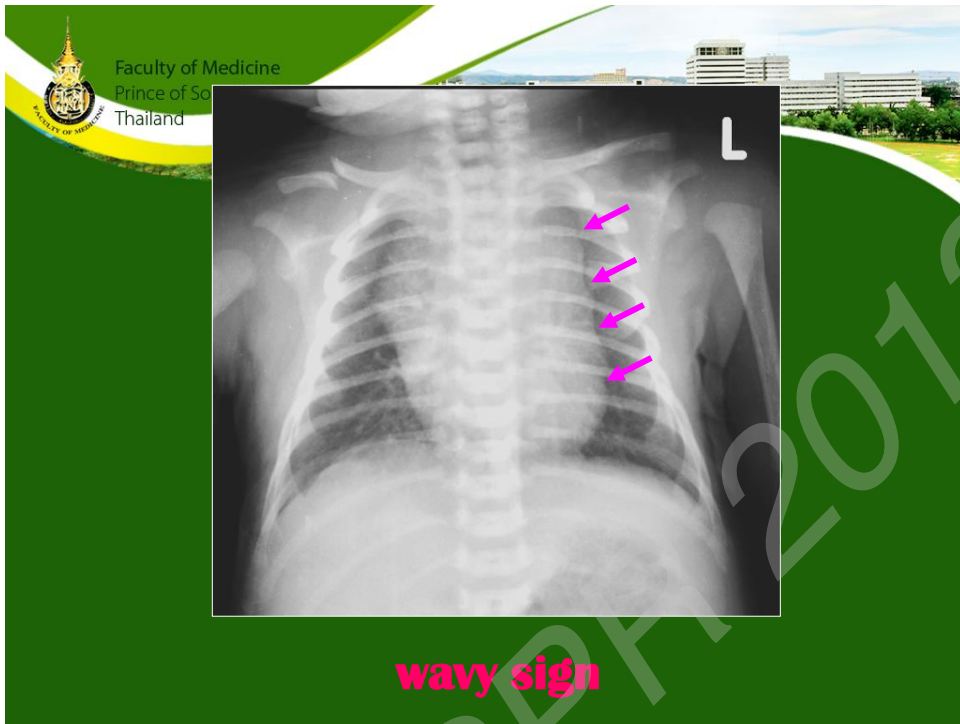
- Unilateral / bilateral
- Wavy margin
- Cardio-thymic notch
- Thymic sail sign



Fac
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Tha



water density



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Thymus

- **Rebound** thymic hyperplasia
- **Ectopic location:** posterior mediastinum/ retrocaval position
- Above sternum during respiration / crying
- US or CT or MRI

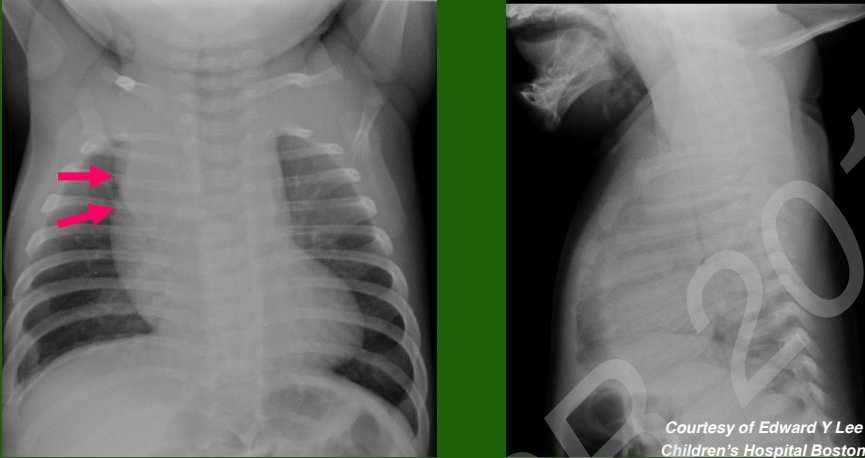
11/12/2009

A 7 year old boy
NHL stage II complete treatment

17/03/2010

19/7/2010

Thymus VS Mediastinal mass ??

