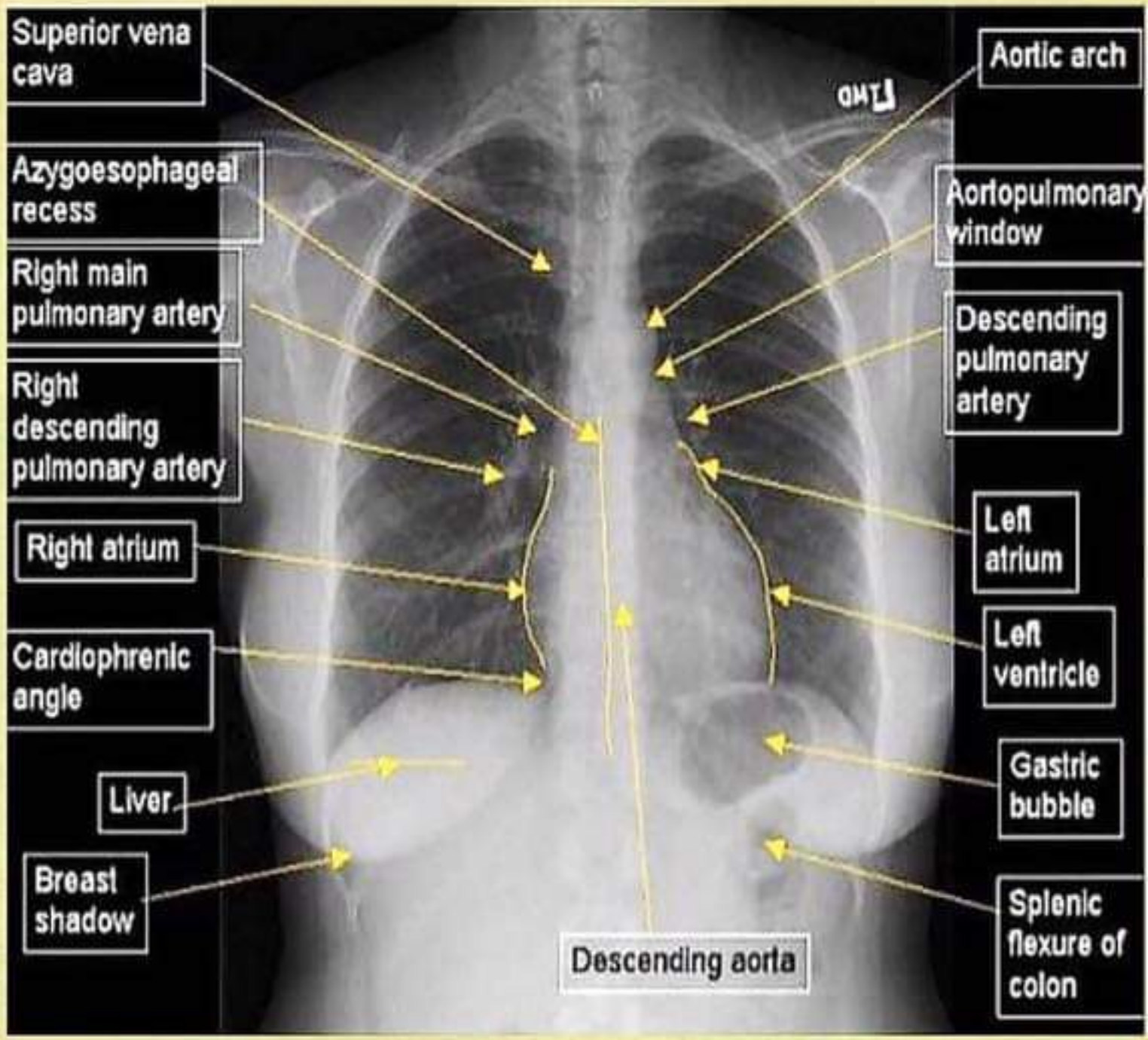
Chest X-ray - Systematic approach

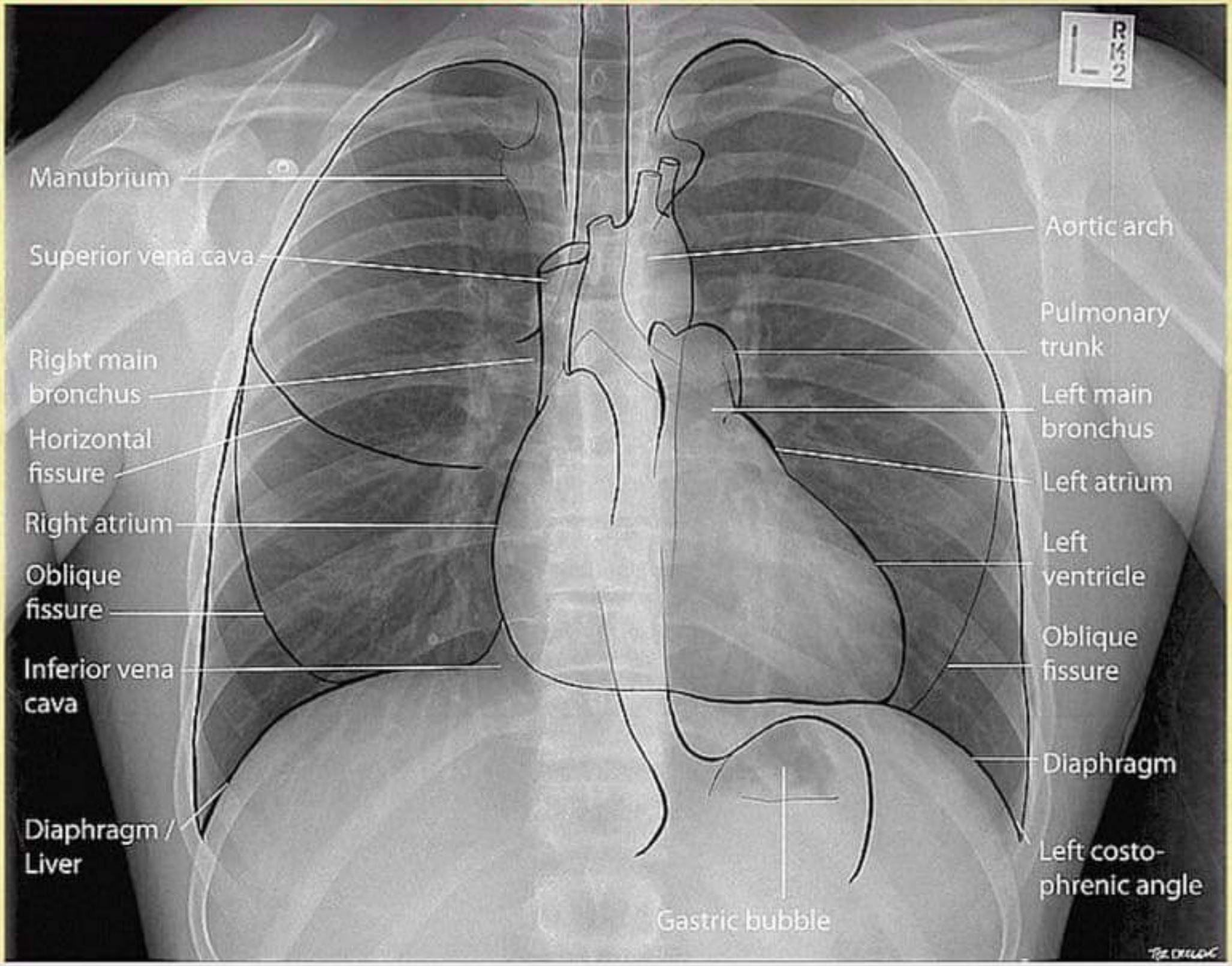
Anatomical structures to check:

1. Trachea and bronchi
2. Hilar structures
3. Lung zones
4. Pleura
5. Lung lobes and fissures
6. Costophrenic angles
7. Diaphragm
8. Heart
9. Mediastinum
10. Soft tissues
11. Bones
12. Below diaphragm and hidden areas



Systematic approach

Anatomical structures to check:

