

# Chest X-ray Interpretation: The ABC's

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Hospital**

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# Objectives

- Describe the basics of chest x-ray interpretation
- Describe a systematic approach to reading chest x-rays
- Identify proper positioning of invasive tubing
- Identify and describe common disease processes seen on pediatric chest films
- Identify a pneumothorax on chest x-ray and verbalize treatment for tension pneumothorax

# Disclosures

- I must disclose that I have nothing to disclose!



# Time for a Poll: Who discovered Chest Xrays

- 1. Thomas Edison in 1895
- 2. Lucy Sol Bissikumer in 1895
- 3. Wilhelm Roentgen in 1895





# The Basics....

Technical quality of the film(Projection,Orientation, Rotation, Penetration and Degree of Inspiration)

Methodology for scanning a film

Radiographic examples of common PICU problems

# Projection

- Defined by the direction of the x-ray beam in relation to the patient.
- Images will be more magnified and less sharp on an AP film compared to a PA, causing the size of the heart and the penetration of the lung fields to be distorted
- Films are assumed to be PA unless “AP” is marked



# Orientation

The film should be marked on the left or right side.

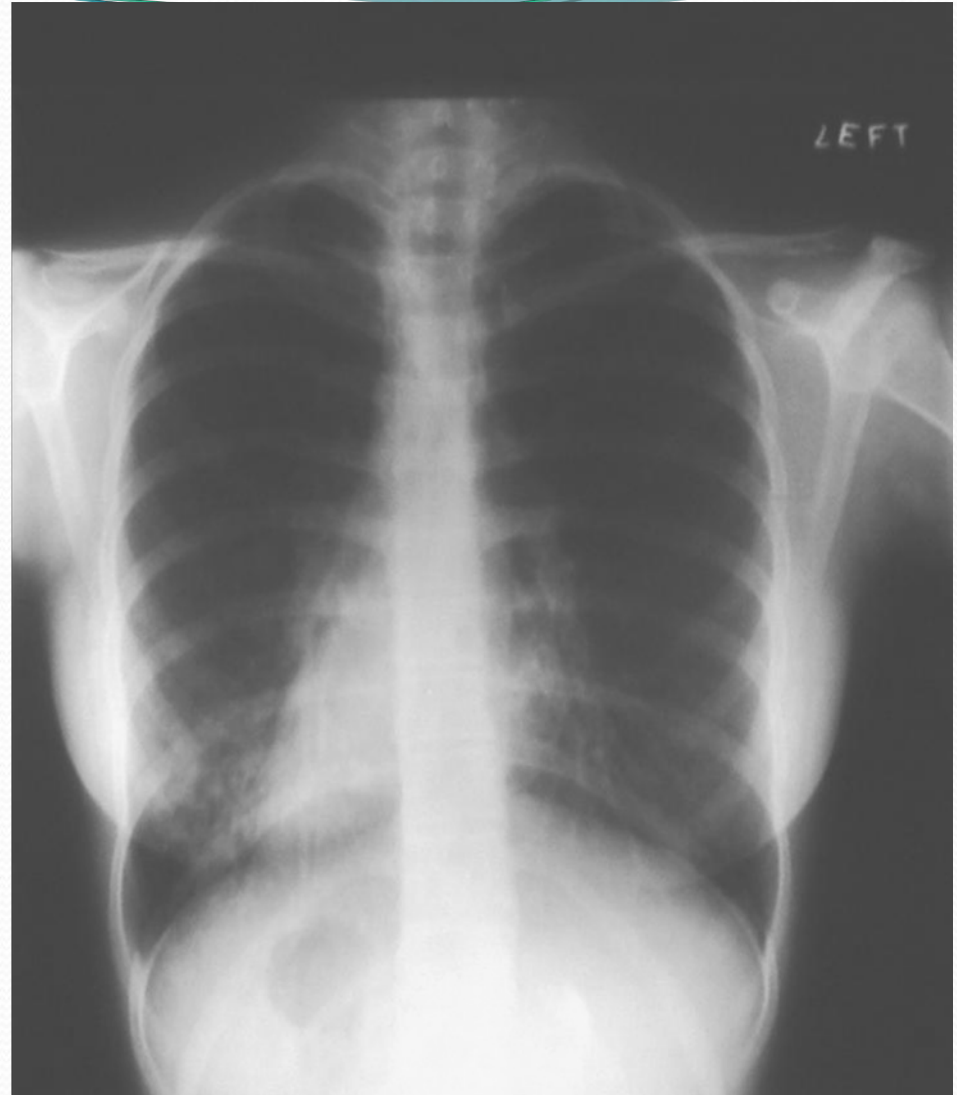
Do not assume that the heart is on the left side of the chest – dextrocardia may be present.

A shift in mediastinum from lung pathology can occur as well making interpretation difficult.



## Is this film reversed?

- Note that the heart and stomach bubble appear on the right – and the film is marked up top.
- Note also that lung fields are hyper expanded (will discuss this later)



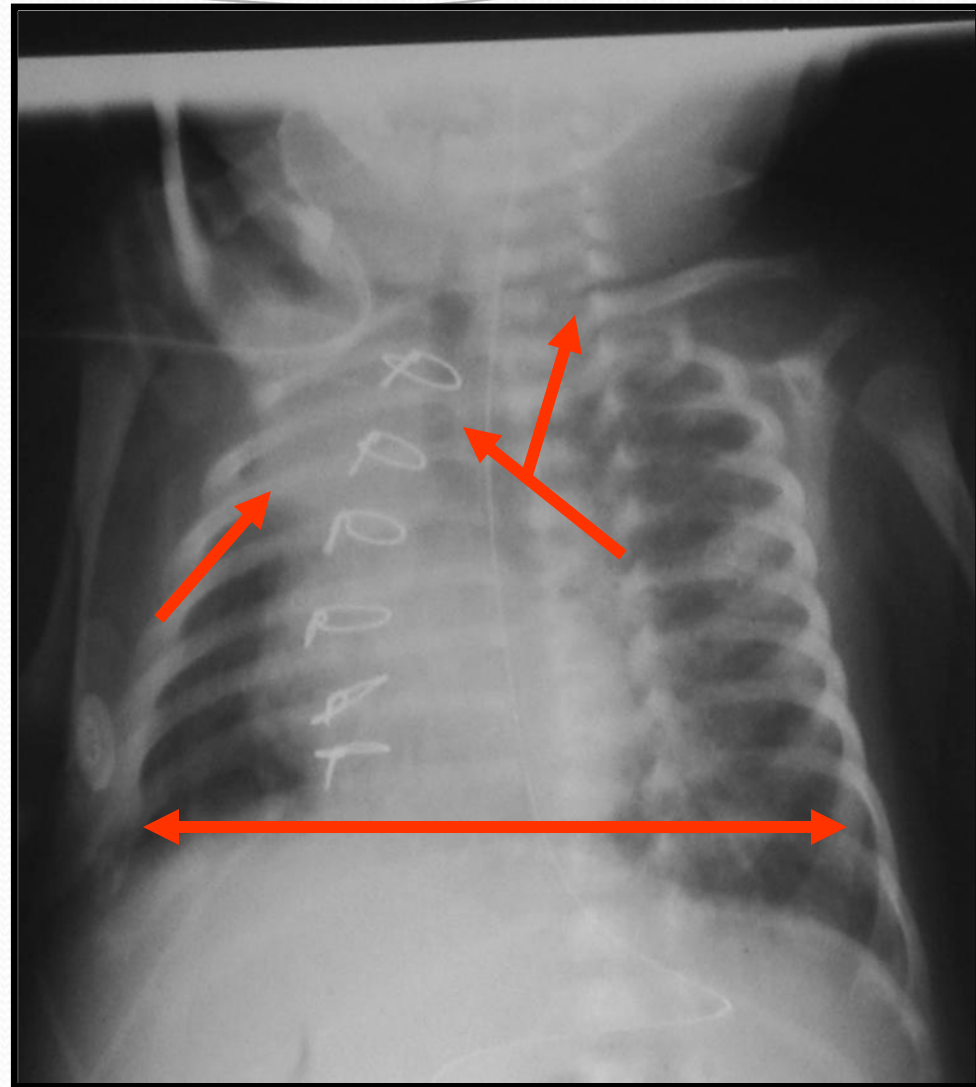
# Rotation

- Identify the medial ends of the clavicles – the vertebral spinous processes should be equidistant between them.
- *Why is that important?* The apparent size and shape of the mediastinal structures will be affected. If the pt is rotated with the left shoulder towards the x-ray beam, the heart will appear larger as more of the left ventricle will be seen and a normal thymus may look like an upper lobe infiltrate.



## Note rotational artifact

- Clavicles are not equidistant from the spine.
- Trachea and sternal wires are displaced to the right.
- Distance from the spine to the outer chest wall is not equal bilaterally.
- Thus causing thymus to appear as a right upper lobe (RUL) infiltrate.





# Penetration

As the xray beam enters the pt, some rays are partially absorbed by the bodies' tissues (creating white images) and some pass through (creating dark images).

The vertebral bodies should be barely visible through the lower part of the heart silhouette.

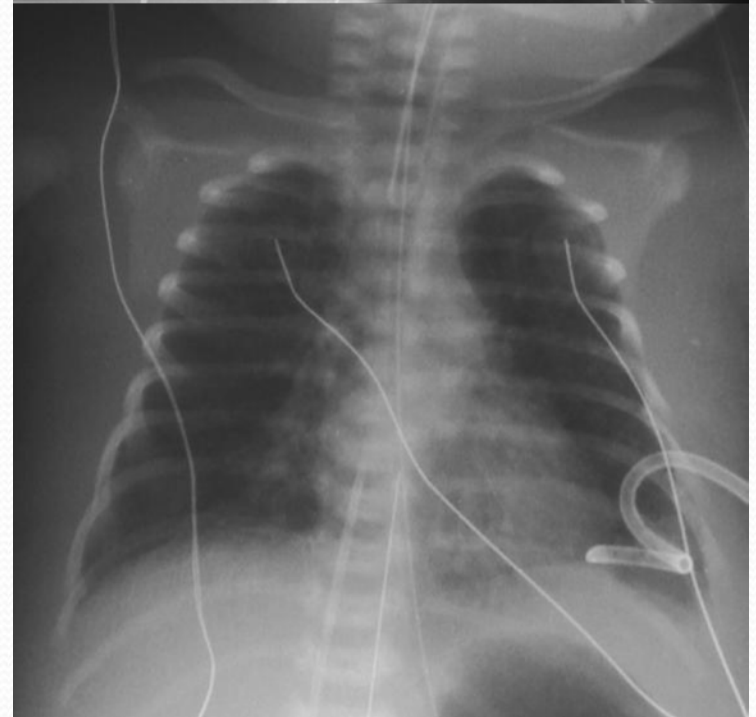
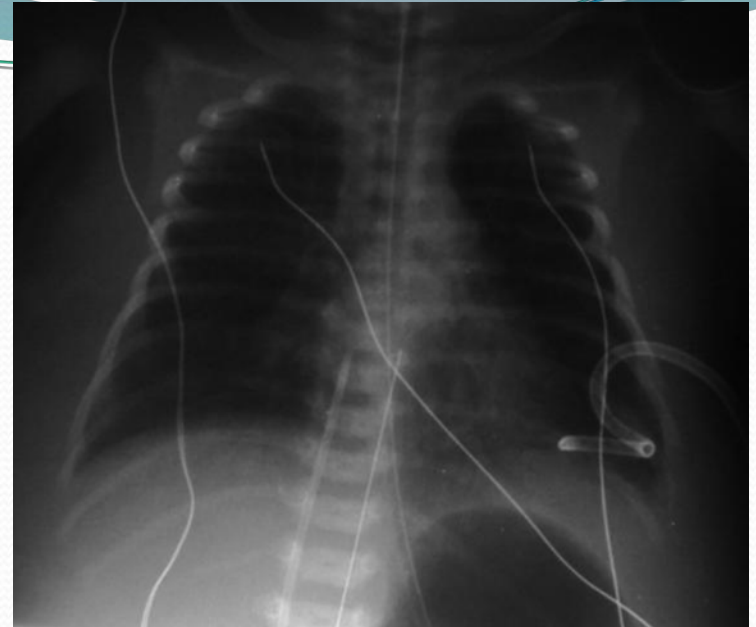
*Why is that important?*

If they are too easily visualized the film is over penetrated and low-density lesions (atelectasis or infiltrates) may be missed.

If they are not visualized at all the film is under penetrated and the lungs will appear whiter or “fluffier” than they really are.

# Overpenetration

- These films are taken a few minutes apart.
- Note that soft tissues and bony structures are washed out on the one on the top.
- It would be very easy to miss any water densities such as infiltrates on this film.

