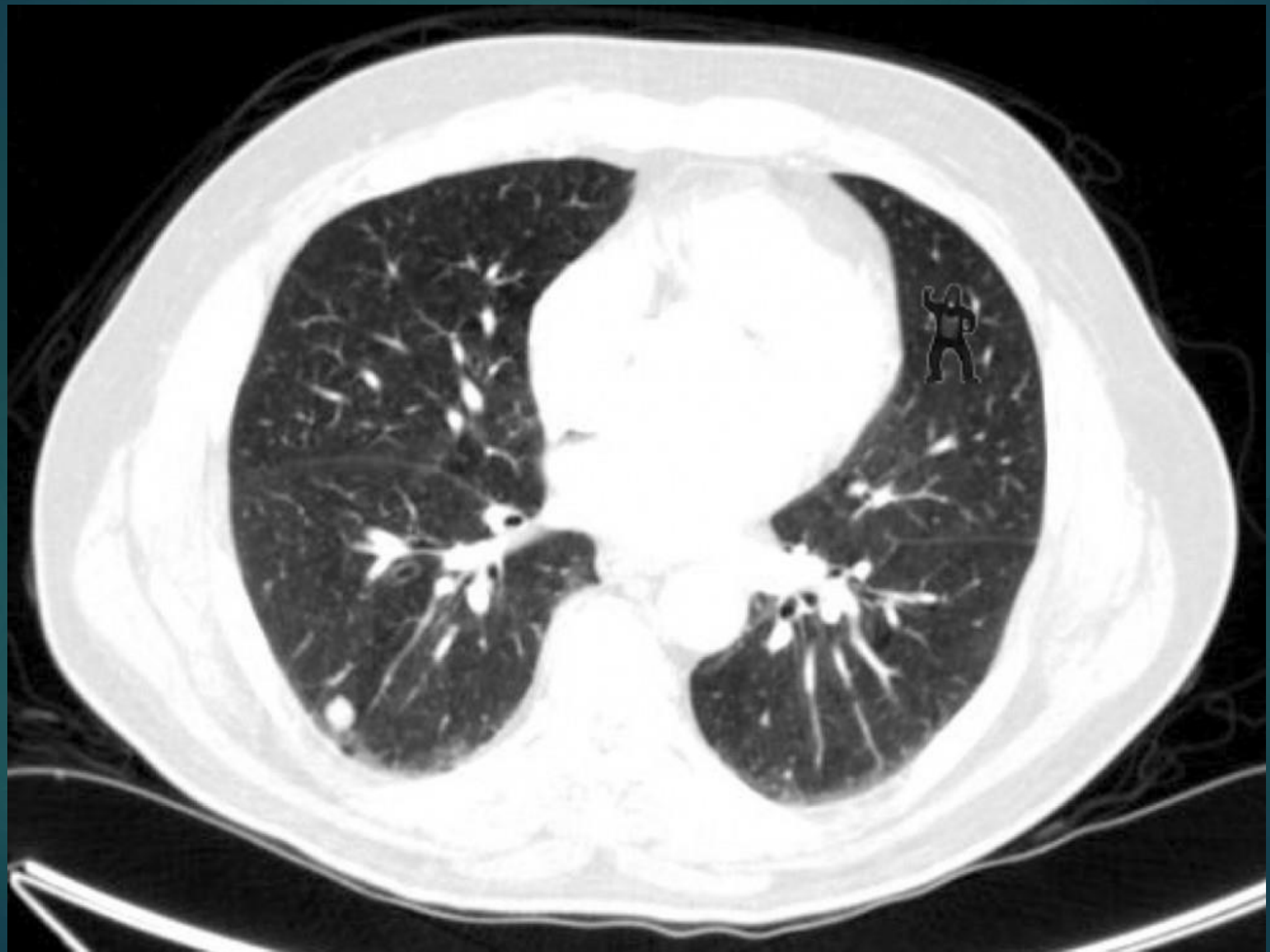