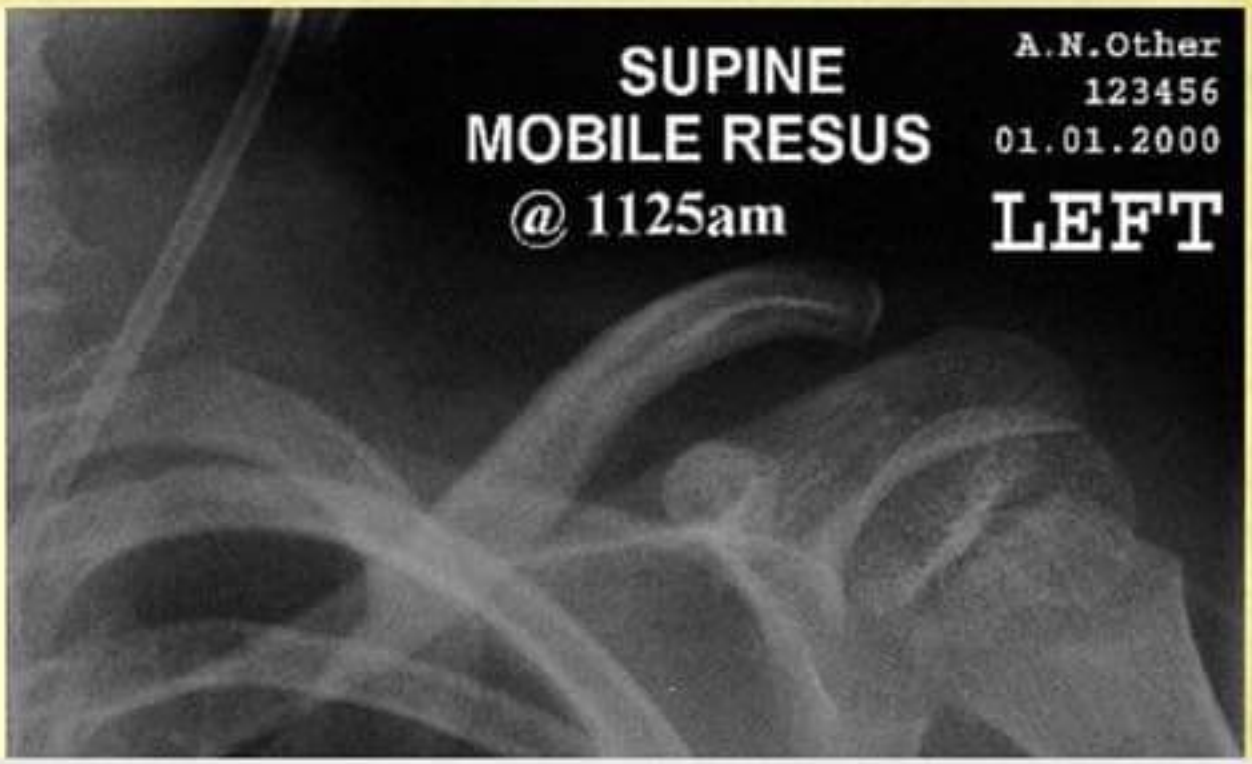


Systematic approach - Patient and image data

- **Check the patient's identity**
- **Note the image date and time**
- **Note the image projection:** Check if a **posterior anterior (PA)** or **anterior posterior (AP)** projection was used, and note if the patient was **standing**, **sitting** or **supine**? Was the **mobile X-ray** machine used?

The image annotations are often useful:

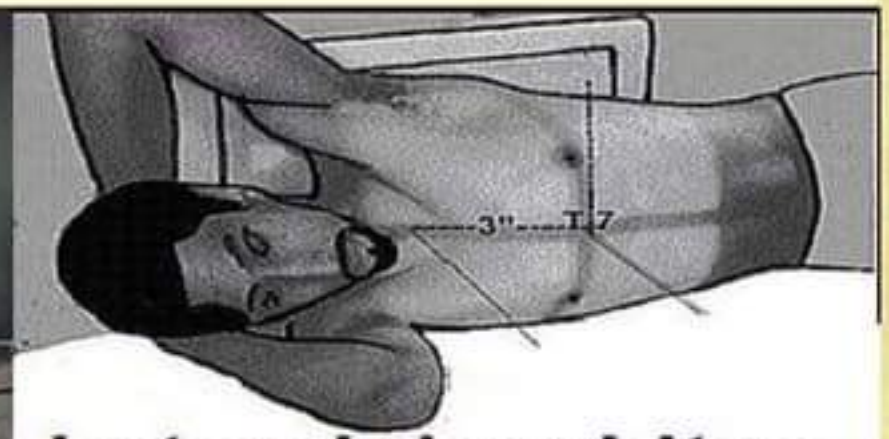
This is a **mobile** chest X-ray taken with the patient **supine**, at **11.25 am** in the **resuscitation** room. The patient's **name**, **ID number** and **date of birth** are annotated. Note the **side marker** is correct.

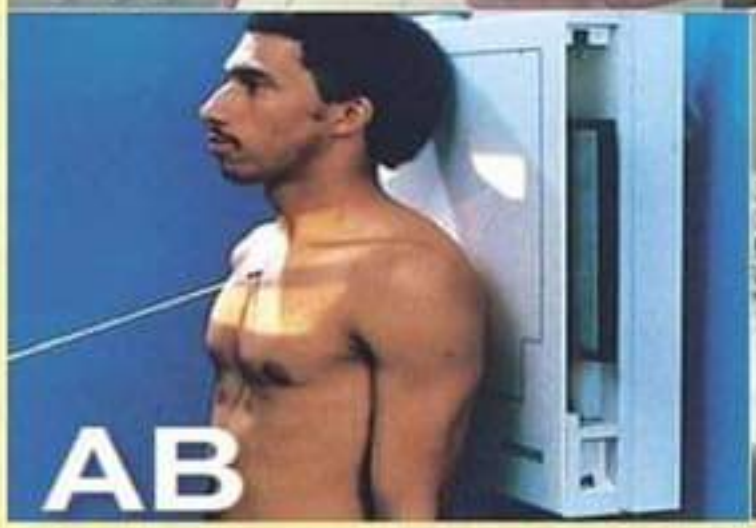


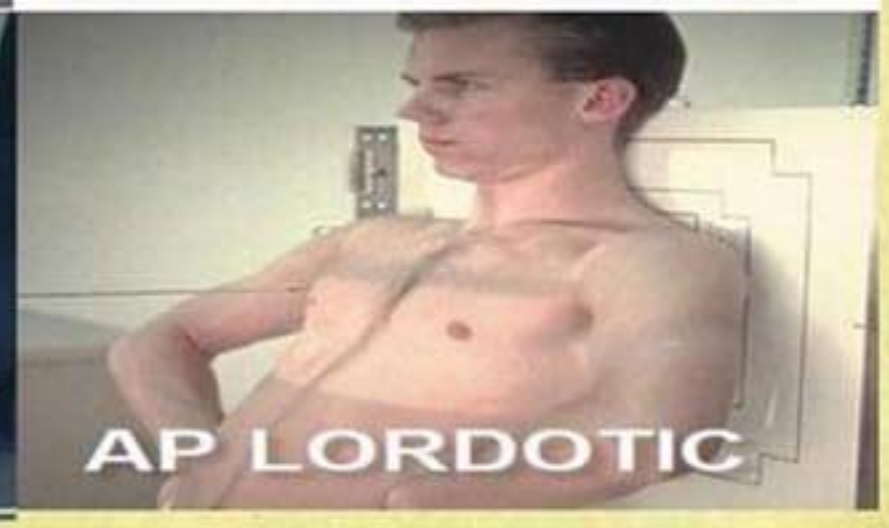
Systematic approach - projection

- **Chest x-ray :**

1. **P-A view**
2. **A-P view :** for Ambulatory limit
3. **Lateral (Lt/Rt) :** for Effusion or thickening
4. A-P supine
5. Lateral decubitus (Lt/Rt)
6. Lordotic : for Apical lesion
7. Oblique (Rt/Lt; post/anterior)