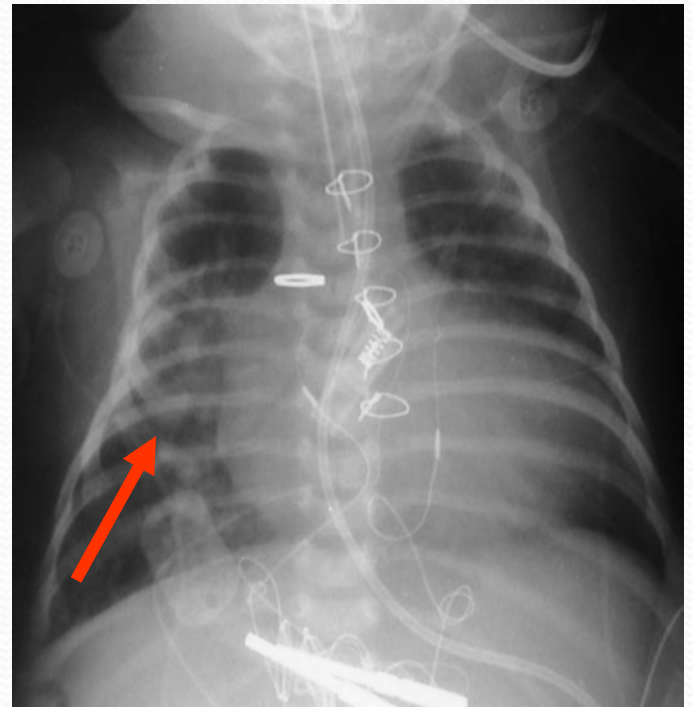




# Underpenetration

In the film on top the diaphragm is not visible, and the vertebral bodies barely so, through the heart.

The film on the bottom was taken a few minutes after the other film – now the heart, tubes and lines are now visible as well as a RUL infiltrate.





# Systematic Review Every Xray

Correct patient identifier?

Lung fields

Diaphragm

Mediastinum

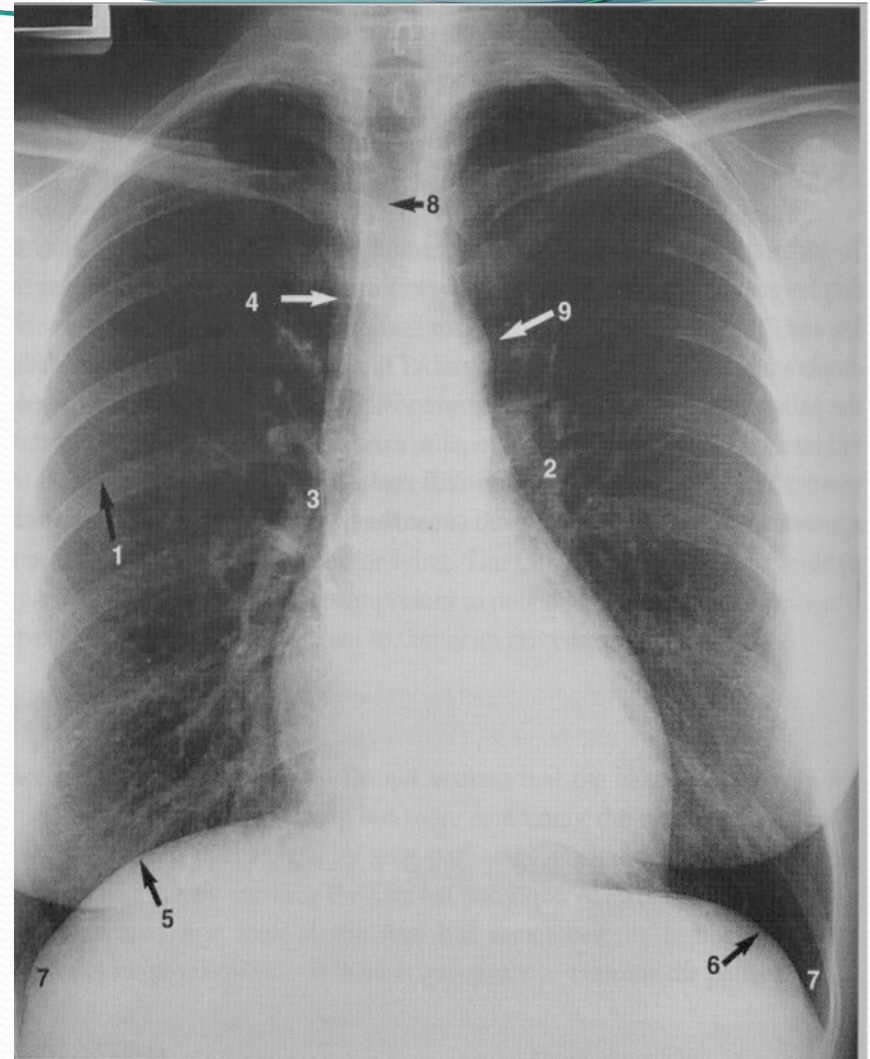
Bony structures

Soft tissues

Tubes and lines

- All of these areas, every patient, every film

1. Lung fields
2. Hilum
3. R. mainstem bronchus
4. R. edge of trachea
5. R. diaphragm
6. L. diaphragm
7. Costophrenic angles
8. Trachea
9. Aortic knob



Chest XRAY Made  
Easy

*Corne et al*



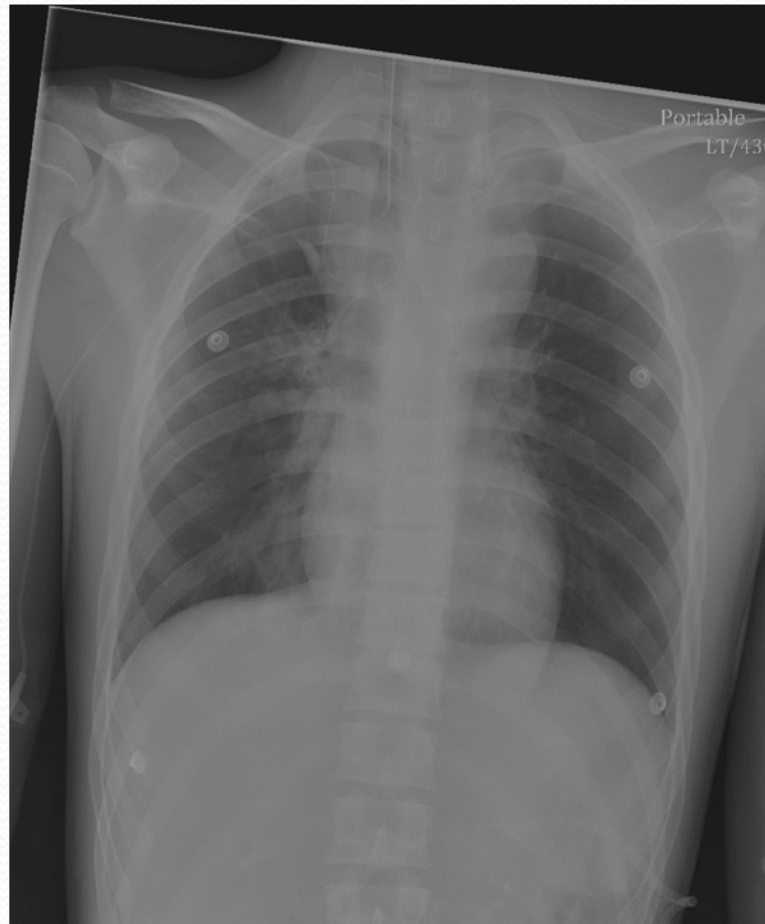
## Question Number 2: The Proper Position for the end of the ETT is:

- 1. Between T<sub>1</sub> and T<sub>3</sub>
- 2. Between T<sub>4</sub> and T<sub>5</sub>
- 3. Just above the clavicles

