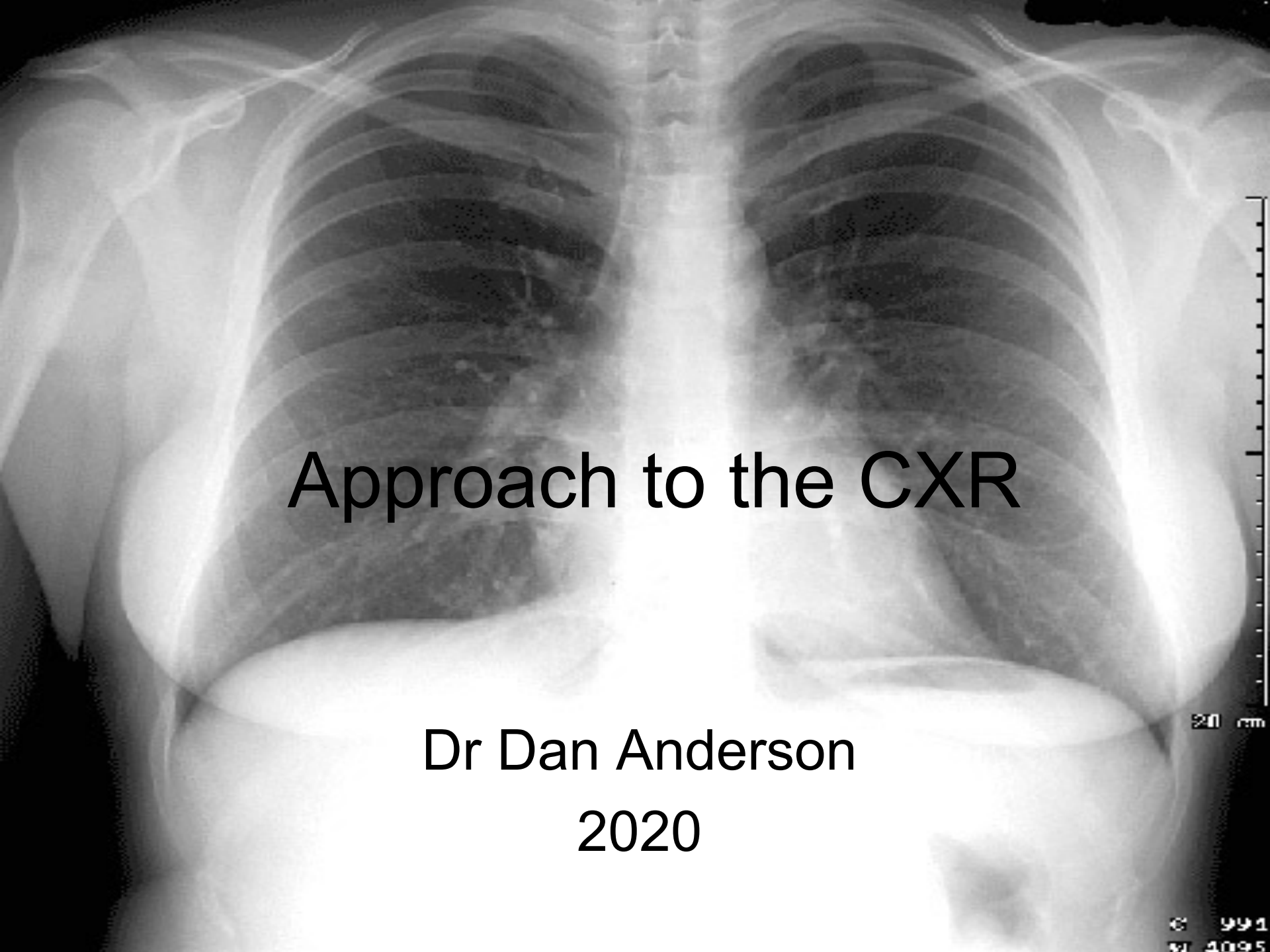


Approach to the CXR

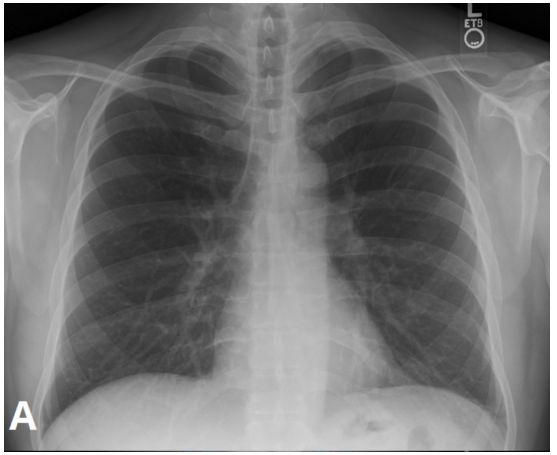
Dr Dan Anderson

2020

CXR Session

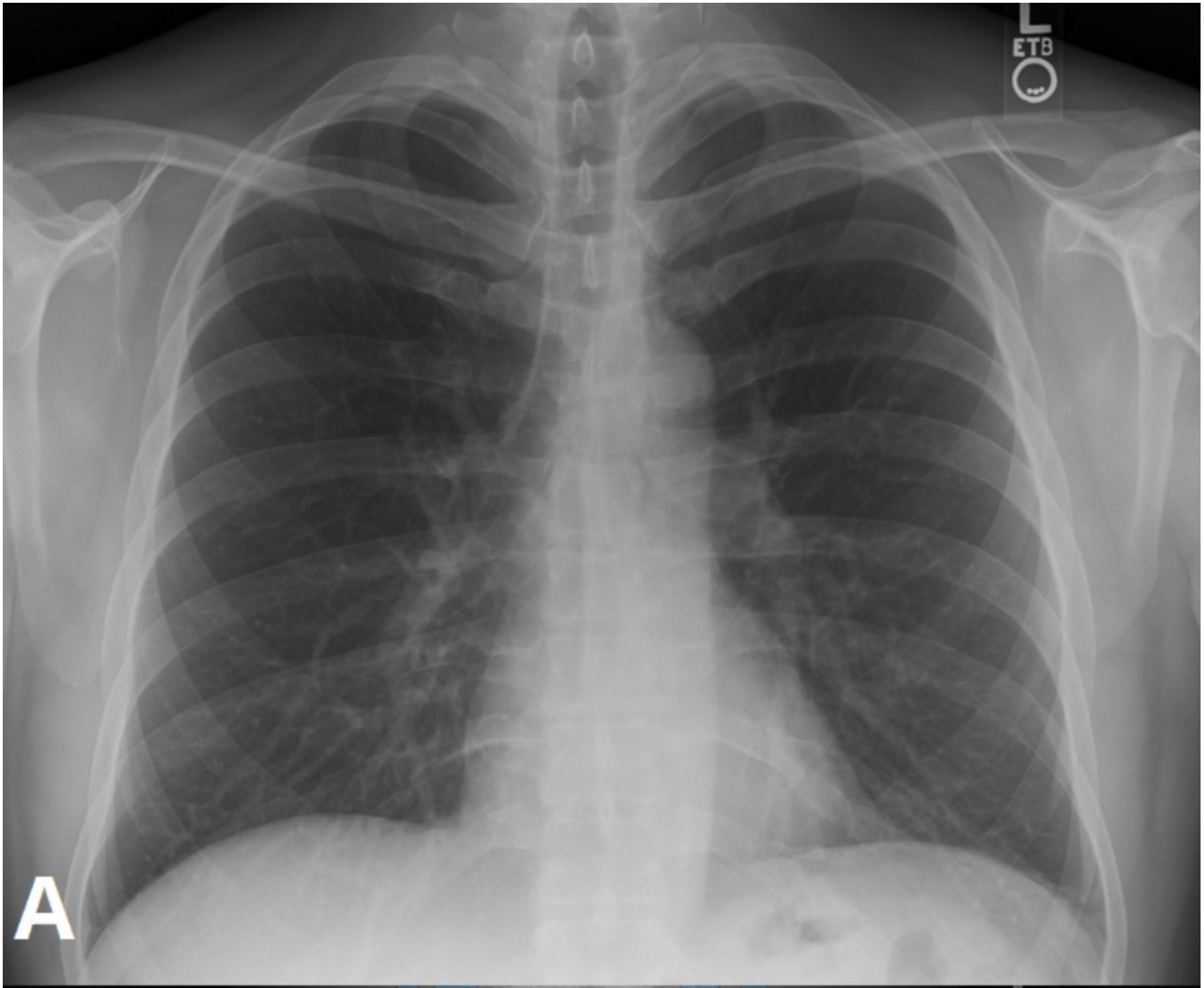
- Interpreting a CXR is a key skill in managing SOB/CP presentations

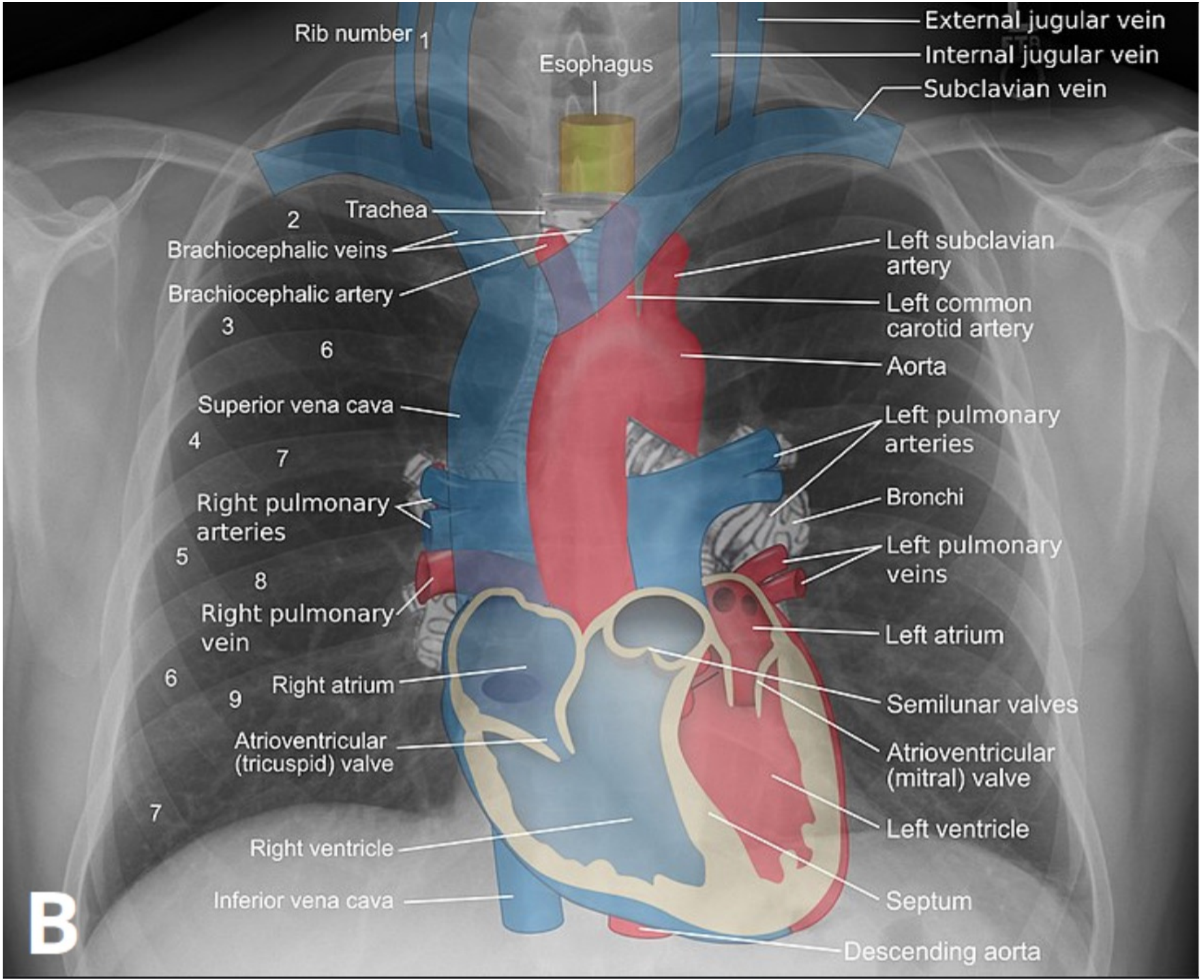
- Learning outcomes
  - Identify the adequacy of a CXR
  - Identify the anatomy on a CXR
  - Identify life threat CXRs
  - Identify common abnormal CXR findings
  - Have a system how to present a CXR



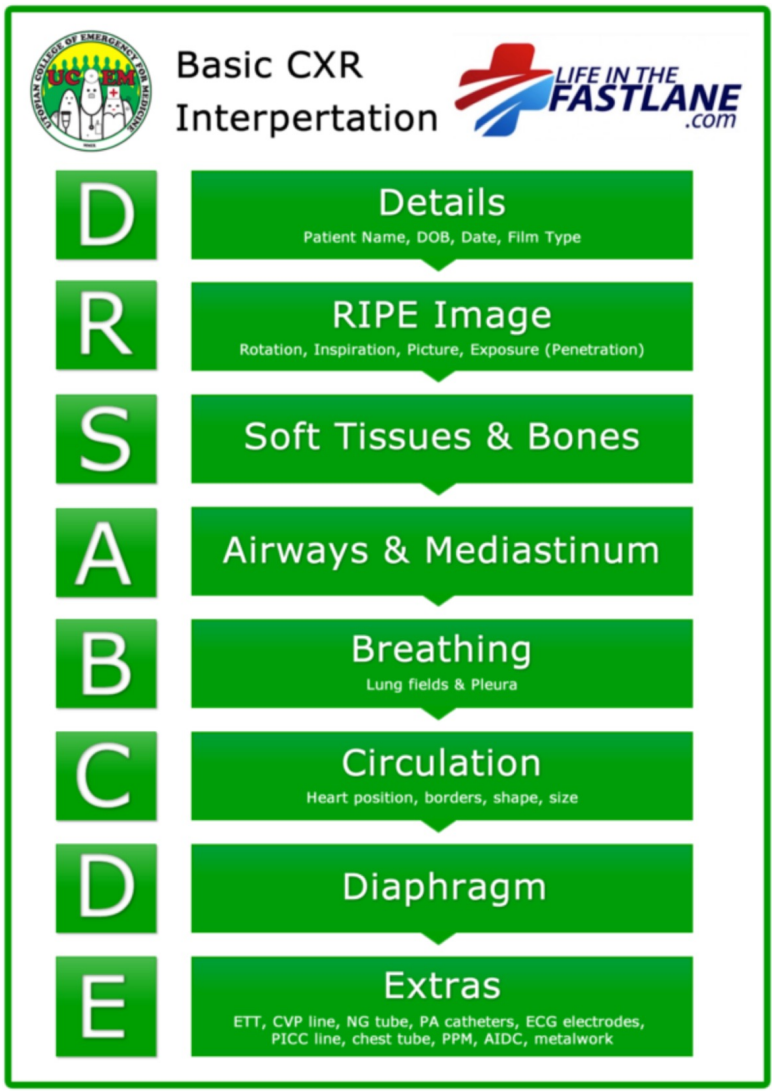
- Structure of session:
  - CXR teaching session: Based on LITFL
  - CXR Quiz Answers
    - Life threat identification
    - Systematic review of CXR
    - Management focusing on 3D's

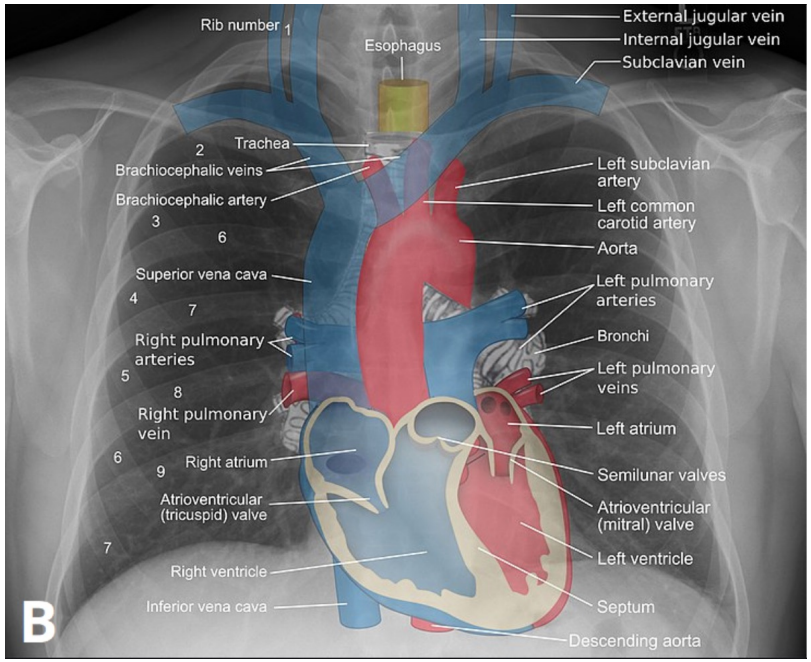
- Resources
  - Online video: https://youtu.be/5xhIEQhVJ9I
  - LITFL: https://litfl.com/drsabcde-of-cxr-interpretation/
  - Articles: BMJ Best Practice


L
ETB
A


Rib number 1
Esophagus
External jugular vein
Internal jugular vein
Subclavian vein
2
Trachea
Brachiocephalic veins
Brachiocephalic artery
3
6
Left subclavian artery
Left common carotid artery
Aorta
Superior vena cava
4
7
Left pulmonary arteries
Right pulmonary arteries
5
8
Bronchi
Left pulmonary veins
Right pulmonary vein
6
9
Right atrium
Left atrium
Semilunar valves
Atrioventricular (tricuspid) valve
Atrioventricular (mitral) valve
7
Left ventricle
Right ventricle
Inferior vena cava
Septum
Descending aorta
B

Evaluation: DRSABCDE





Match & Label

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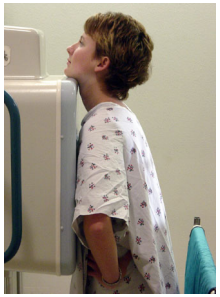
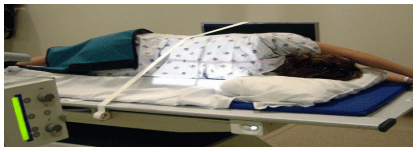
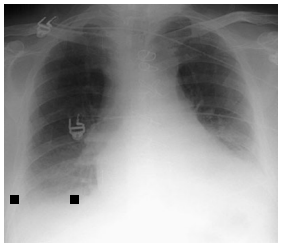
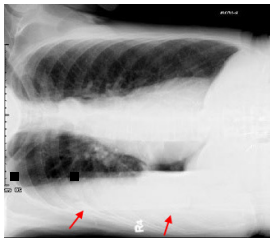
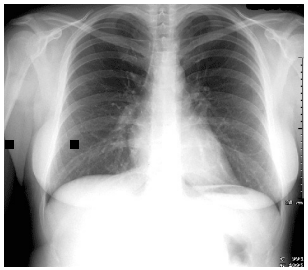
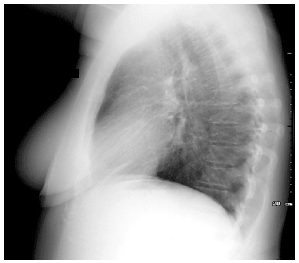
3. 

4. 

a. 

b. 

c. 

d 

I.AP

II.PA

III.Lat

IV.Decub

Match & Label: Answers

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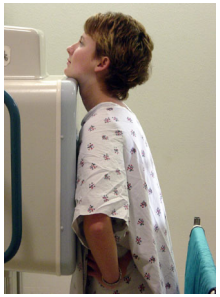
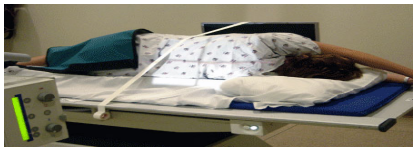
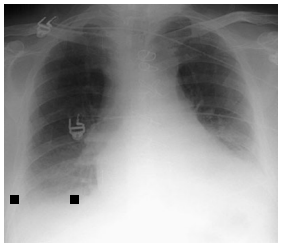
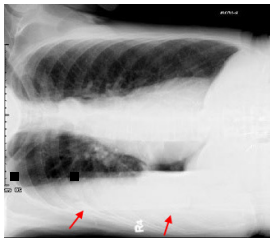
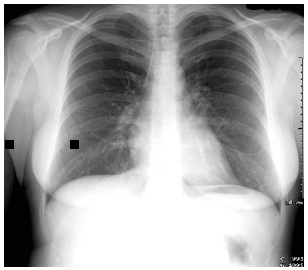
2. 

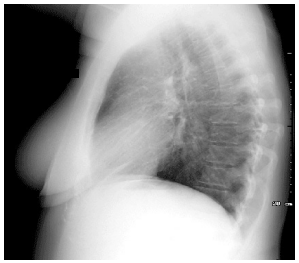
3. 

4. 

a. 

b. 

c. 

d 

I.AP

II.PA

III.Lat

IV.Decub

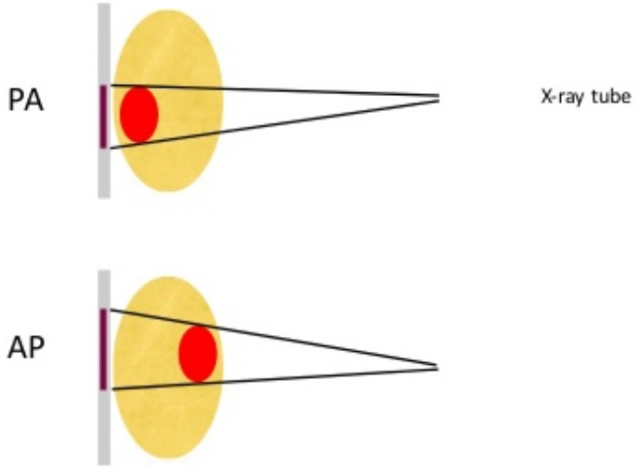
1dIII, 2aI, 3cII, 4bIV

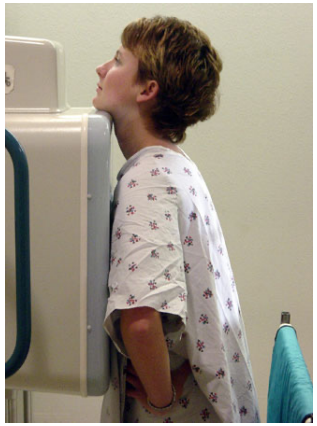
PA vs AP

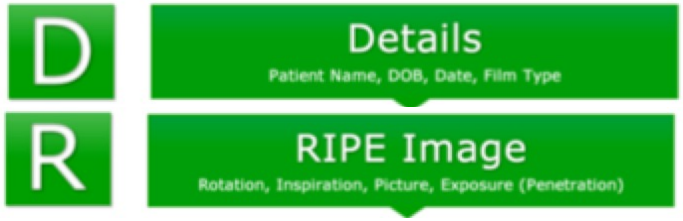
PA vs AP view

	PA view	AP view
Clavicle	Over lung fields	Above lungs apex
Scapulae	Away from lung fields	Over lung fields
Ribs	Posterior ribs distinct	Anterior ribs distinct
Heart		Relatively enlarged

Effect of projection on apparent heart size



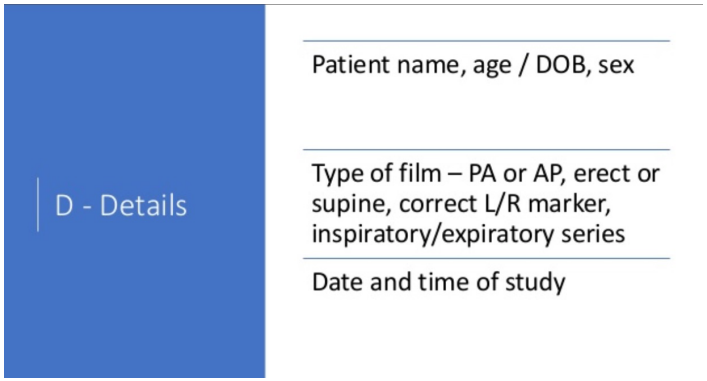




Evaluation

Details:

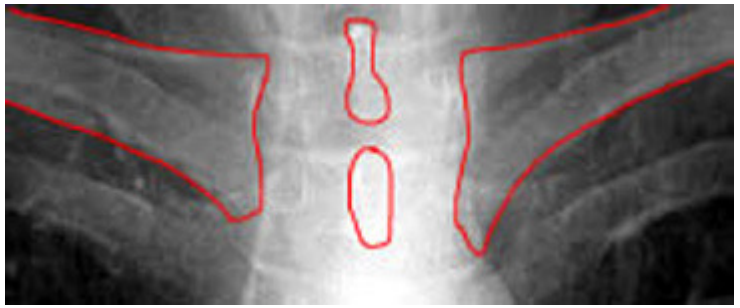
- ❑Correct patient
- ❑Correct date
- ❑Correct view

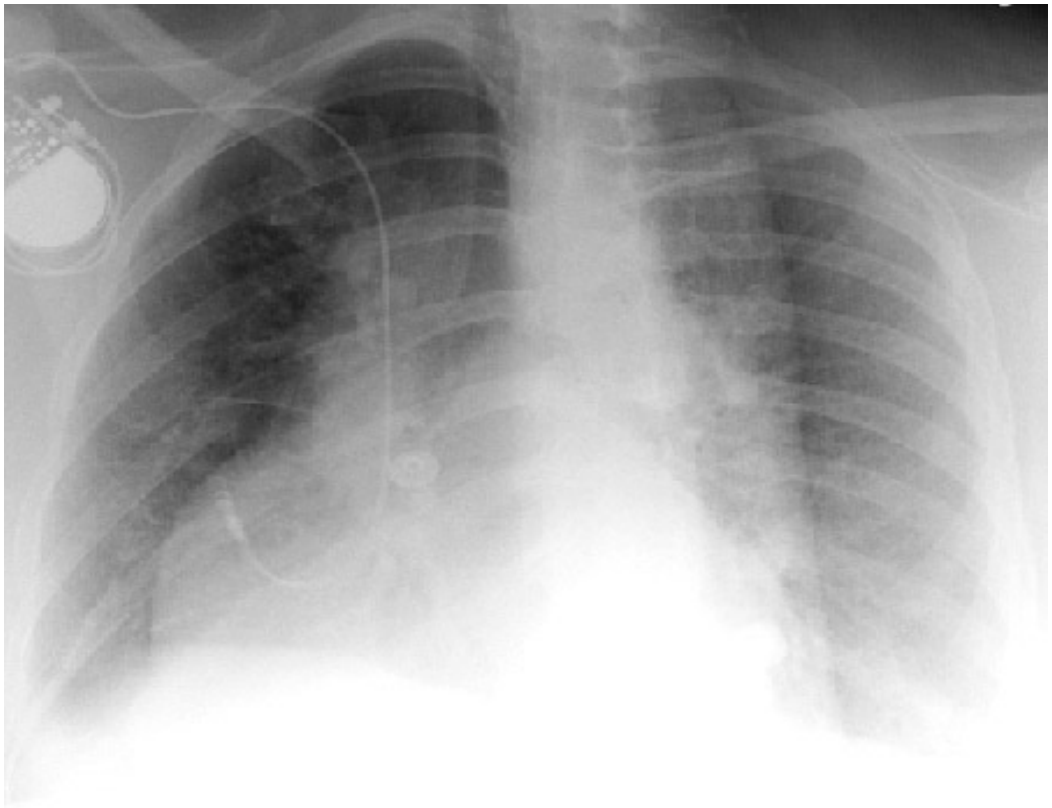


Adequacy: RIPE

- ❑Rotation
- ❑Inspiration
- ❑Picture
- ❑Exposure (penetration)

Rotation



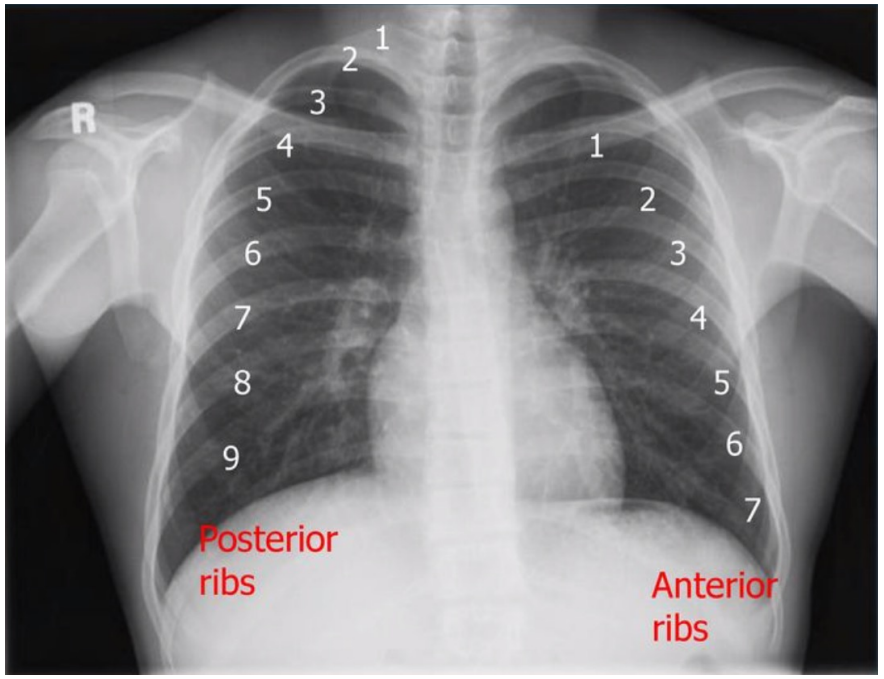


Left: An obviously rotated CXR severely limits interpretation

Hint: Look for equal distances between the clavicular heads and spinous processes. Or make sure the spinous processes are at least midline

Inspiration

- The CXR should be taken in full inspiration
- Can you count
  - 8-10 posterior ribs?
  - 5-6 anterior ribs MCL?