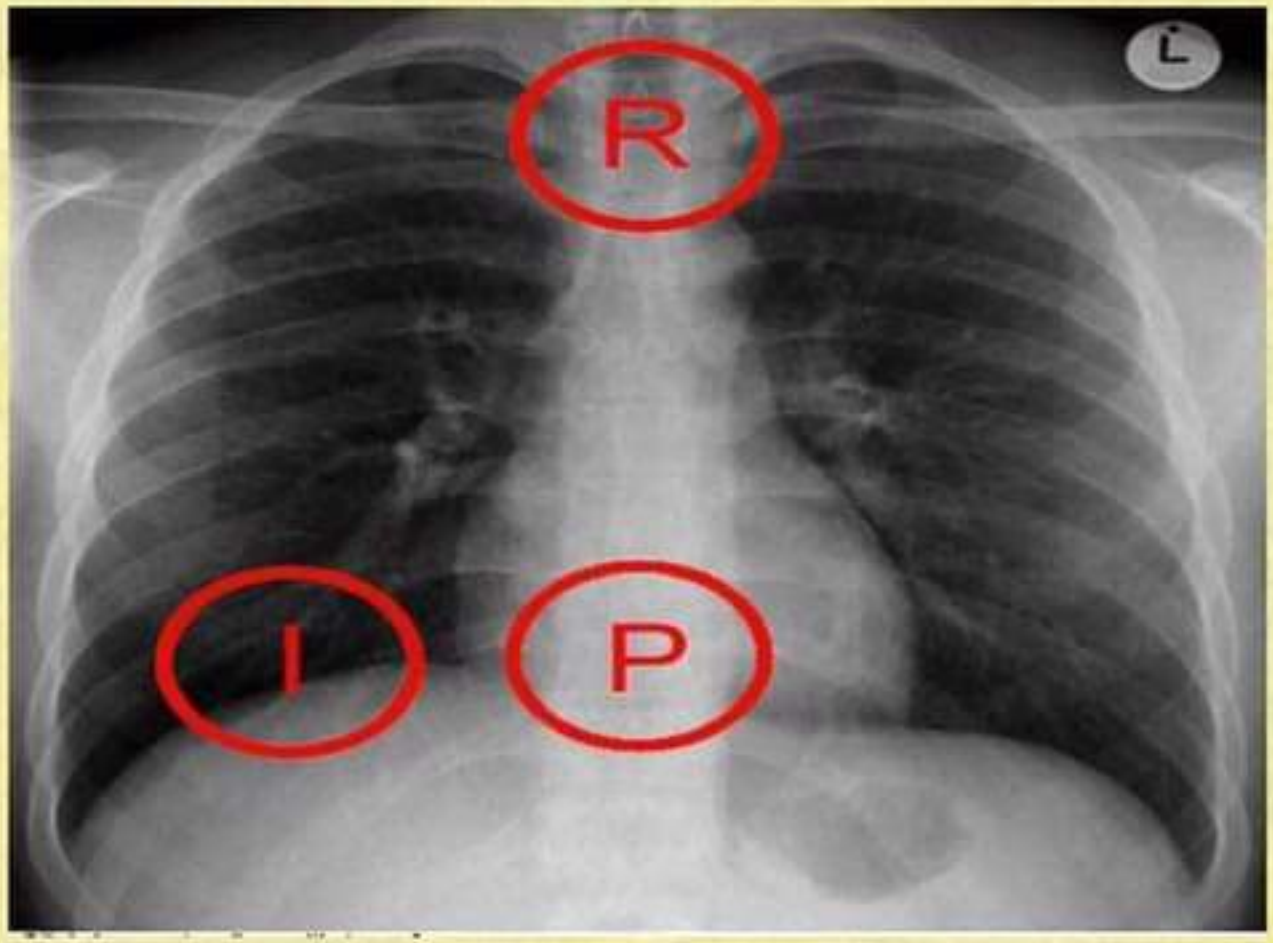






Systematic approach - Image quality

- **Assess the image quality:** The chest X-ray should be checked for **r**otation, **i**nspiration and **p**enetration (**Mnemonic-RIP-Rest In Peace**).



- **Comment on the presence of medical artifacts**
- **Can the clinical question still be answered?**

Systematic approach - The obvious abnormality

- It is often appropriate to start by describing **the most striking abnormality**. However, once you have done this, it is vital to **continue checking** the rest of the image. Remember that **the most obvious abnormality may not be the most clinically important**.

The elephant in the image!

If there is **an elephant** in the image, **don't ignore it**! **Describe** it in detail and then use your system to continue examining the image.

Systematic approach - Describing abnormalities

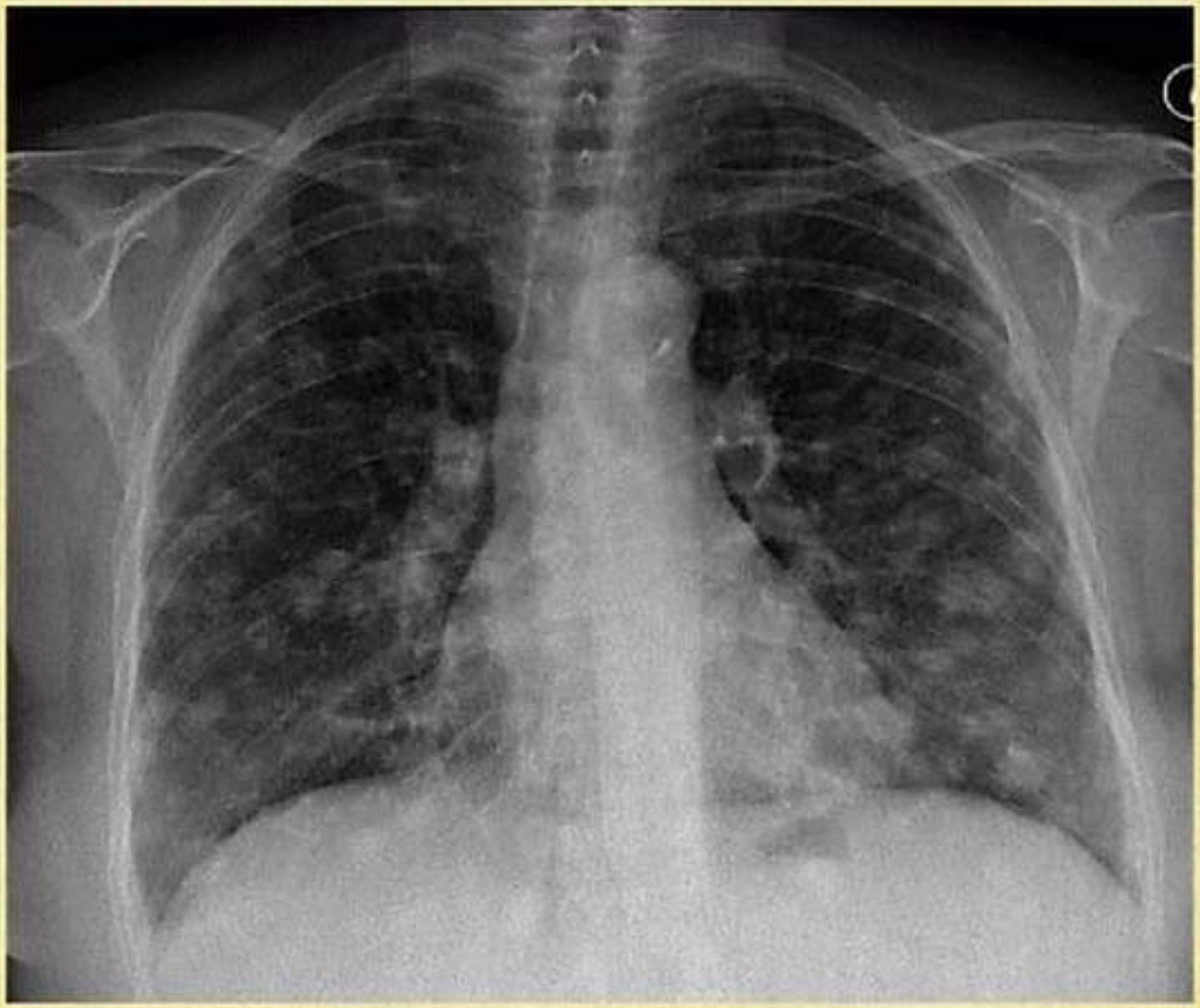
- 'Shadowing', 'Opacification', 'increased density', 'increased whiteness' are all **acceptable** terms
- **'Lesion descriptors'** may lead you towards a diagnosis
- Be **descriptive** rather than **jumping** to a diagnosis

'Lesion descriptors'

1. **Tissue involved** Lung, heart, aorta, bone etc.
2. **Size** Large/ Small/Varied
3. **Side** Right/ Left Unilateral/ Bilateral
4. **Number** Single/ Multiple
5. **Distribution** Focal/ Widespread
6. **Position** Anterior/ Posterior/Lung zone etc.
7. **Shape** Round/ Crescentic/etc.
8. **Edge** Smooth/ Irregular/Spiculated
9. **Pattern** Nodular/ Reticular(netlike)
10. **Density** Air/ Fat/Soft tissue/ Calcium/Metal

Systematic approach - Describing abnormalities

'Shadows, opacities, densities'



- ❑ **Tissue involved:** Lung
- ❑ **Size:** Small (>2 cm)
- ❑ **Side:** Bilateral
- ❑ **Number:** Multiple
- ❑ **Distribution:** Widespread
- ❑ **Position:** Mainly middle to lower zones
- ❑ **Shape:** Round
- ❑ **Edge:** Irregular
- ❑ **Pattern:** Nodular
- ❑ **Density:** Soft tissue

➢ Diagnosis:

- ❑ Description helps with diagnosis. Once you have put all the above terms together, there can only be **one diagnosis**.