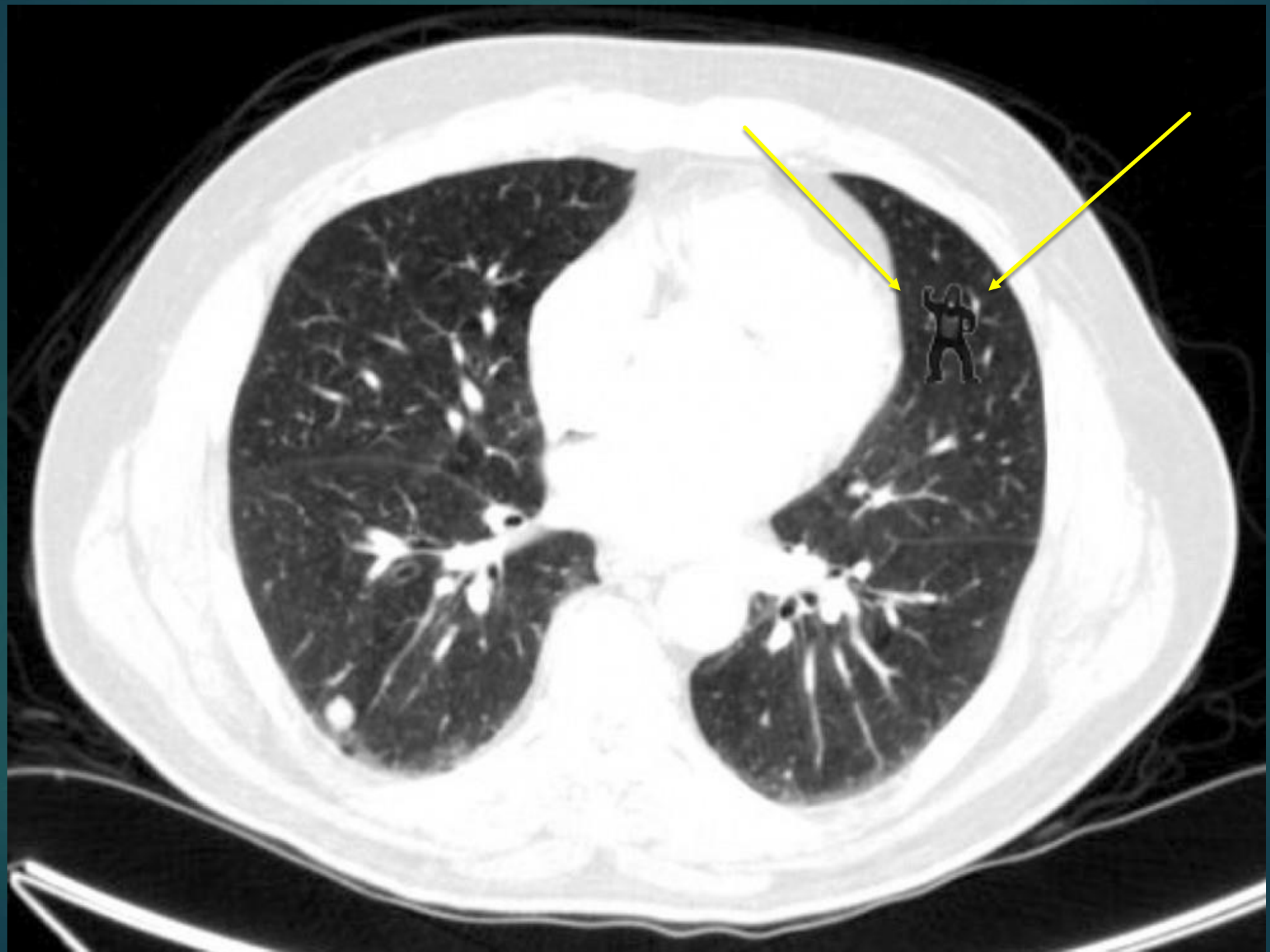
Shades of Gray