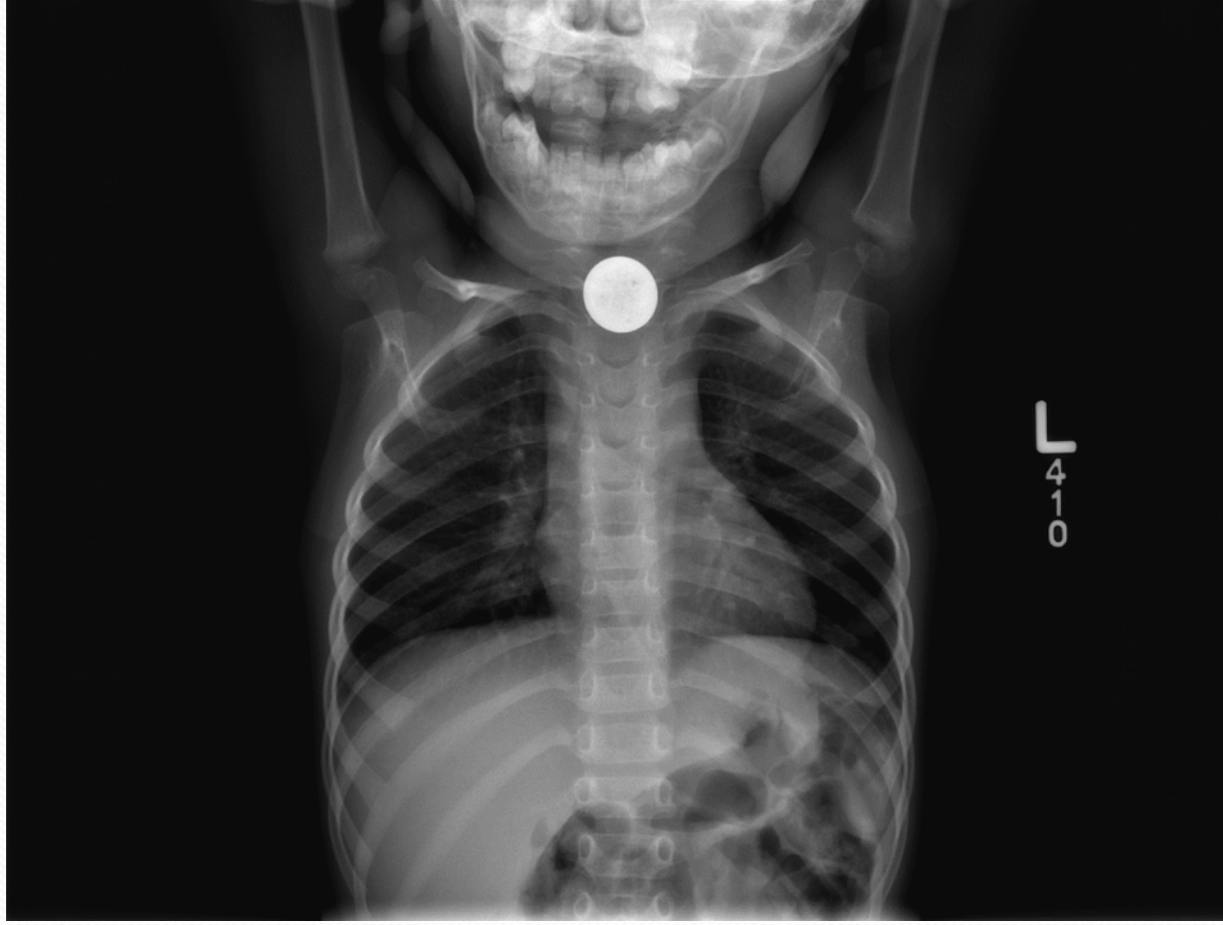


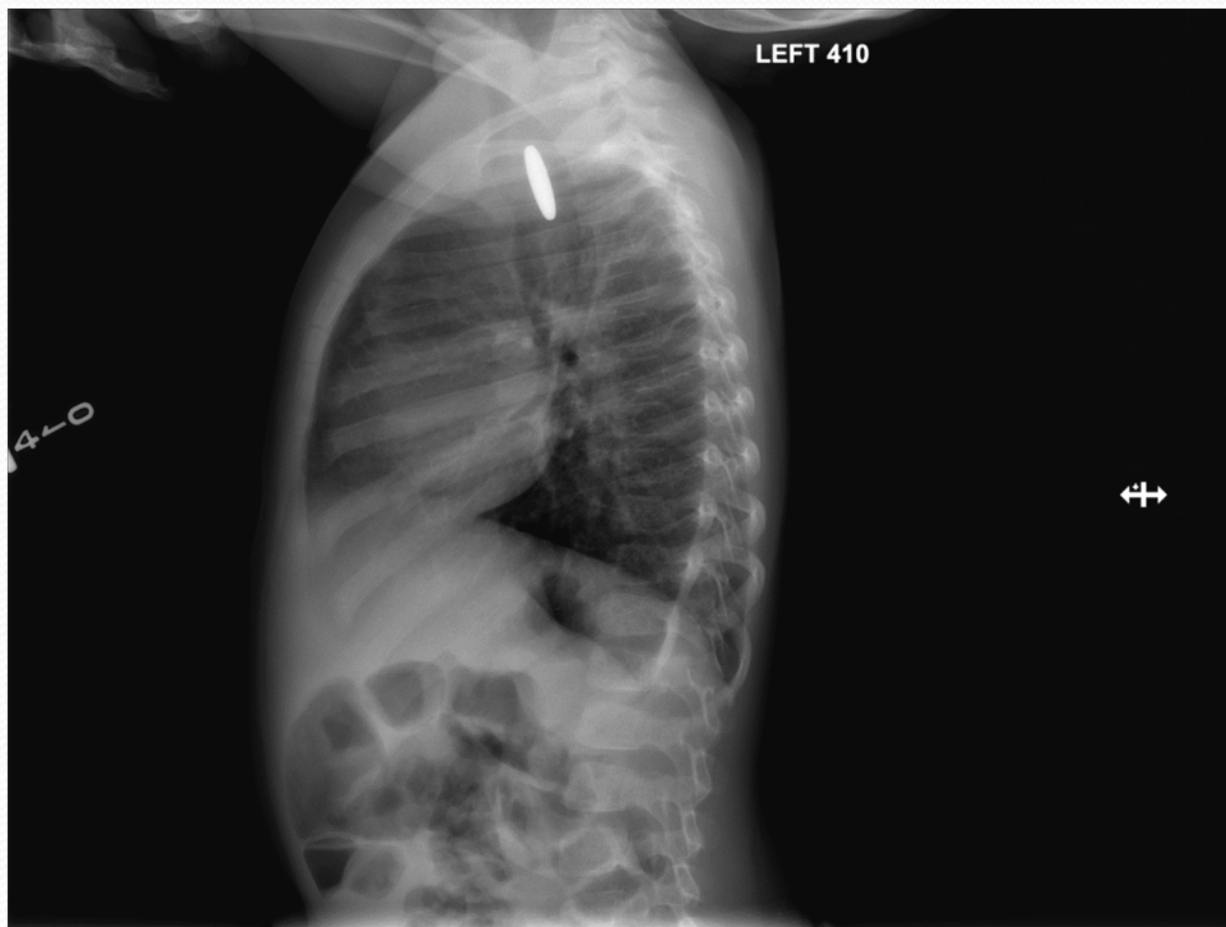
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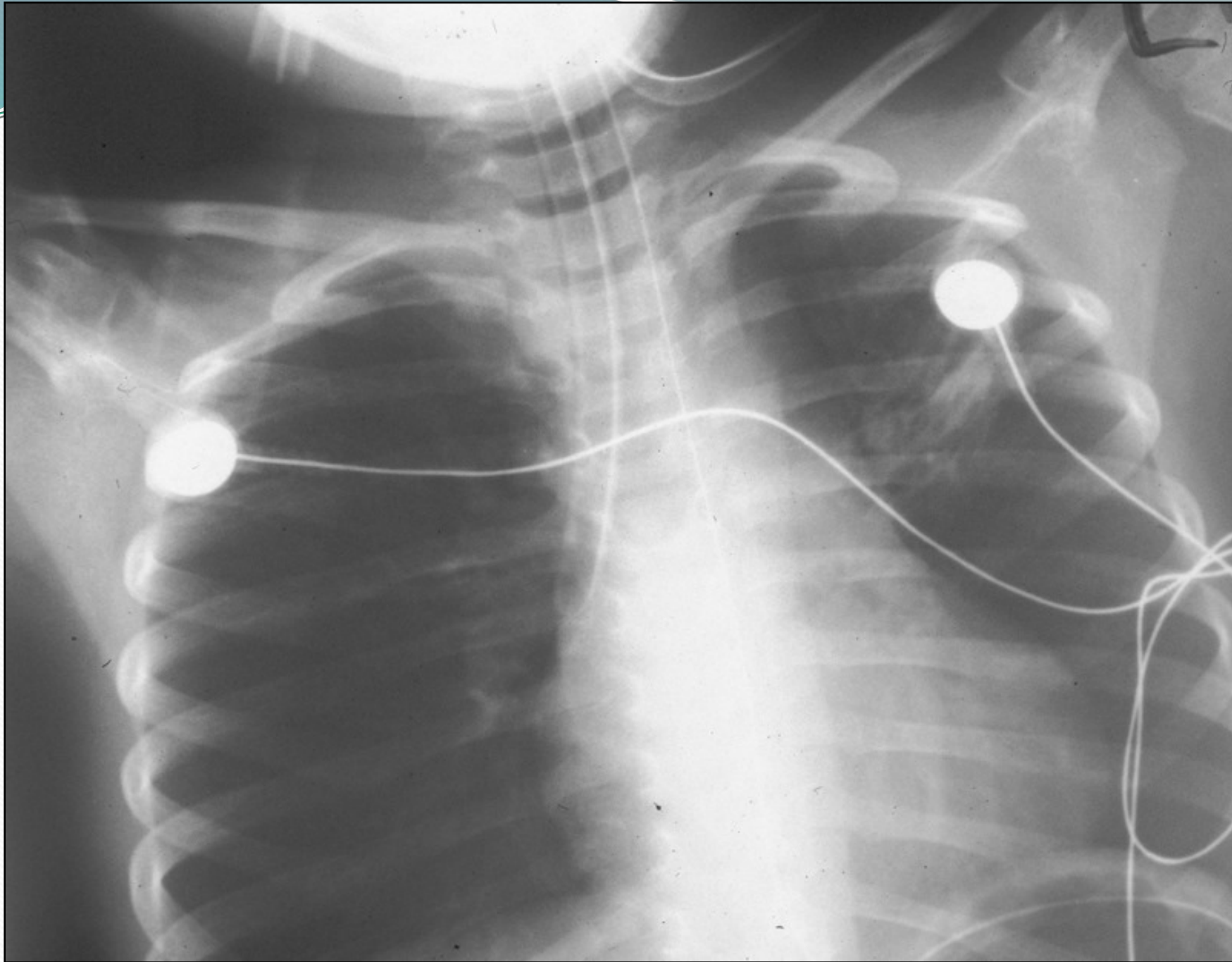








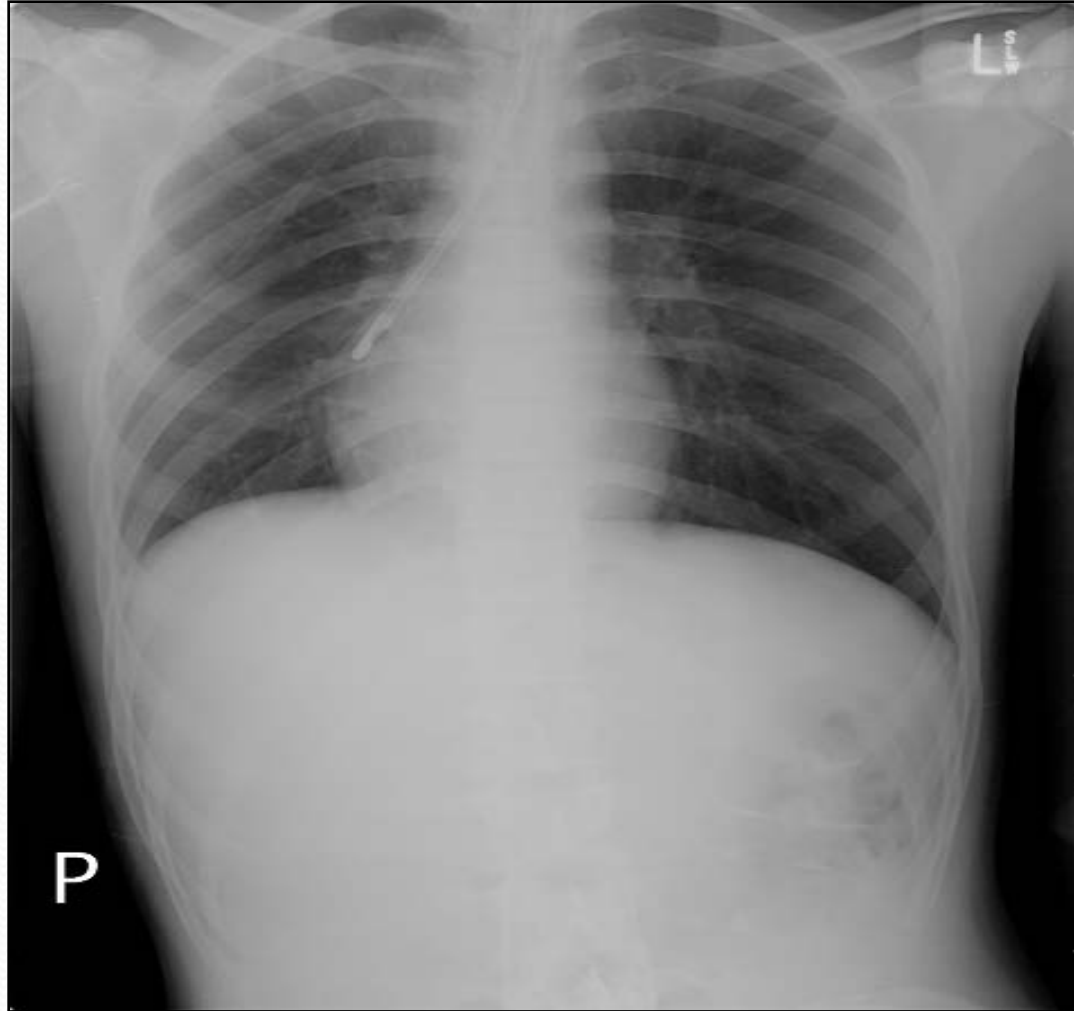




# Enteral Feeding Tubes and Lines

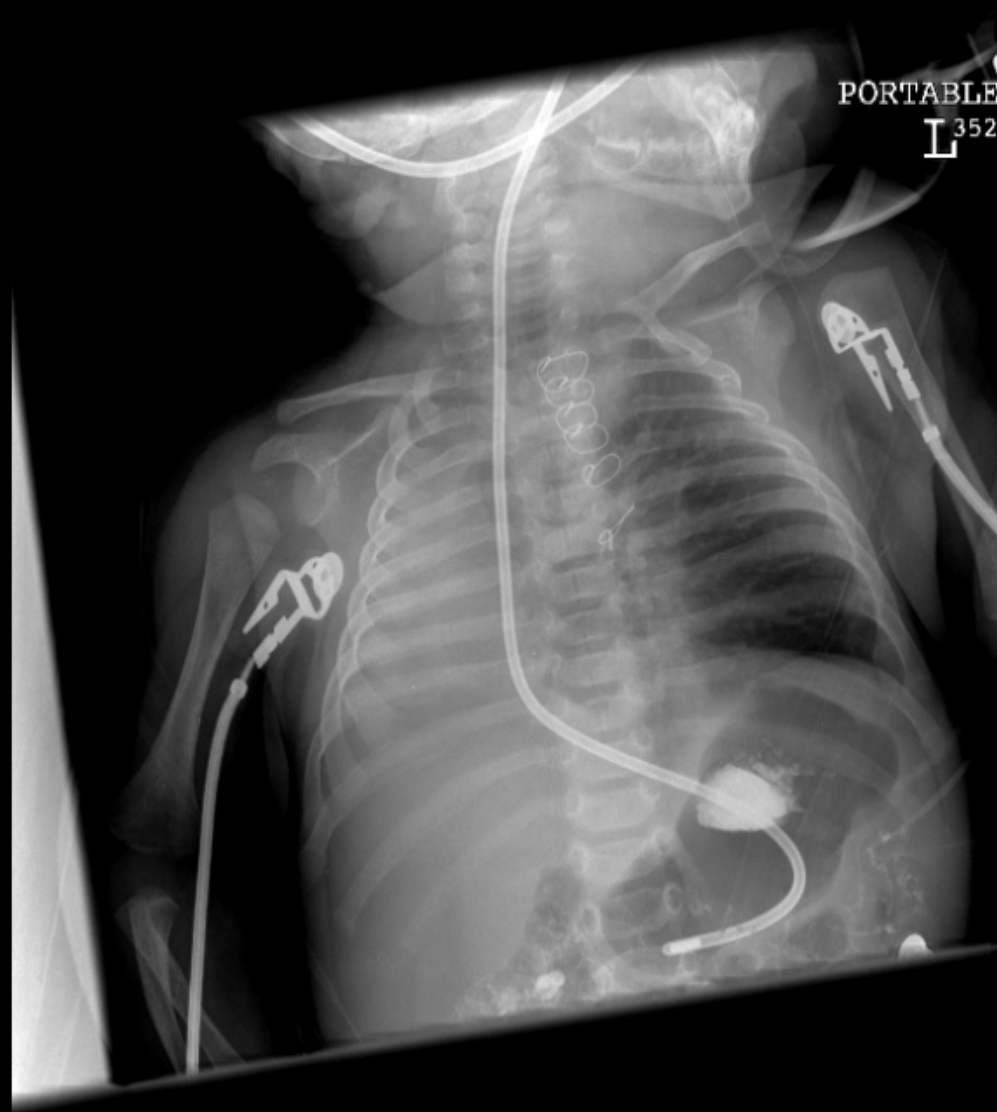
- Nasogastric
- Salem sump
- Nasoduodenal
- PICC
- Central venous lines