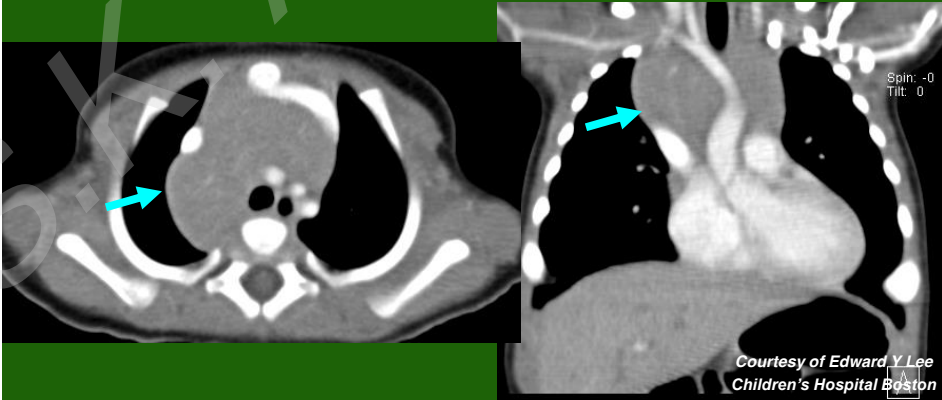


Courtesy of Edward Y Lee
Children's Hospital Boston

2-month-old girl with fever and coughing

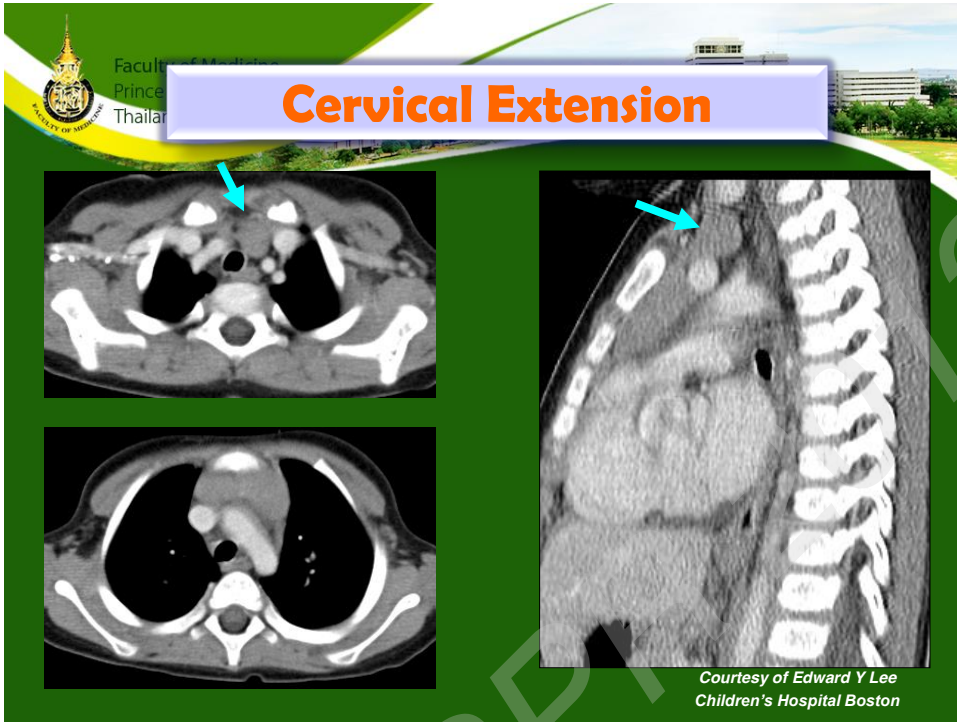
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Posterior Mediastinal Extension



Courtesy of Edward Y Lee
Children's Hospital Boston

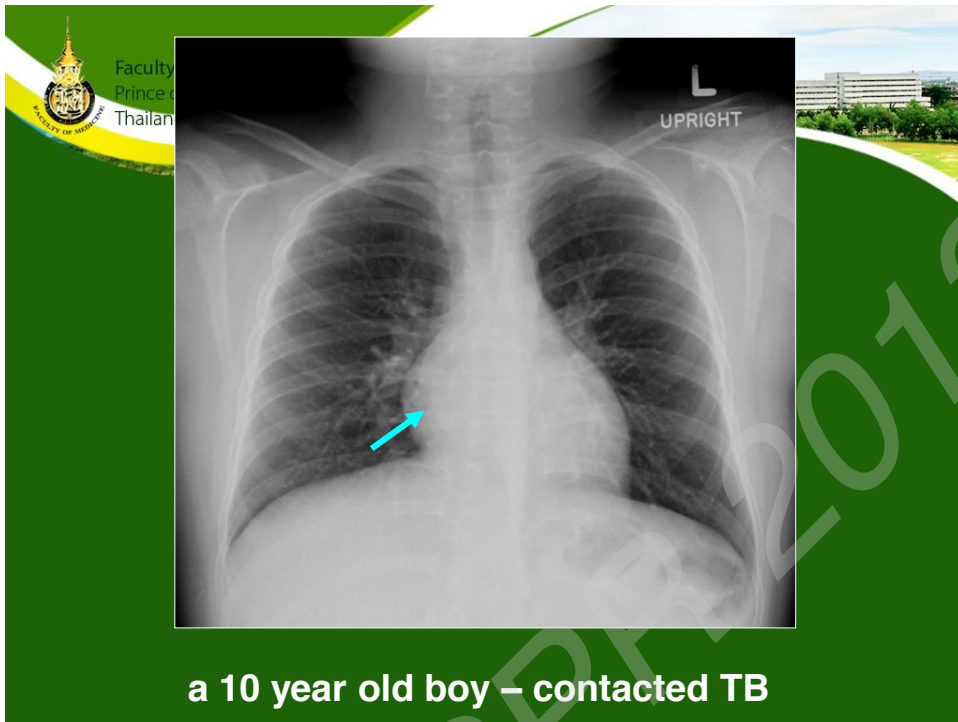
Key Point!: contiguous with normal thymus



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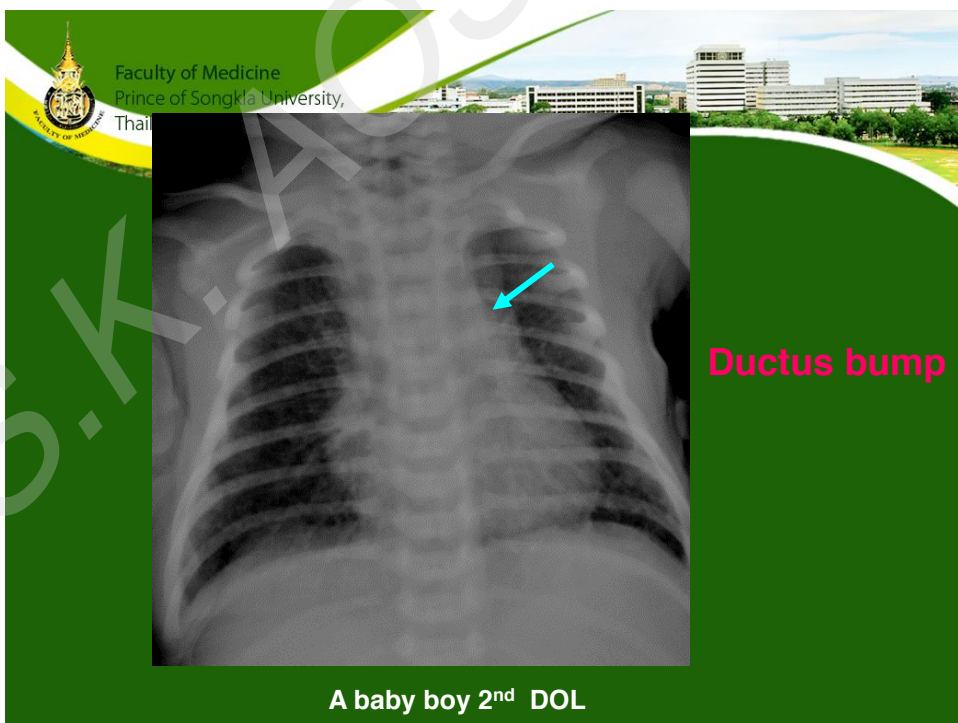
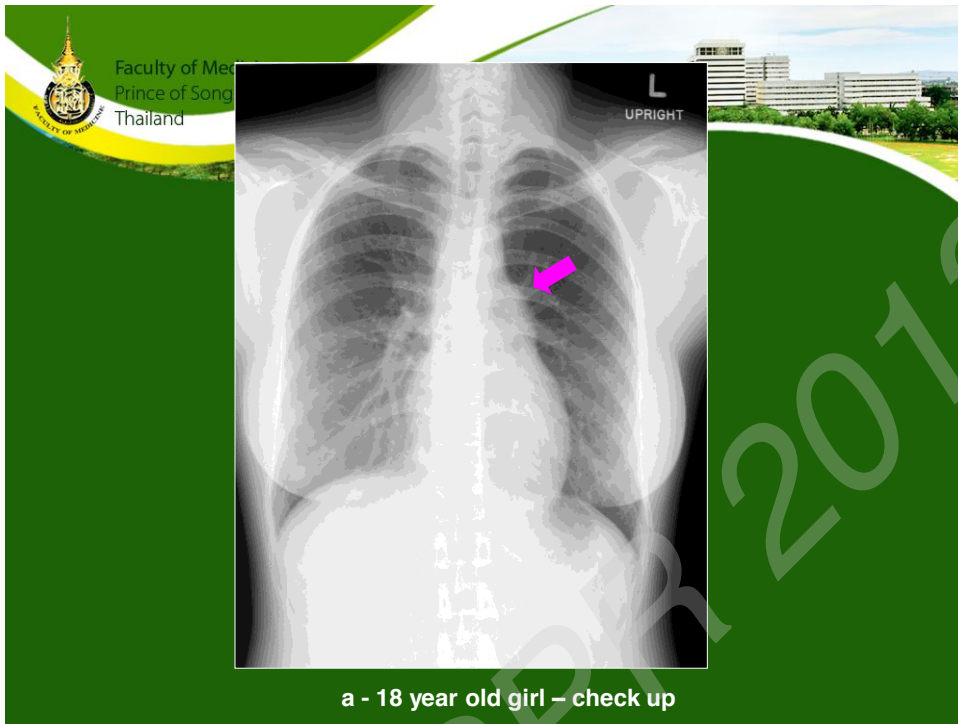
Normal Pulmonary Vascular Structures