X-RAY Interpretation

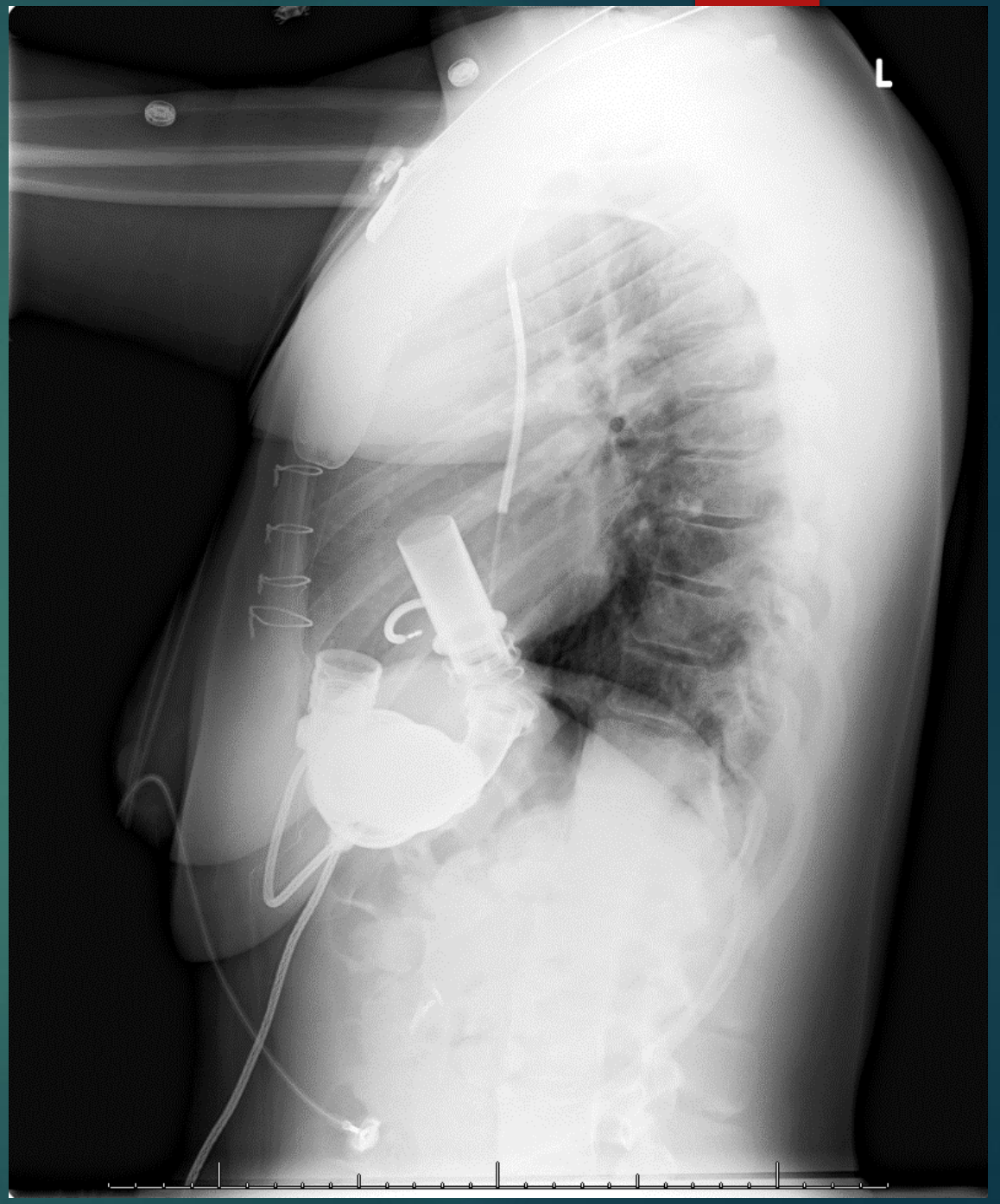
JAMES C. ZEDAKER, MPAS, PA-C, EM-CAQ





Radiographic Densities

Air	Black
Fat	Black
Bone	White
Metal	White
Calcium	White
Muscle, Organs, Soft Tissue	Shades of Gray



What Makes an Adequate Chest X-Ray?