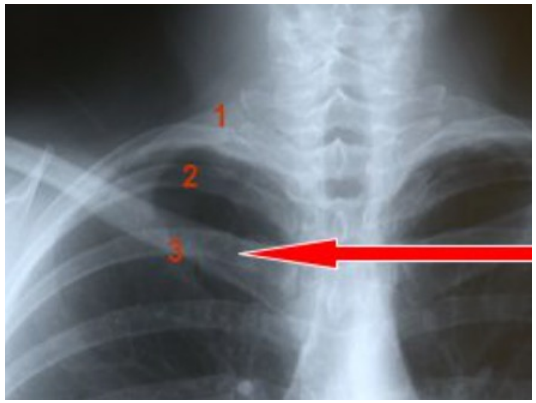
About 8 posterior ribs are showing

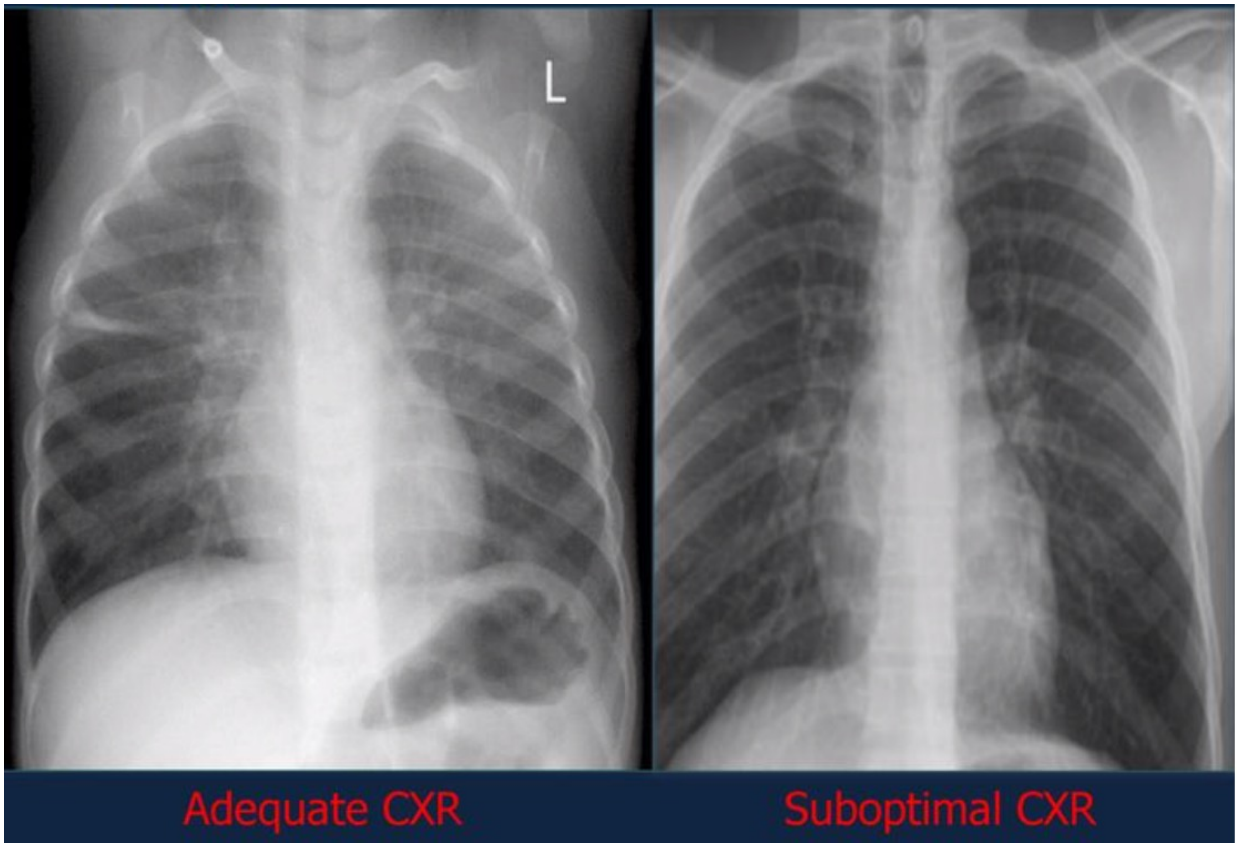
Poor inspiration can crowd lung markings producing pseudo-airspace disease

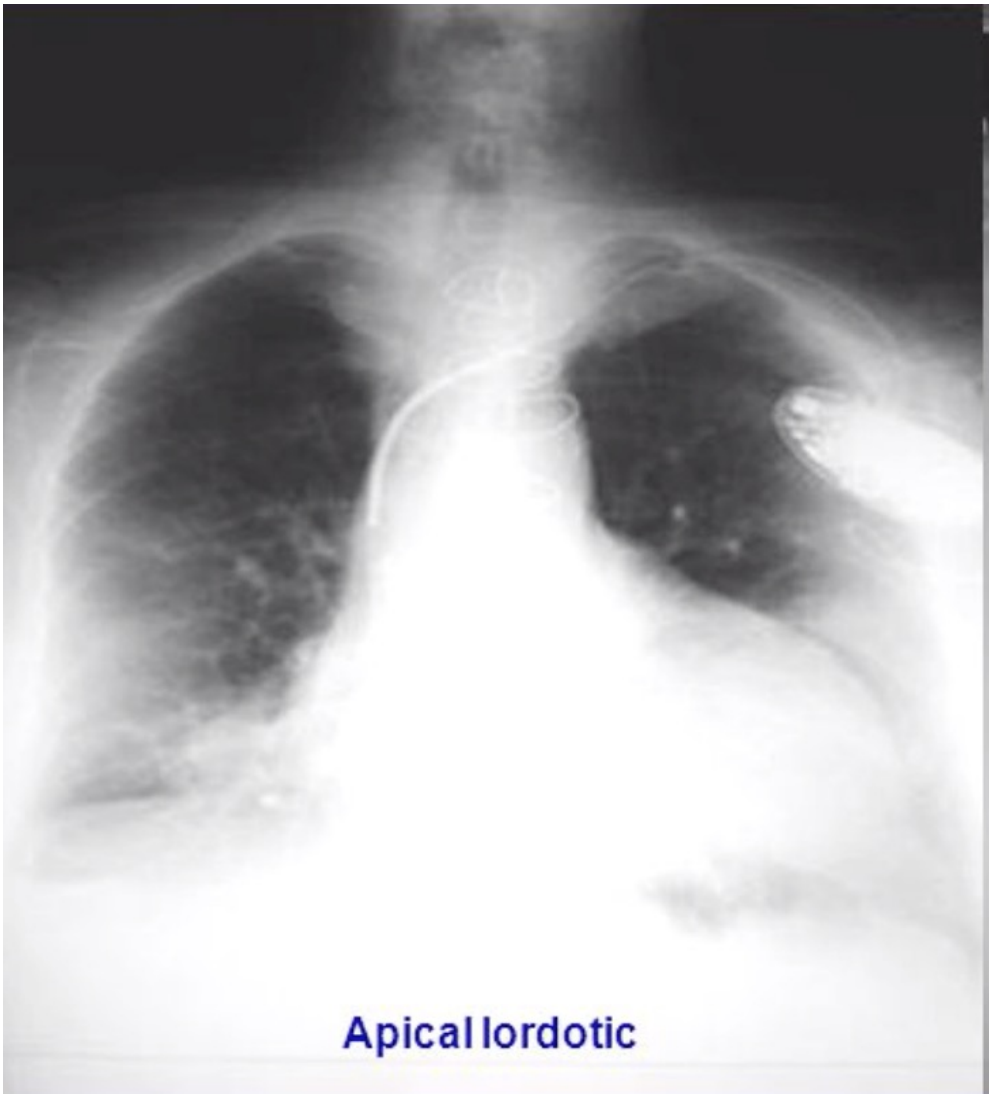
With better inspiration, the "disease process" at the lung bases has cleared

9-10 posterior ribs are showing

Picture



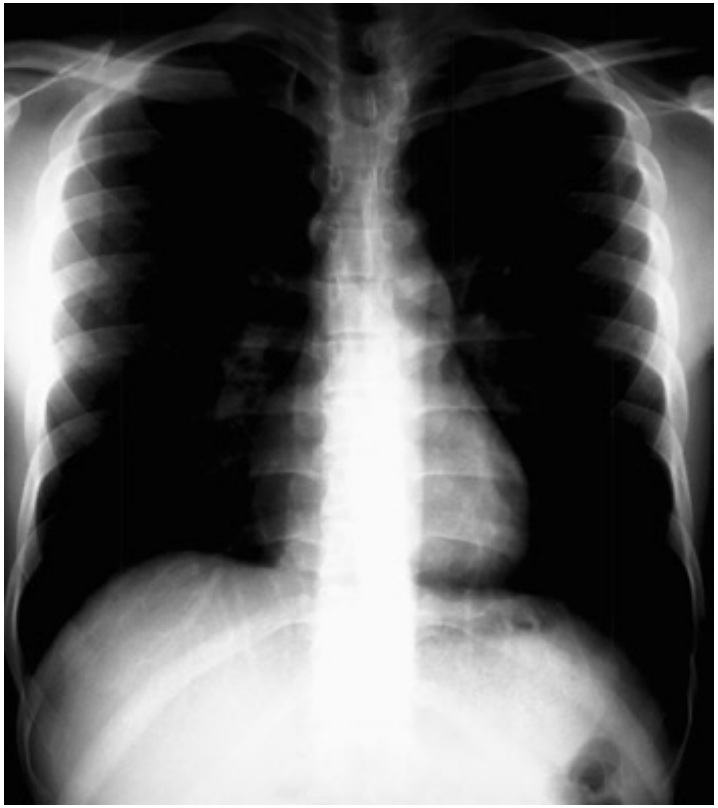




Apical lordotic

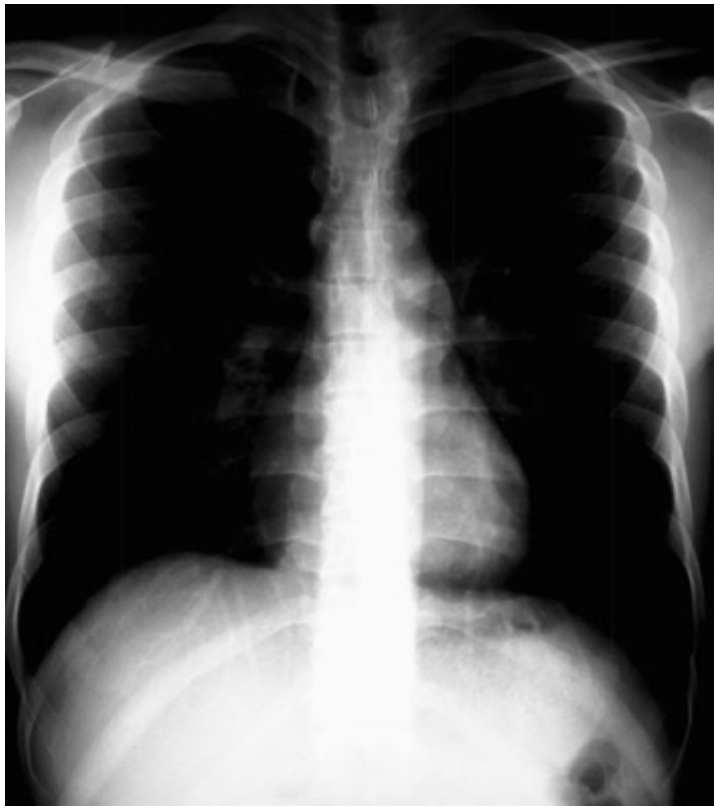
Same patient, not lordotic

Exposure



Which is over and which is under exposed?

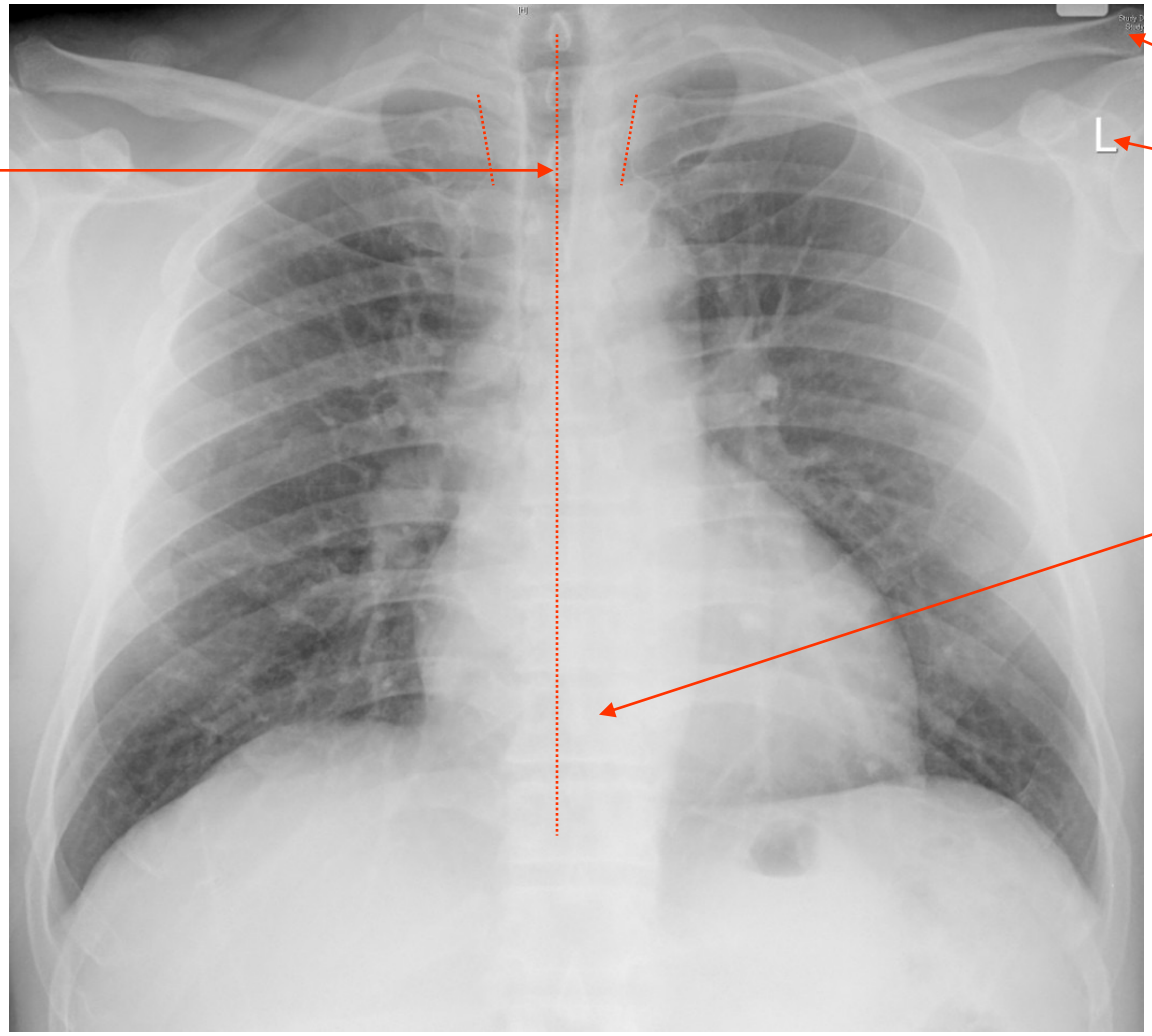
Exposure



The mid thoracic boney spaces should be just visible through the heart to T4

X ray looks “too black”, is it over exposed; “too white” is it under exposed?

Summary: Details then RIPE



Match & Label

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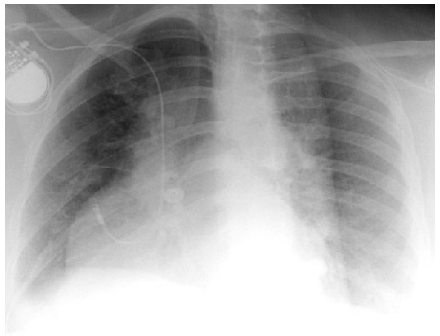

2.

3.

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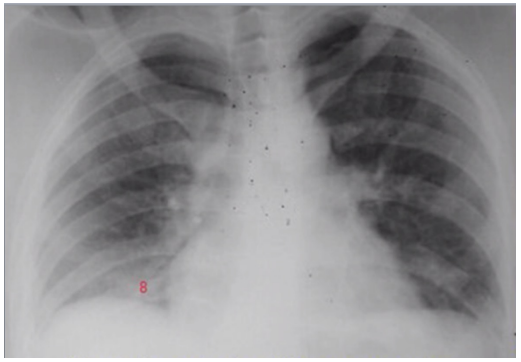

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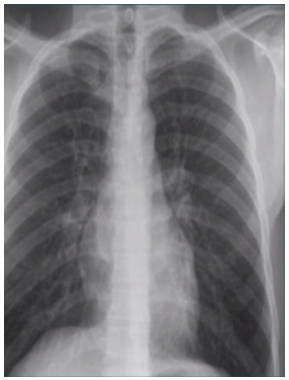
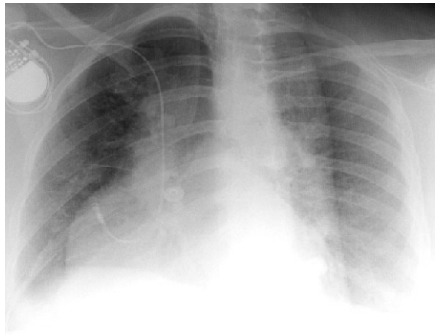


a. Over exposed
b. Under exposed
c. Rotated
d. Poorly collimated
e. Under inspiration

Answers

1. 

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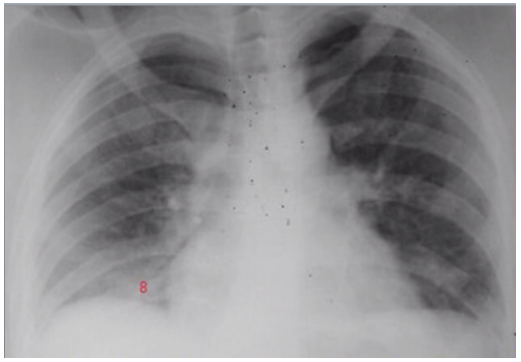
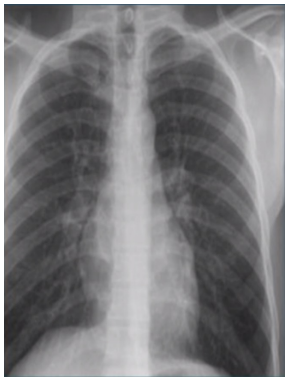
4. 

5. 

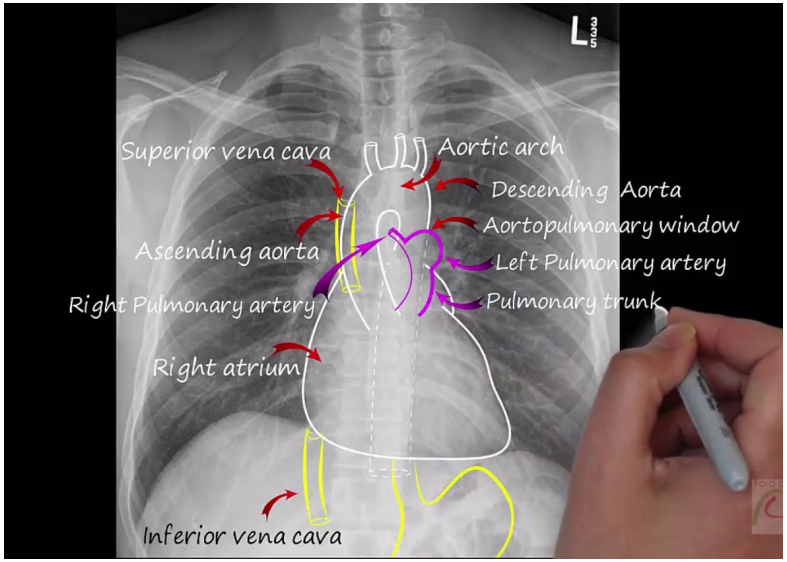
1c, 2b, 3a, 4e/c, 5d

a. Over exposed
b. Under exposed
c. Rotated
d. Poorly collimated
e. Under inspiration

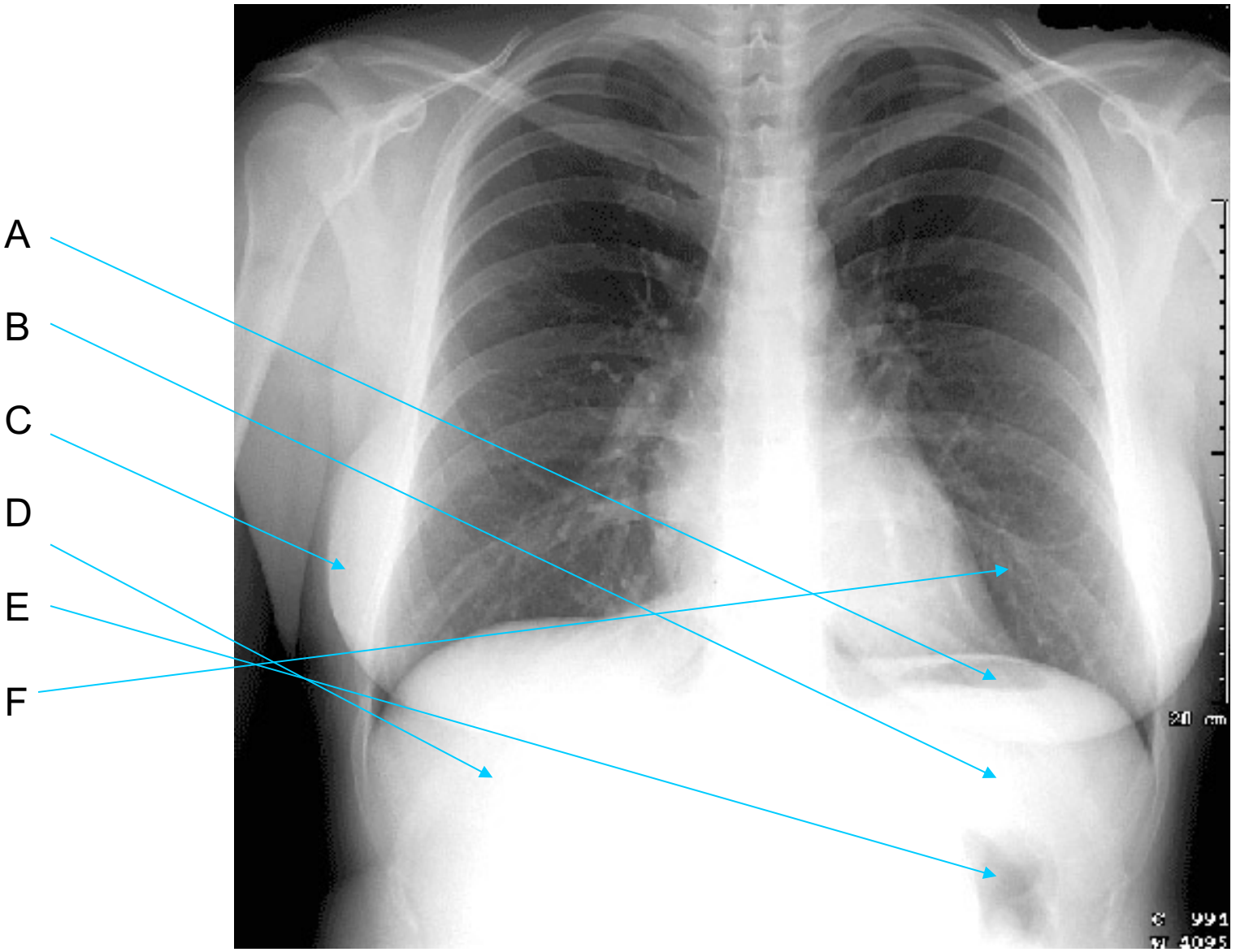
D
R
S
A
B
C
D
E

Anatomy

- Soft tissues & Bones
- Airway & Mediastinum
- Breathing
- Circulation
- Diaphragm
- Extras