- Confluence of the pulmonary veins at right paraspinal region
- Prominent normal MPA in adolescent girls
- Post stenotic dilatation in PS



Normal Pulmonary Vascular Structures

- Confluence of the pulmonary veins at right paraspinal region
- Prominent normal MPA in adolescent girls
- Post stenotic dilatation in PS





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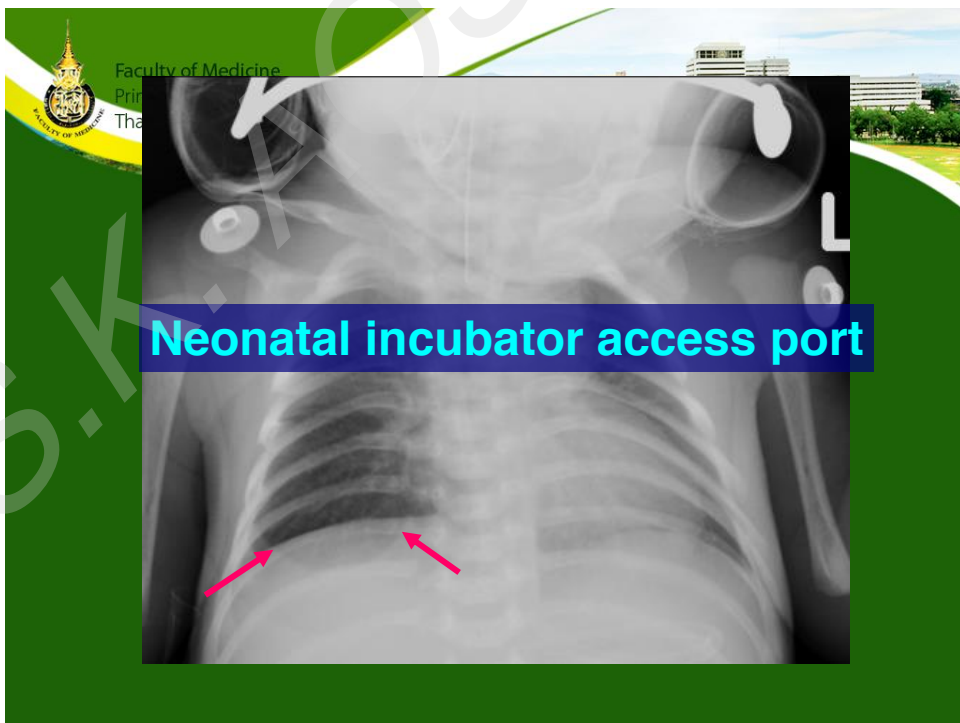
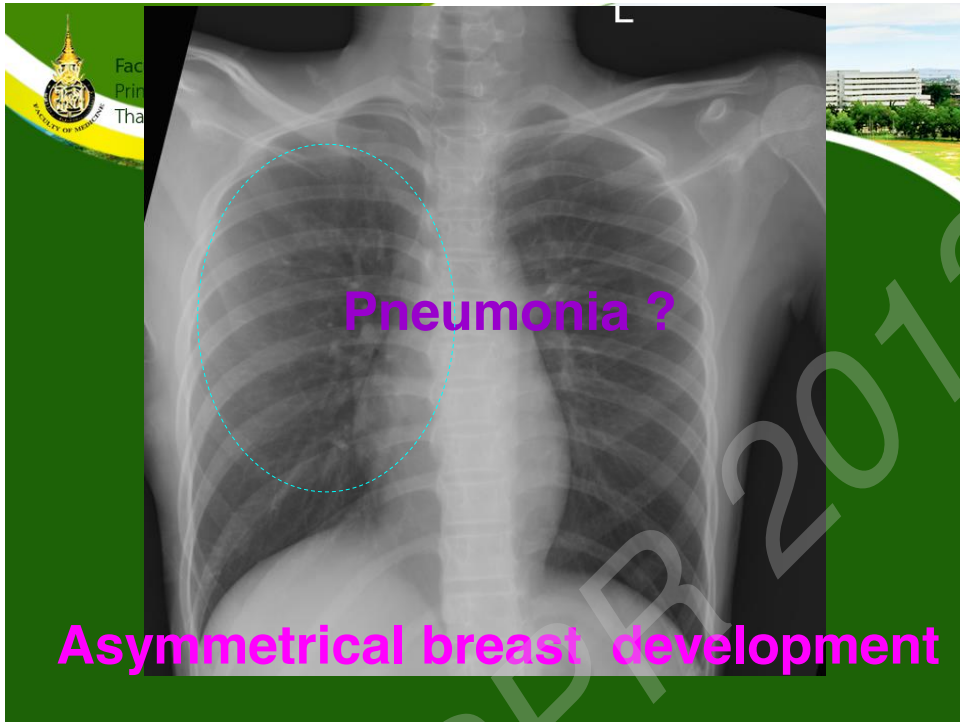
Ductus Bump