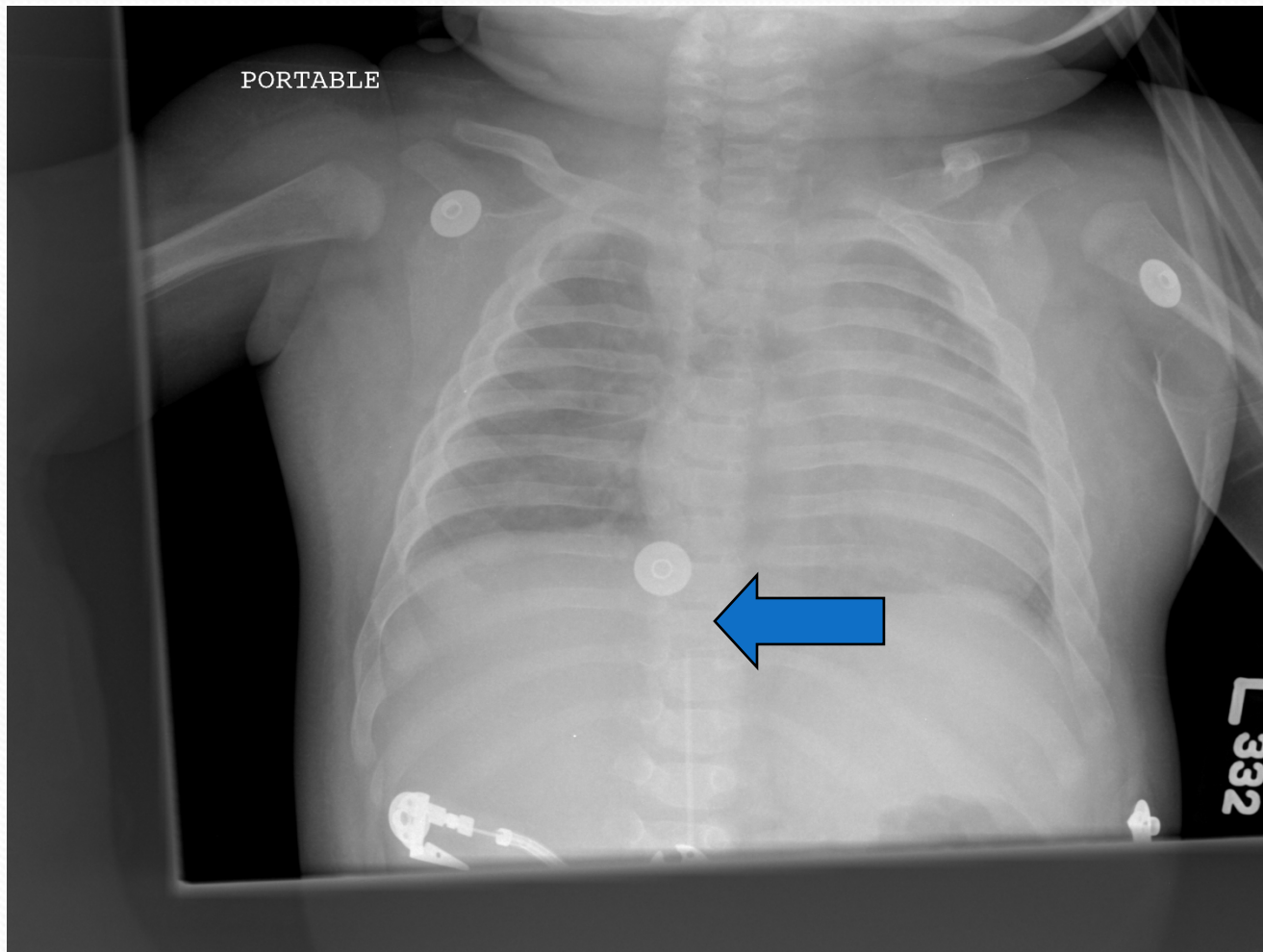


(NX IgM)  
2.10 (IgM)

WV1141 L2449

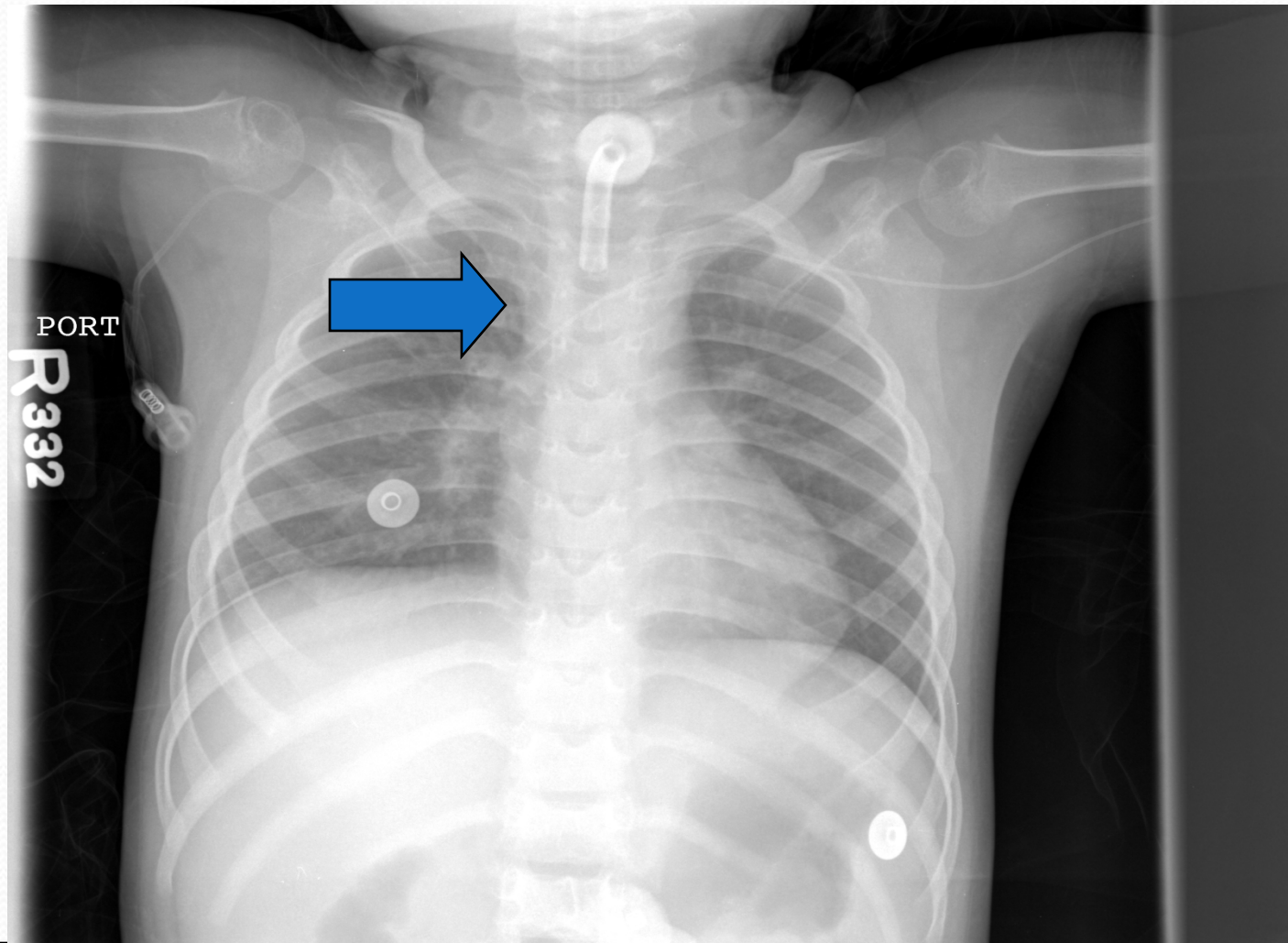
IMG626  
chest  
Zoom: 24.5%

# CVL Position- IVC





# CVL Position- SVC



# Common PICU Pathology

- Lung fields
  - Infiltrates (Alveolar, Interstitial, Mixed)
  - Atelectasis
  - Obstructive airways diseases
- Pleural space
  - Pleural effusions
  - Pneumothoraces
- Diaphragm



Question 3: Volume loss lesions such as atelectasis will have what effect on surround structures?

- 1. No effect
- 2. Push surrounding structures away from the area of atelectasis
- 3. Pull surrounding structures toward the area of atelectasis.

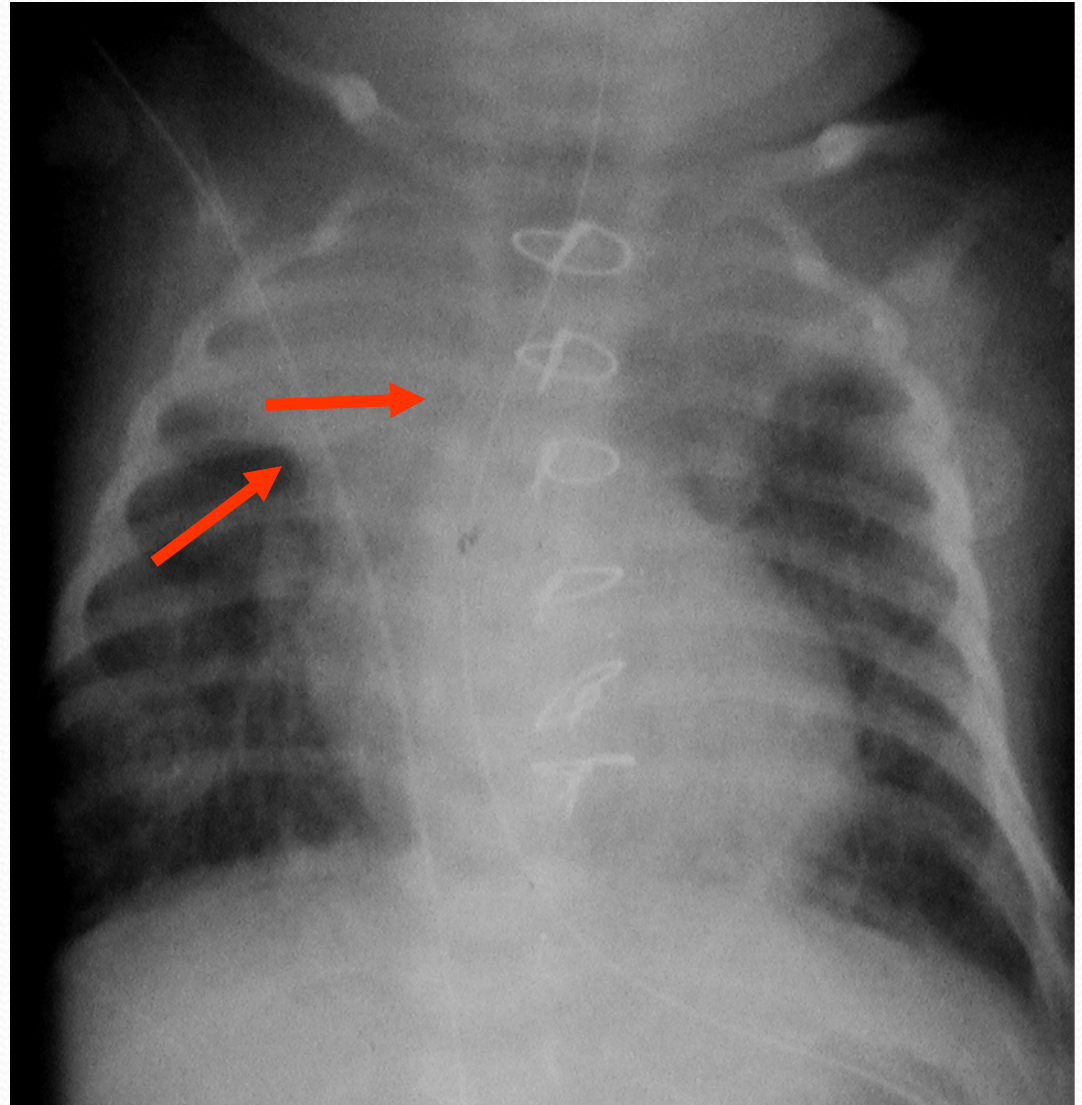


# Atelectasis

Collapse of lung units results in loss of volume in that part of the lung distorting the surrounding landmarks.

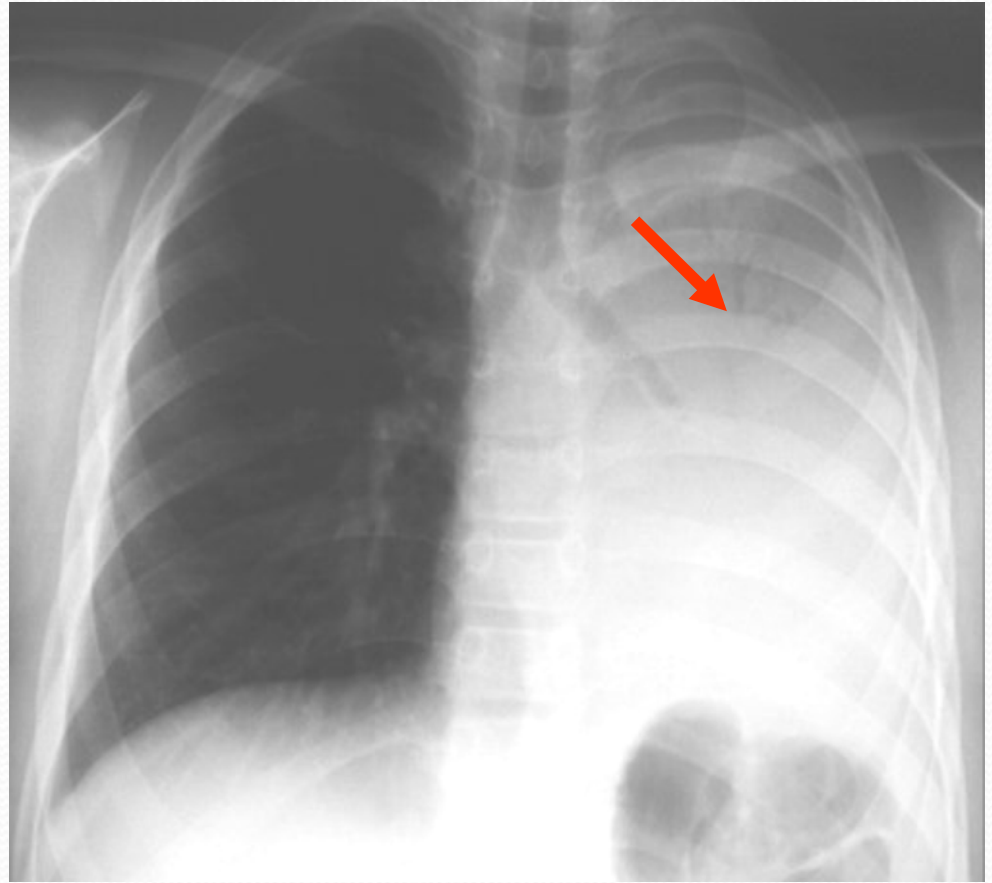
- RUL – horizontal fissure will be displaced upward, may pull the trachea to the right.
- RML – will obscure the R heart border.
- RLL – will obscure the diaphragm and poss. pull the horizontal fissure downward.
- LUL – may pull the trachea to the left.
- LLL – may obscure the diaphragm.