❑ Metastatic disease

Systematic approach - Locating abnormalities

- Consider its **anterior-posterior** position.
- A **lateral view** may help, but 3D location may also be possible on a posterior-anterior (PA) view if you have a knowledge of chest X-ray **anatomy** and an understanding of the **'silhouette' sign.**

The 'silhouette' sign:

- The silhouette sign is **a misnomer** !
- It should be called the **'loss of silhouette' sign**.
- Normal adjacent anatomical structures of differing densities form a **crisp 'silhouette**,' or **contour**.
- Loss of a **specific contour** can help determine the position of a disease process.

Systematic approach - Locating abnormalities

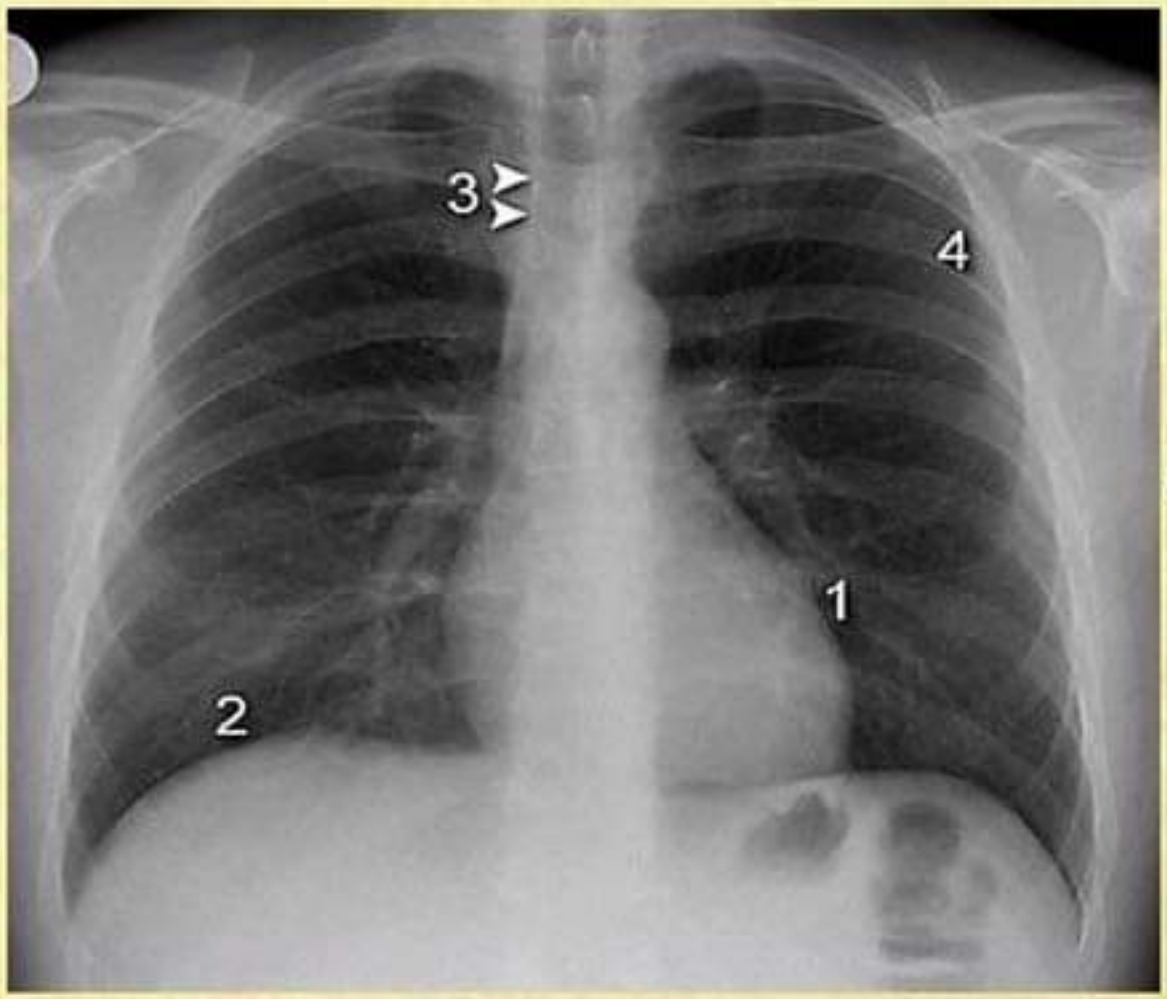
The 'silhouette' sign: Loss of contour of :

1 - **Left heart border** → **Lingula** disease

2 - **Hemidiaphragm** → **Lower lobe** lung disease

3 - **Paratracheal stripe** → **Paratracheal** disease

4 - **Chest wall** → **Lung**, **pleural** or rib disease



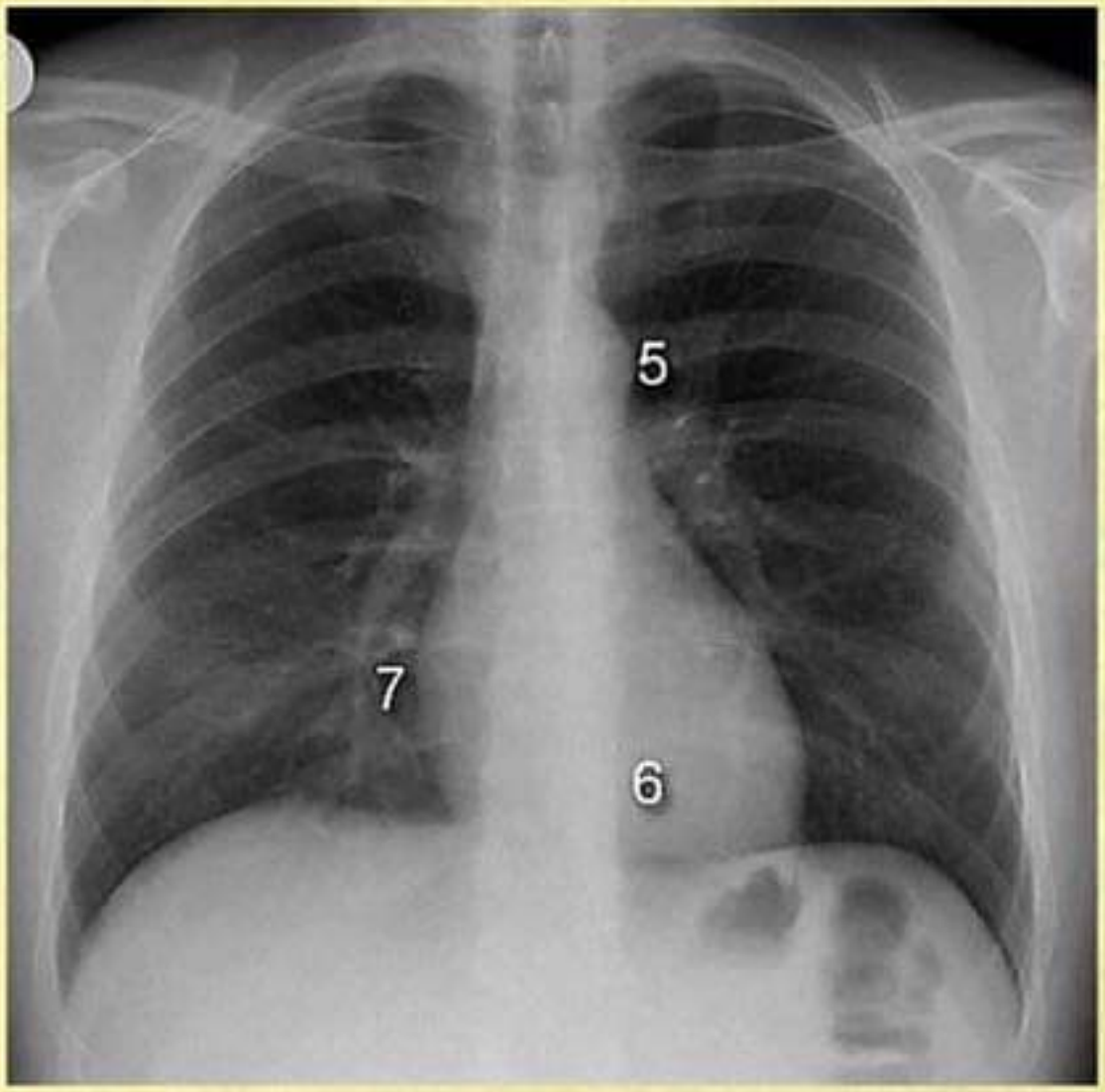
Systematic approach - Locating abnormalities