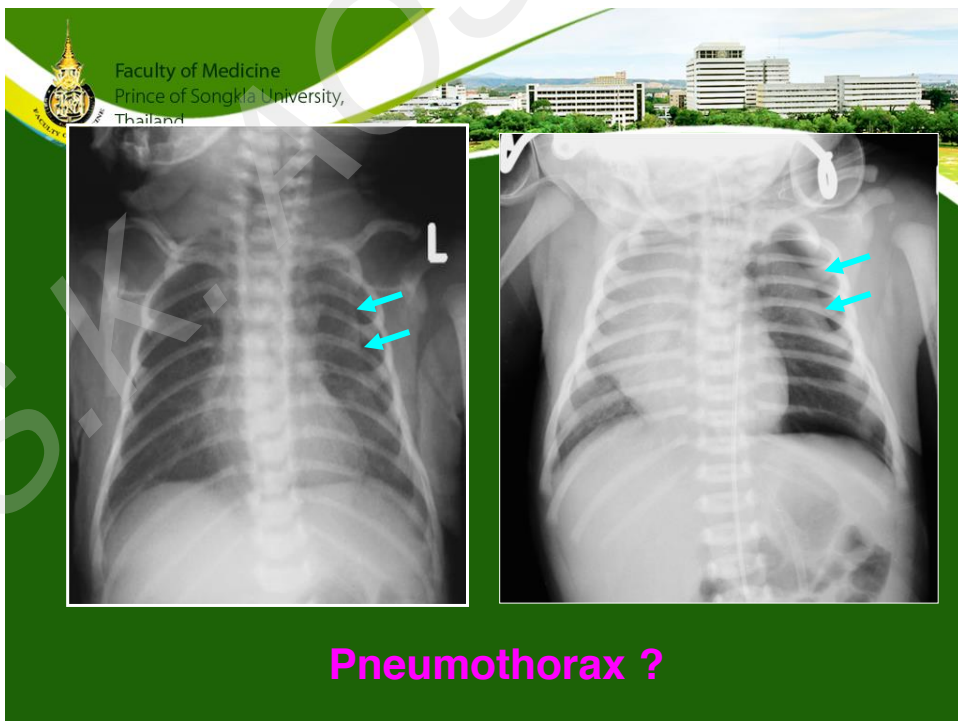
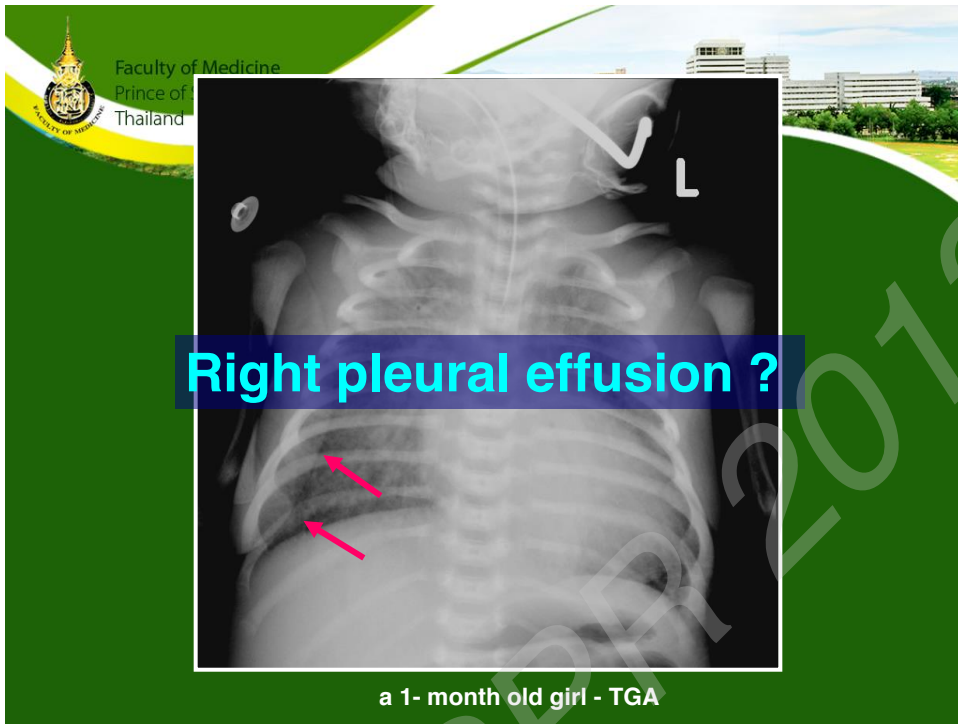
- Transient limited to newborn
- Prominent aortic knob
- Distended PA and DA
- The most prominent on 2nd or 3rd DOL



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Extrinsic to the Lungs







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Skin Fold

- Performed portable in ICU
- Misinterpreted as pneumothorax
- Pleural line – distinct, curvilinear parallel lateral chest wall
- Skin fold – indistinct and random course