Penetration: spine visible through heart

Inspiration: a least 8 posterior ribs visible

Rotation: Spinous process' equally between clavicle

Magnification: AP will magnify heart slightly

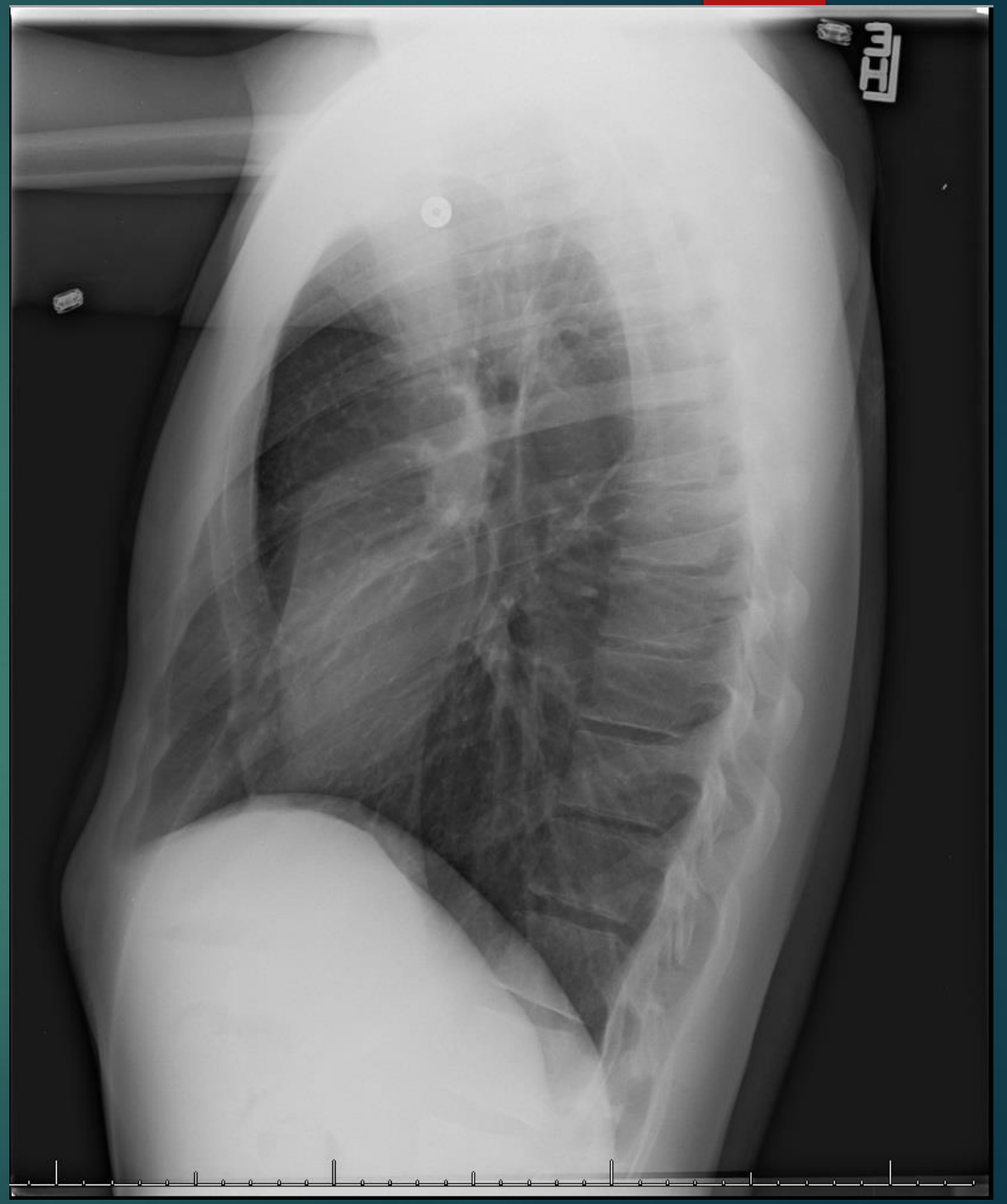
Angulation: clavicle has "S" shape and superimposes 3rd or 4th ribs.