Soft Tissue



Soft Tissue

A: Gastric Bubble

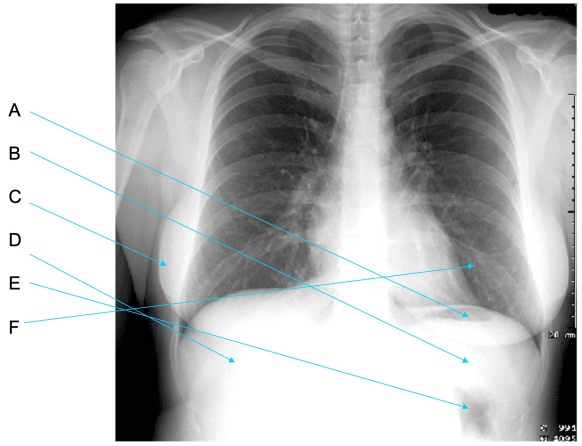
B: Spleen/stomach

C: Breast shadow

D: Liver

E: Splenic flexure

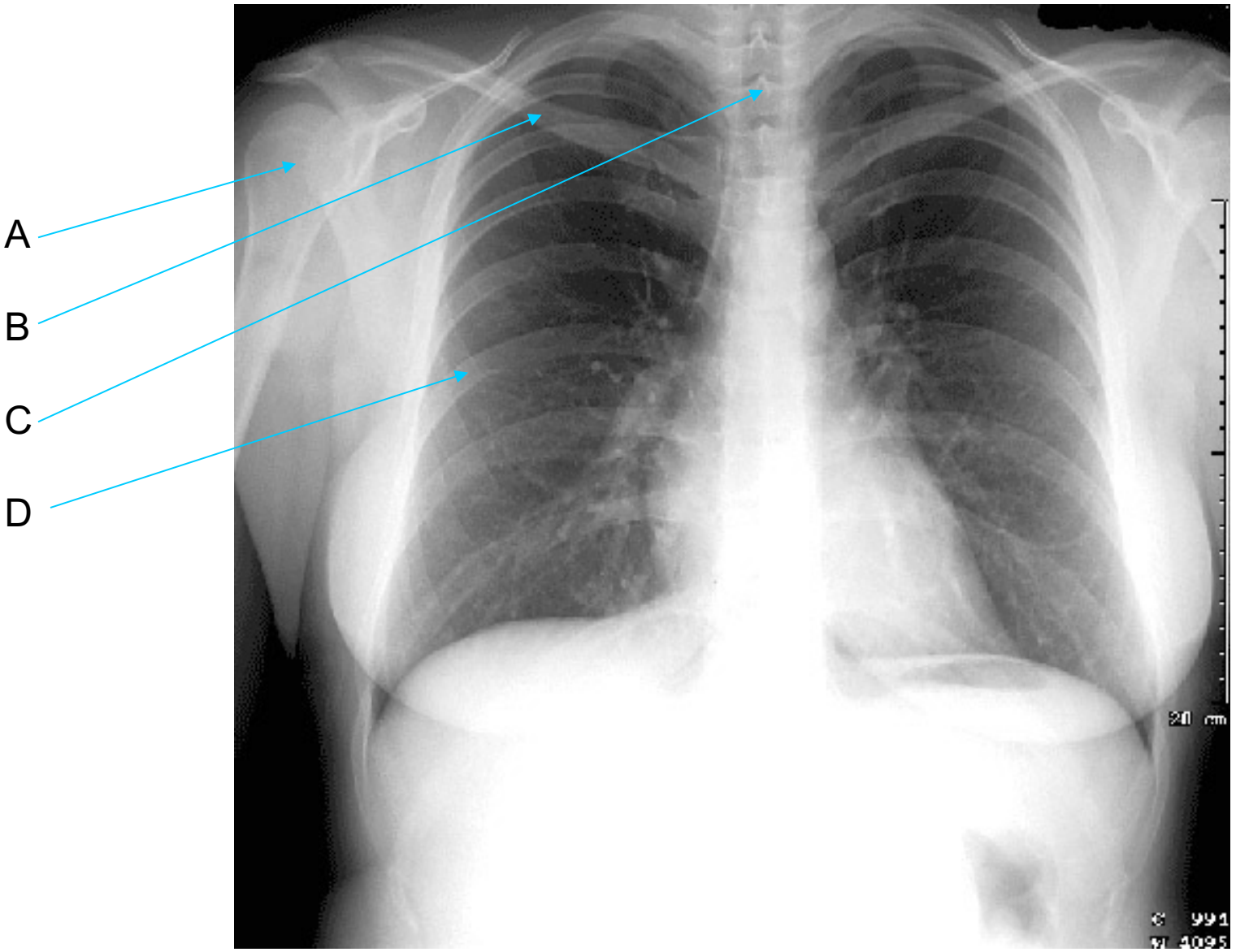
F: Pulmonary vessel



Tips

- Surgical emphysema can be subtle first sign of pneumothorax

Bones



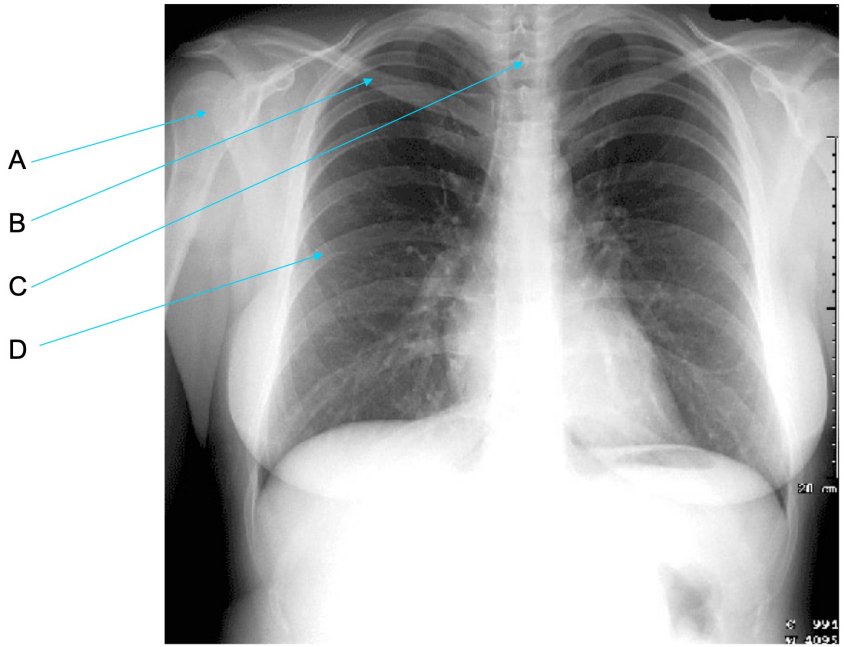
Bones

A: Humeral Head

B: Clavicle

C: Spinous Process/Vert body

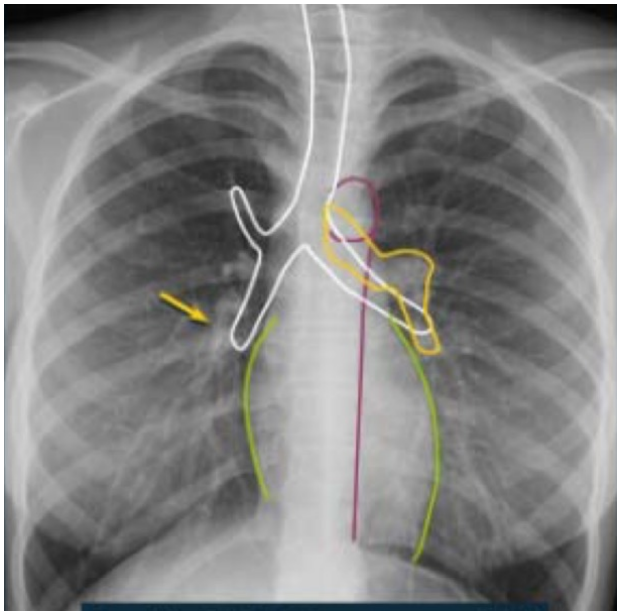
D: Rib (8th)

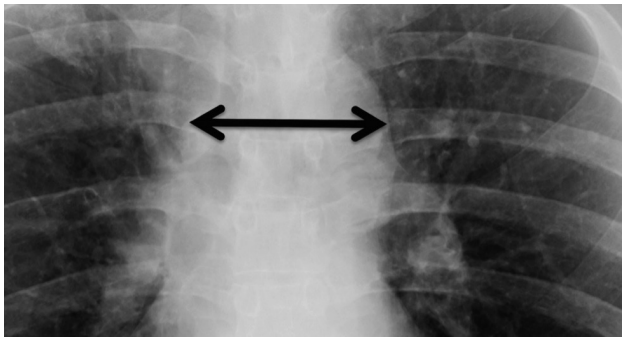


Tips

- Humeral head dislocations are easily missed if reduced GCS/posterior
- Rib fractures more easily seen if rotate to view ribs vertically

Airway & Mediastinum





Airway

•**Is the trachea central?** Trachea – central or slightly to right lung as crosses aortic arch. Can be pushed or pulled by pathology.

•Carina & RMB/LMB

- Splayed carina's can mean subcarinal adenopathy

Mediastinum

•**Mediastinal width <8cm***

•**Mediastinum normal shape?**

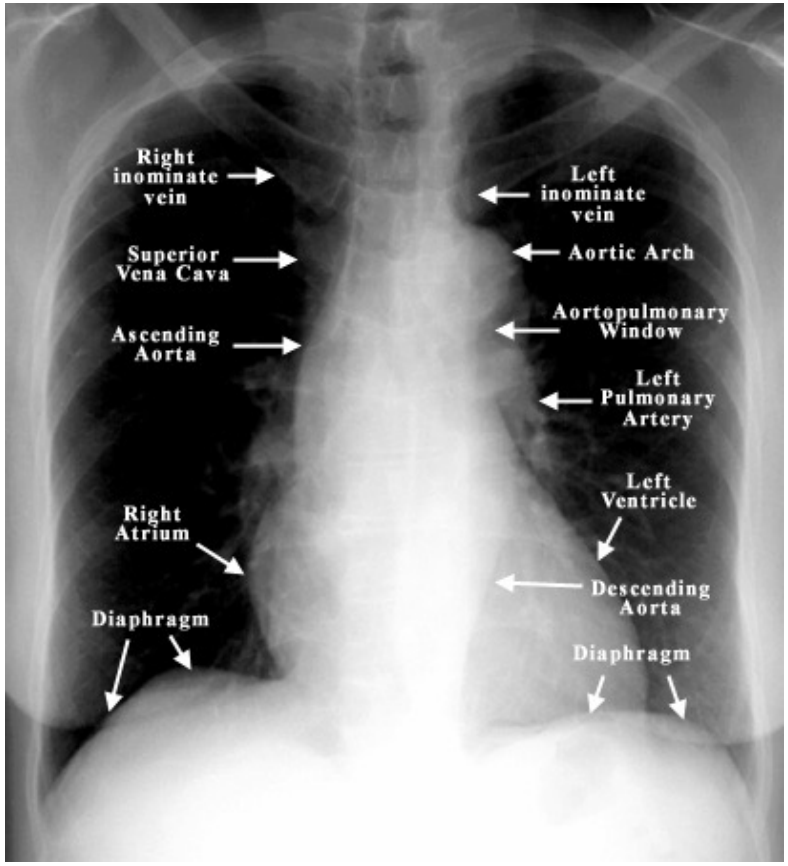
•Aortic knuckle/AP window

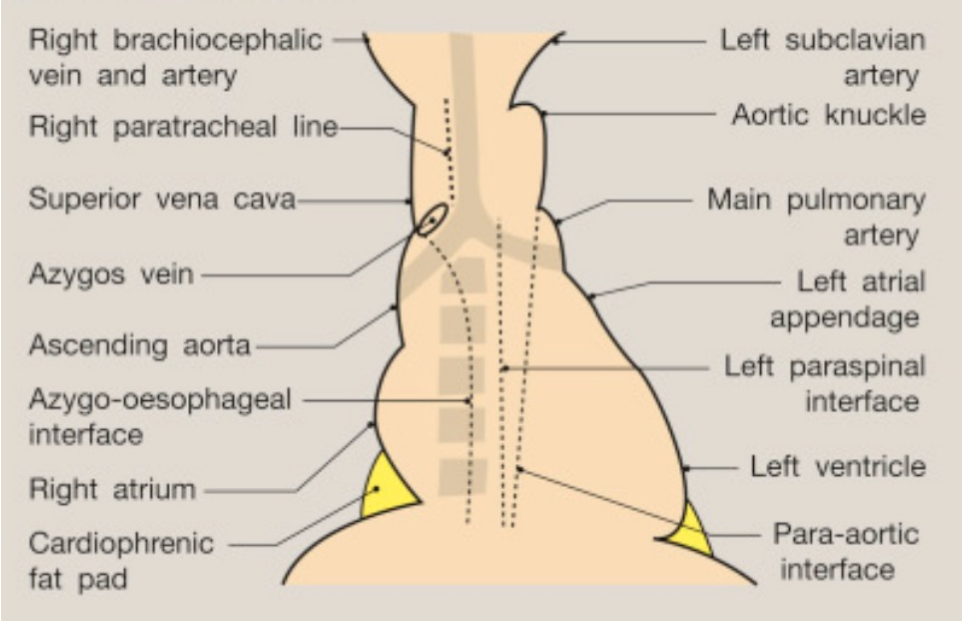
•Hilum

•Check vessels, calcification.

•Tip: *Mediastinal width can vary widely with obesity and projection, look at old CXRs if available

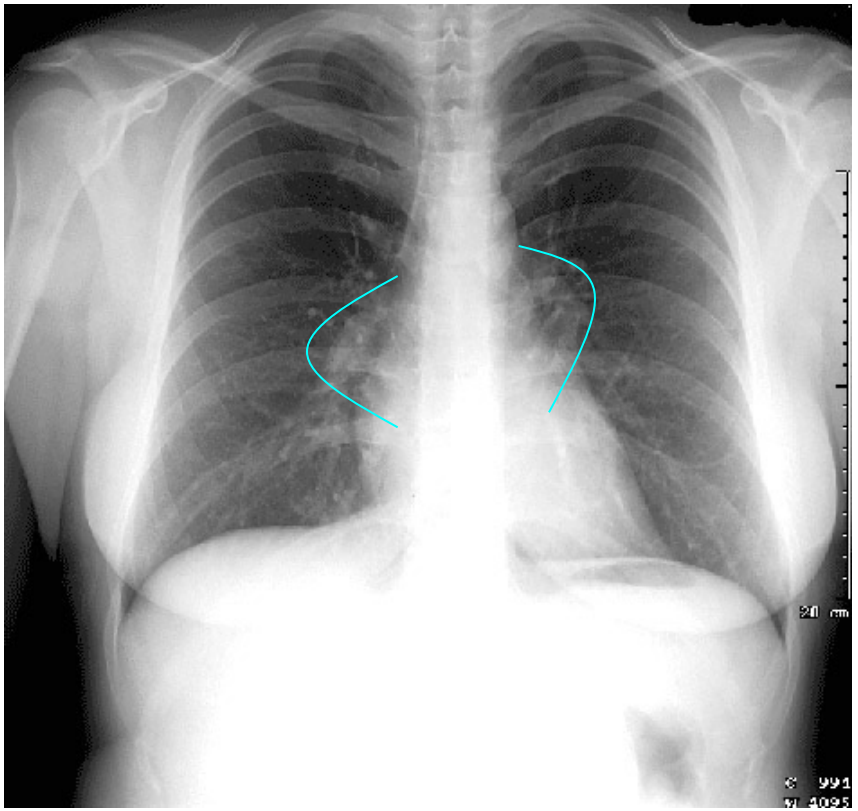
Mediastinal Borders





The Hilum

- Made up of:
  - Pulmonary artery and vein's
  - Main and lobar bronchi
  - Lymphatic's
- Located: T6-7
- L) usually higher (2cm) compared to the R)
- L) usually more square compared to the v shaped R)



Breathing

Lung Fields:

•Vascularity – to ~2cm of pleural surface (~3cm in apices), vessels in bases > apices

•Pneumothorax – don't forget apices

•Lung zone outlines – abnormal opacity/lucency, atelectasis, collapse, consolidation, bullae

•Horizontal fissure on Right Lung

•Pulmonary infiltrates – interstitial vs alveolar pattern

•Coin lesions

•Cavitary lesions

Pleura

•Pleural reflections

•Pleural thickening

Lung "Fields"

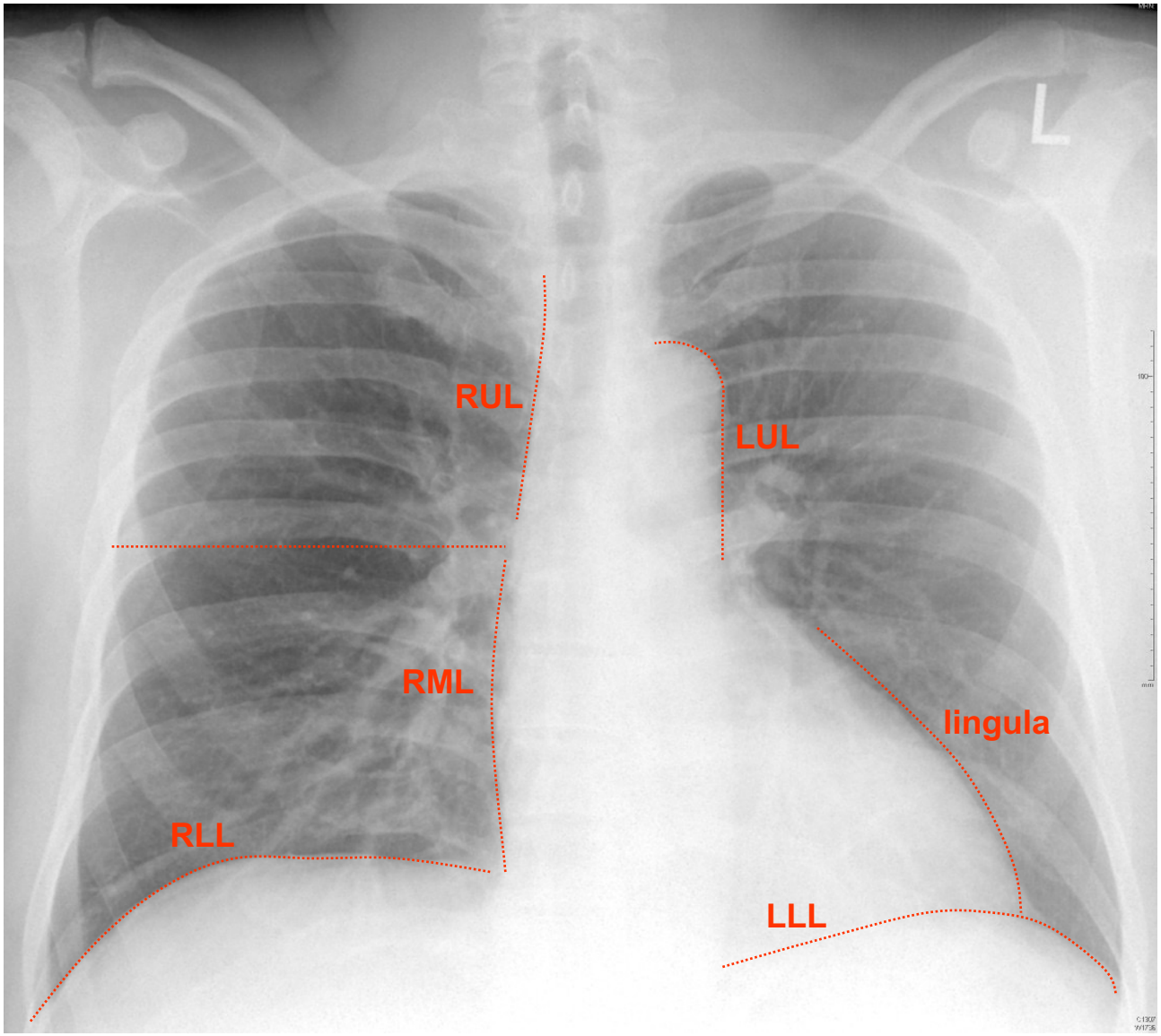
- **Are the lung zones clear?**
- **Are the outlines clear? (pleura)**
- **If there is a change in density**
  - Is it more black? ie. "increased lucency"– pneumothorax, COPD, PE westernmark sign etc
  - Is it more white? ie. "opacification" e.g. Fluid: effusion, consolidation. Pus: infection, CHF. Cells: cancer. Foreign body.

Tips

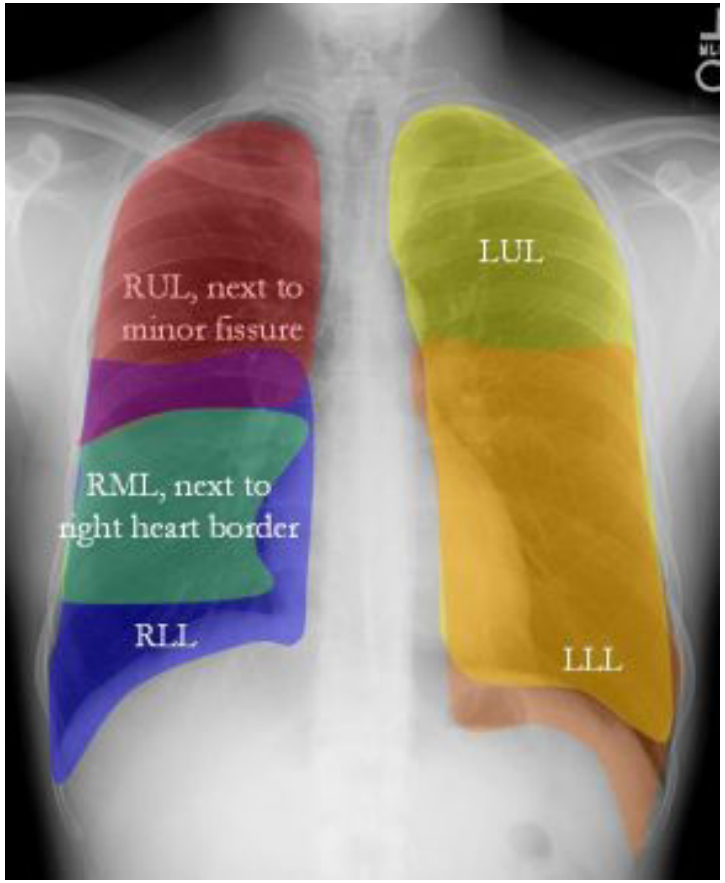
•Check lung apices

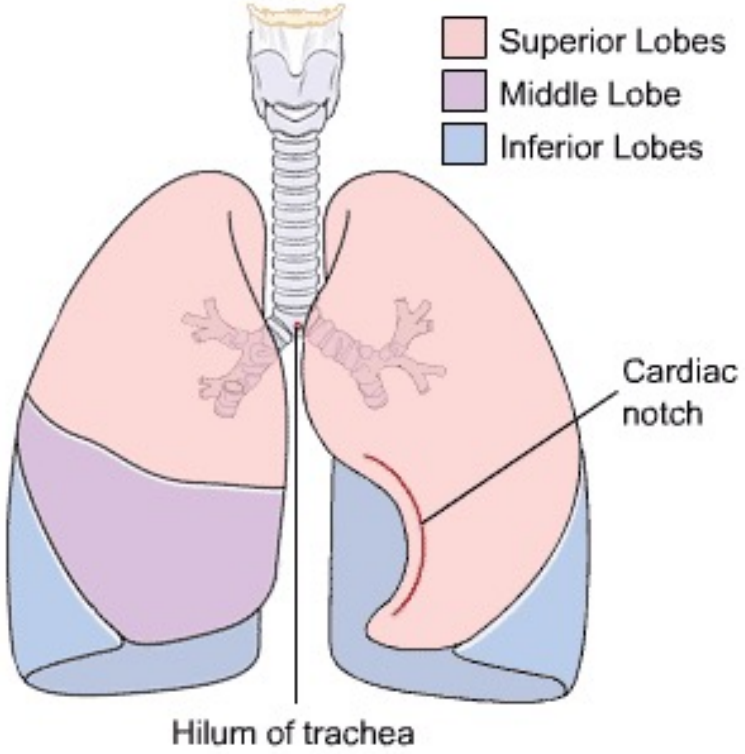
•Don't overcall the nipple shadow

•The medial border of the scapula can look like a Px


L
RUL
LUL
RML
lingula
RLL
LLL

Breathing: Lungs

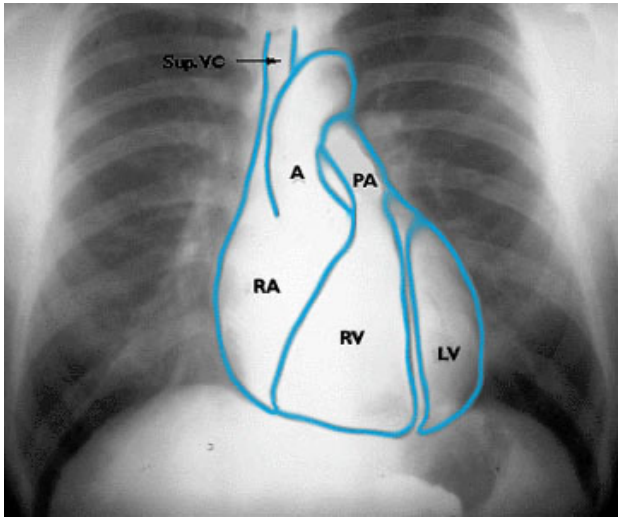


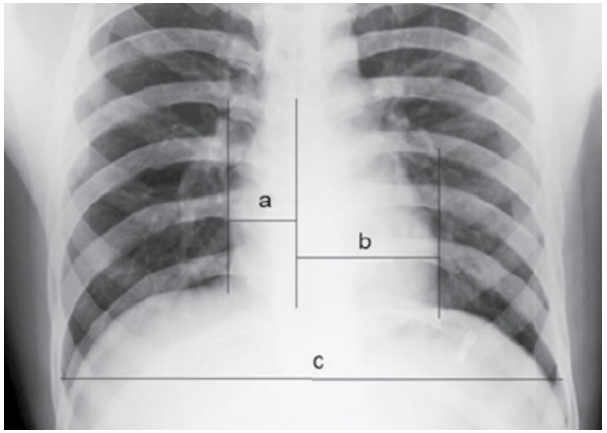


Circulation

- Heart position –⅔ to left, ⅓ to right
- Heart size – CTR = cardiothoracic ratio, measure on PA film (normal <0.5)
- Heart borders – R) border is R) atrium, L) border is L) ventricle & atrium
- Heart shape
- Aortic strip

- Heart
  - **Is it the right size?**
  - **The right shape?**
  - **Has it moved?**
  - **Clean borders? (overlap with mediastium)**





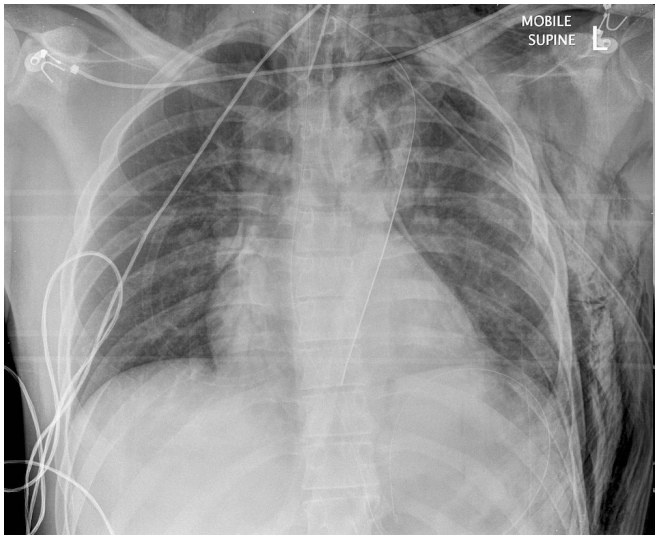
Diaphragm

- Hemidiaphragm levels – Right Lung higher than Left Lung (~2.5cm / 1 intercostal space)
- Diaphragm shape/contour
- Cardiophrenic and costophrenic angles – clear and sharp
- Gastric bubble / colonic air
- Subdiaphragmatic air (pneumoperitoneum)

- Diaphragms
  - **Can you see them?**
  - **Is there "free air"?**
  - **Is there blunting of the costo-phrenic angles?**

Extras

- ETT, CVP line, NG tube, PA catheters
- ECG electrodes, PICC line, chest tube
- PPM, AIDC, metalwork

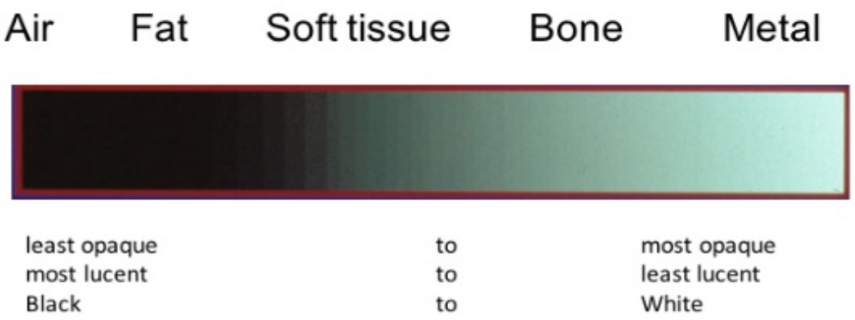


- Accessories
  - Can I see tubes, lines, artifact, etc?
  - Are they in the right place?
  - Do they obscure things I want to see?