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Skeleton

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Immature Pediatric Skeleton

- Simulating abnormalities to the inexperienced observers

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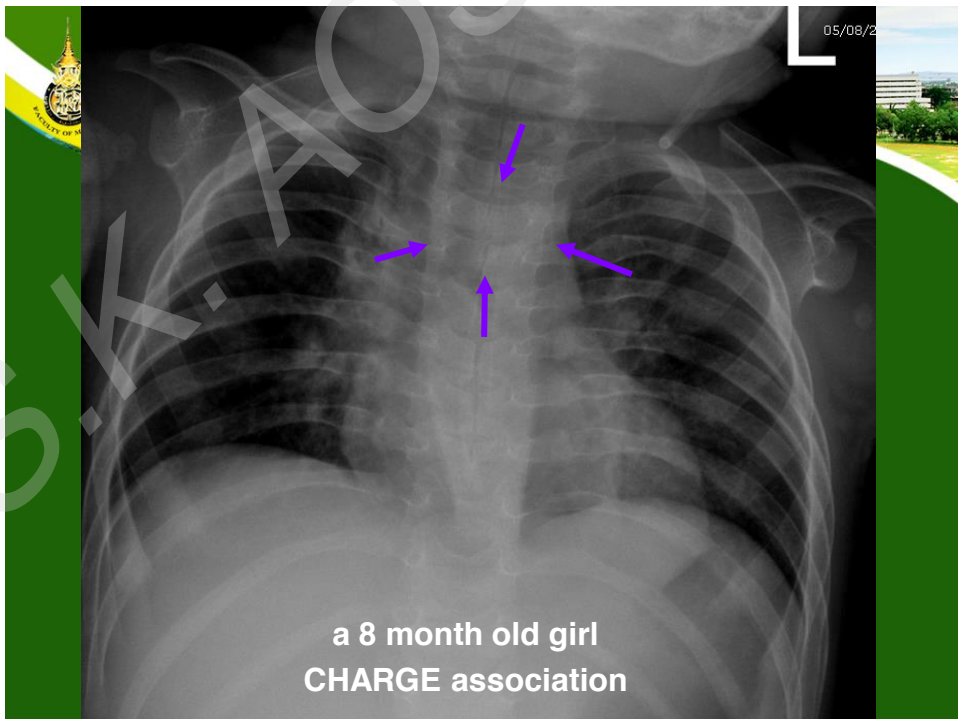


L-DEC

Mediastinal mass ?

Sternal Ossification Centers

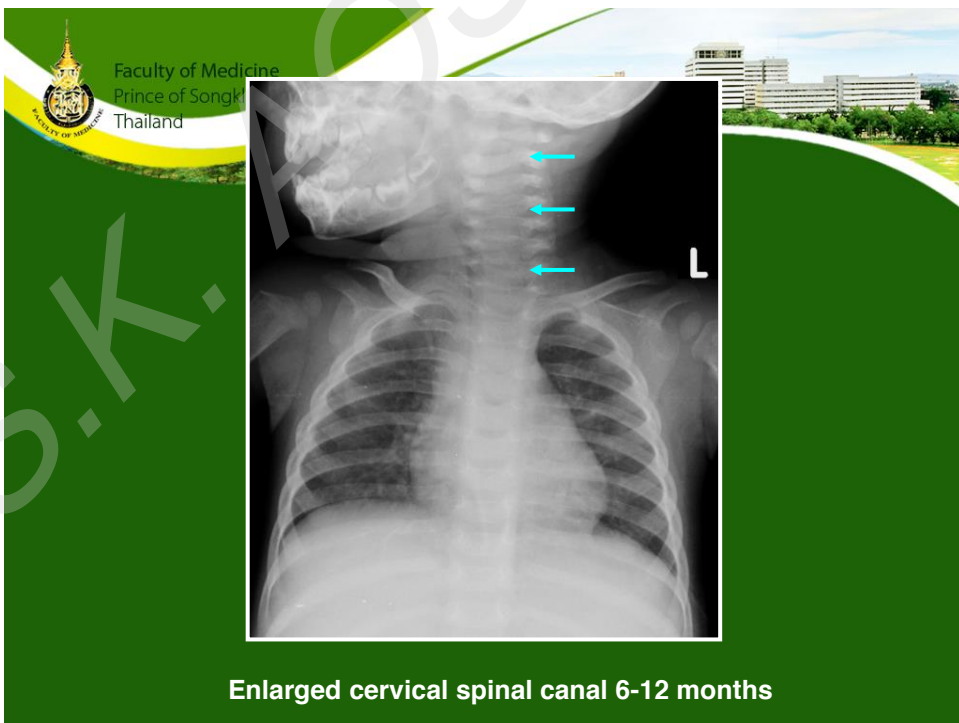
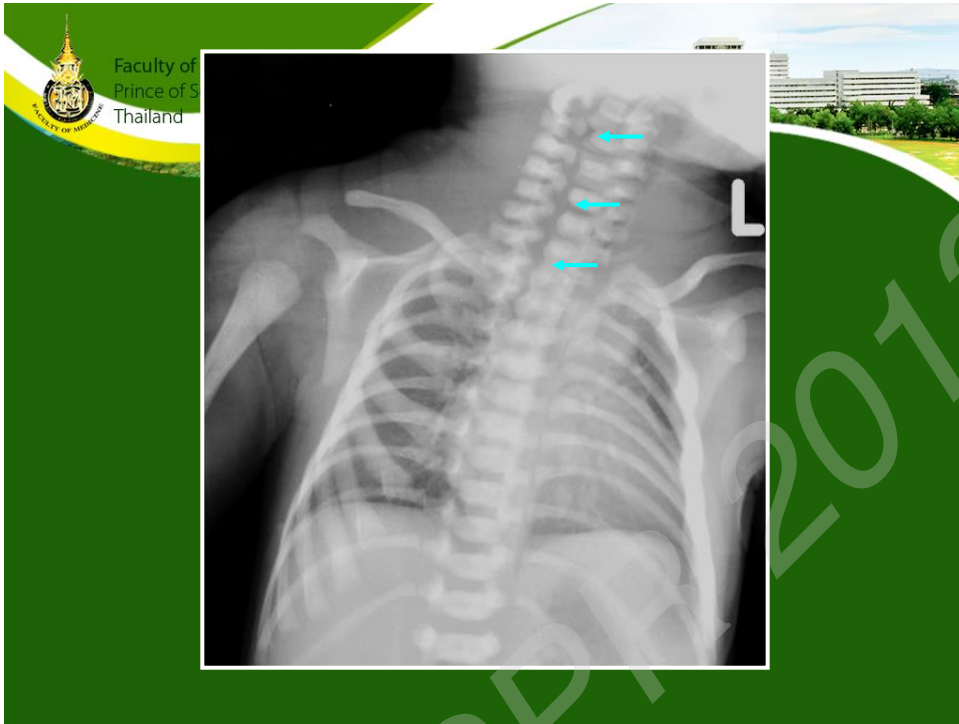
- Not fused in infants and young children
- Slightly oblique
- Manubrial ossification center: mistaken for a mediastinal mass or foreign body