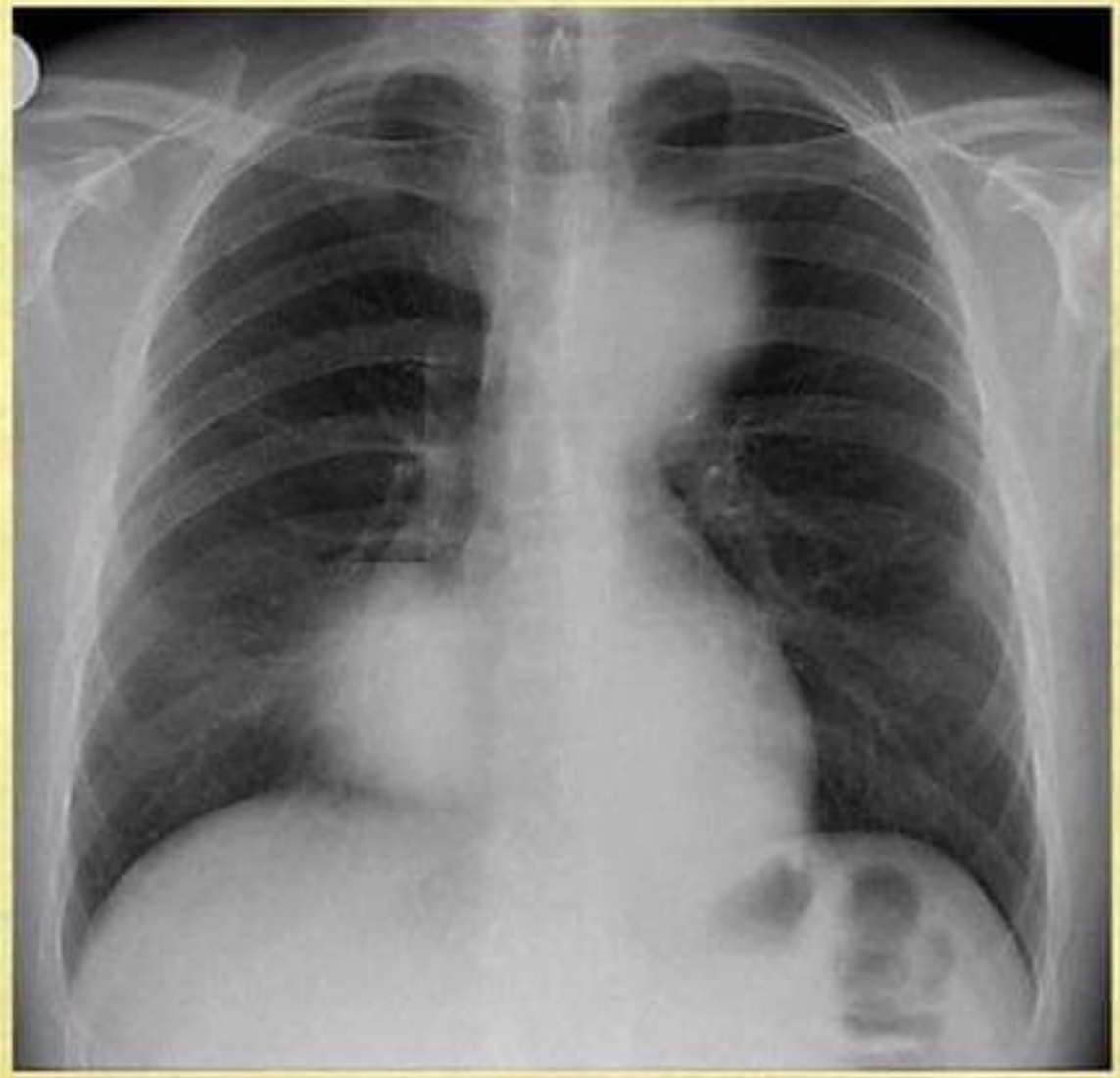
The 'silhouette' sign: Loss of contour of :

5 - **Aortic knuckle** ➡ **Anterior mediastinal** or **left upper lobe** disease

6 - **Paraspinal line** ➡ **Posterior thorax** disease

7 - **Right heart border** ➡ **Middle lobe** disease



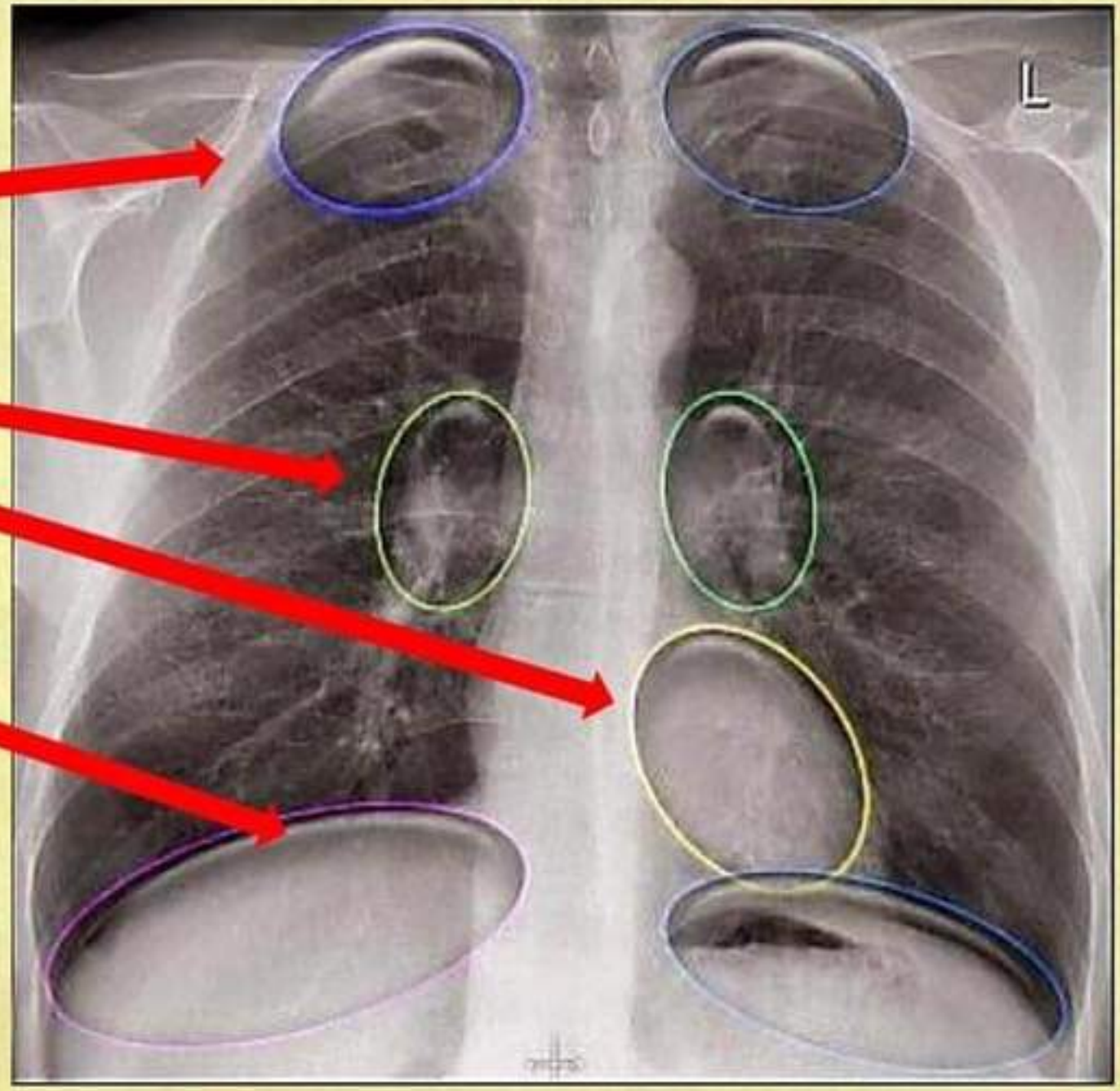


Systematic approach - Review areas

- After a systematic look at **the whole chest X-ray**, it is worth re-checking **hidden areas** that may conceal important pathology.