CXR lingo

TERMINOLOGY PERTINENT TO THE CHEST X-RAY:

Term	Definition
Lucency	Darker area on the image as relatively more of the administered x-rays reaching the detector
Opacity	Whiter area on the image due to absorption of the x-rays prior to reaching the detector
Consolidation	Process by which air in the lungs is replaced by products of disease rendering the lung more solid
Nodule	Opacity < 3 cm in diameter
Mass	Opacity > 3 cm in diameter
Line	Linear opacity < 2 mm in thickness
Stripe	Linear opacity 2 – 5 cm in thickness
Hilum	Singular
Hila	Plural
Hilar	Adjective



How to present the CXR

DETAILS

•This is a frontal (AP/PA) (supine/erect)

•Chest radiograph

•In a "…." year old (man/woman/child)/skeletally immature person.

•Taken on "date/time"

ADEQUACY

•This is an adequate film (Rotation, Inspiration, Picture, Exposure)

INTERPRETATION

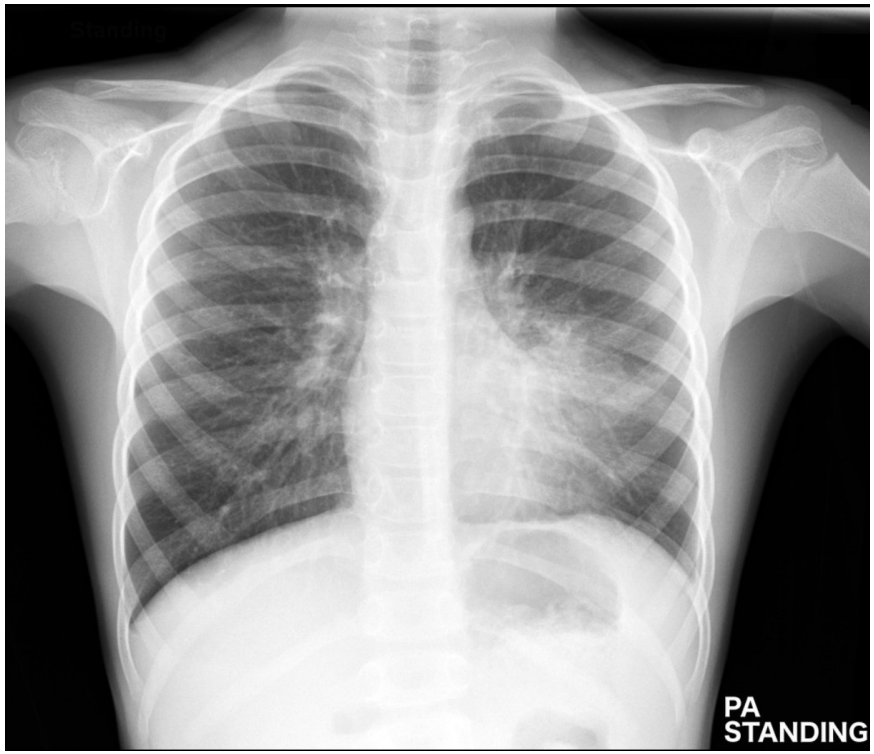
•There is an obvious abnormality in the …

•Or/ I do not see an obvious abnormality and I will now go through the CXR systematically

SUMMARY

CONCLUSION including immediate management

3 Practice CXR's



DETAILS

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•Chest radiograph

•In a "…." year old (man/woman/child)/skeletally immature person.

•Taken on "date/time"

ADEQUACY

•This is an adequate film (Rotation, Inspiration, Picture, Exposure)

INTERPRETATION

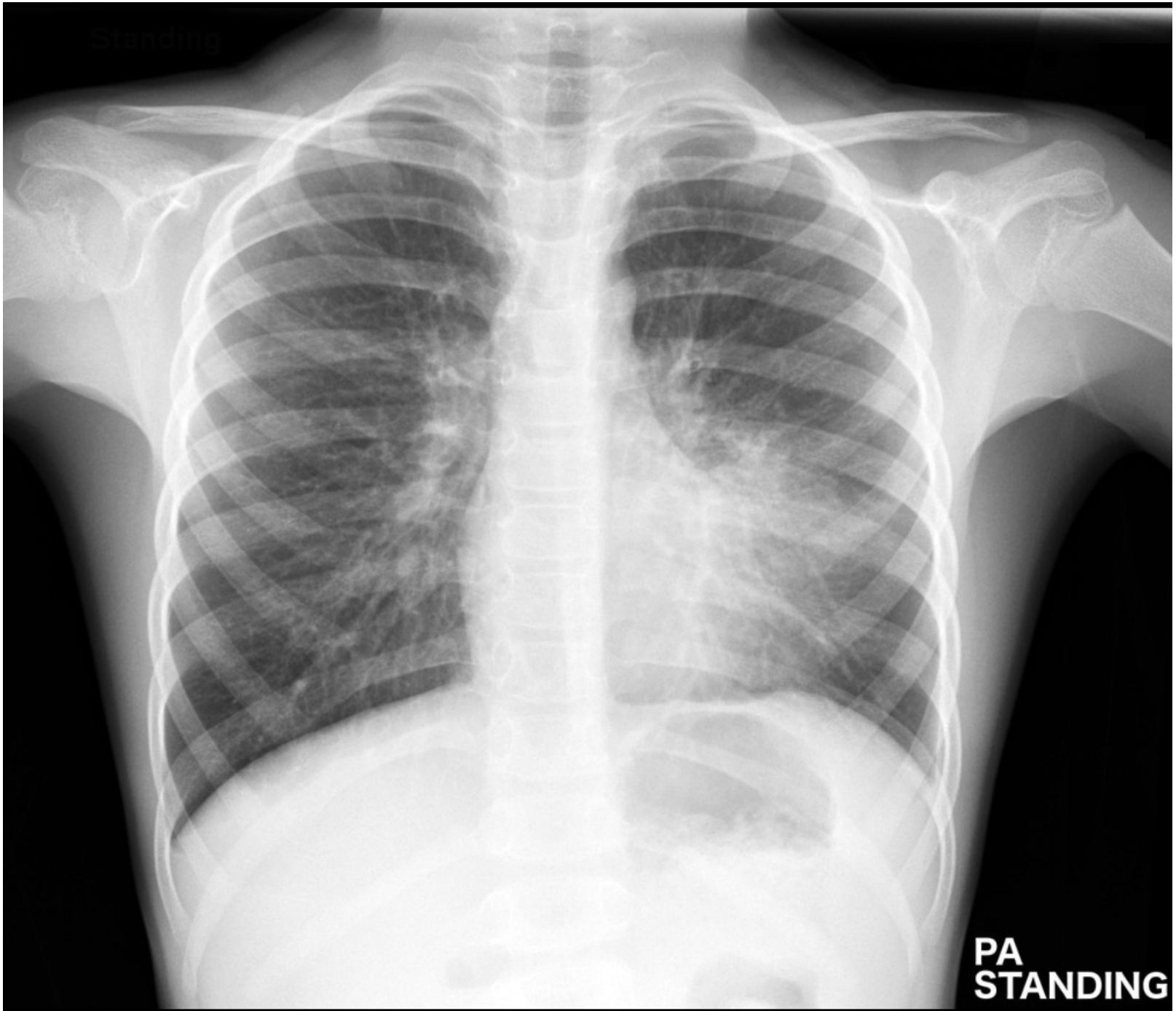
•There is an obvious abnormality in the …

•Or/ I do not see an obvious abnormality and I will now go through the CXR systematically

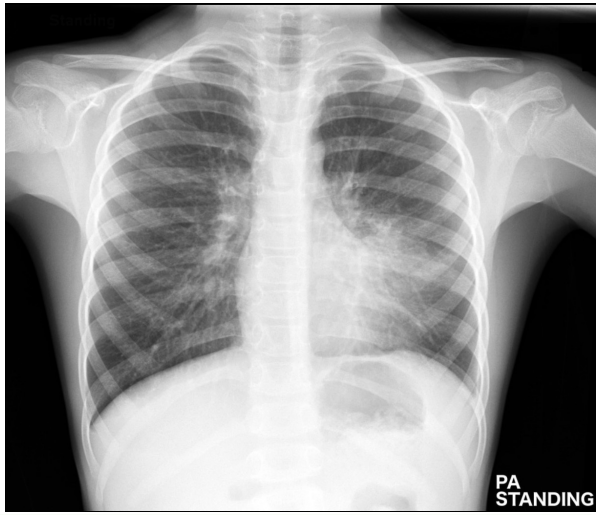
SUMMARY

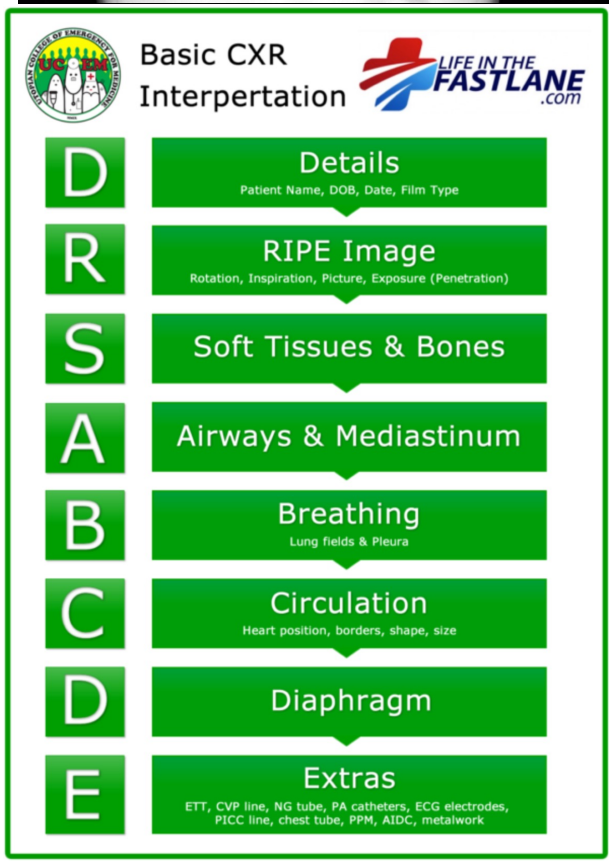
CONCLUSION including immediate management

CXR 1: Mr DJ, 22 yrs old, exam date: today: PC: Cough and fevers



- Mr DJ, 22 yrs old, exam date: today





CXR 1

DETAILS

•This is a frontal (AP/PA) (supine/erect)

•Chest radiograph

•In a "…." year old (man/woman/child)/skeletally immature person.

•Taken on "date/time"

ADEQUACY

•This is an adequate film

- Rotation
- Inspiration
- Picture
- Exposure

INTERPRETATION

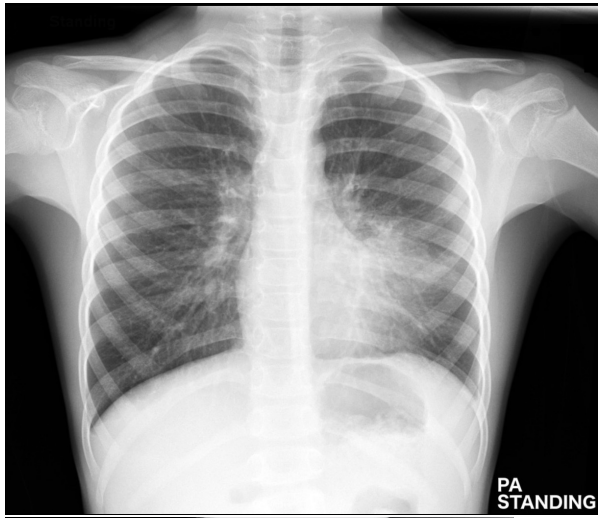
•There is an obvious abnormality in the …

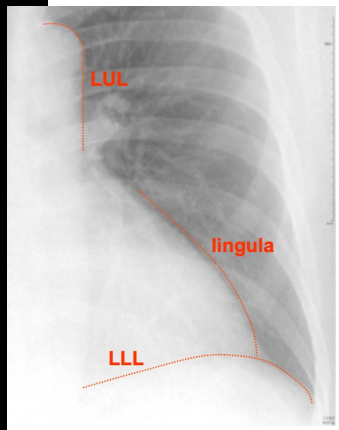
•Or/ I do not see an obvious abnormality and I will now go through the CXR systematically (Sb/Am/C/D/E)

SUMMARY

CONCLUSION including immediate management

CXR 1: Answers





D Erect PA CXR, 22year old man, Taken today

R This is an adequate film (Rotation - nil, Inspiration- 10 post ribs, Picture well collimated, Exposure - appropriate)

S Soft tissues normal, bones normal

A Central trachea, Mediastinum normal

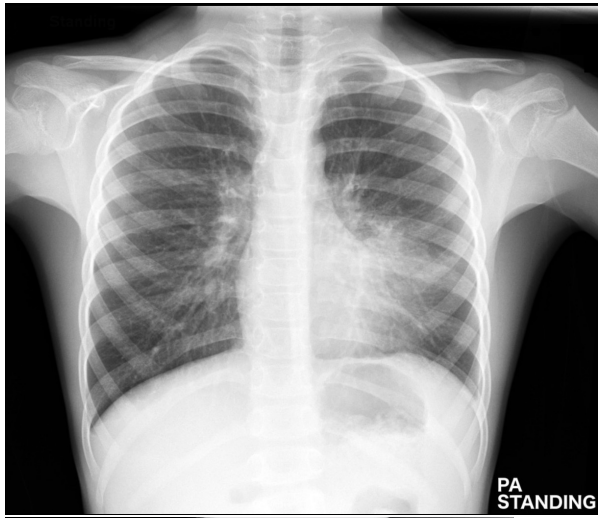
B L) Lung midzone consolidation – left heart border obscured

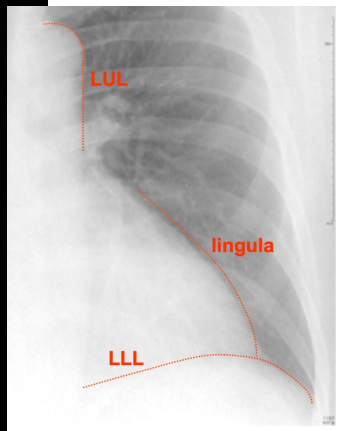
C Heart size normal

D No free air, right diaphragm mild flat

E No accessory tubes

CXR 1: Answers





DETAILS

- This is an erect PA CXR
- In a 22year old man
- Taken today

ADEQUACY

- This is an adequate film

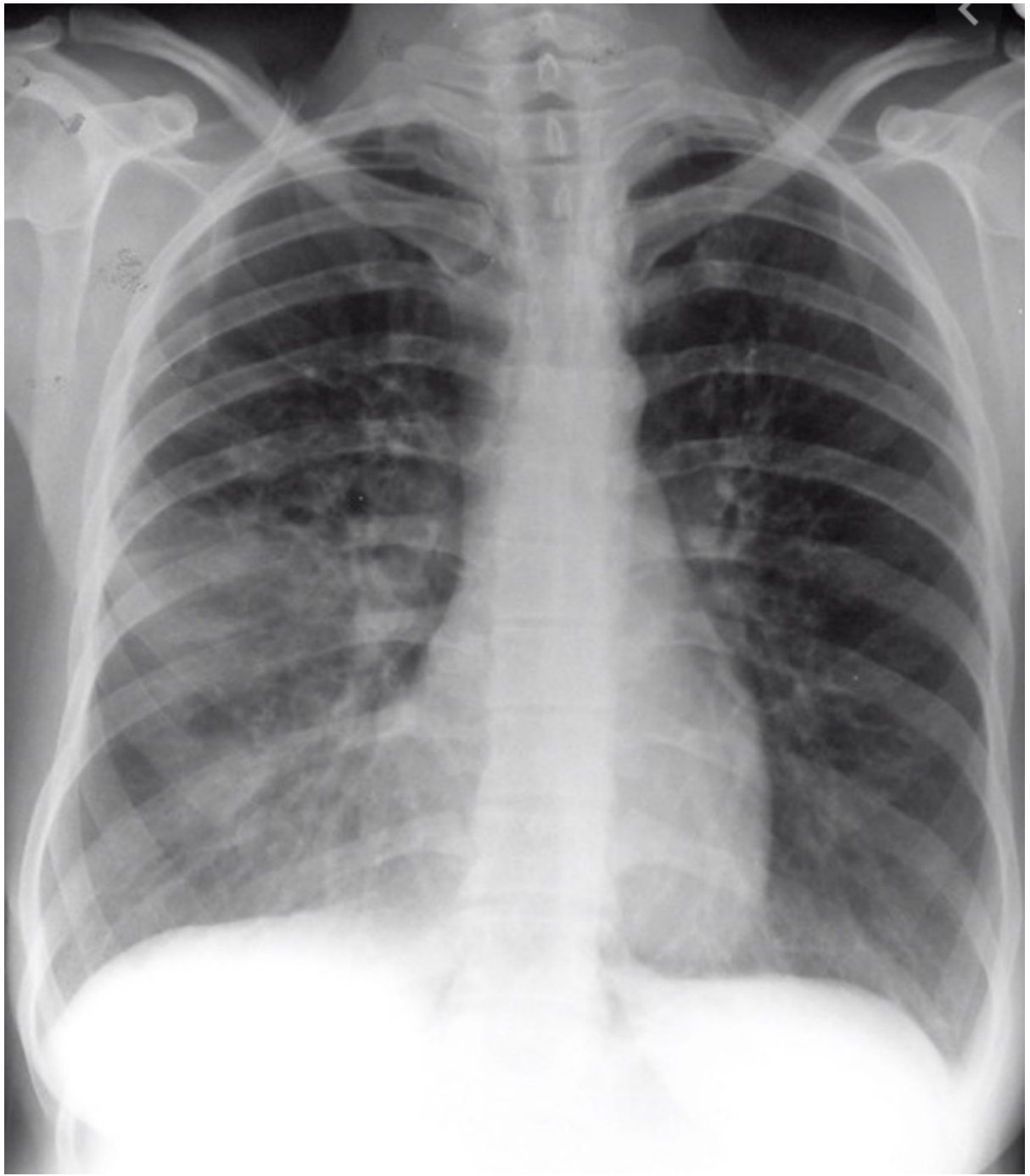
INTERPRETATION

- There is an obvious abnormality in the left lung midzone with consolidation and obscuration of the left heart border. There is no gross hilar adenopathy. Nil collection.

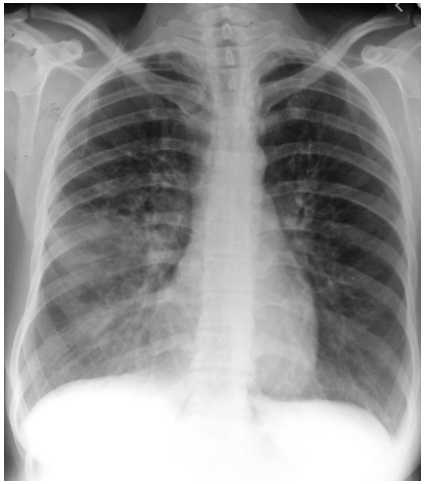
SUMMARY: Features are most in keeping with a lingular lobar pneumonia. (also on lateral – shown as density over the heart shadow)

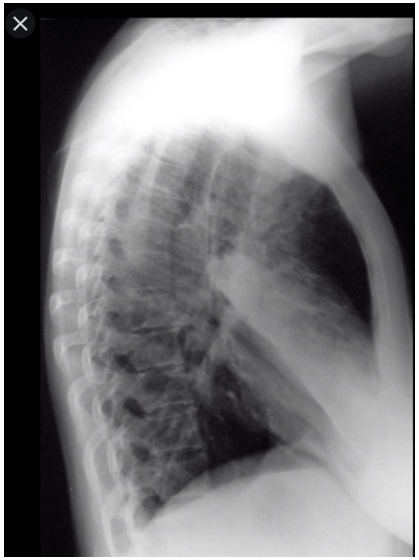
I'd consider antibiotic therapy based off PSI, and O2/hydration based off clinical exam. Gen Med often asks for urinary antigens/resp panel swab.

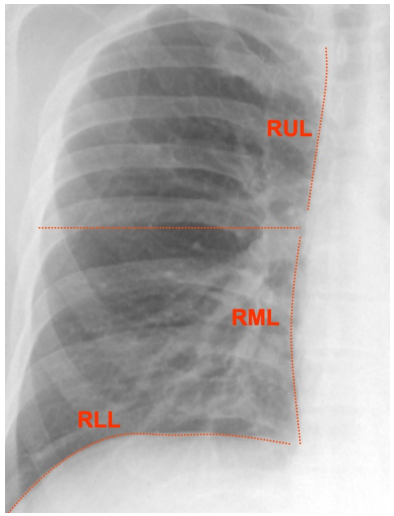
CXR 2: Mr DJ, 22 yrs old, exam date: today: PC: Cough and fevers



CXR 2: Answers







DETAILS

- This is an erect PA CXR
- In a 22year old man
- Taken today

ADEQUACY

- This is an adequate film (Rotation - nil, Inspiration- 10 post ribs, Picture well collimated, Exposure - appropriate)

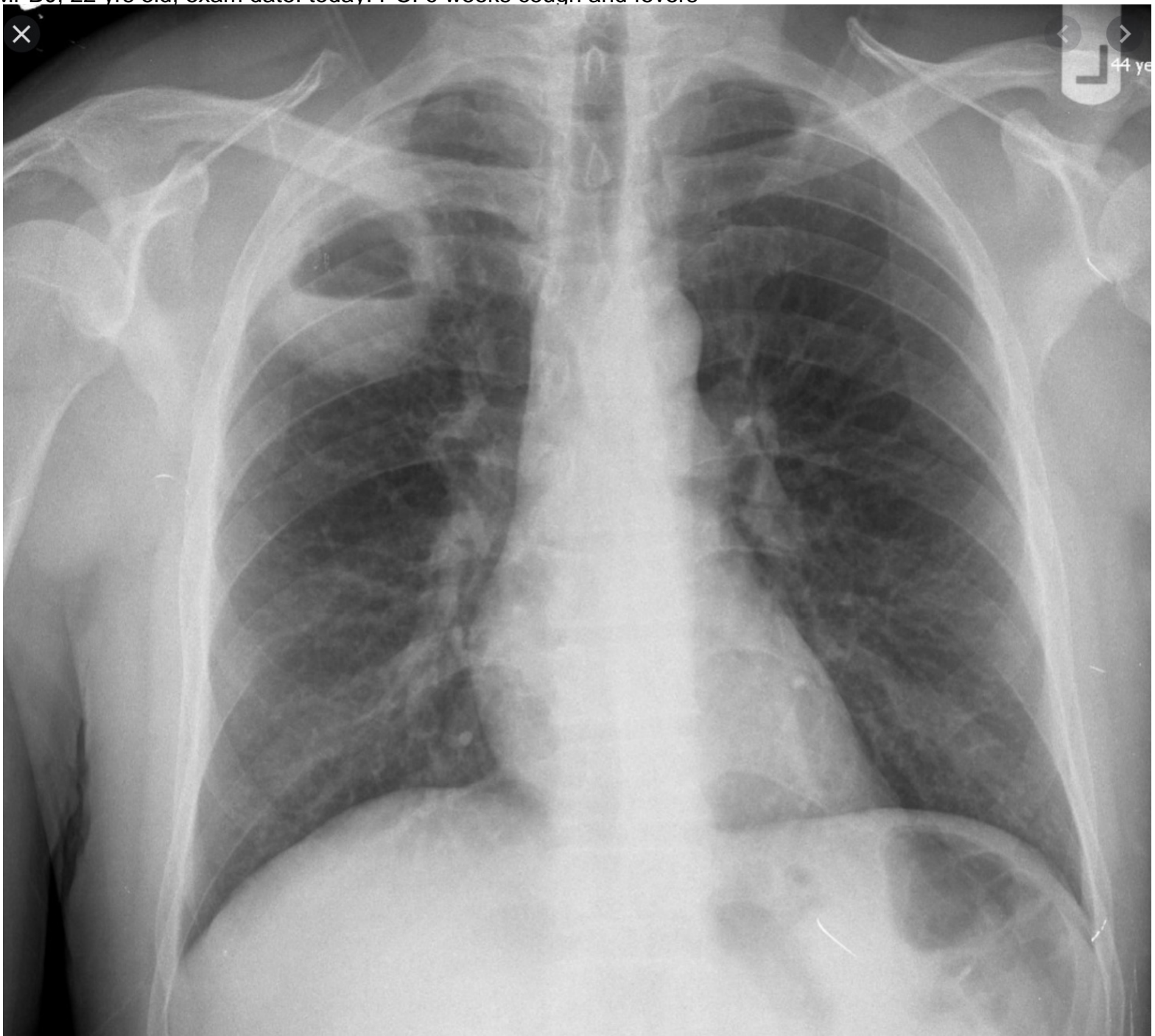
INTERPRETATION

- There is an obvious abnormality in the right lung mid and lower zone with consolidation and obscuration of the right heart border. There is no gross hilar adenopathy. Nil collection.