Normal Chest X-Ray

- Trachea
- Head of the Clavicle
- Coracoid Process – Scapula
- Medial Scapular Border
- Breast Shadows
- Right Hilum
- Right Pulmonary Artery
- Left Hilum
- Left Pulmonary Artery
- Right Atrium
- Left Ventricle
- Ascending Aorta / Superior Vena Cava
- Aortic Knob
- Cardiophrenic Angle
- Hemidiaphragm
- Costophrenic Angle

Normal Chest X-Ray

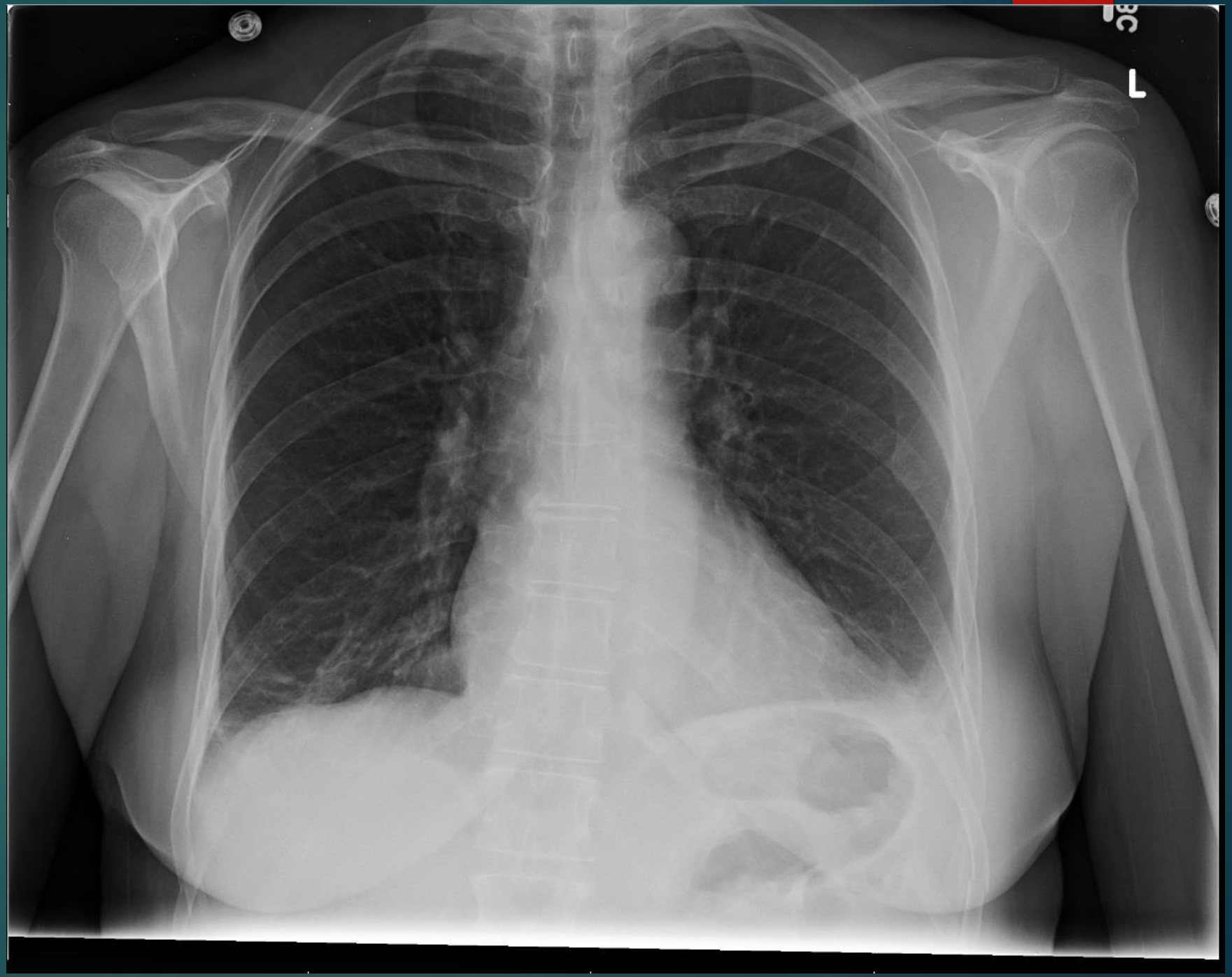
- Clear Space Behind the Sternum
- No obvious shadow with hila
- Equal height of vertebral bodies with parallel end plates
- Sharp costophrenic angles
- Left hemidiaphragm usually obscured