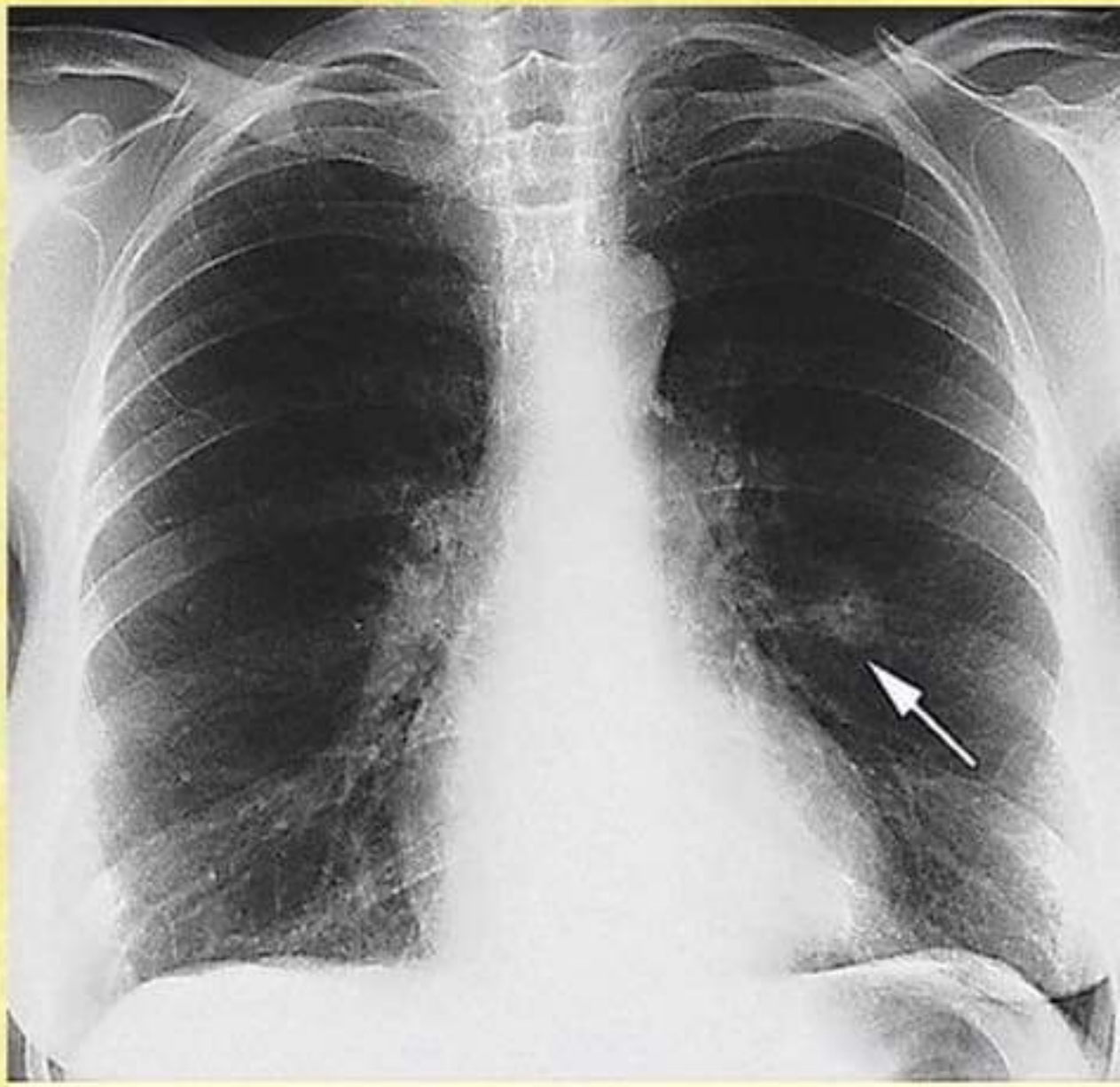
Hidden areas:

- **Apical zones**
- **Hilar zones**
- **Retrocardial zone**
- **Zone below the dome of diaphragm**



Systematic approach - Interpretation

- ❑ Whatever the findings are, they should only be interpreted in view of **the clinical setting**.
- ❑ Remember to **treat the patient - not the X-ray!**
- ❑ Occasionally there will be an unexpected finding **(Incidental Finding)**, which may need to be considered with caution, especially if **equivocal** or if it does **not fit the clinical scenario**.



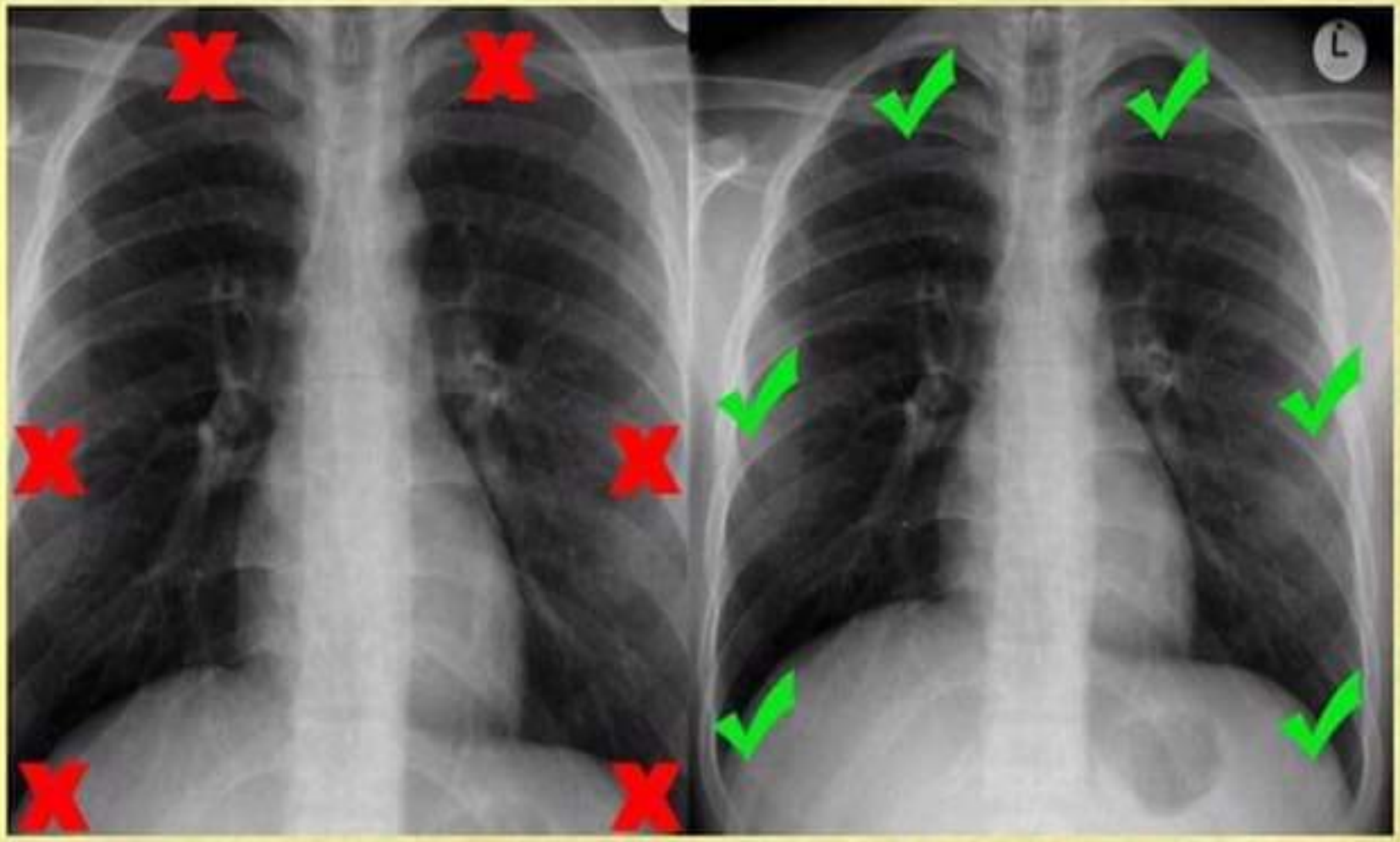
Posteroanterior (PA) chest radiograph shows an **incidental finding** of a **solitary pulmonary nodule** adjacent to the left hilum.

Chest X-ray quality - Inclusion

- ❑ Check the image for: **Inclusion**, **Projection**, **Rotation**, **Inspiration**, **Penetration** and **Artifact**.
- ❑ Check to see if **a poor quality** X-ray demonstrates **a life threatening** abnormality before **dismissing it**.
- ❑ Check to see if **the clinical question** still be answered?