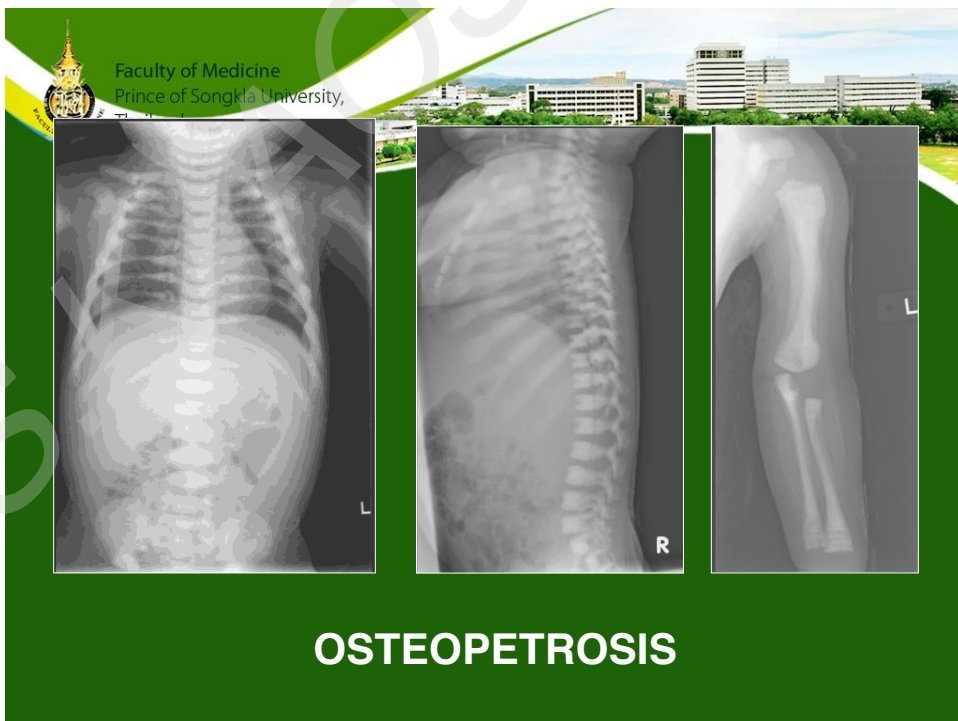
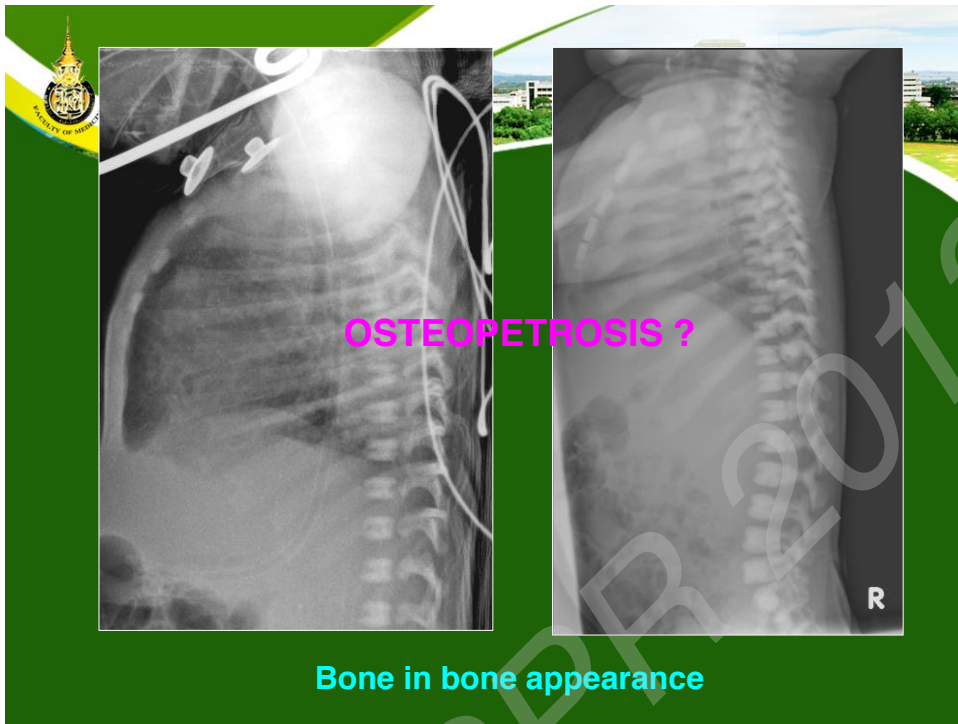




Incomplete Ossification

- Caudal – Cranial posterior spinal fusion
- Thoracic posterior spinal elements 1st year
- Cervical spinal elements 2nd-3rd year
- Lack of clinical finding or pathologic widening of spinal canal





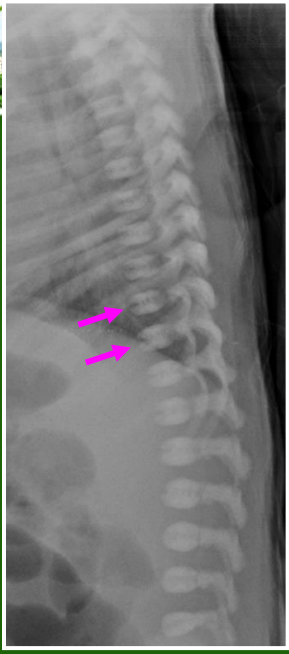
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Bone in Bone Appearance


- Younger than 2 months
- Will diminish with time

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Axially oriented cleft??




The image is a lateral X-ray of the spine. Two pink arrows point to a cleft in the vertebral body of a lumbar vertebra, which is oriented axially. The cleft is a radiolucent line that runs parallel to the long axis of the vertebra, a characteristic finding in certain types of vertebral fractures or developmental defects.