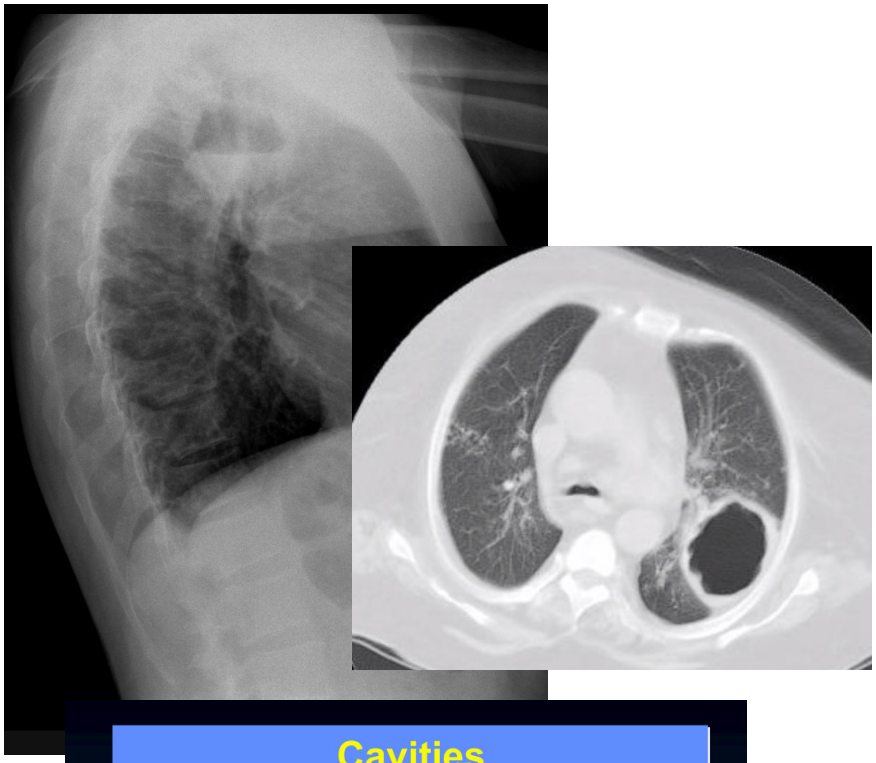
SUMMARY: Features are most in keeping with a right middle lobe pneumonia. (also on lateral – shown as density over the heart shadow)

I'd consider antibiotic therapy based off PSI, and O2/hydration based off clinical exam. Gen Med often asks for urinary antigens/resp panel swab.

CXR 3: Mr DJ, 22 yrs old, exam date: today: PC: 6 weeks cough and fevers



CXR 3: Answers



Cavities

	Thickness of Wall	Inner Margin	A|F Level
Carcinoma	Thick	Nodular	+/-
TB	Thin	Smooth	No
Abscess	Thick	Smooth	Yes

DETAILS

- This is an erect PA CXR
- In a 22year old man
- Taken today

ADEQUACY

- This film is adequate

INTERPRETATION

- There is an obvious abnormality in the right lung upper zone. It is a thick walled cystic structure with an air fluid level. The remaining lungs are clear. There is no gross hilar adenopathy. No calcifications.

SUMMARY: Features are most in keeping with a right upper lobe lung abscess. (also on lateral – shown as density over the heart shadow)

I'd consider antibiotic therapy after discussion with ID/Respiratory, and O2/hydration based off clinical exam. TB needs to be excluded. Strep/Klebsiella can cavitate. Same with some lung cancers.

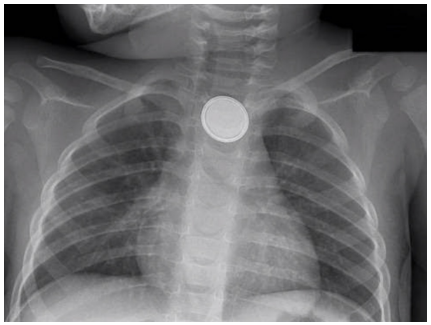
Quiz time: Life Threat CXRs

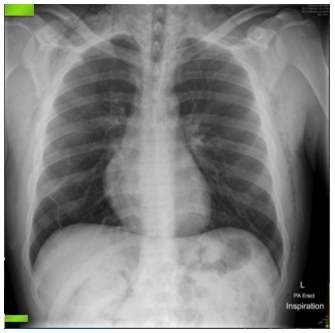
- State the life threat (Danger)
- Give Summary with Impression
- Recommend first line management (Distress)

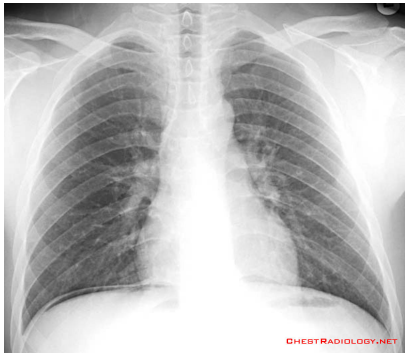
EXAMPLE: Choking child after playing with coin in mouth, reduced sats.

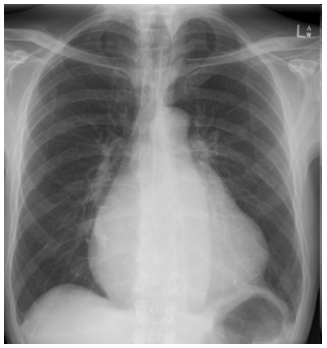
- This is an airway life threat
- There is a linear metallic foreign body projected over the trachea, it appears to be an aspirated coin
- Manage in paeds resus and put out anaesthetic airway emergency call, see if ENT available, set up for RSI

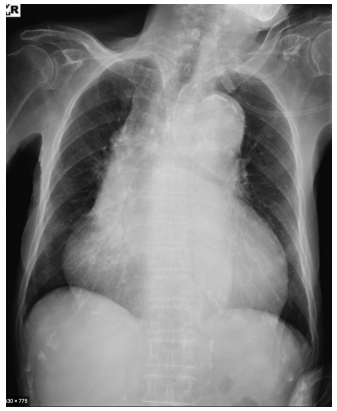
Quiz time: 8 CXR

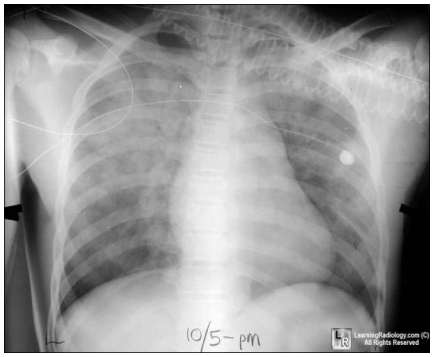


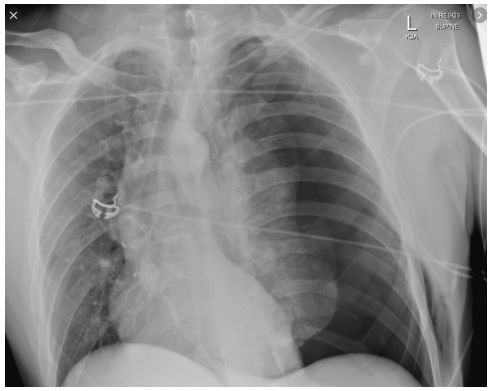


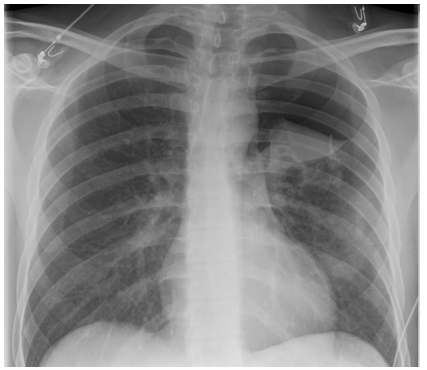


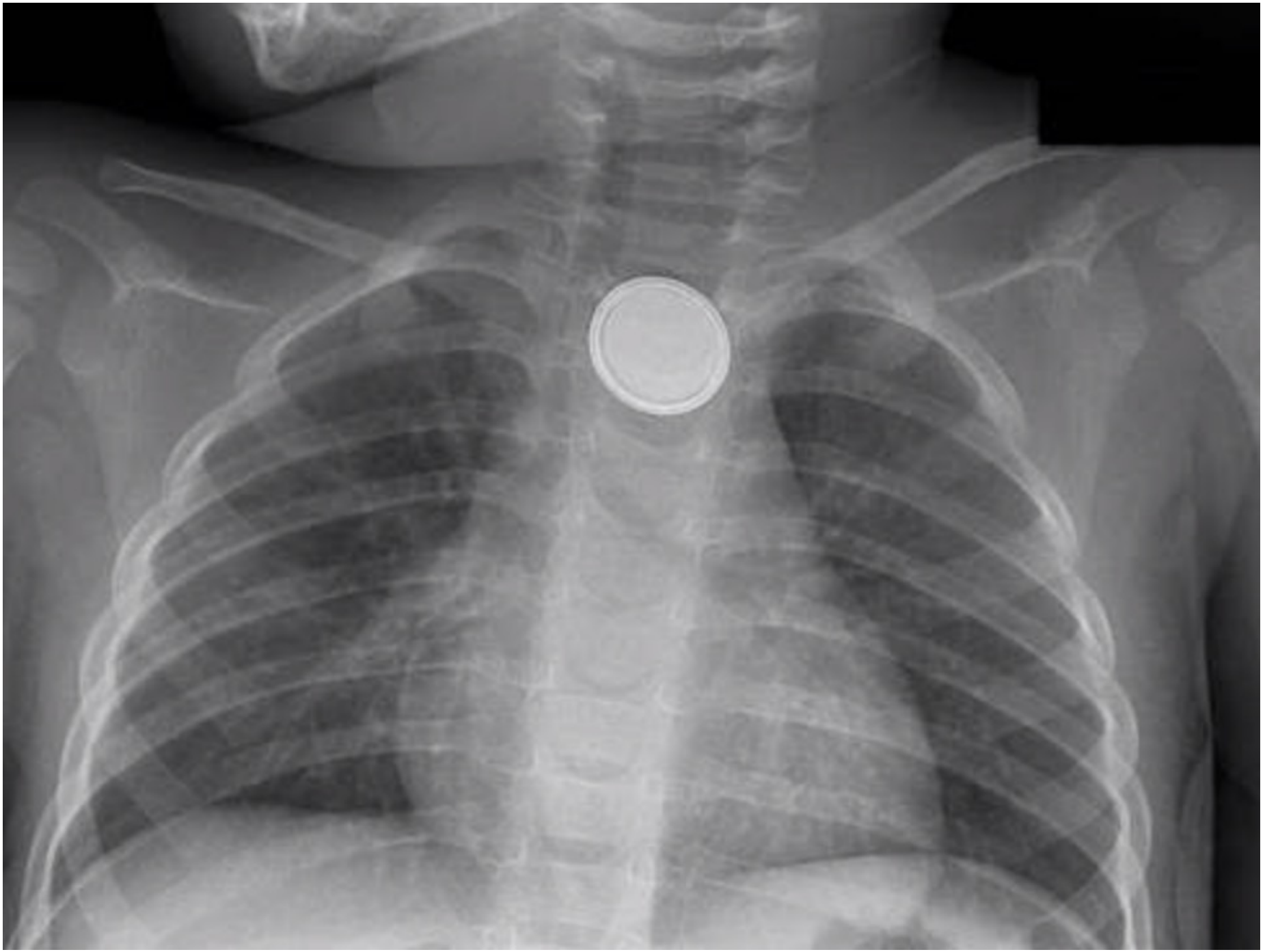


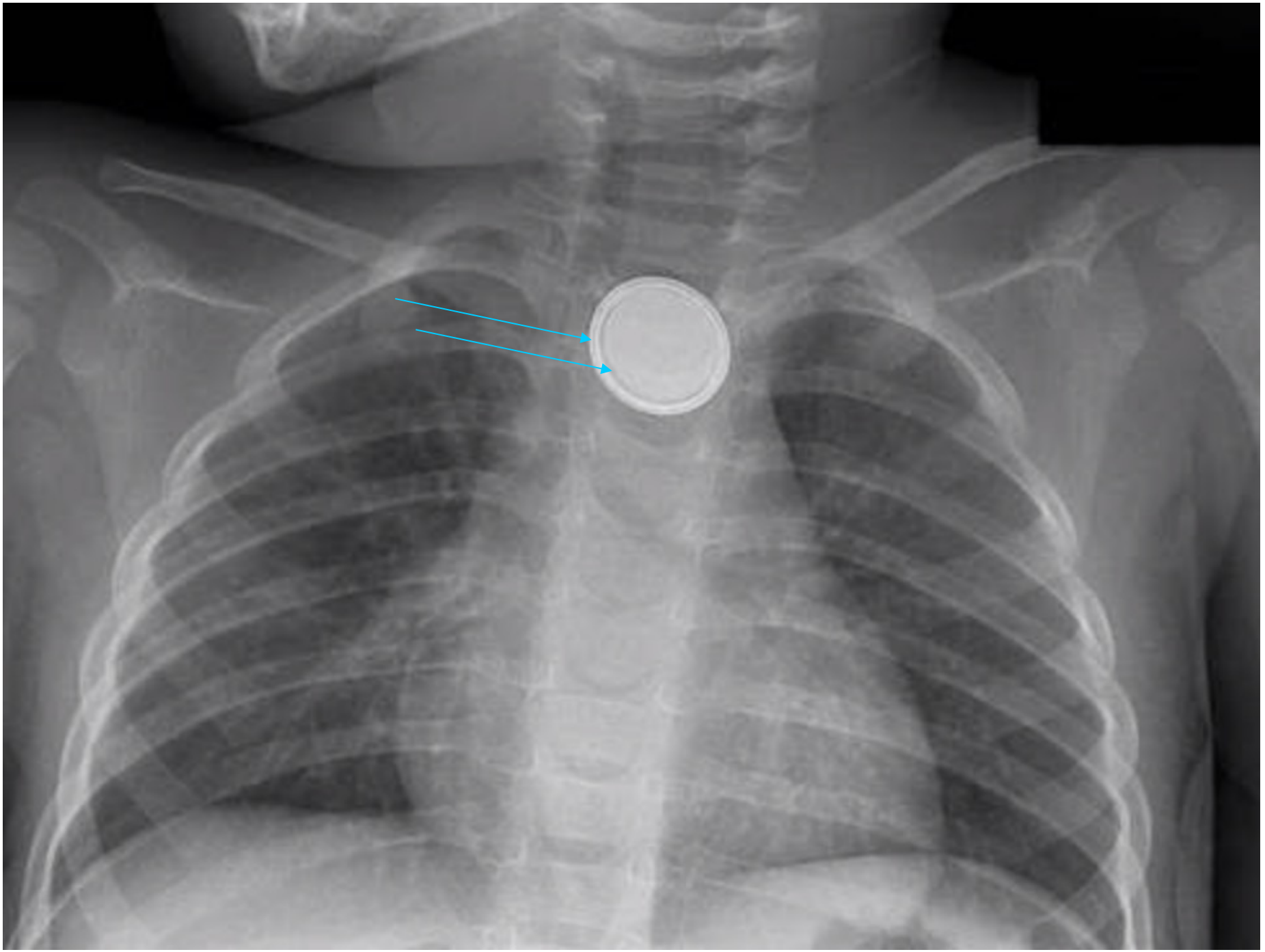




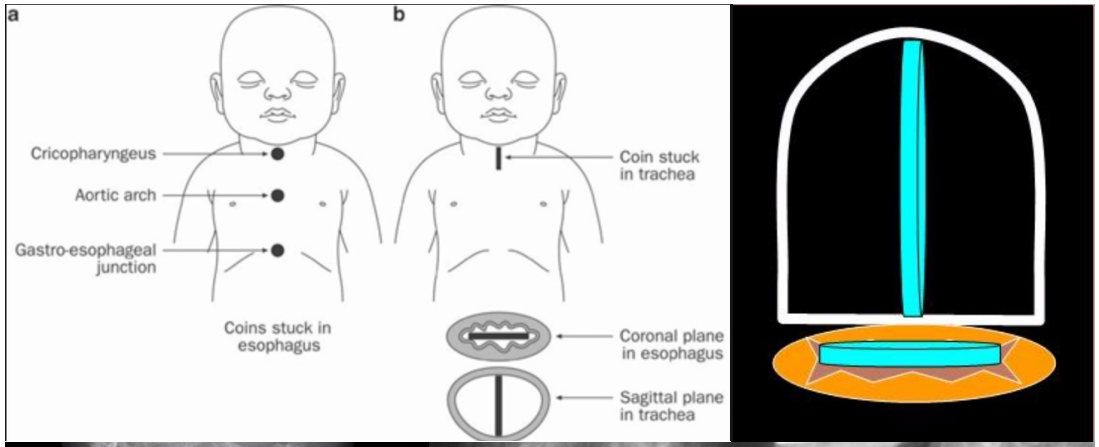


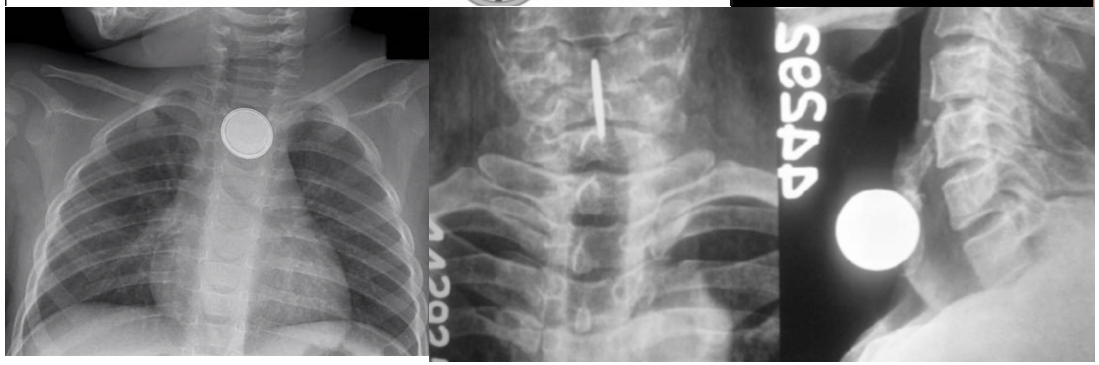




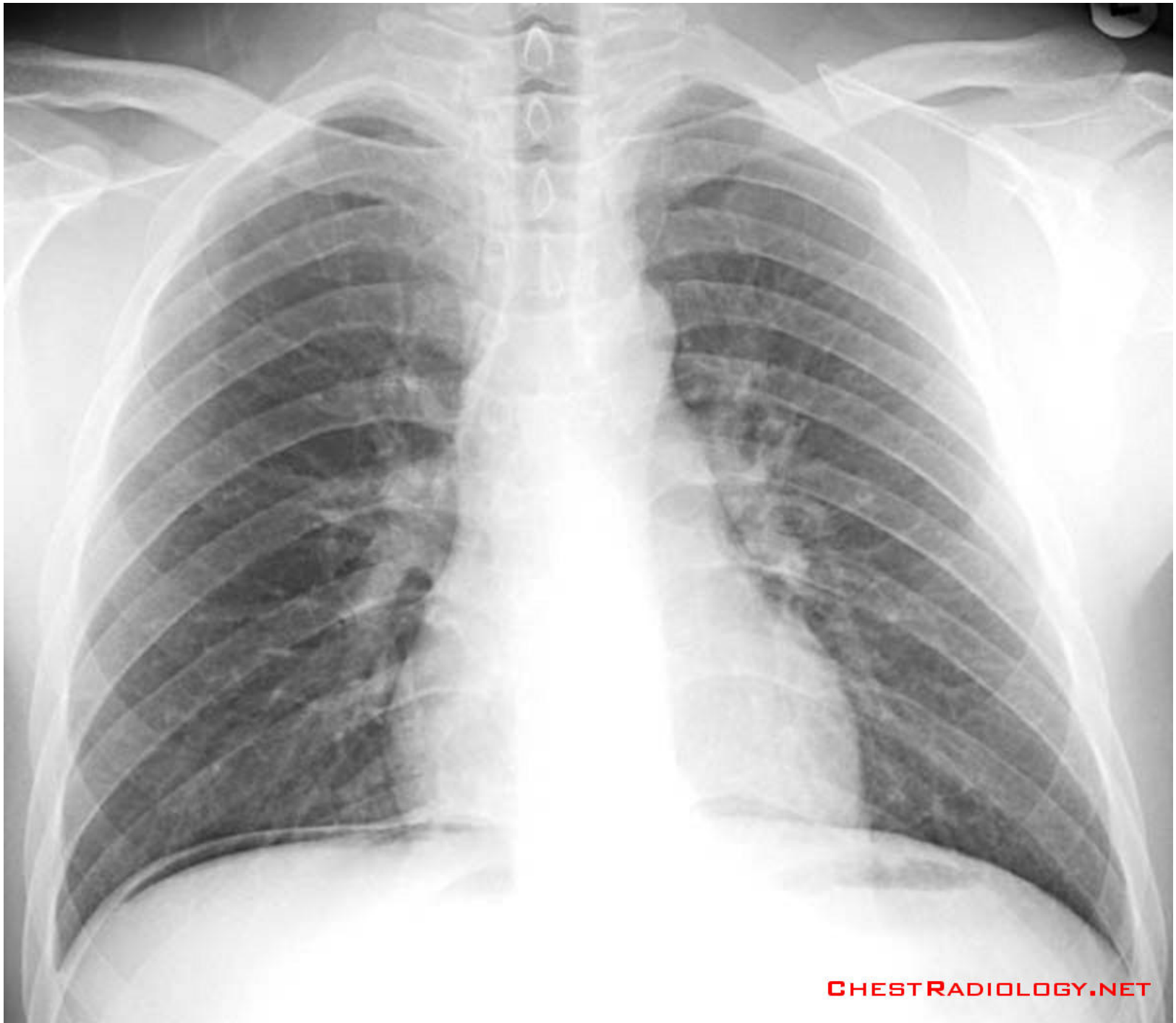


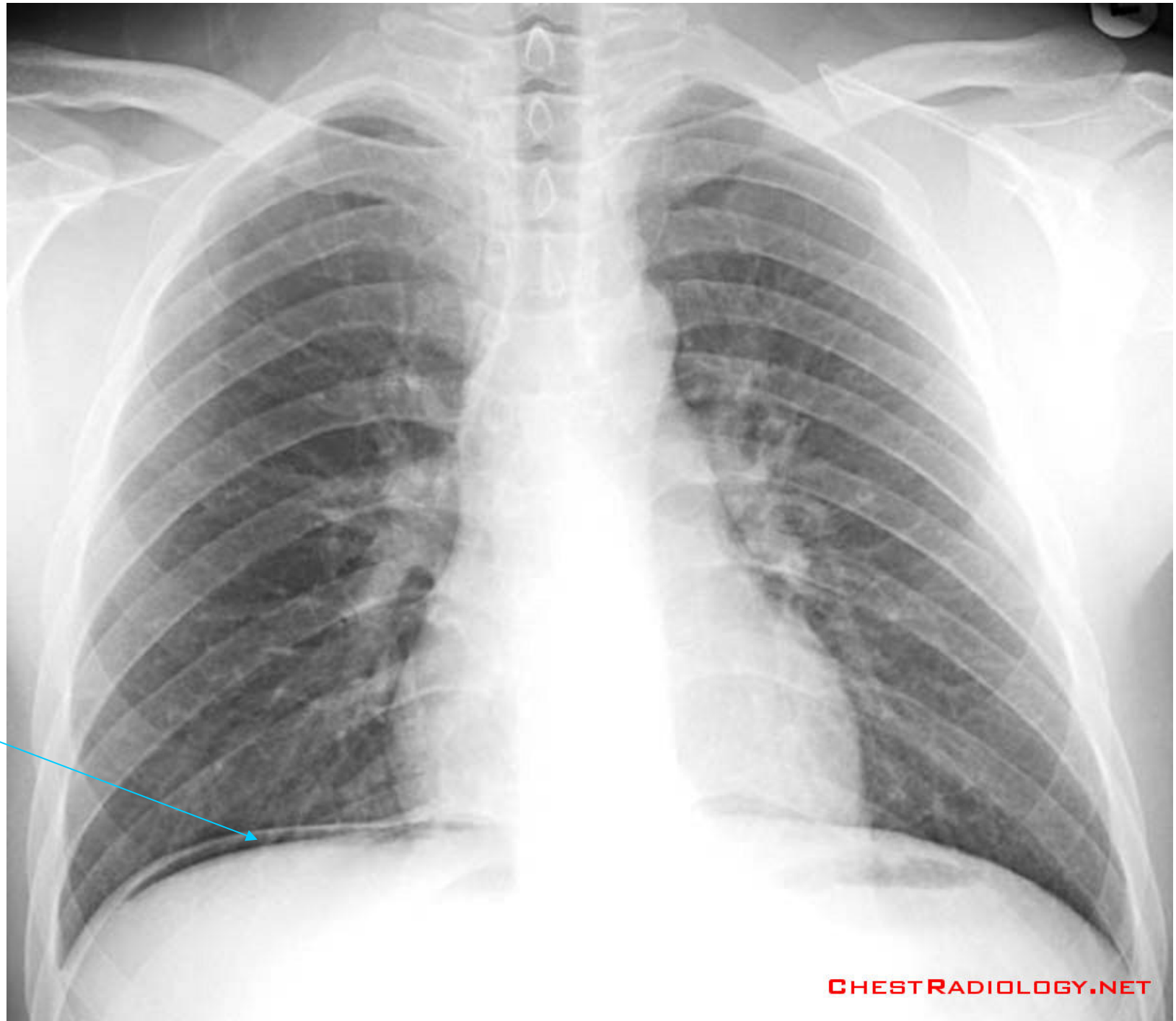
Foreign Body





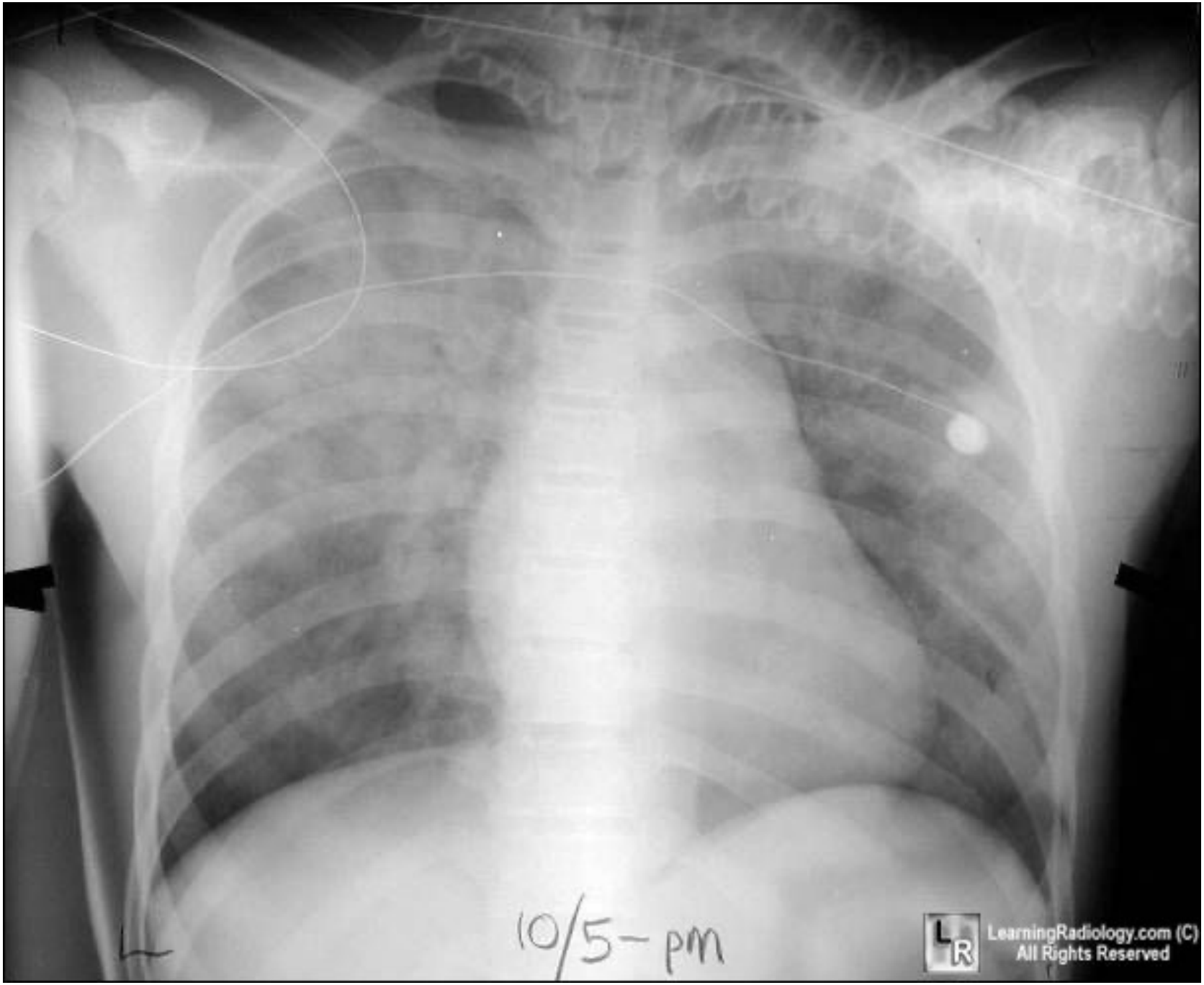
- Trachea vs Oesophagus
- Coin vs Button Battery
- If in oesophagus - will it pass?