Inclusion:

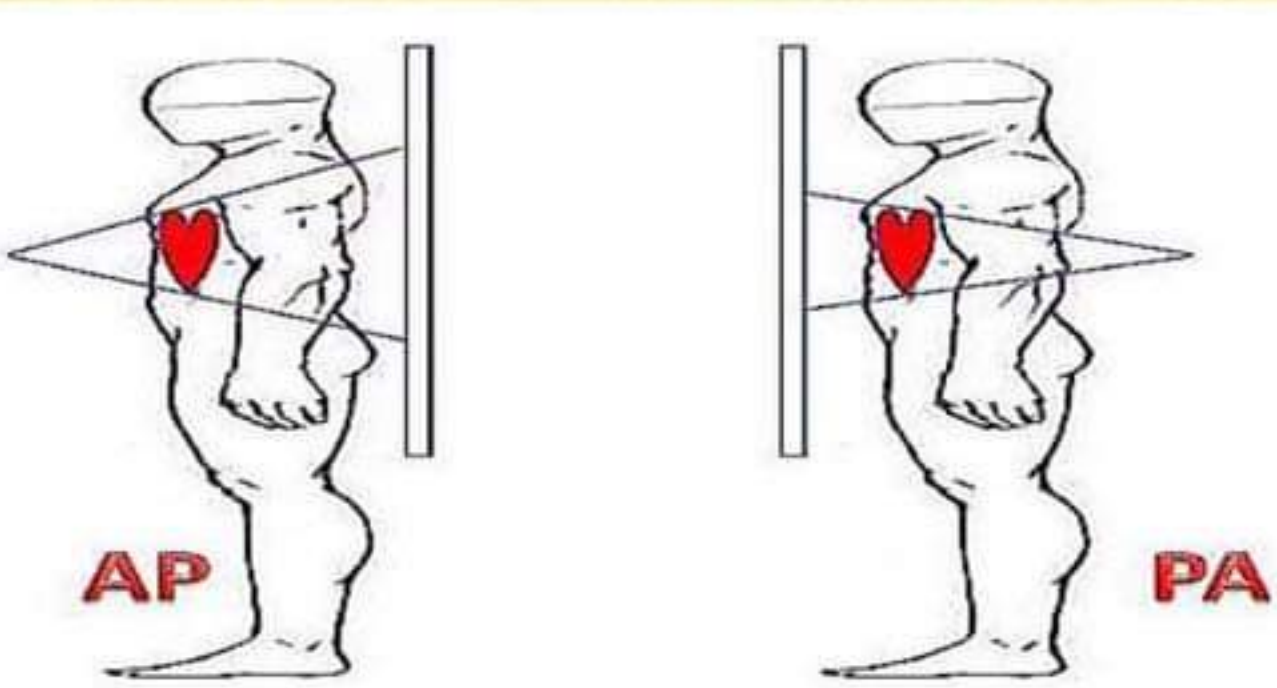
A chest X-ray should include **the entire thoracic cage** (**first ribs, Costophrenic angles, Lateral edges of ribs**).

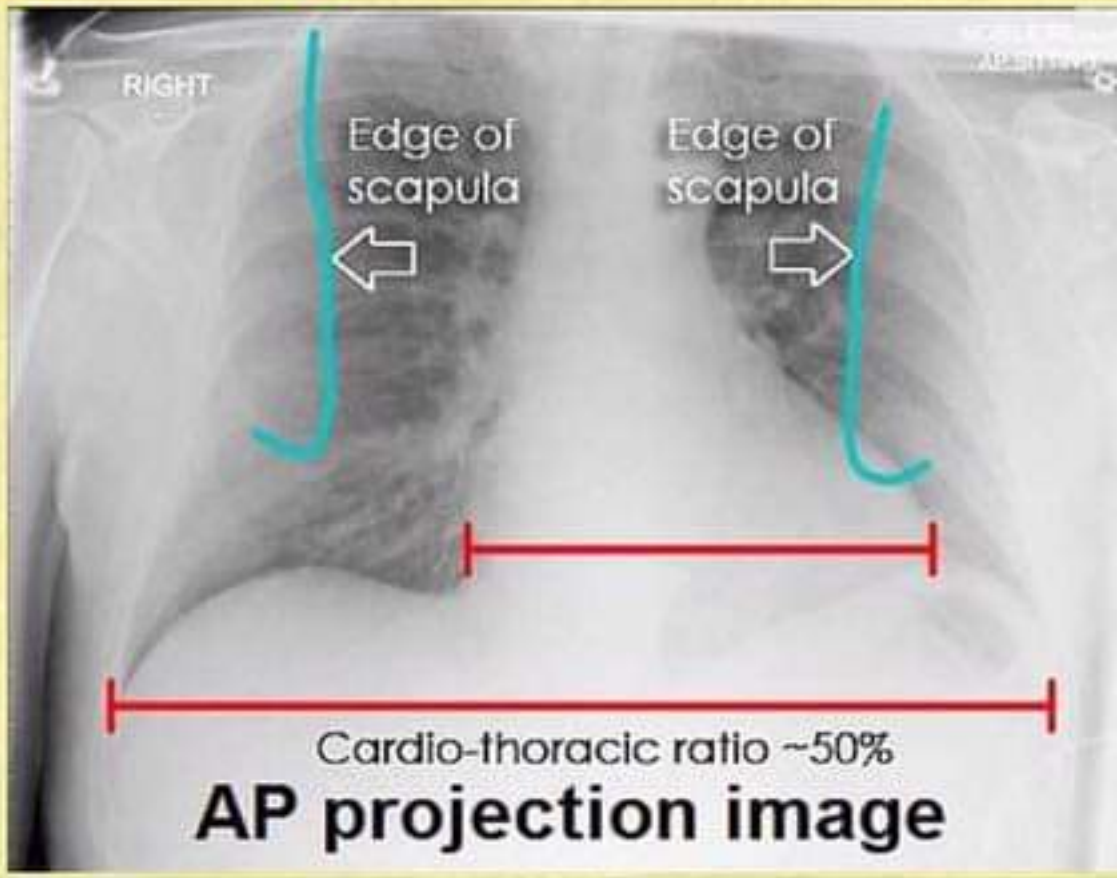


Chest X-ray quality - Projection

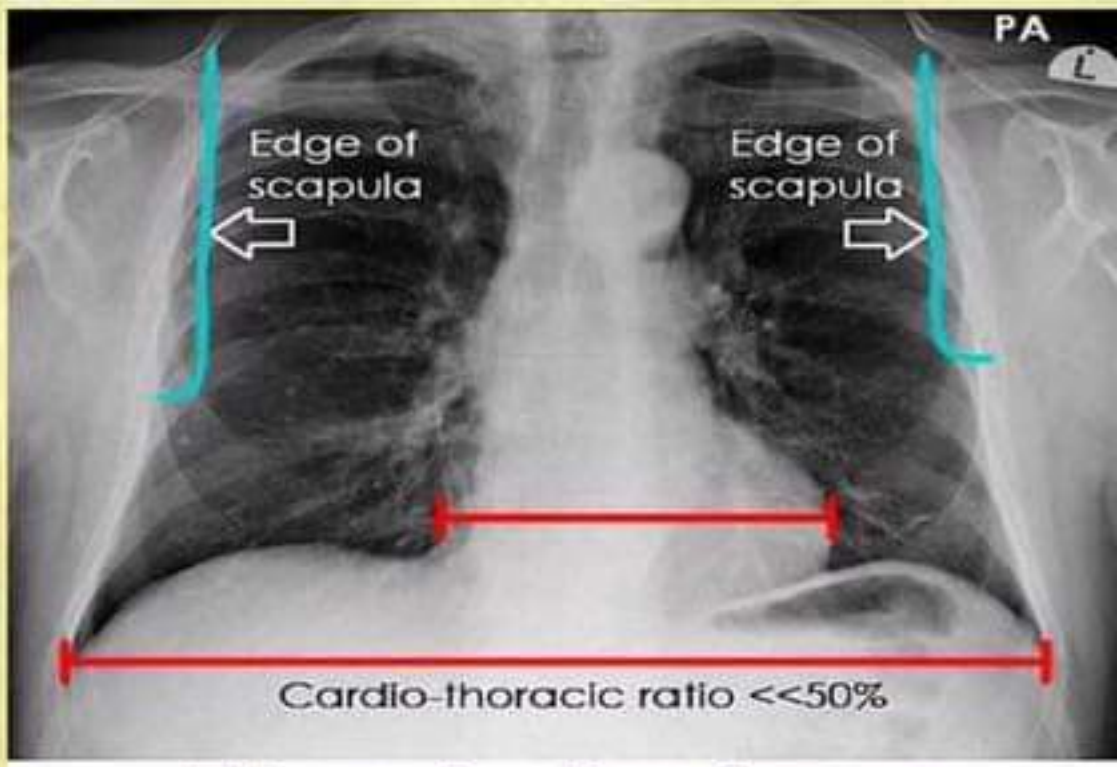
AP projection :

- AP projection image is of **lower quality** than PA image.
- **The scapulae** are **not retracted** laterally and they remain projected over each lung.
- **Heart size** is **exaggerated**