- RUL, LUL atelectasis
- The horizontal fissure is displaced upwards.
- The trachea is displaced to the right.
- Note presence of sternal wires and NG tube.



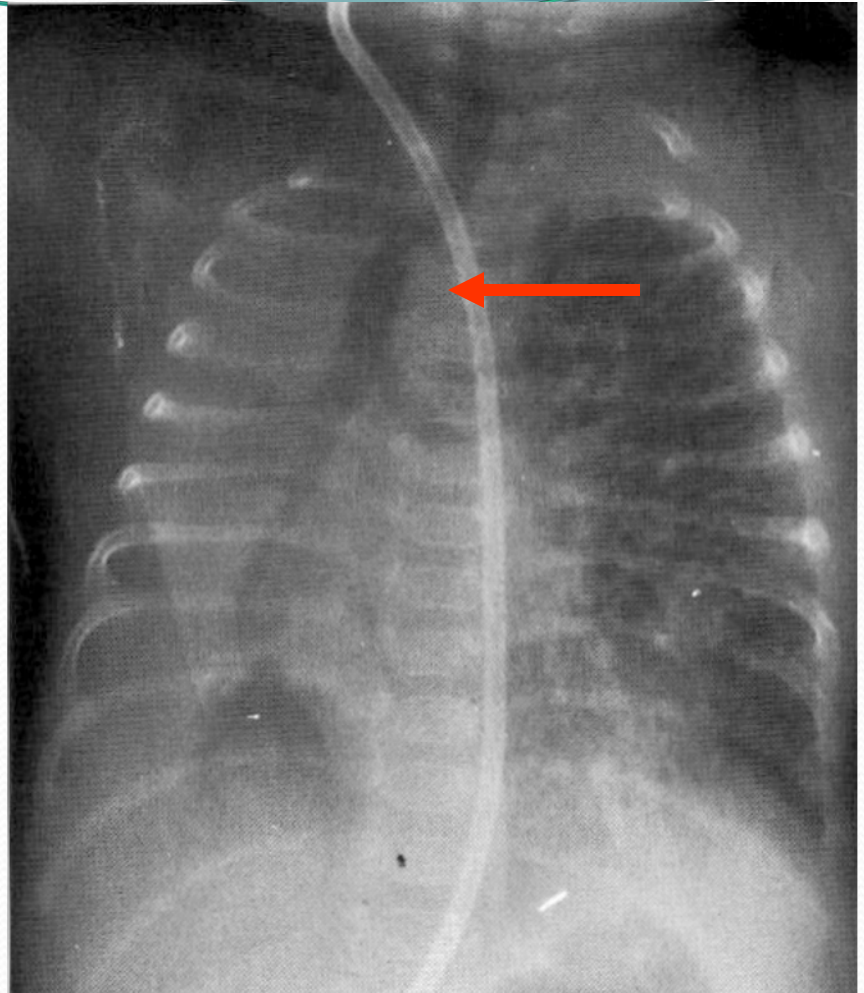


- Atelectasis of left lung – note that heart is displaced into the left hemithorax and the diaphragm is obscured.
- There are air bronchograms present suggesting some infiltrative process as well.





- This film is slightly rotated to the right (making the L. hilum more prominent) but the collapse of the right lung is apparent with resultant shift of the trachea and heart to the right.

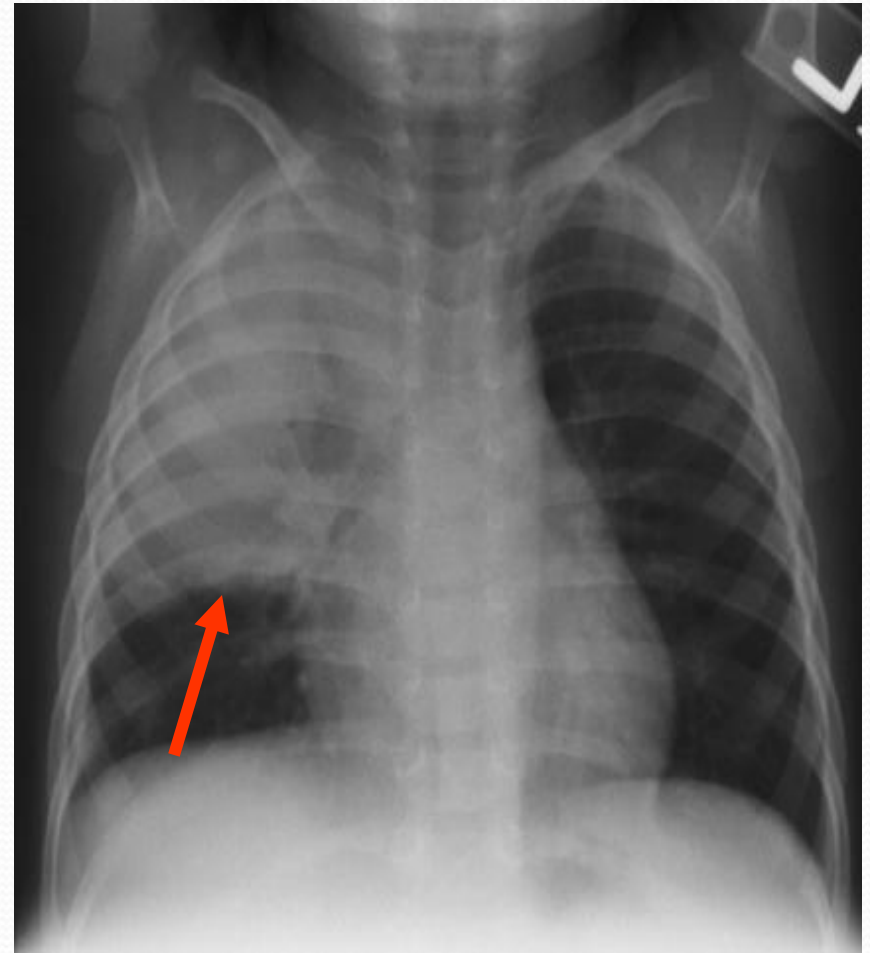


## Question 4: Bacterial pneumonias tend to be...?

- 1. Well demarcated and limited to a single side
- 2. Diffuse areas of haziness seen in all lung fields
- 3. Require surgical intervention



- Well-demarcated segmental (RUL) infiltrate – most likely bacterial pneumonia.
- Note downward displacement of horizontal fissure from this space-occupying infiltrate (if this were atelectasis the fissure would be pulled up).



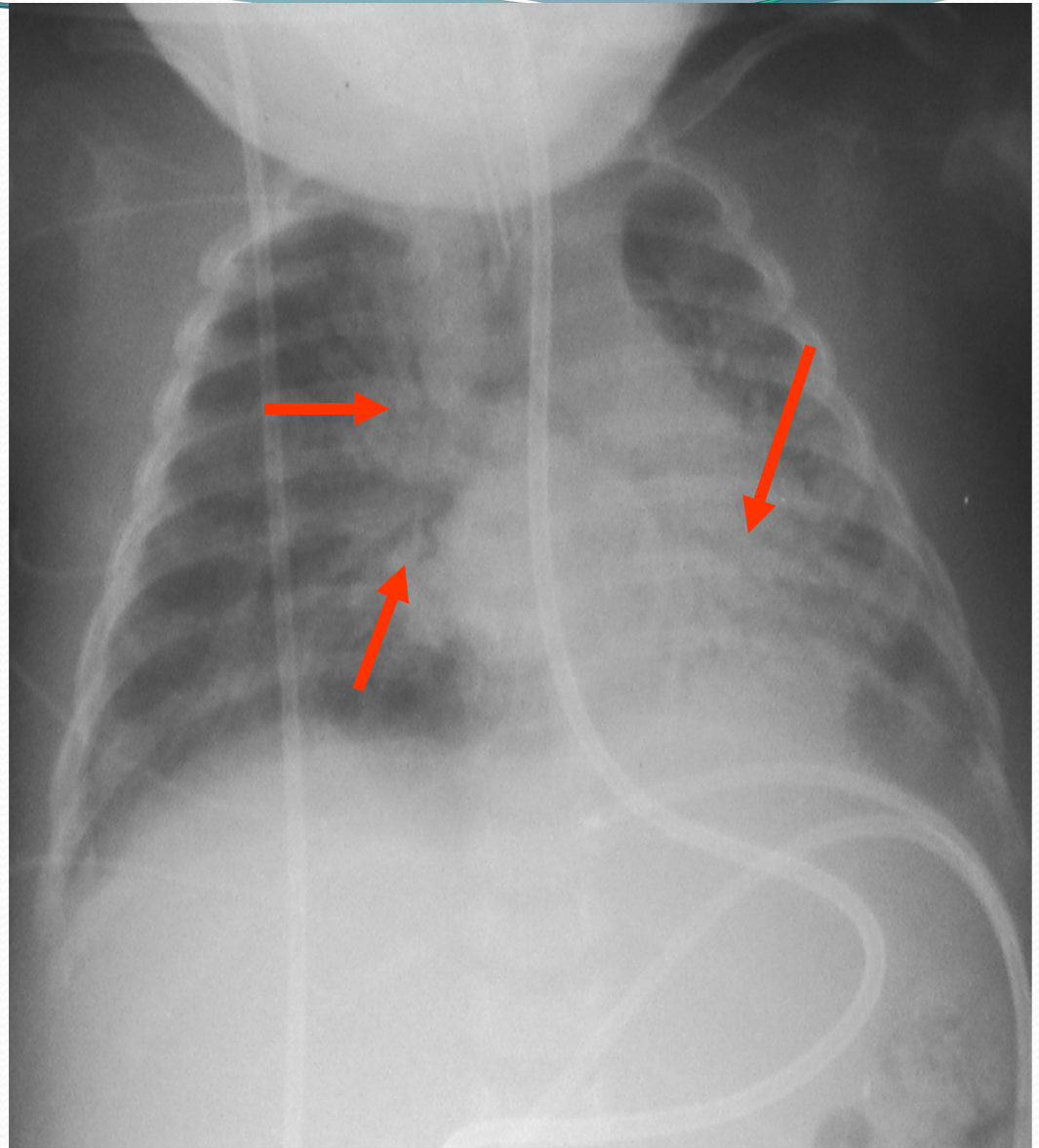


# What do you think of this?

- Case Study: 6mo with 4 day history of cough, increased work of breathing, wheezing, poor feeding.
- What's your diagnosis?

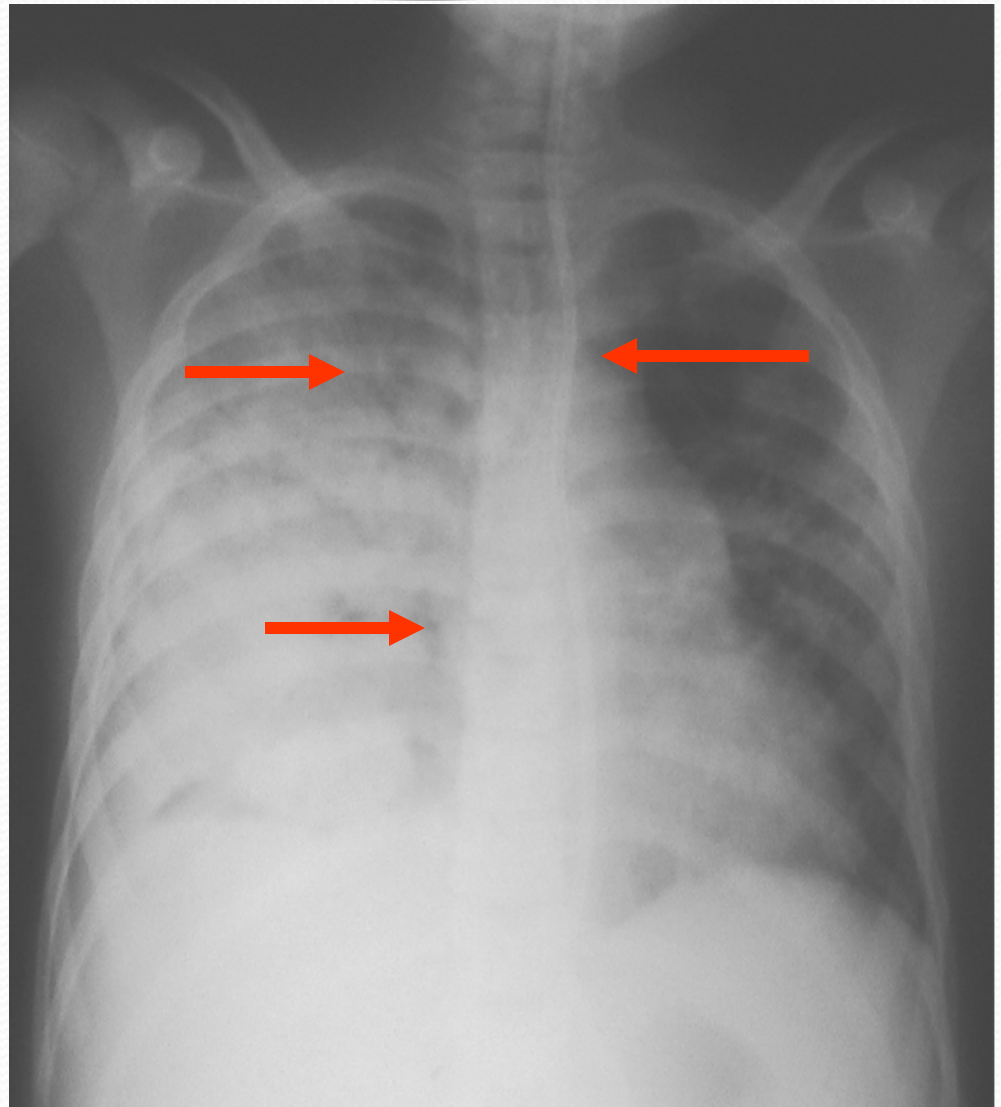


- Note ill-defined opacities with air bronchograms in RU/ML and LLL - typical of alveolar infiltrates.
- ETT is between carina and clavicles; ND is well into the duodenum. A VP shunt may also be present





- RU / ML alveolar consolidation.
- The right heart border is obscured.
- Air bronchograms are present.
- The trachea and NG tube are pushed to the left.