CHESTRADIOLOGY.NET


CHESTRADIOLOGY.NET

Free Air

- Where to see it?
- Where did it come from?
- Are there mimics?
- Can XR exclude it?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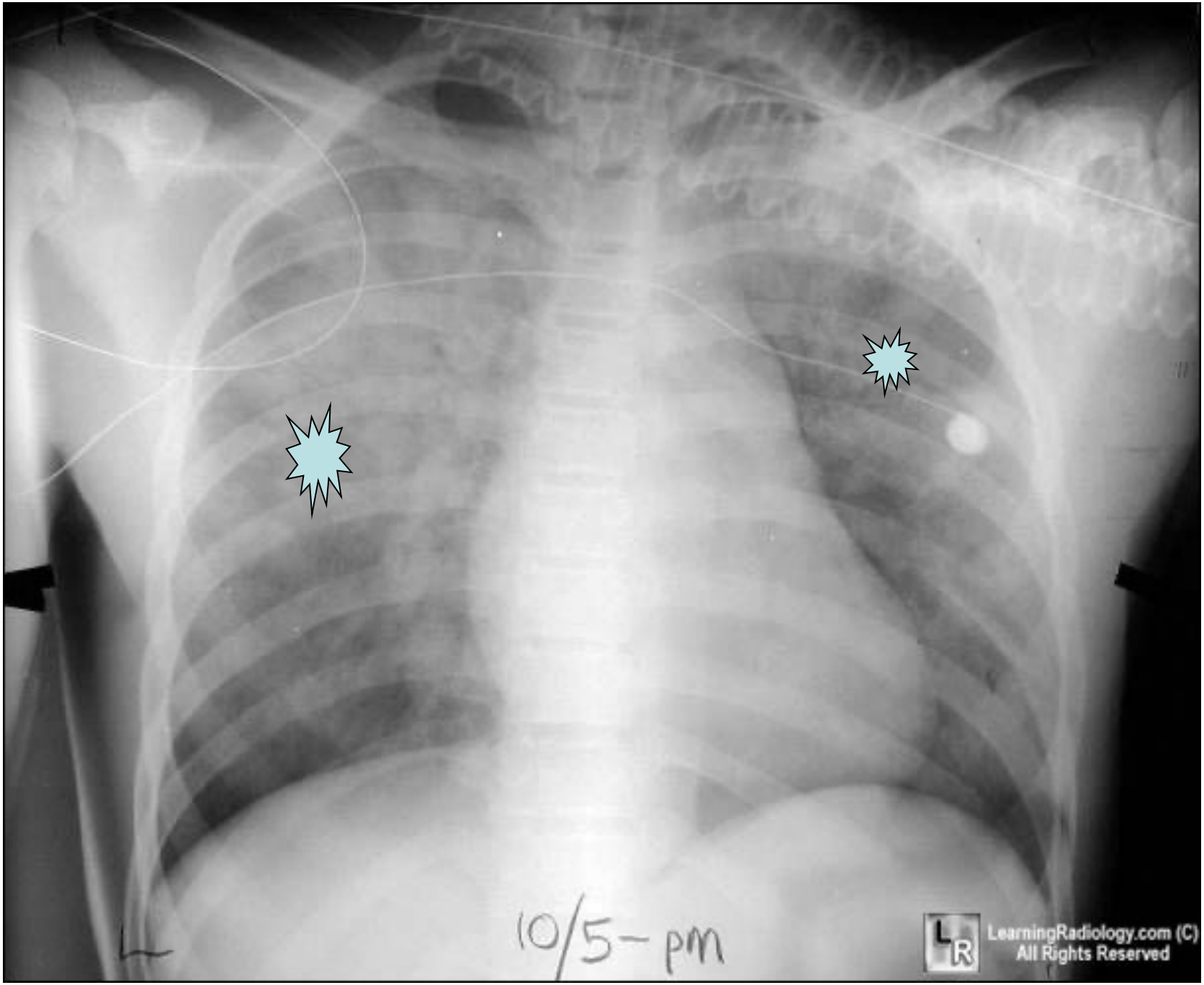
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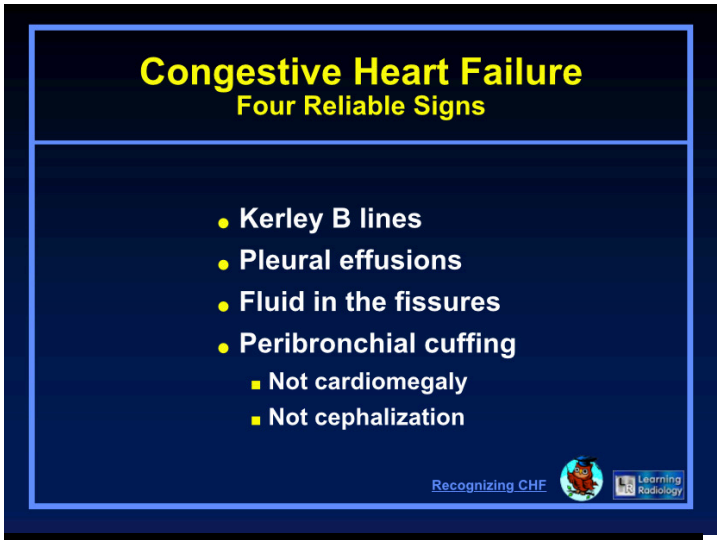
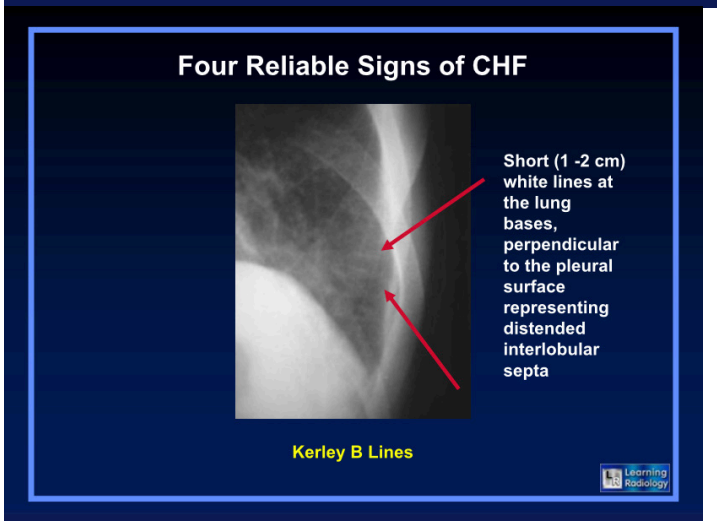
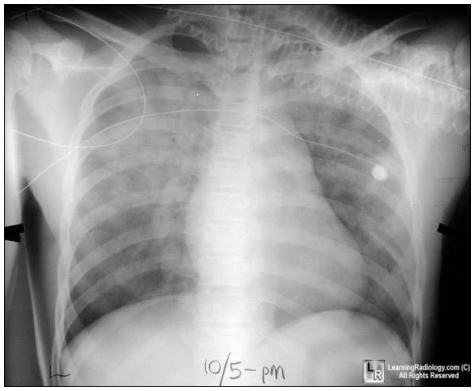
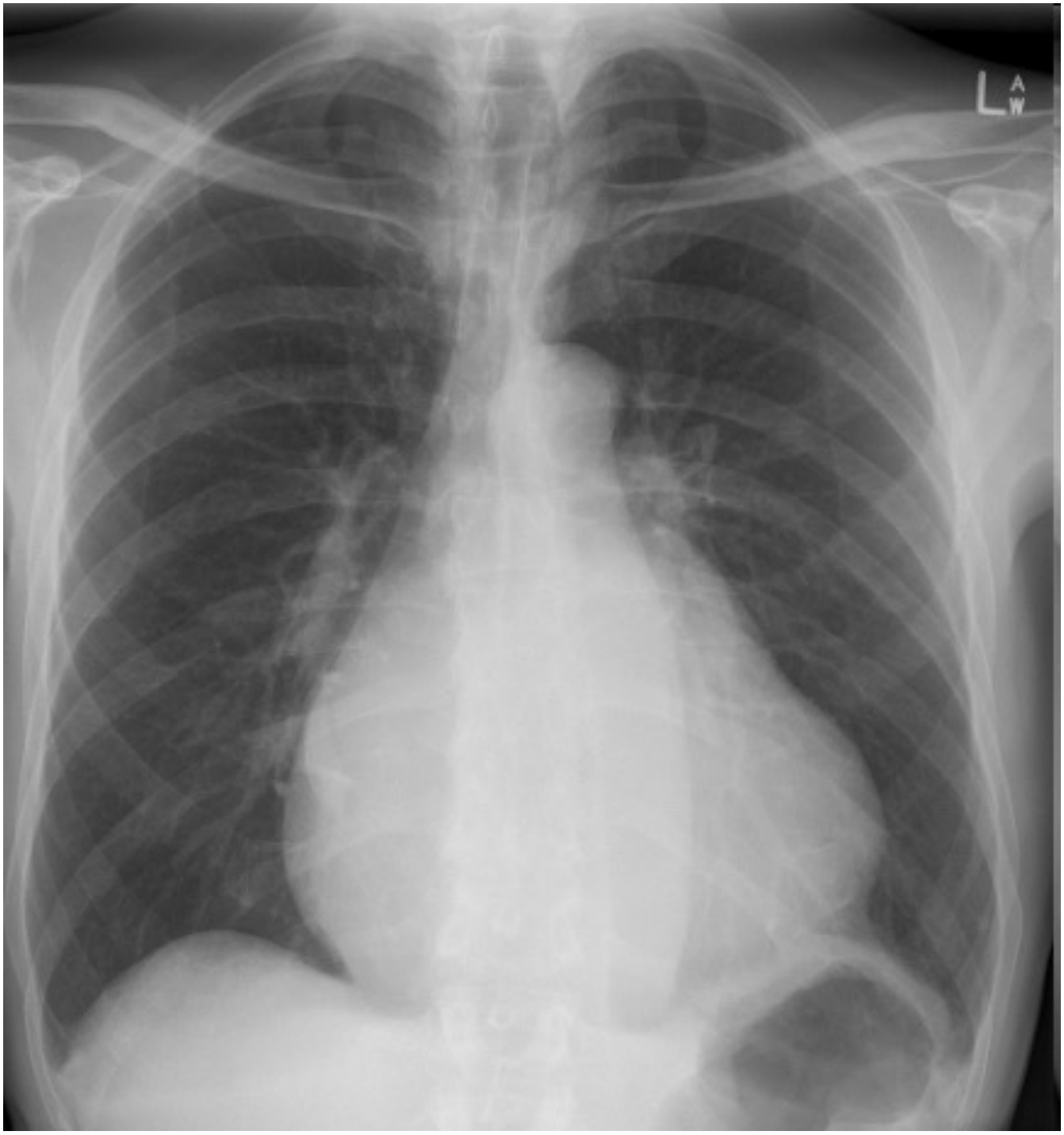
Failure





- What is the severity?
- Why did this occur?
- Can failure occur with a normal size heart?

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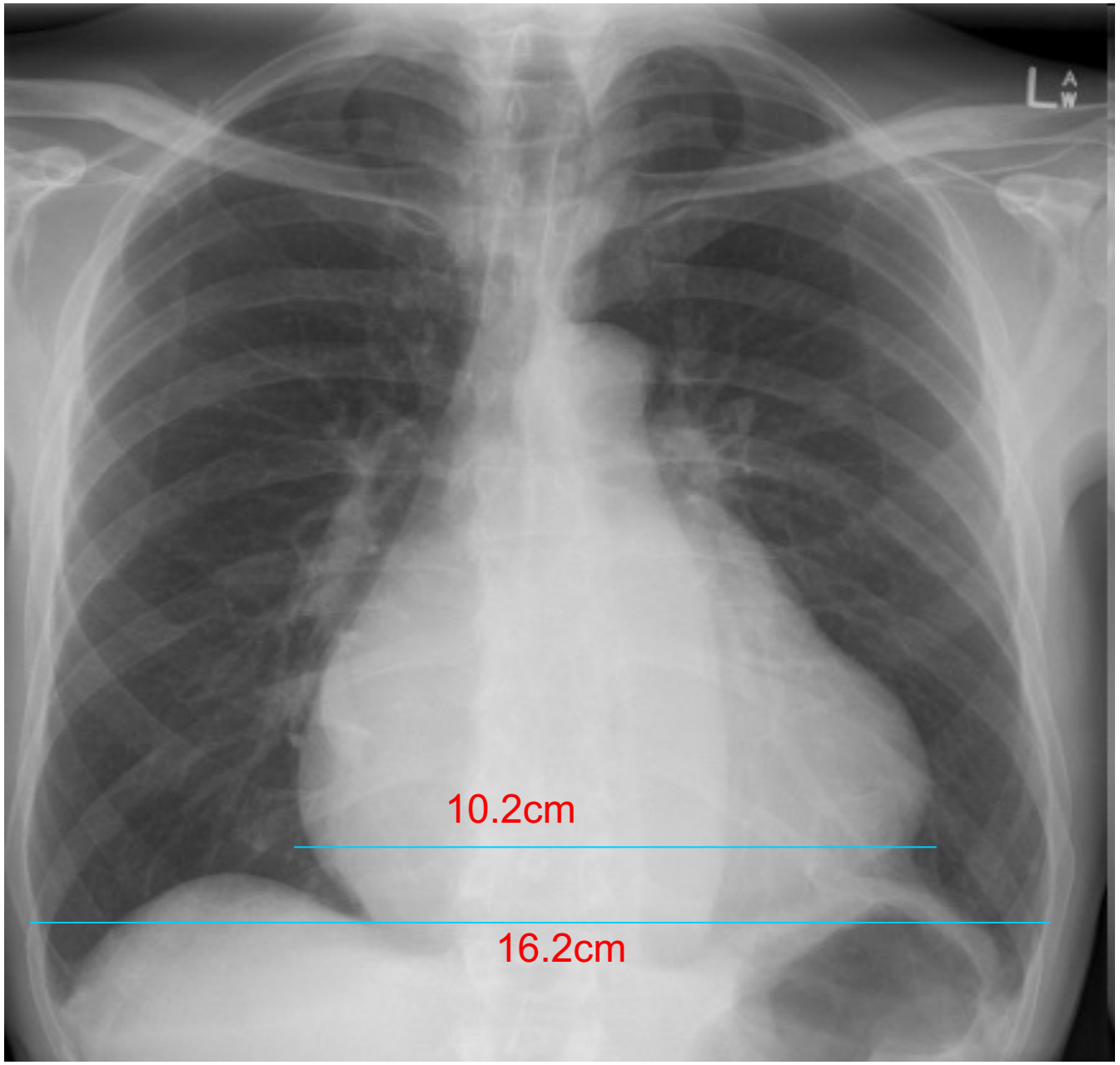
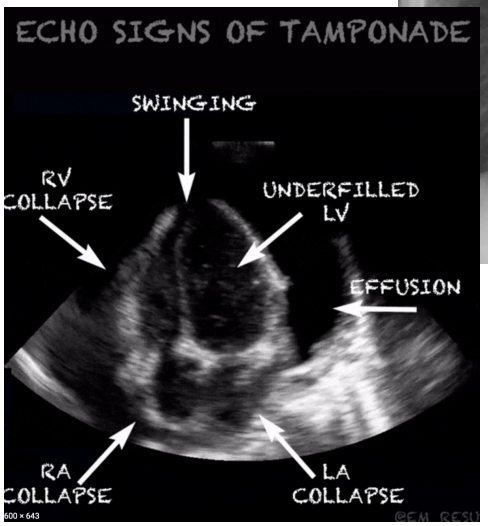
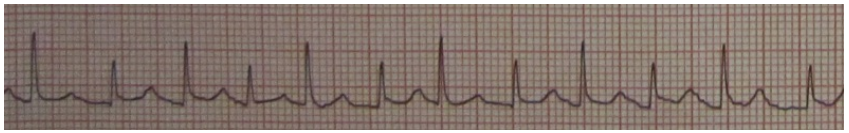


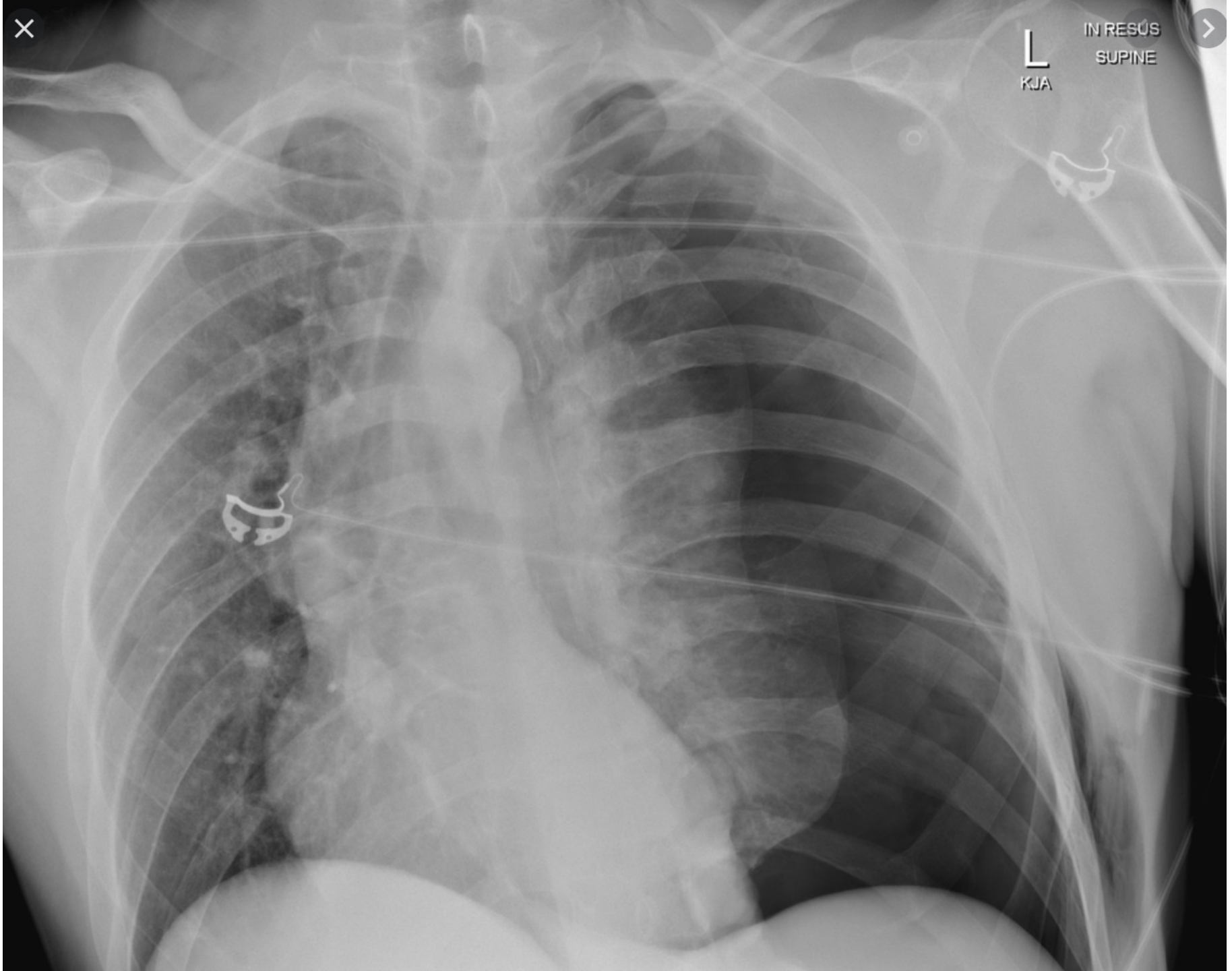
Cardiomegally (CTR 10.2/16.2cm)

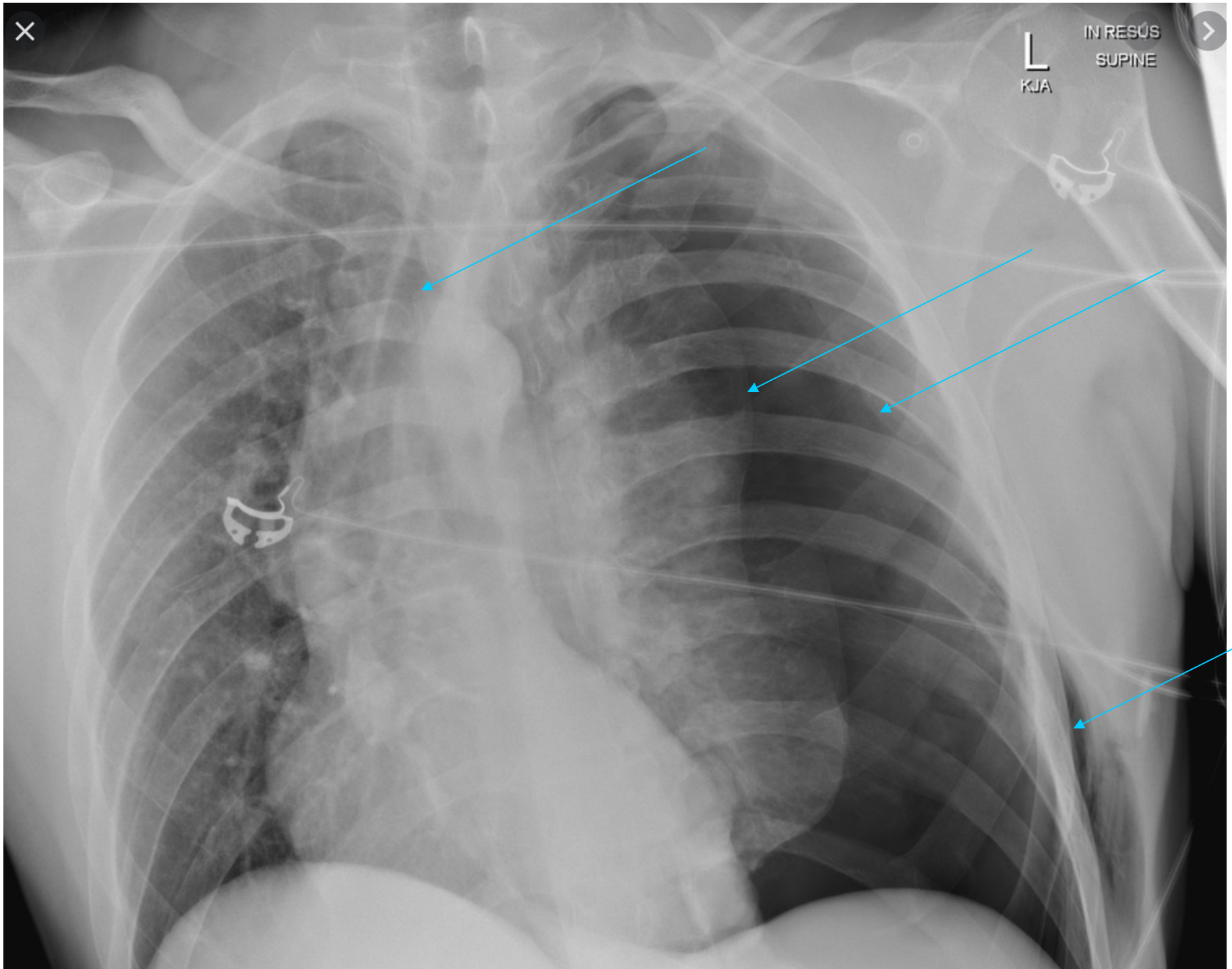
Pericardial effusion



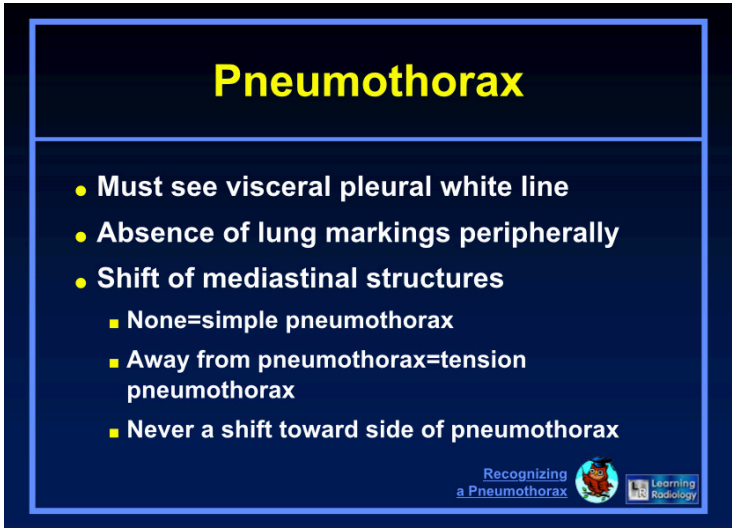


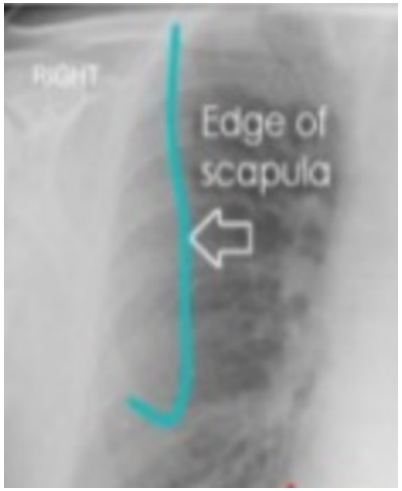
- Is this Tamponade?
- What is the cause?
- What else causes a large heart?
- Can you call it cardiomegally on an AP supine film?