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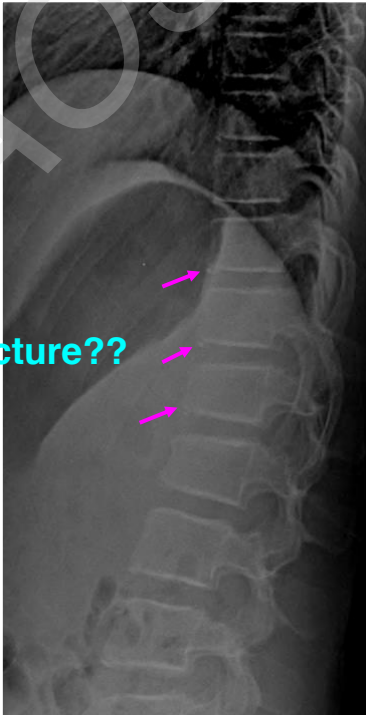
Vertebral Notch

- Young infants
- Noted in lateral projection
- Anterior notch – sinusoid blood space
- Posterior notch – penetrating arteries and veins



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avulsion fracture??

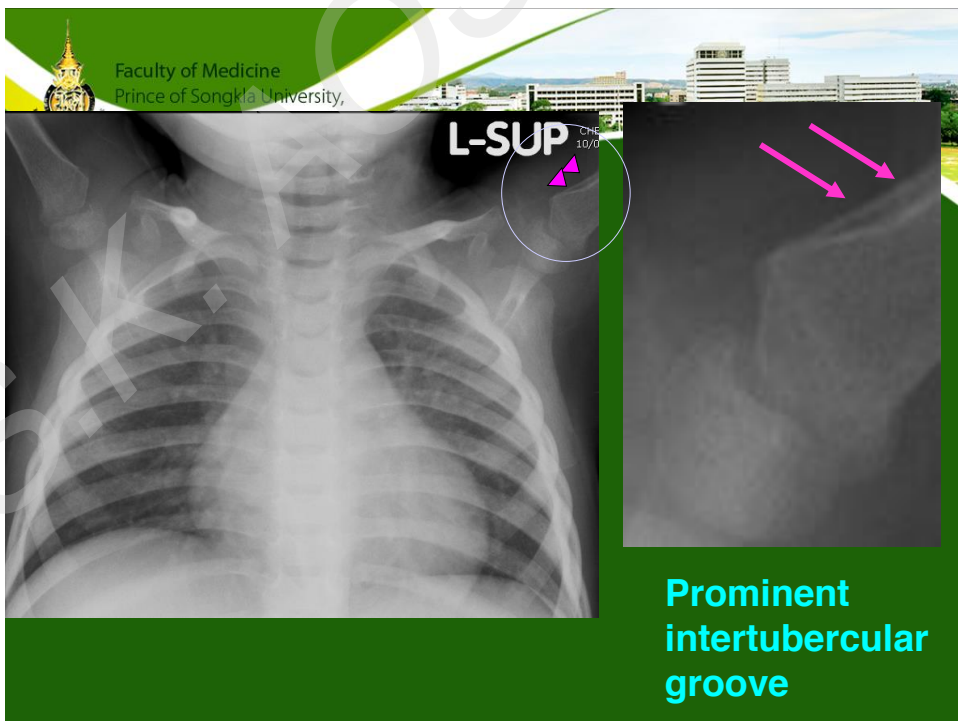





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Partial Ossification


- Early ossified cartilaginous ring epiphysis at 12 years
- Mimic avulsion fracture



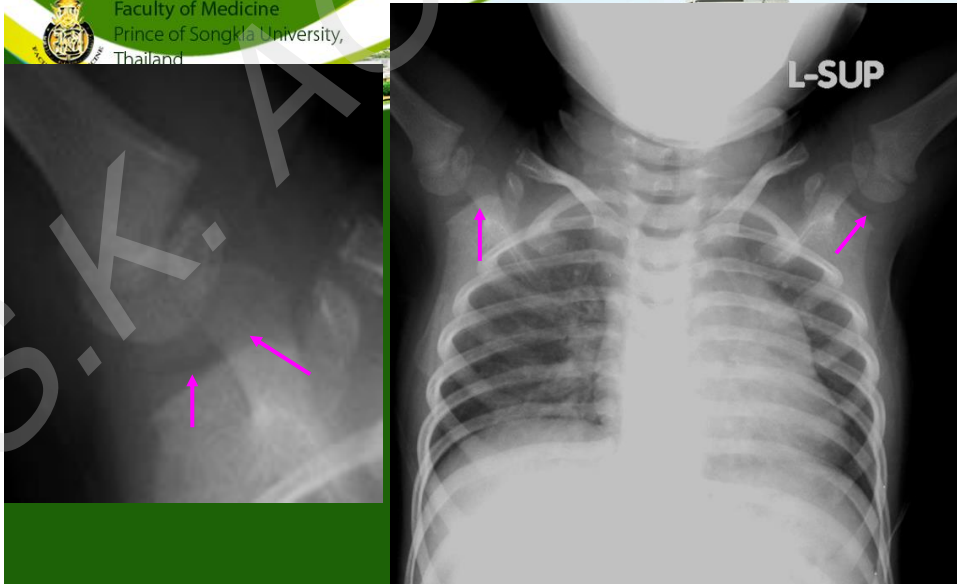


Prominent Intertubercular Groove

- Tendon of long head of biceps tendon
- Simulate periosteal reaction or focal bony erosion
- Bilateral and symmetrical



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L-SUP



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Joint Vacuum

- Immobilization
- Glenohumeral joint
- Intra-articular nitrogen gas



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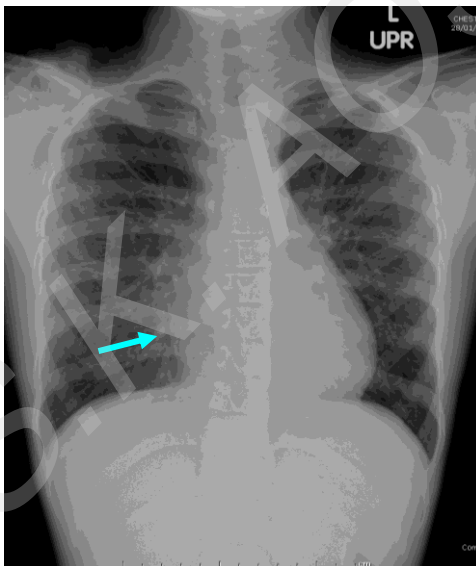
Congenital Bony Anomalies