# Case Study 2

- Case study: 8 year old with 2 day history of cough and increased WOB after playing soccer. Unable to speak in full sentences without stopping for breath
- What's your diagnosis
- What is your treatment?

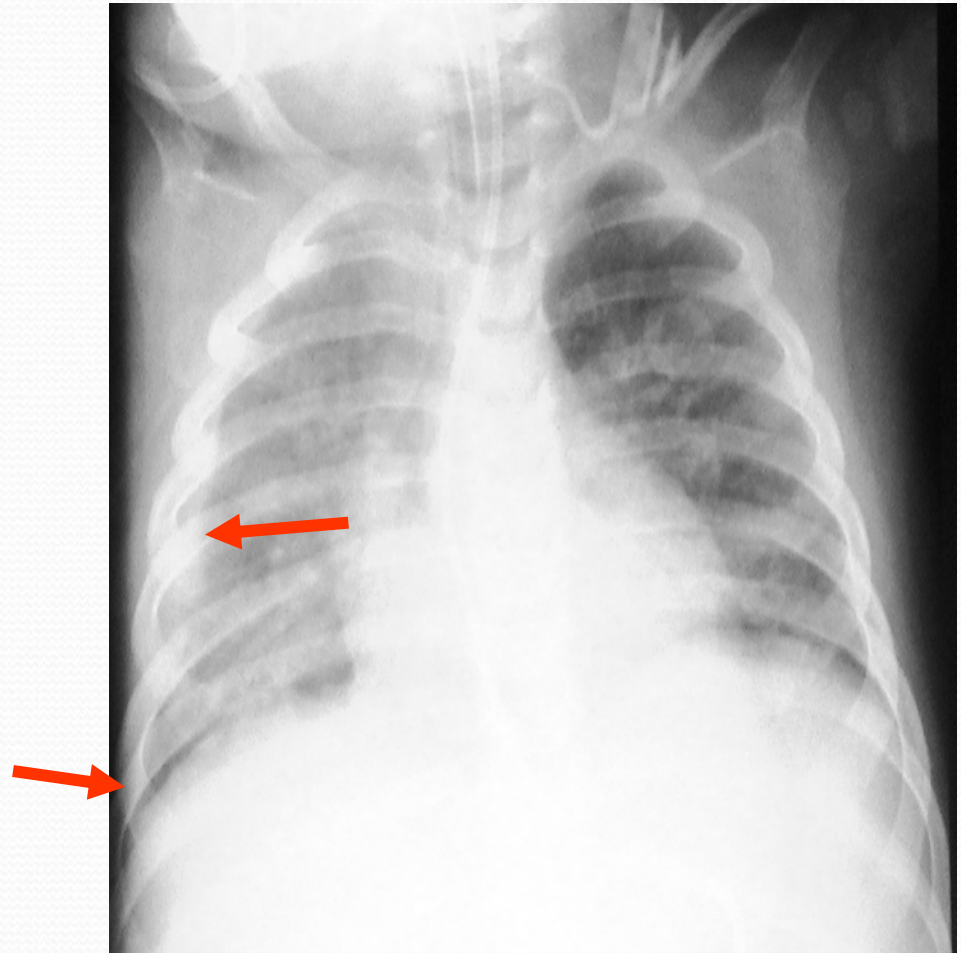


# Pleural Space diseases

- Pleural effusions -
  - Transudates (<30 g/L protein): congestive heart failure, cirrhosis, nephrotic syndrome
  - Exudates (>30 g/L protein): pneumonias, malignancy, pancreatitis, collagen vascular diseases
  - Radiographically indistinct
- Pneumothoraces

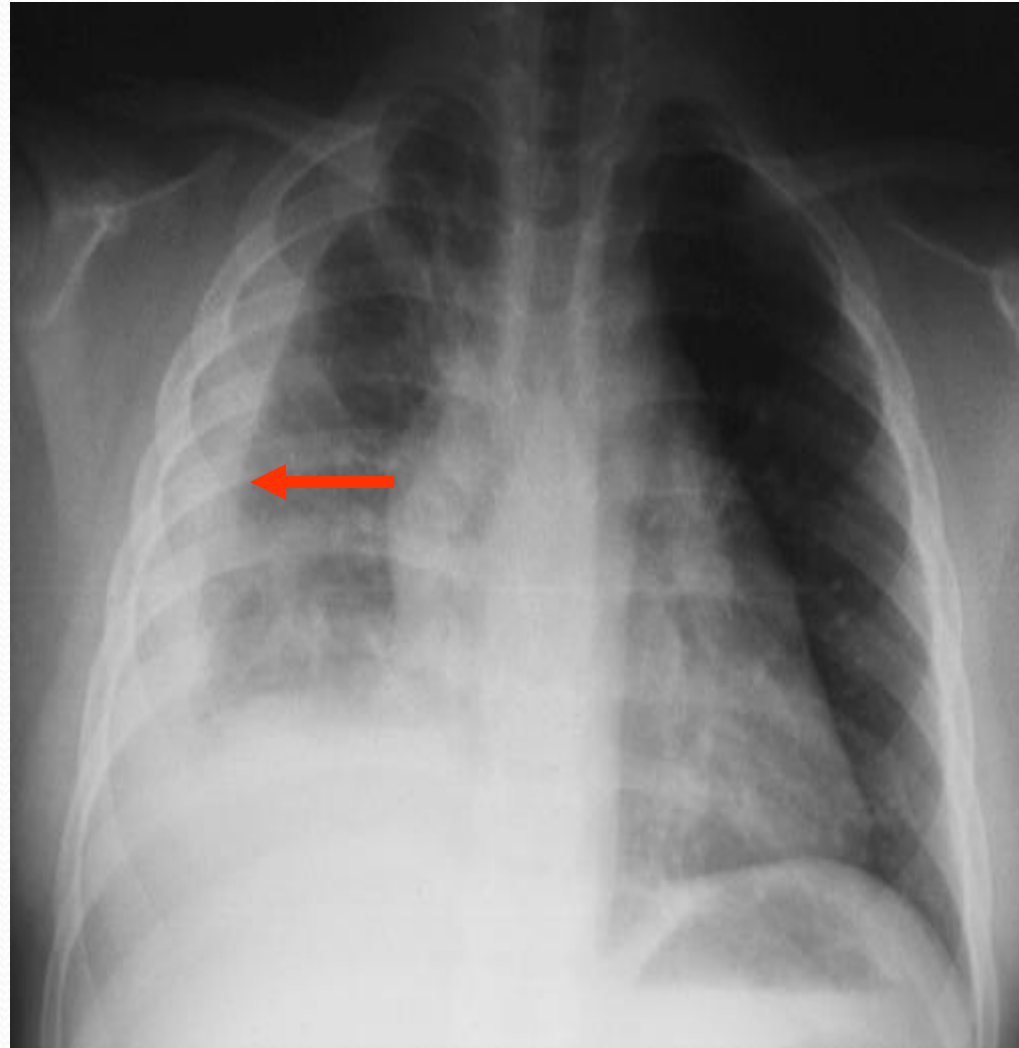


- Note right sided pleural effusion.
- The right lung field appears less penetrated – this is fluid layering out along the back.
- There is blunting of costophrenic angle.
- A demarcated line of fluid along the lateral border is present.





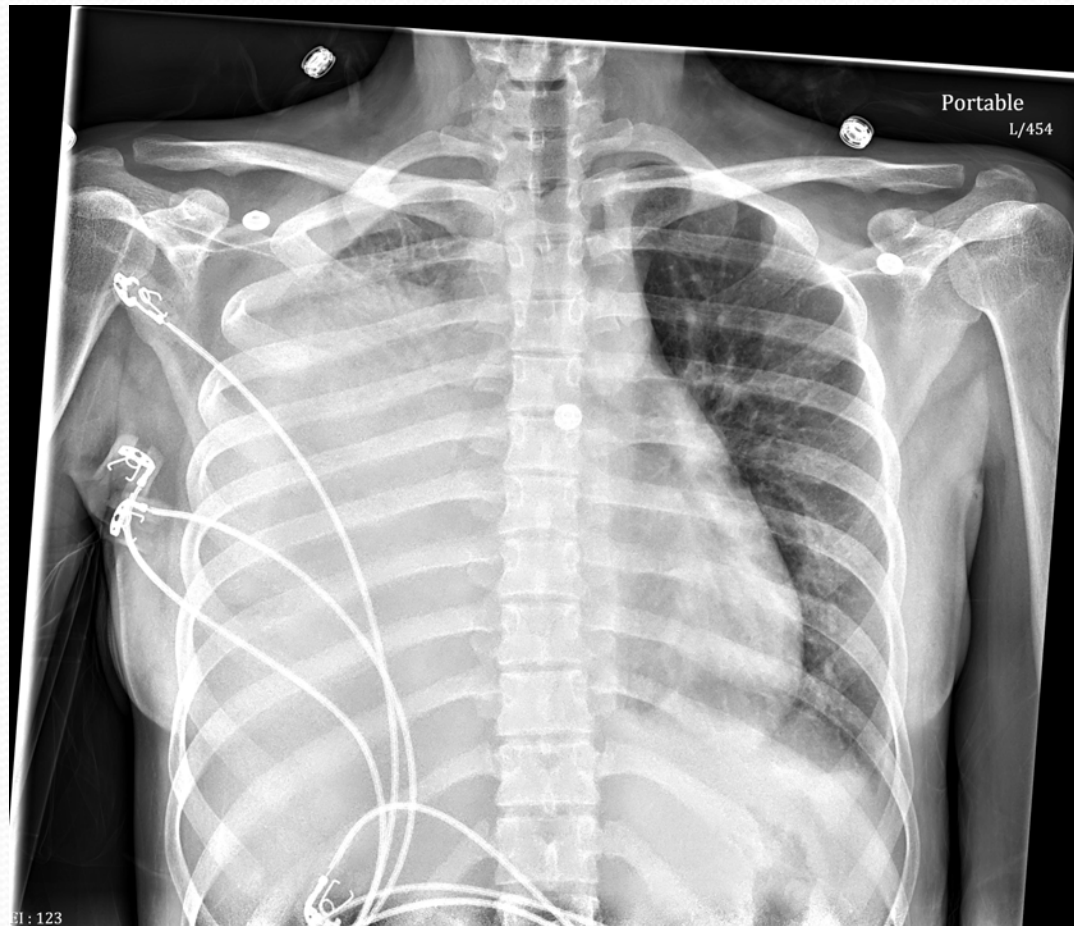
- R. pleural effusion obliterating the costophrenic angle and diaphragm.
- The fluid is layering out along the right side and back.



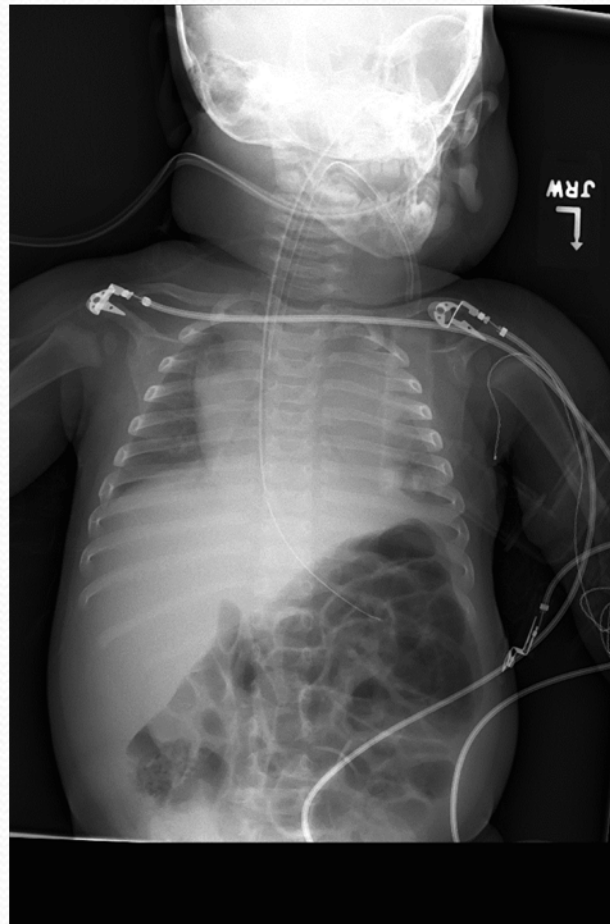
# Can you spot at least 3 things wrong with this film?