L
KJA
IN RESUS
SUPINE

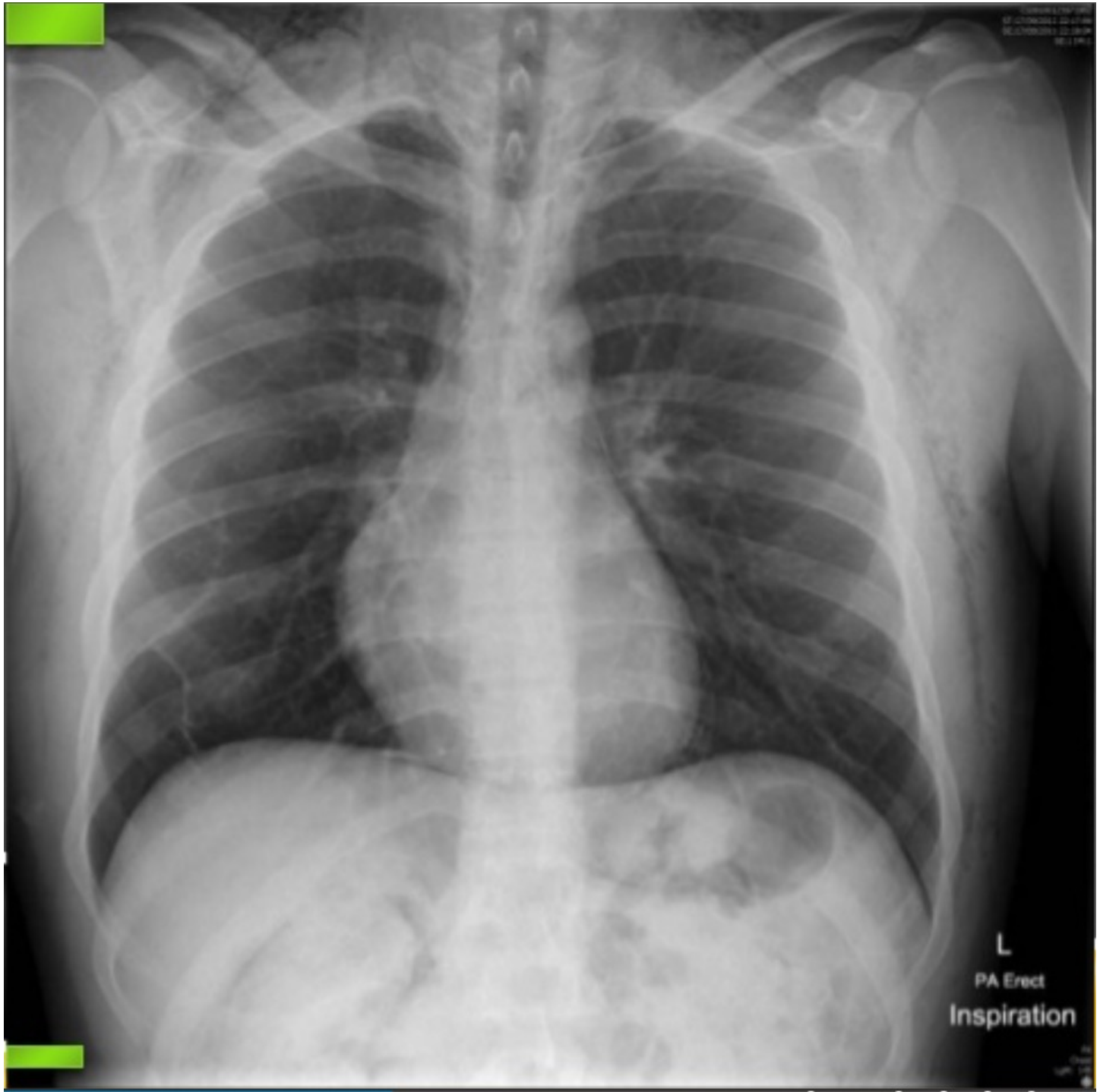

L
KJA
IN RESUS
SUPINE

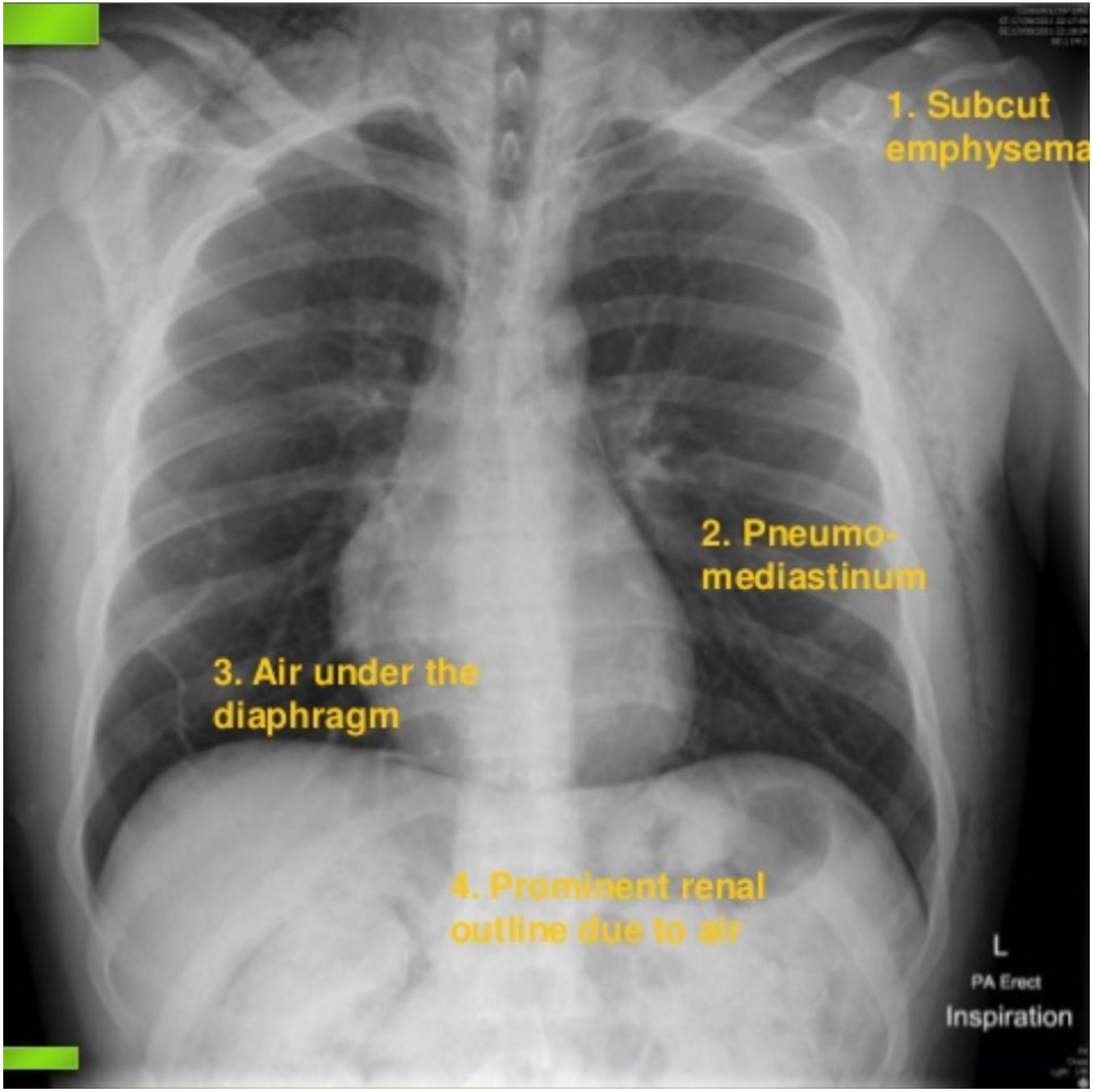
Tension pneumothorax



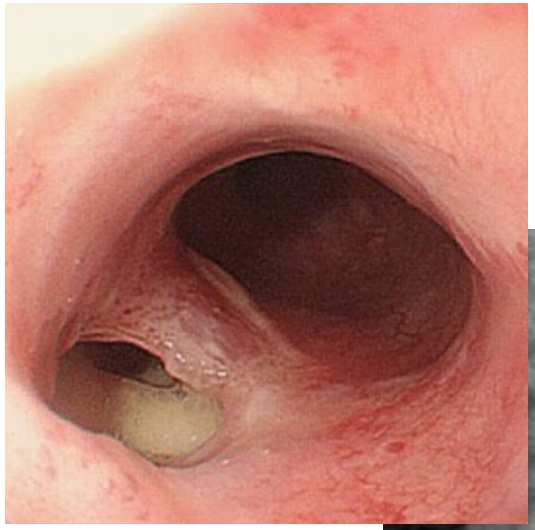


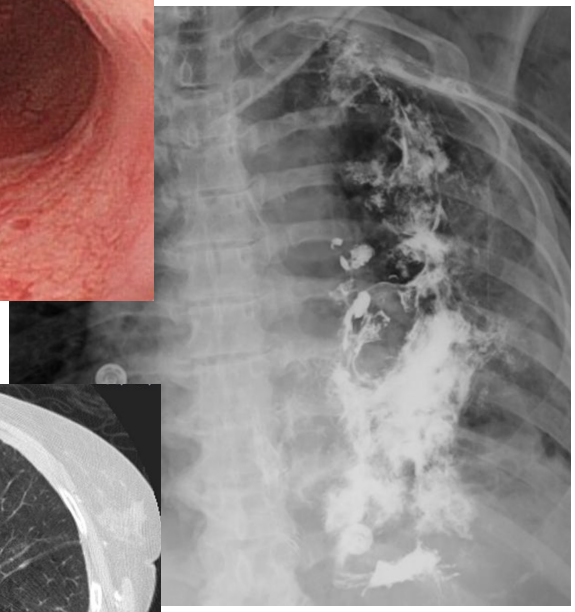
- Px features on CXR
- Inspiratory vs Expiratory films
- Tension features?
- Called the CXR that should “never be taken”
- Pneumothorax mimics

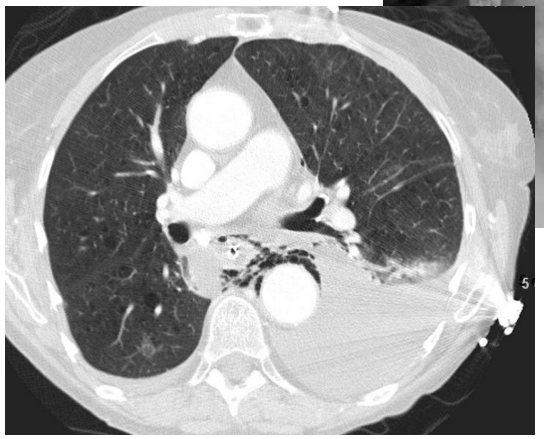

L
PA Erect
Inspiration


1. Subcut emphysema
2. Pneumo-mediastinum
3. Air under the diaphragm
4. Prominent renal outline due to air
L
PA Erect
Inspiration

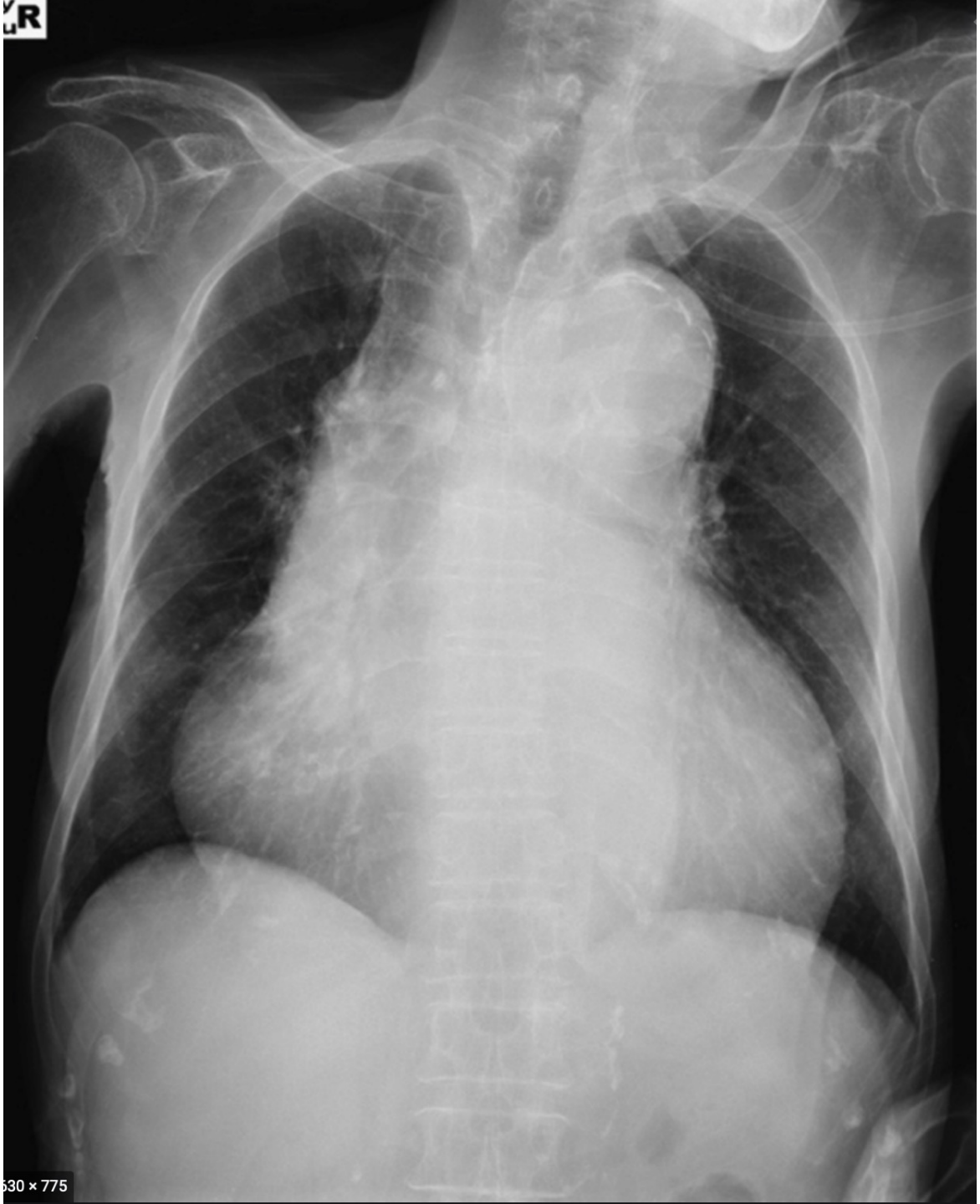
Boerhaave Syndrome

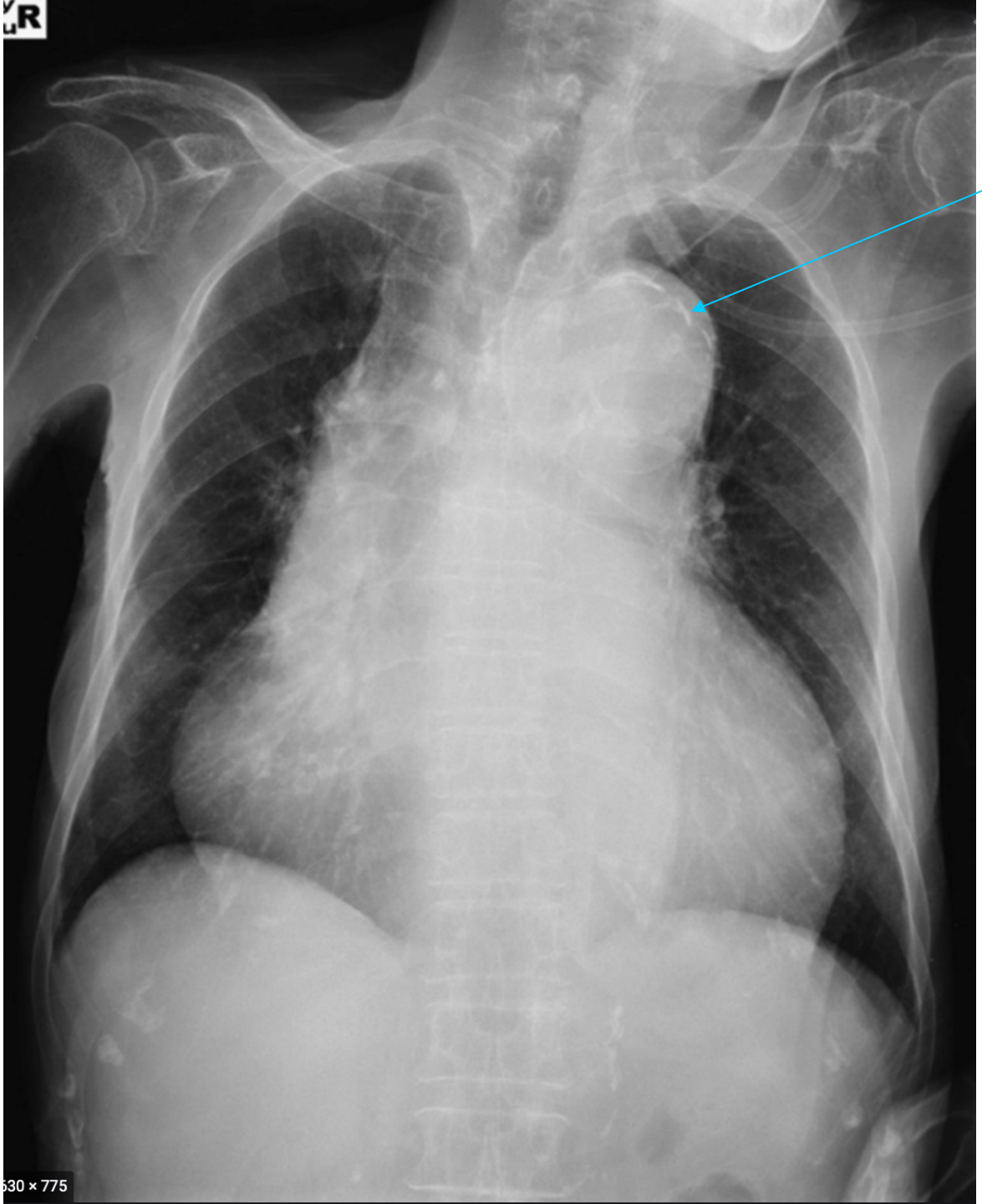




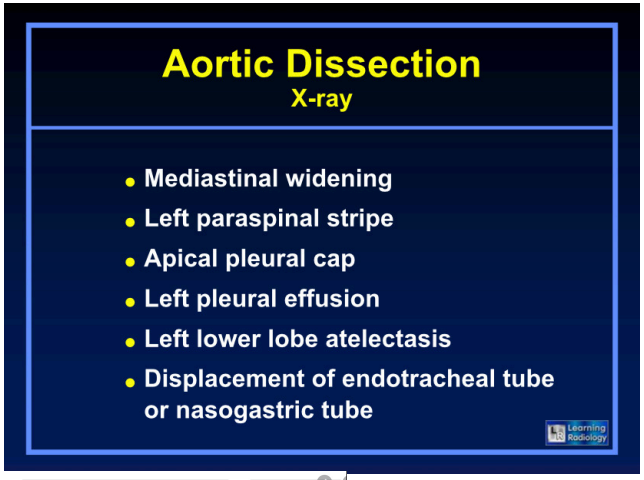


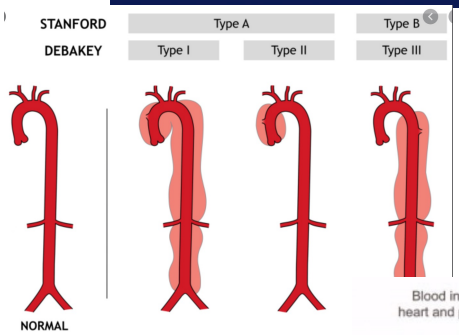
- What is the cause?
- What are the usual CXR features?
- What is management?

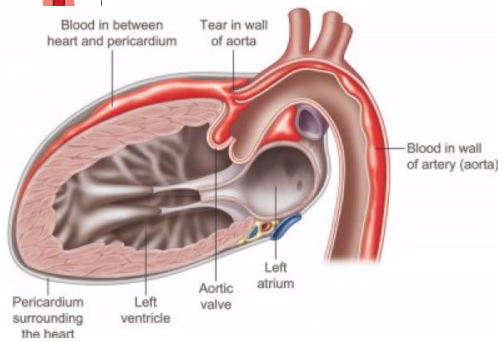

R
630 × 775


R
530 × 775

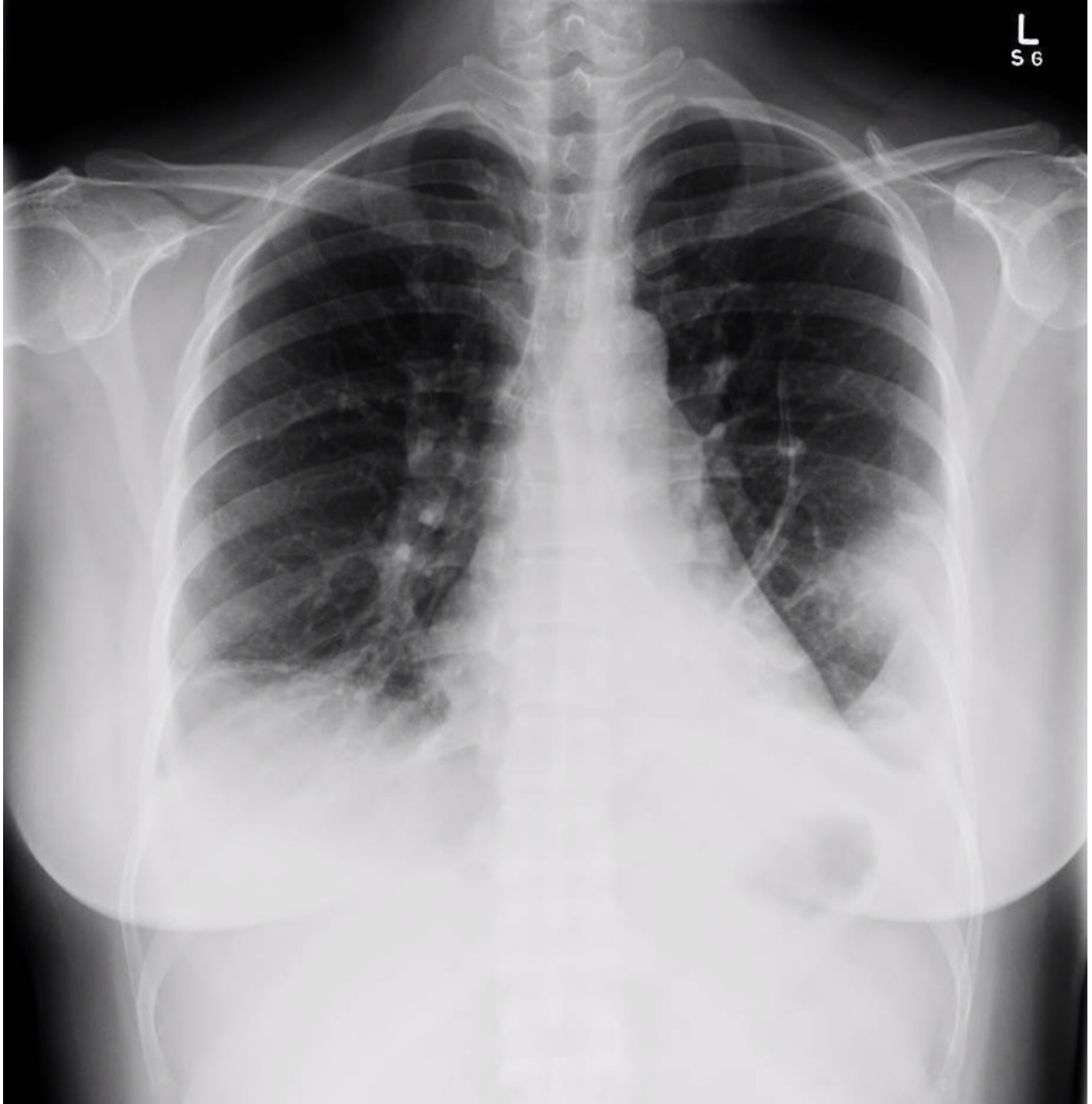
Aortic Dissection

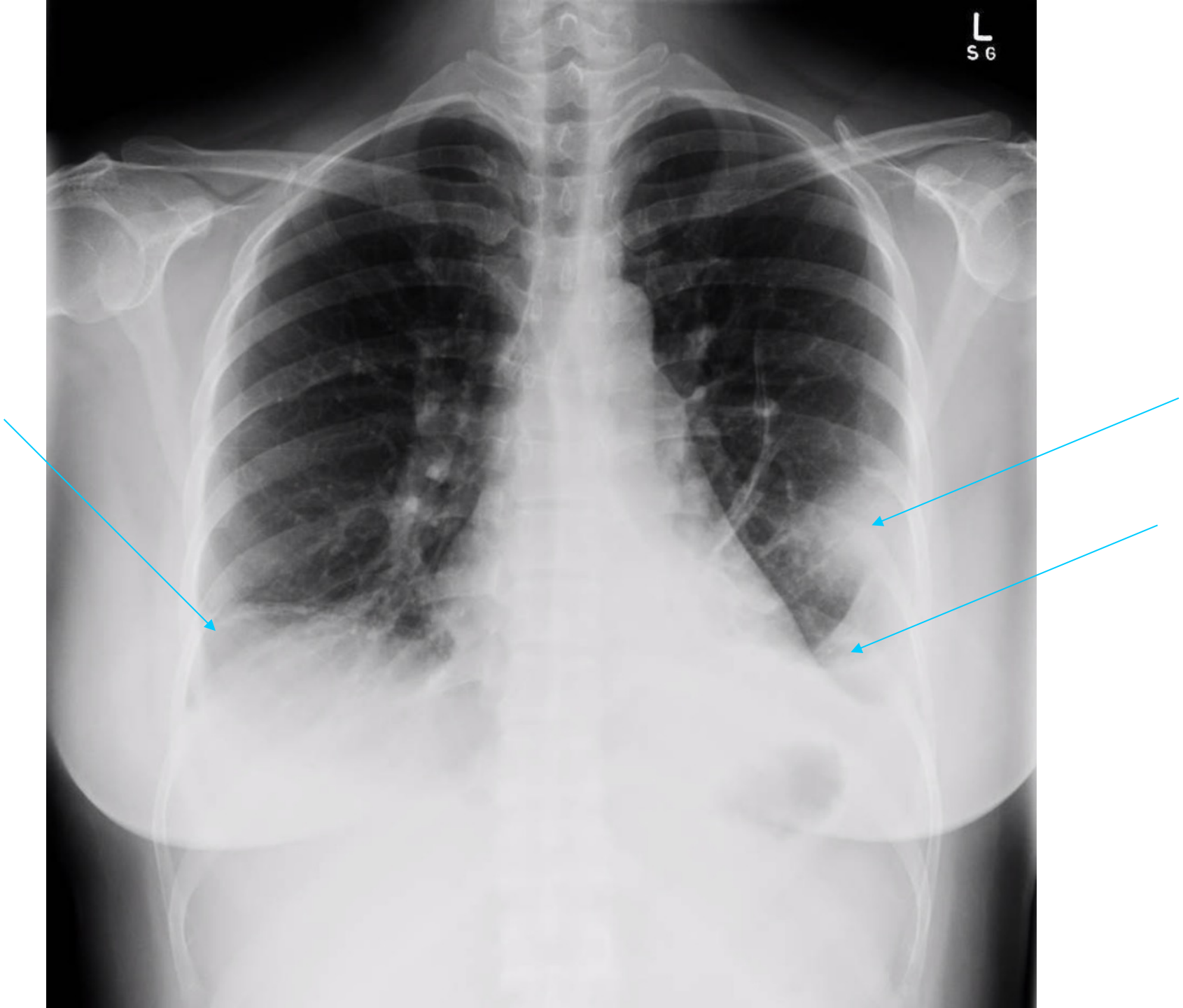




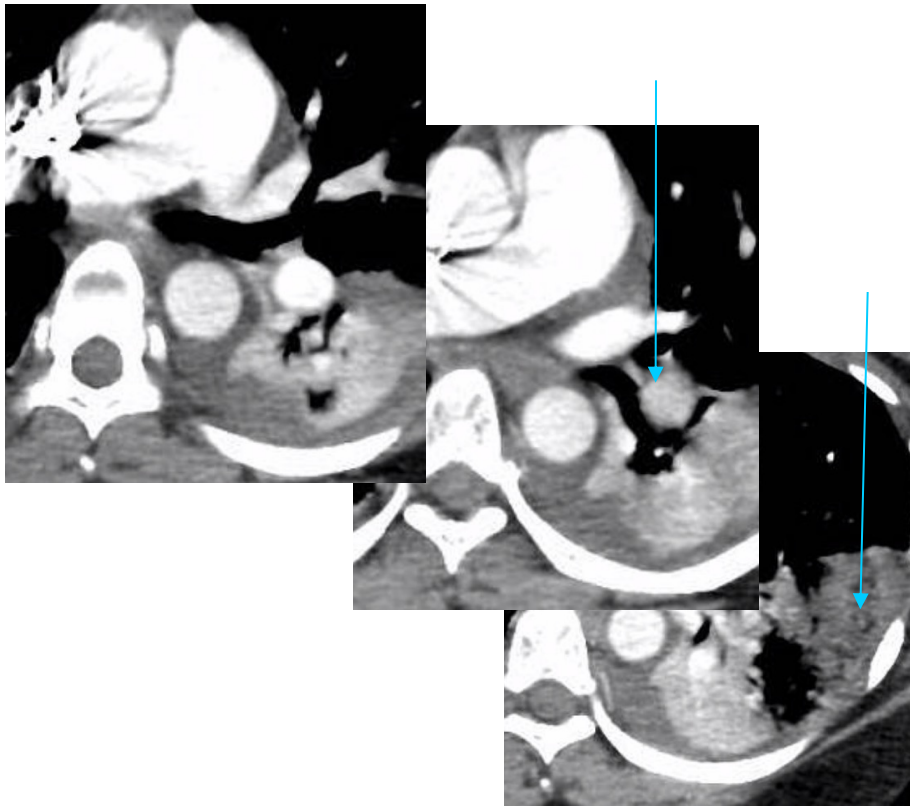


- What are the CXR features?
- What are the two main types?
- What is the management?