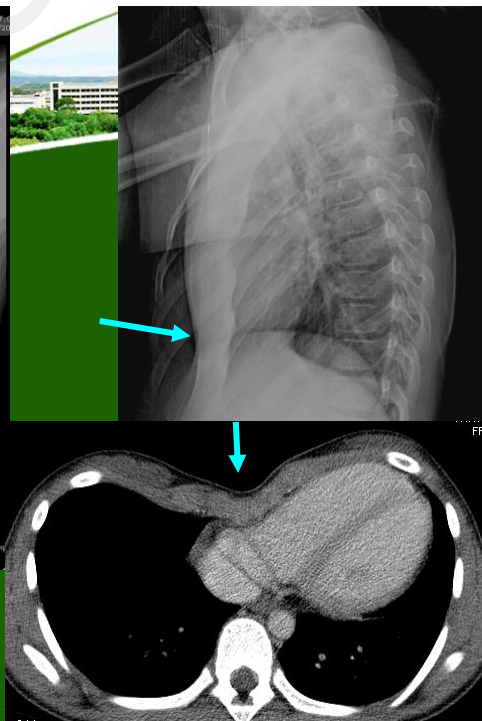
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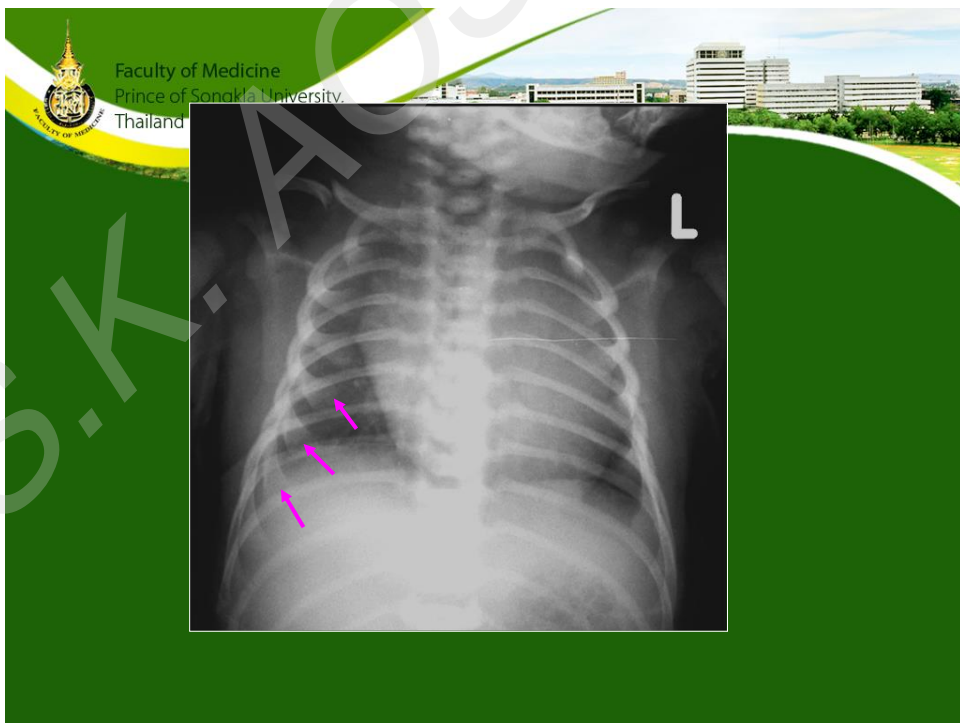
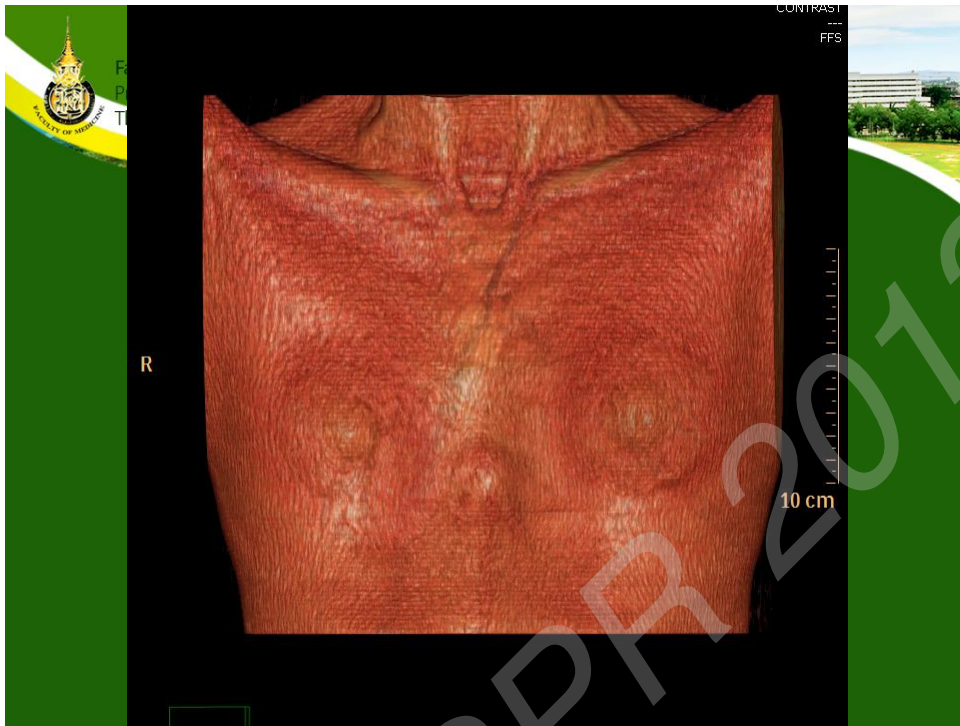
Pectus Excavatum

- Narrow AP dimension
- Cardiomegaly
- Obscured right heart border
- Relatively vertical orientation of anterior ribs



A 9 year old girl
pectus excavatum







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Ribs

- Bulbous cartilaginous anterior rib ends
- Misleading calcified mass or expansile rib



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Take Home Points

- Technical factors, un-cooperative patients, external factors
- Normal structures and immature skeleton
- Prevent misinterpretation
- Repeated radiographs, additional views or other advanced imaging