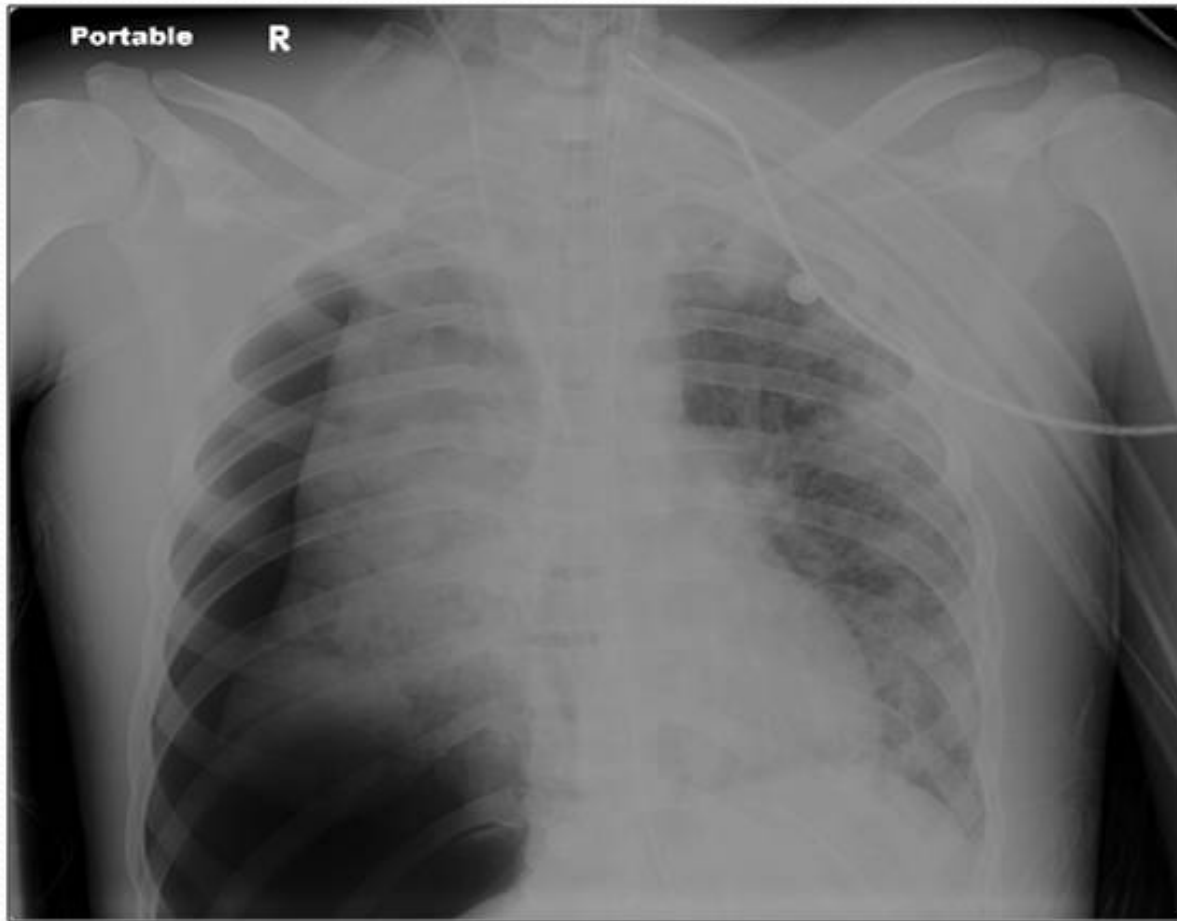


## Final Question: The following are signs of tension pneumothorax

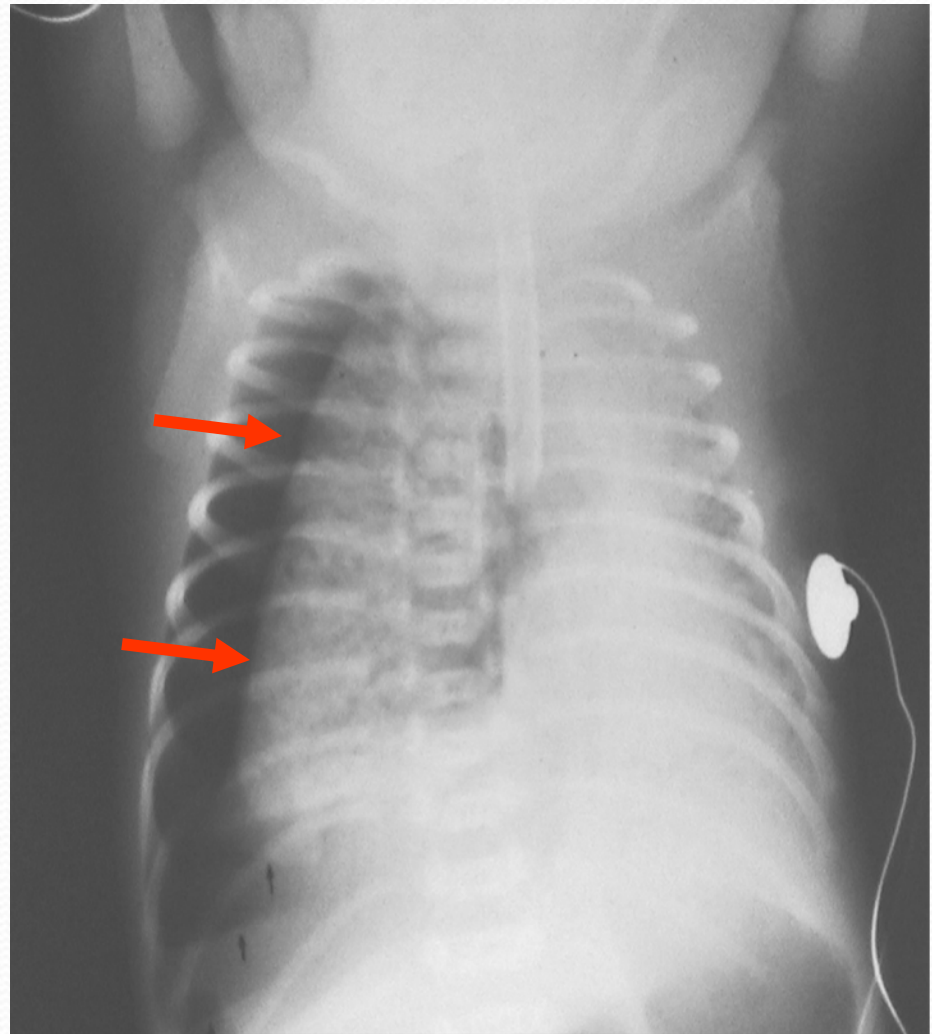
- 1. normotensive, bradycardia, normal saturations
- 2. hypotension, tachycardia, decreased saturations
- 3. apnea, normotensive, bradycardia, decreased saturations



# Tension Pneumothorax



- This is a tension pneumothorax – note the ETT and heart are shifted into the left chest and the diaphragm is shifted downwards.
- This is a medical emergency – the free air needs to be evacuated immediately (preferably before a chest film is obtained).

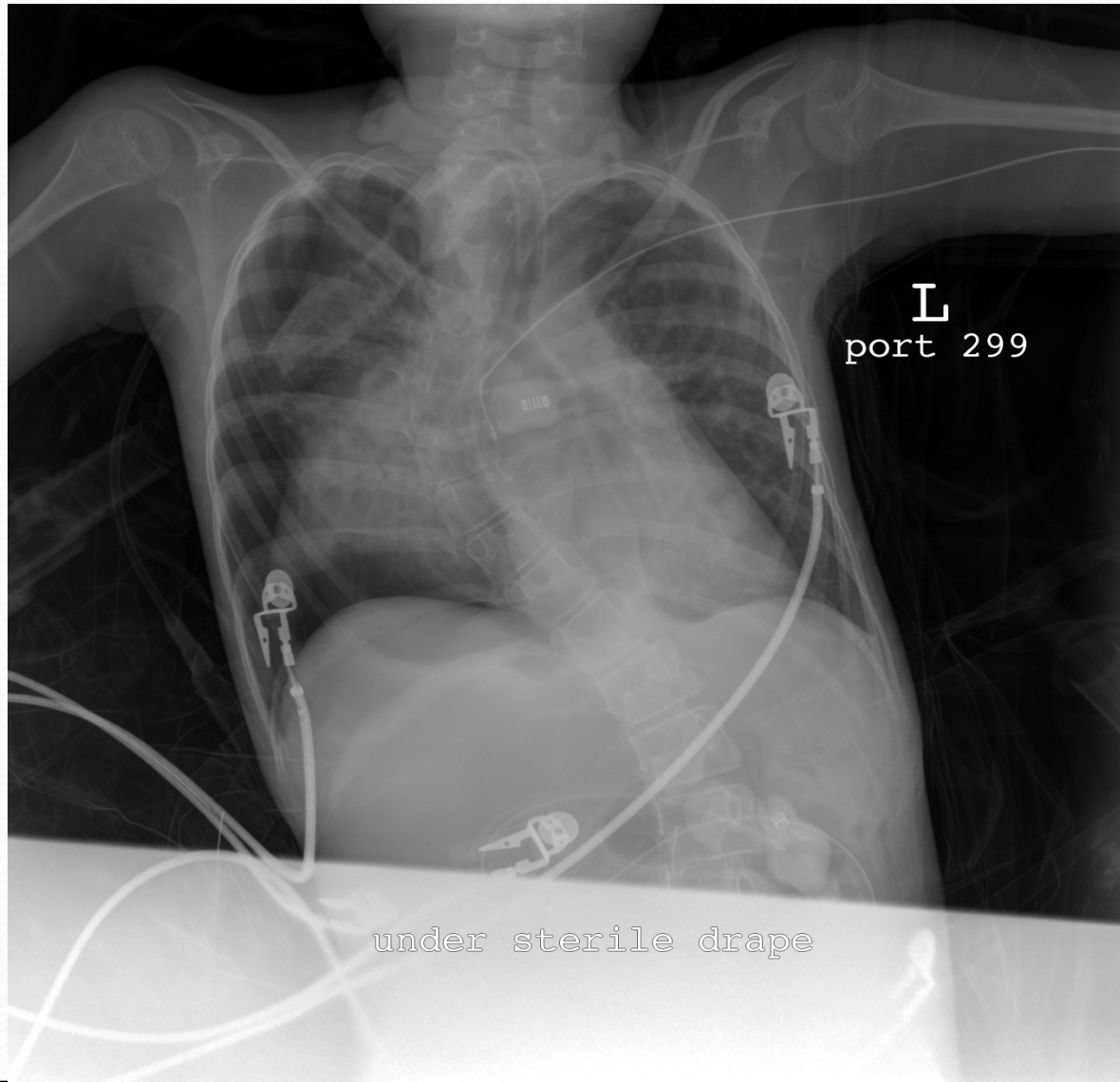




# Pneumothorax treatment

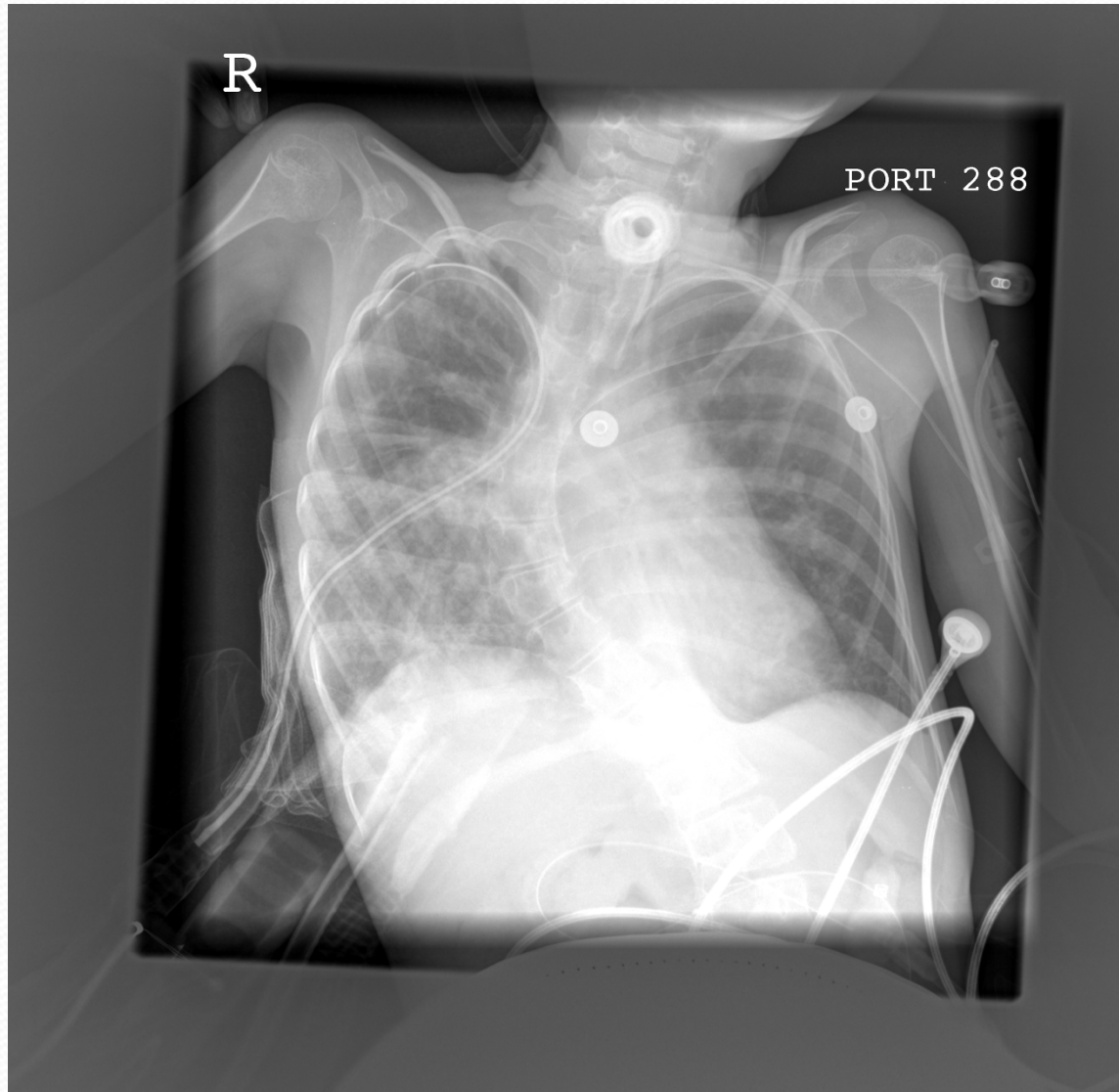
- Immediately recognize life threatening event
- Do not wait for chest xray to verify-clinical assessment
- Needle the chest
- Prepare for immediate chest tube placement
- Follow up chest film