AP projection image

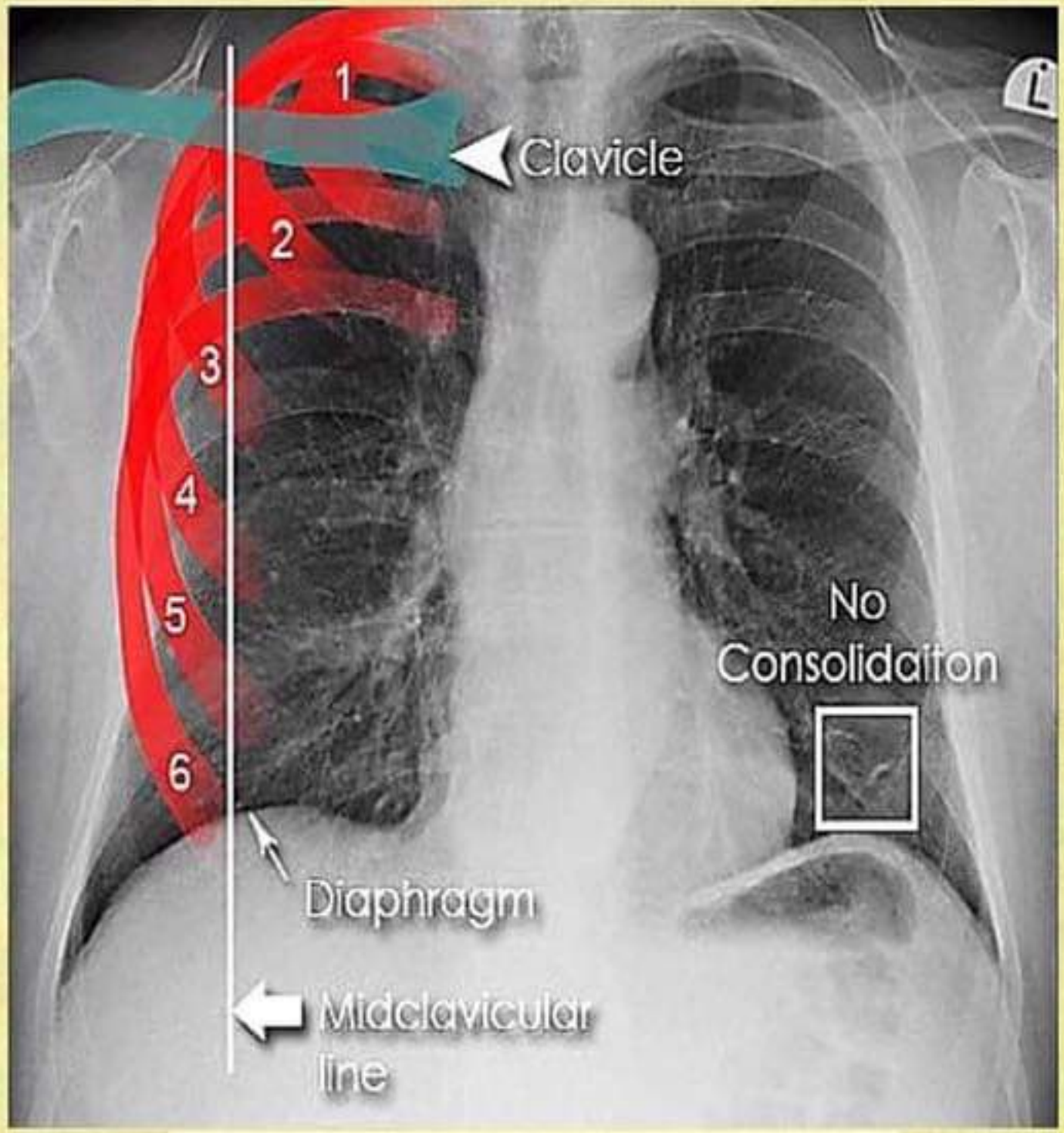


PA projection image

Chest X-ray quality - Inspiration & lung volume

Assessing inspiration:

- ❑ Count ribs down to the diaphragm.
- ❑ The diaphragm should be **intersected by**:
  - ➢ the **5th to 7th** (**right 6th anterior rib**) **anterior ribs** in the **mid-clavicular** line or
  - ➢ The **8th–10th** (**9th**) **posterior ribs** .

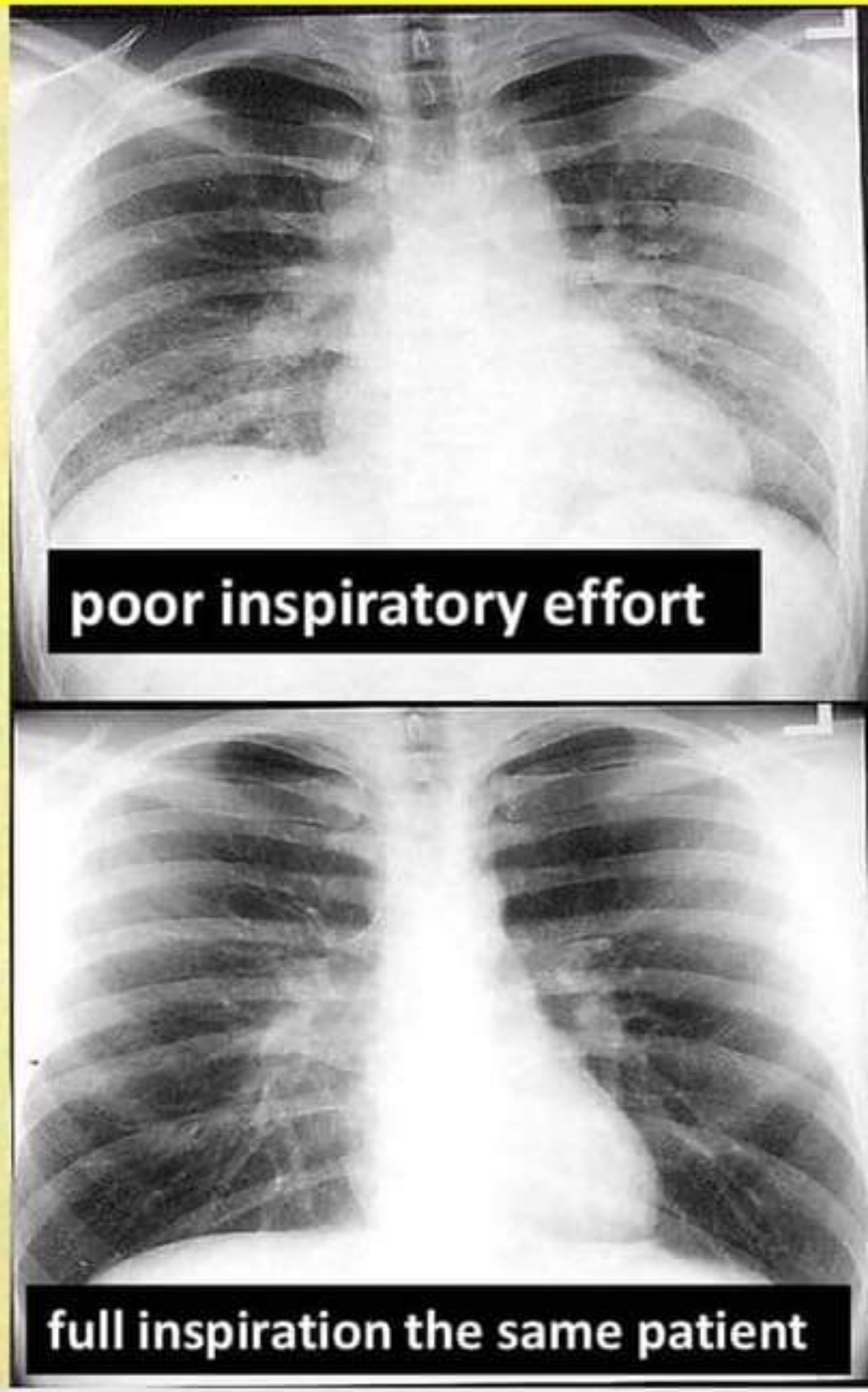


CXR in full inspiration

Chest X-ray quality - Inspiration & lung volume

If the image is acquired in **the expiratory phase** or with a **poor inspiratory effort**:

1. **The lungs** are relatively **airless** and their **density is increased**.
2. **Increase** in **lower zone opacity**
3. **The hila** are compressed and appear **more bulky**
4. **Exaggeration** of **heart size**
5. **Obscuration** of **the lung bases**.



poor inspiratory effort

full inspiration the same patient