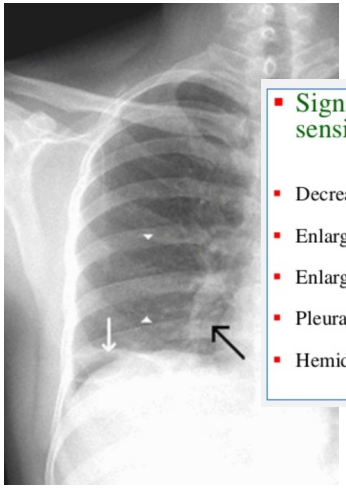

L
SG


L
S G

Pulmonary embolism

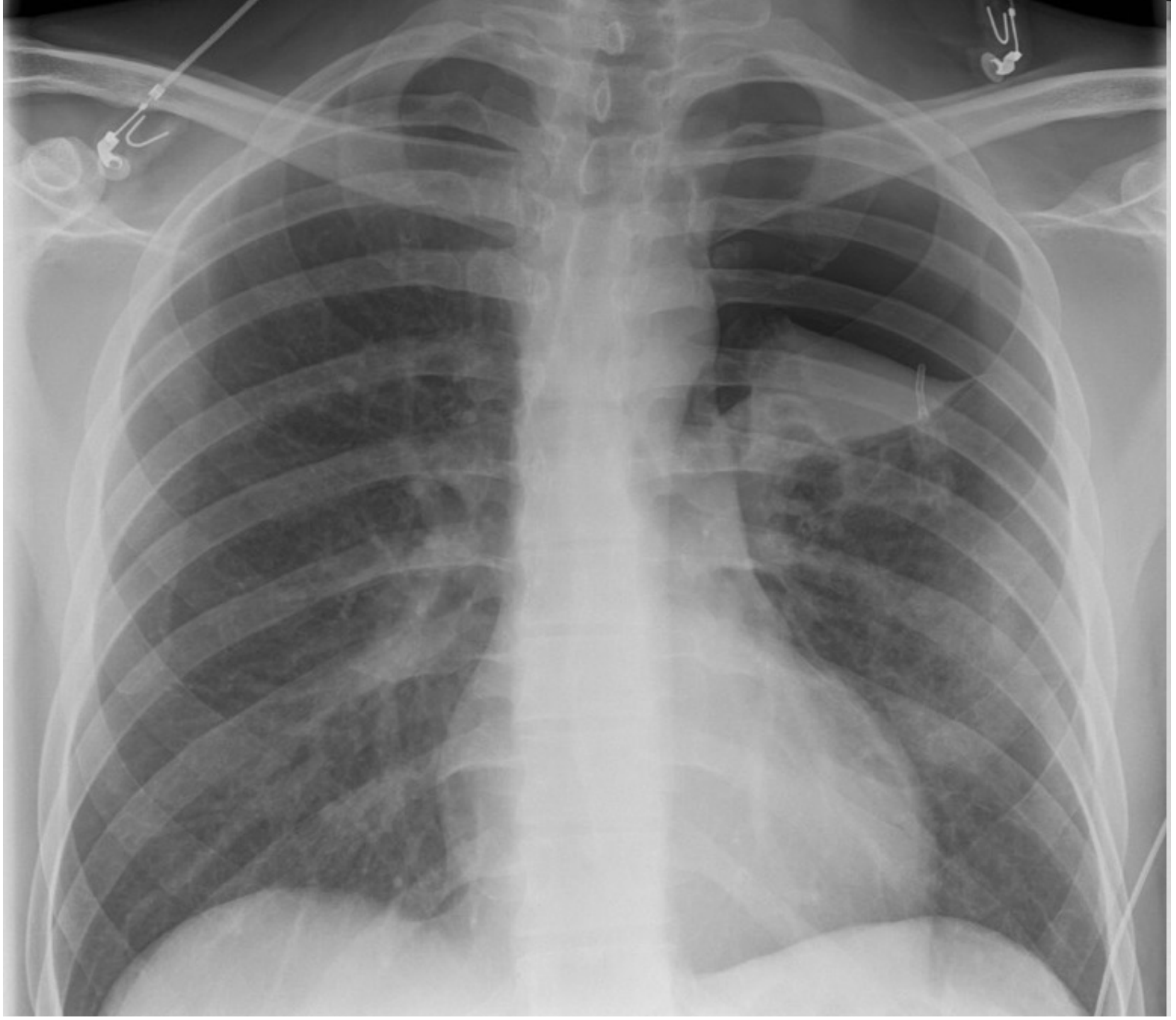


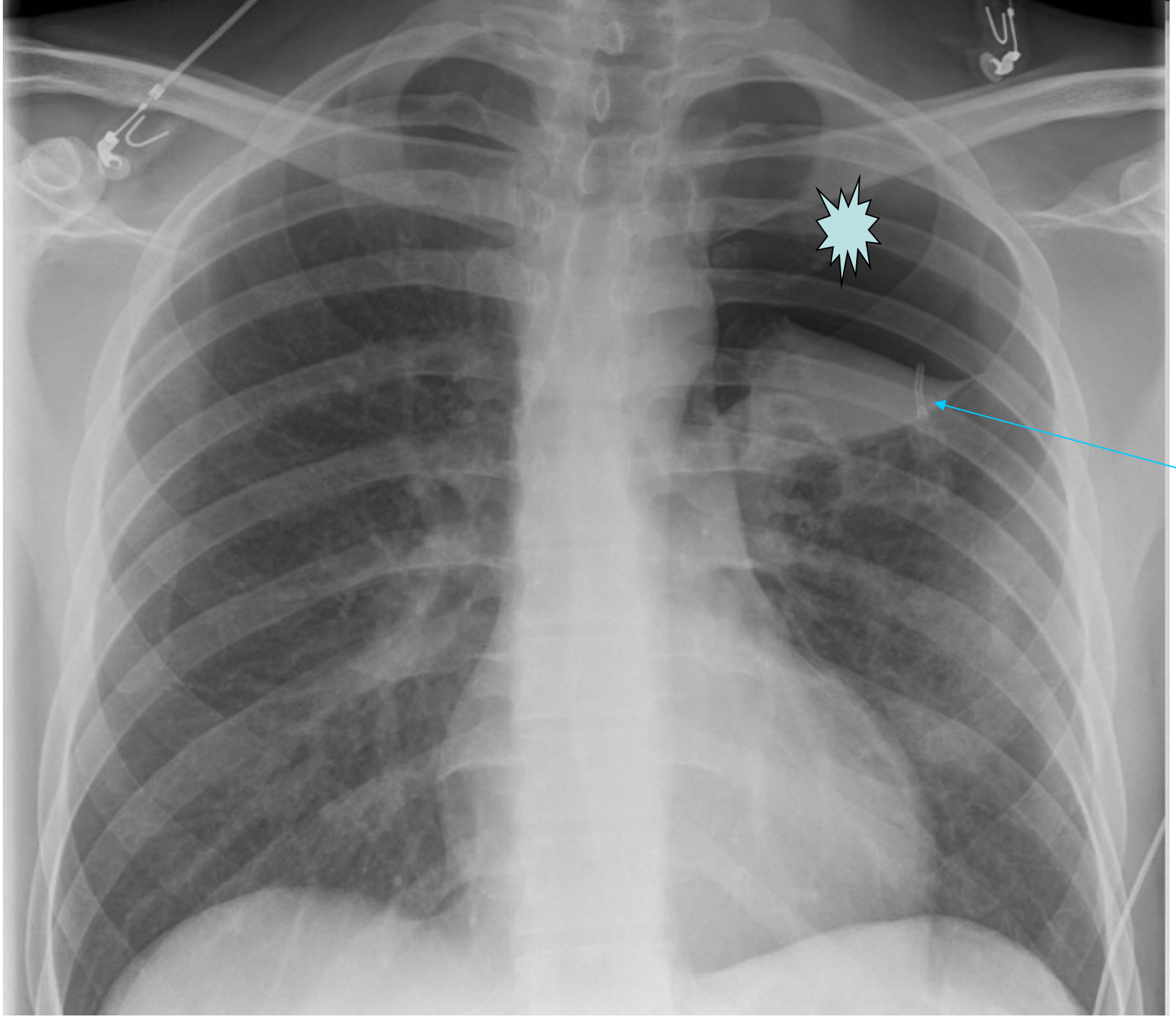
- What are the CXR findings
- How do you tell how severe a PE is?



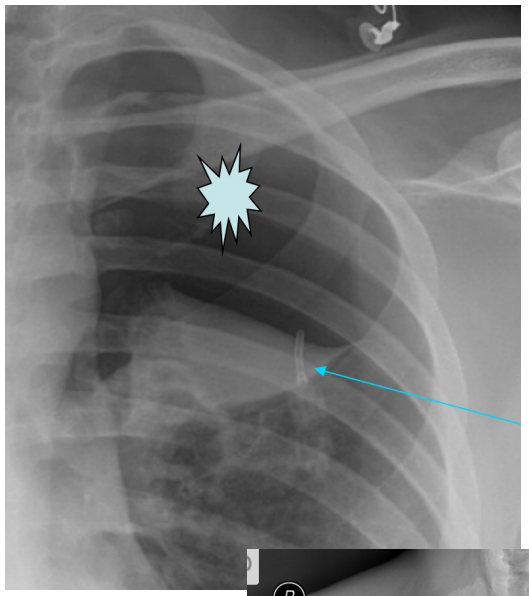
- Signs with relative high specificity but low sensitivity for acute pulmonary embolism:
  - Decreased vascularity in the peripheral lung (Westermark sign).
  - Enlargement of the central pulmonary artery (Fleischner sign).
  - Enlarged right descending pulmonary artery (Palla's sign)
  - Pleural based areas of increased opacity (Hampton hump).
  - Hemidiaphragm elevation.

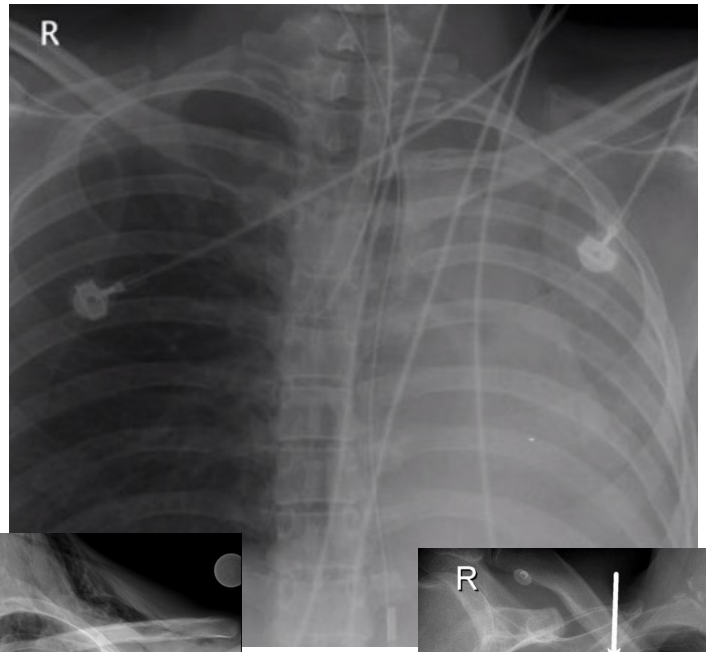
- CXR (abnormal in 70%)
  - Atelectasis is most common (esp >24 hrs after onset of symptoms)
  - Pleural effusion
  - Hampton's Hump
  - Westermark's sign[23]

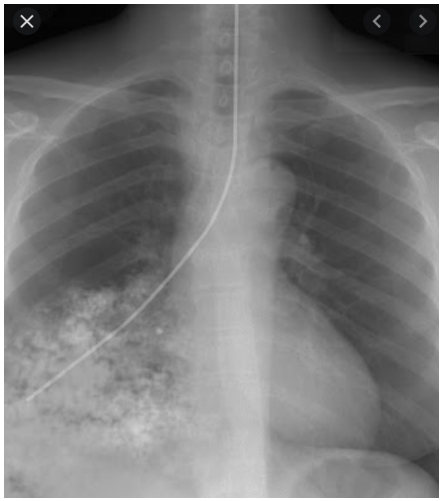


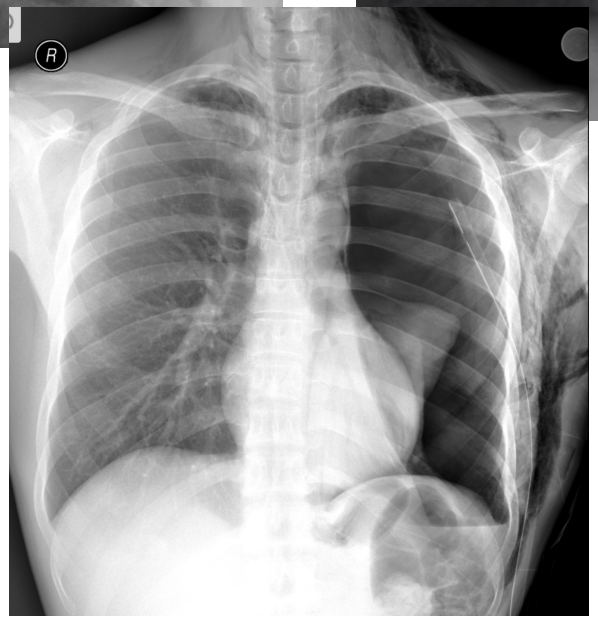


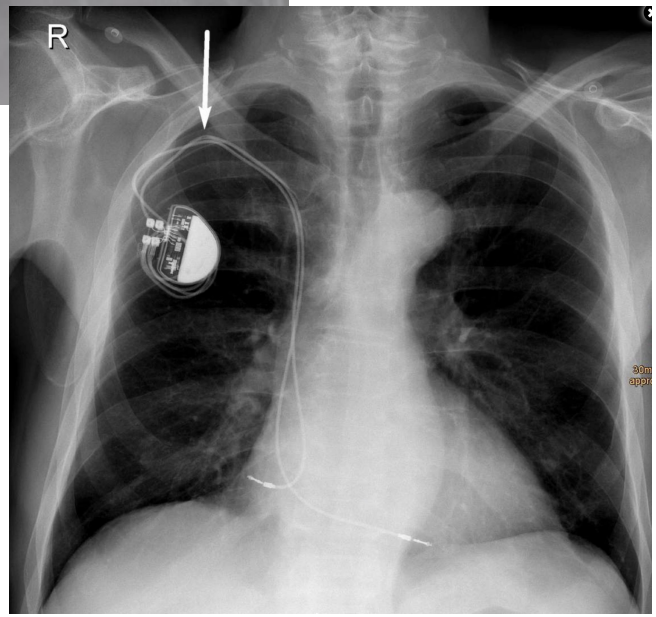
Post procedure CXR



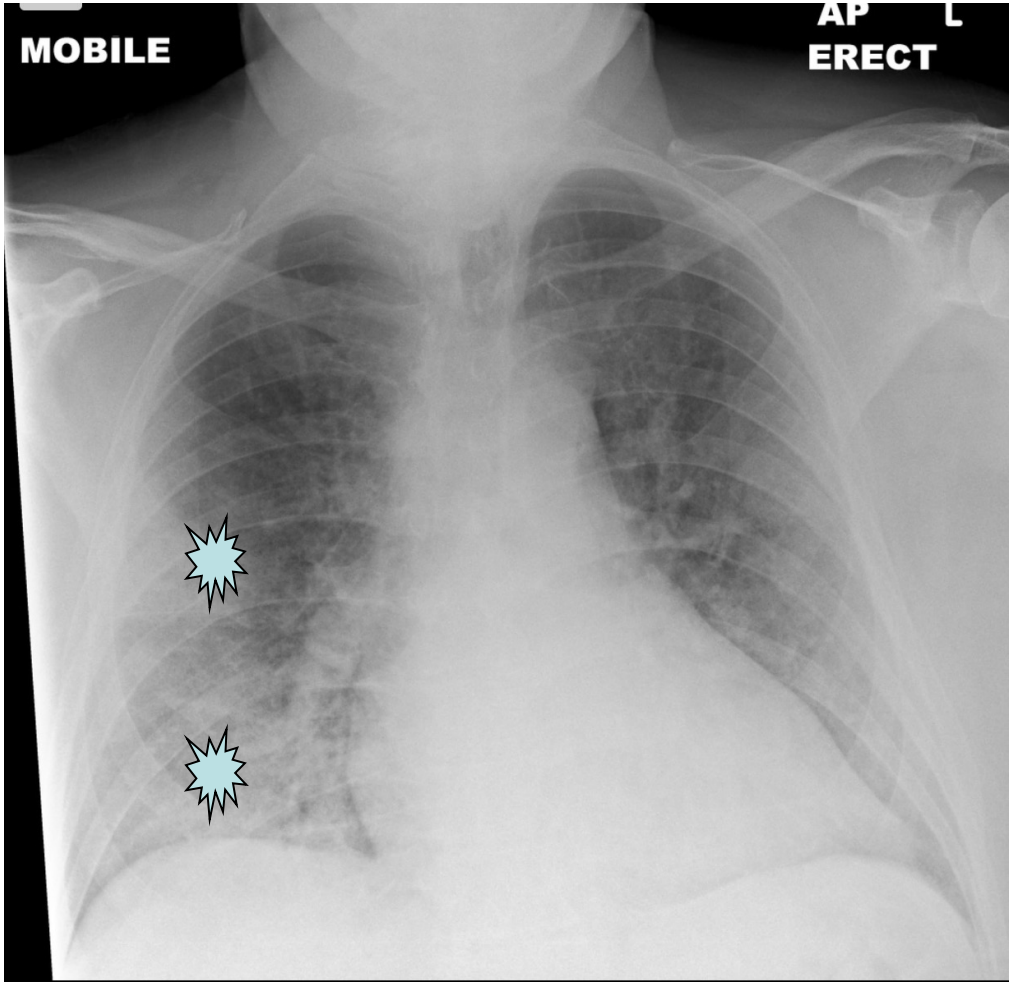


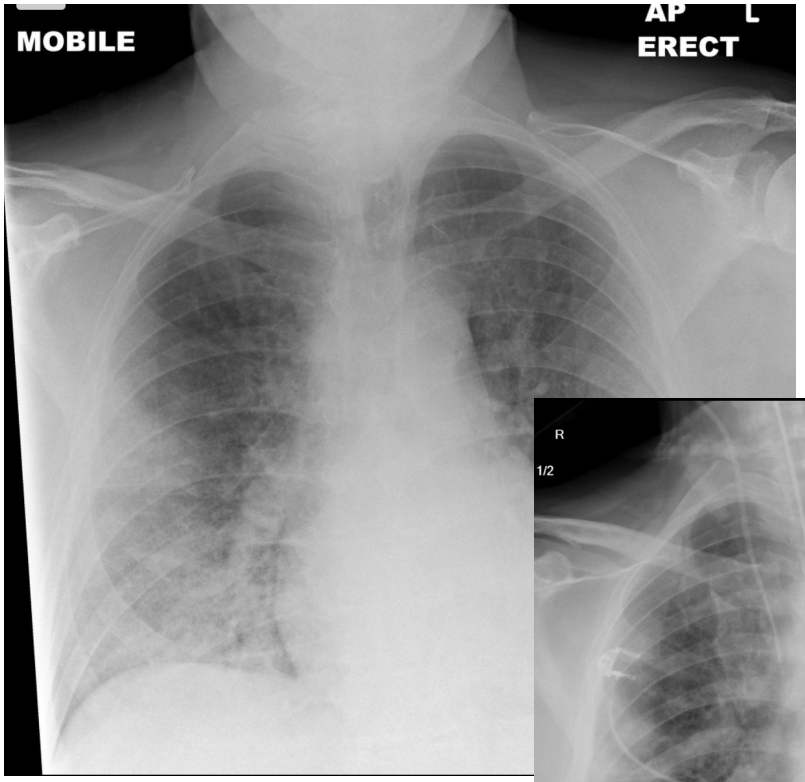






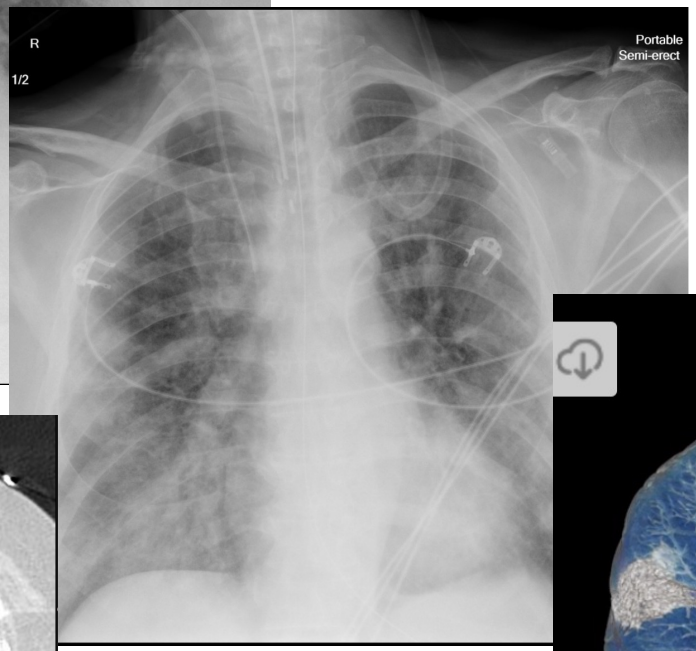
Fever, cough, sats 80%. Family member covid +ve

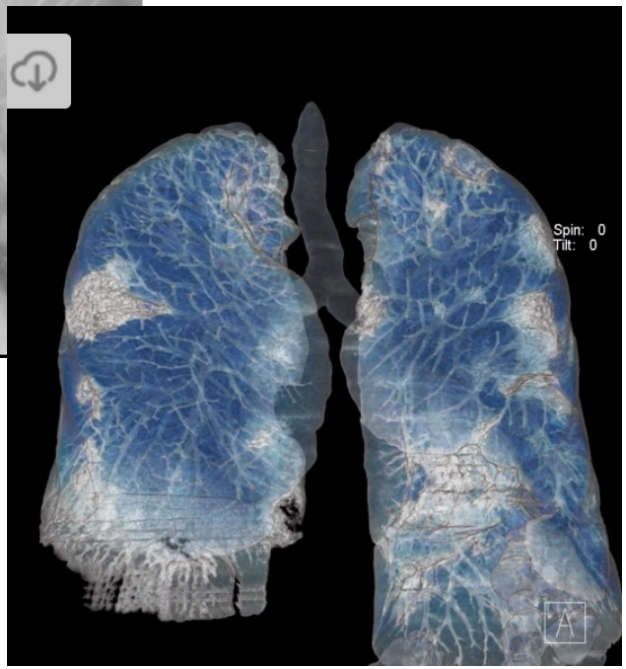

MOBILE
AP
ERECT



What are the CXR findings of COVID19

Can you predict who will become more unwell?

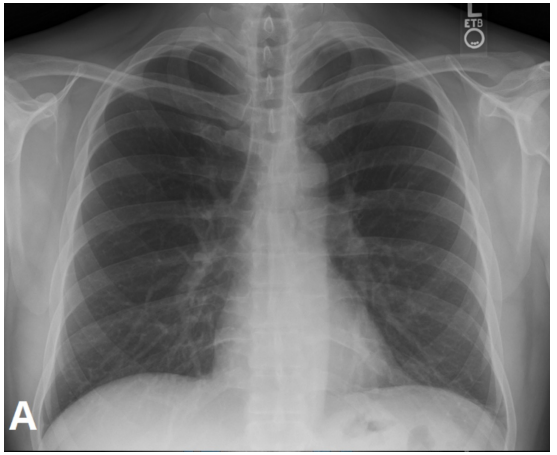




CXR Session

- Interpreting a CXR is a key skill in managing SOB/CP presentations

- Learning outcomes
  - Identify the adequacy of a CXR
  - Identify the anatomy on a CXR
  - Identify life threat CXRs
  - Identify common abnormal CXR findings
  - Have a system how to present a CXR



- Structure of session:
  - CXR teaching session: Based on LITFL
    - Focus on systematic review of CXR
  - CXR Quiz Answers
    - Life threat identification
    - Management focusing on 3D's

- Resources
  - Online video: https://youtu.be/5xhIEQhVJ9I
  - LITFL: https://litfl.com/drsabcde-of-cxr-interpretation/
  - Articles: BMJ Best Practice