# Pneumothorax





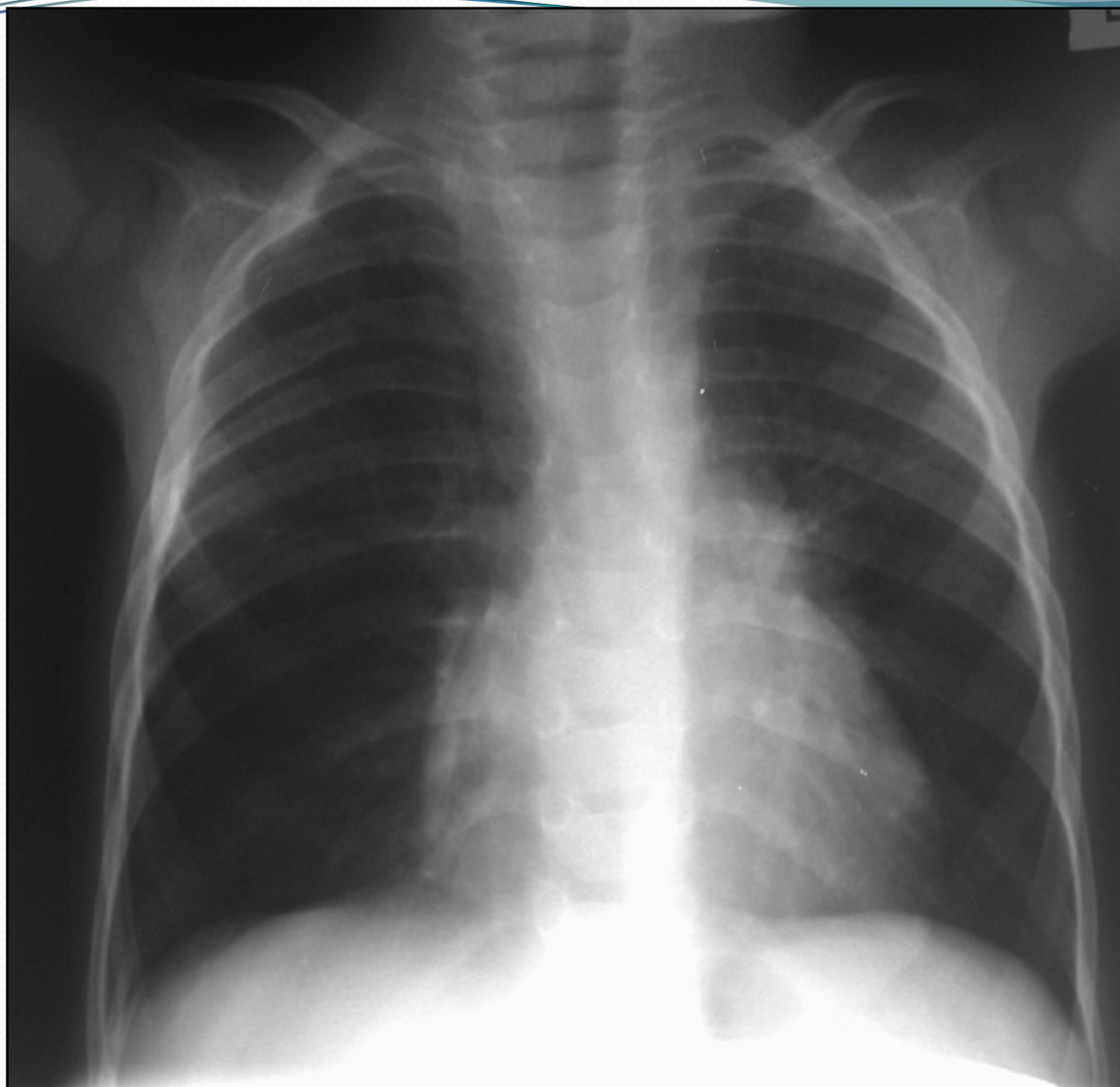
# Pneumothorax Post Chest Tube





Now it's your turn!!

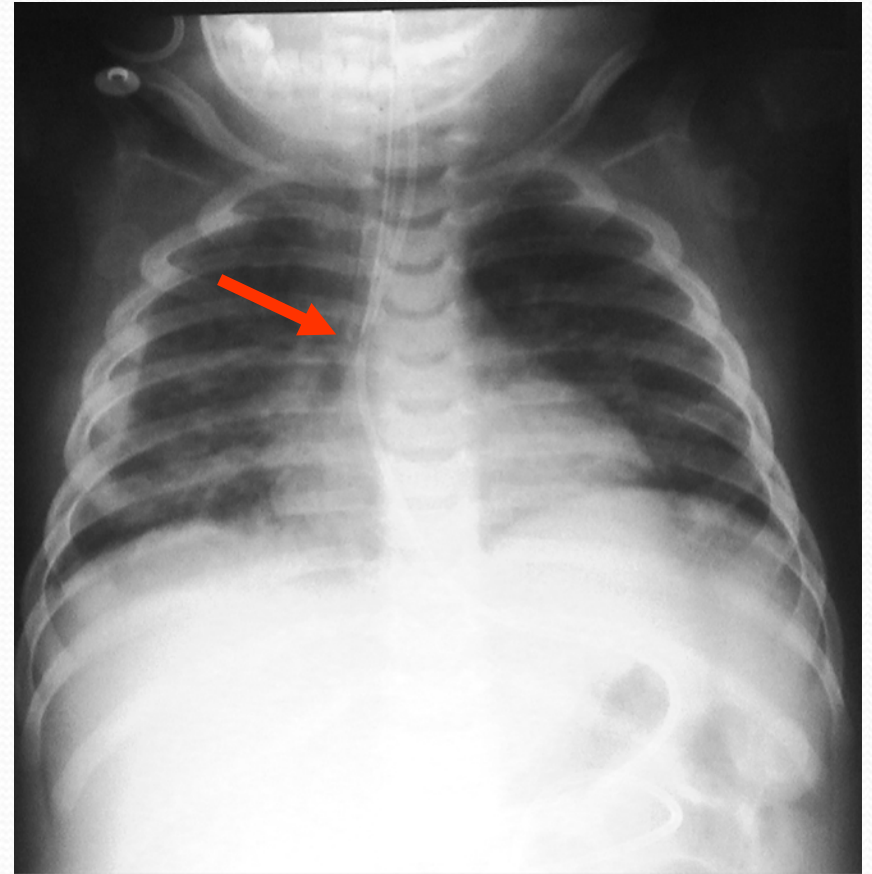




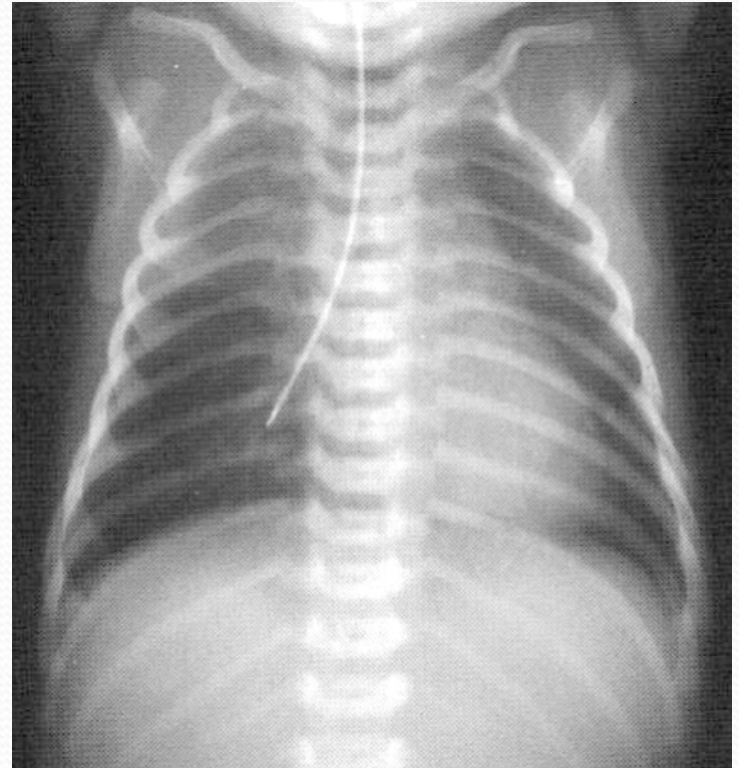




- ETT in R main stem bronchus.
- Pleural effusion, infiltrates – R>L.
- NG coiled in stomach.

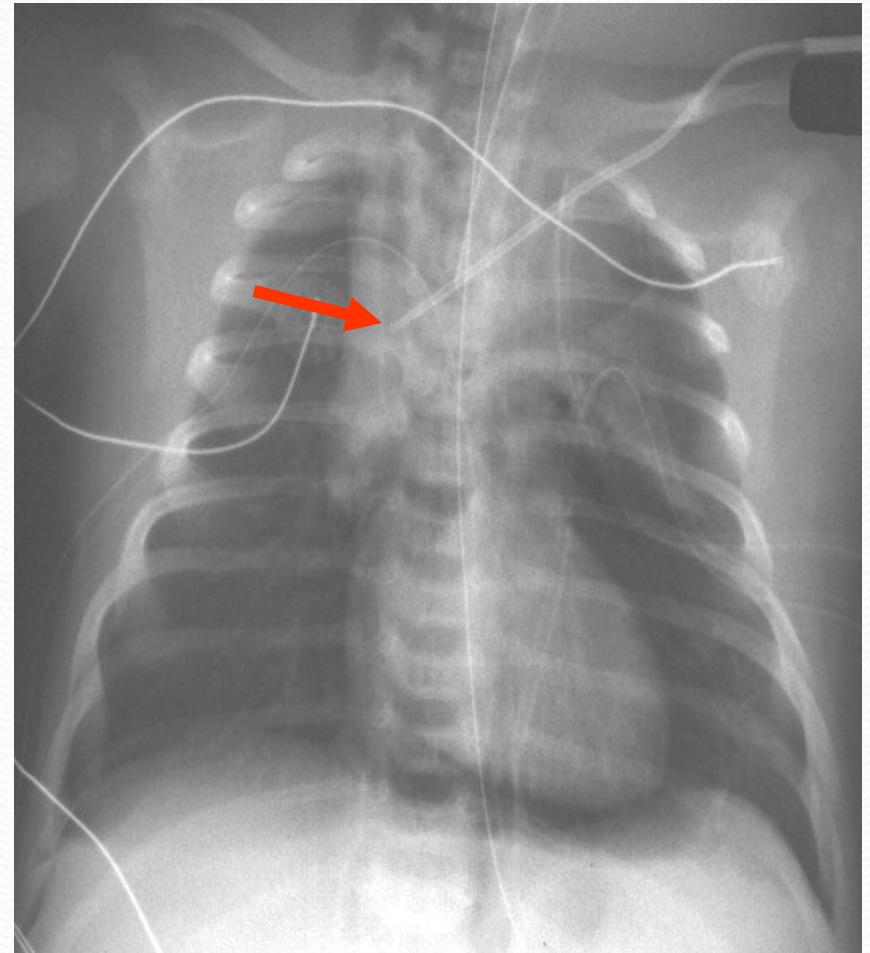


- What's wrong with this picture?





- Pneumopericardium – a life threatening disease as it may cause tamponade.
- This may be caused by the CVL rupturing through SVC into the pericardium (the line should be angling downwards and parallel to the vessel walls) .
- The air lifts up the thymic tissue and completely surrounds the heart.
- The ETT is in good position.



# References

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