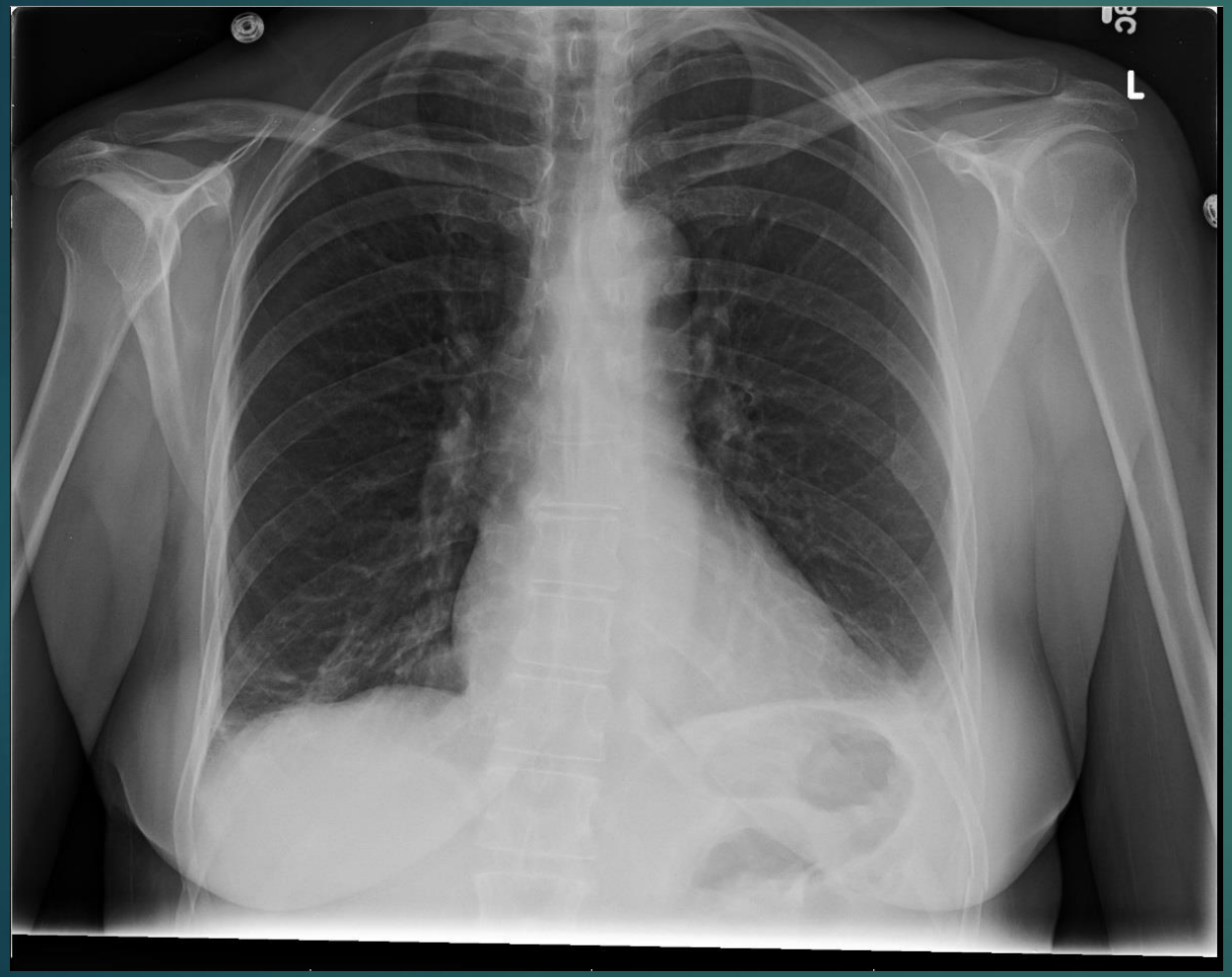
Rib Fractures

- Underlying injury is usually more important than the rib fracture.
- 3 or more rib fractures – Increased risk of visceral injury
- Ribs 4-9 – Fractures Common
  - Displaced – Pneumothorax
  - 2 in each of 3 contiguous ribs = Flail Chest
- Ribs 10-12 – Evaluate for liver or spleen injury
- Not all rib fractures are detectable by plain film x-ray

Rib Fracture

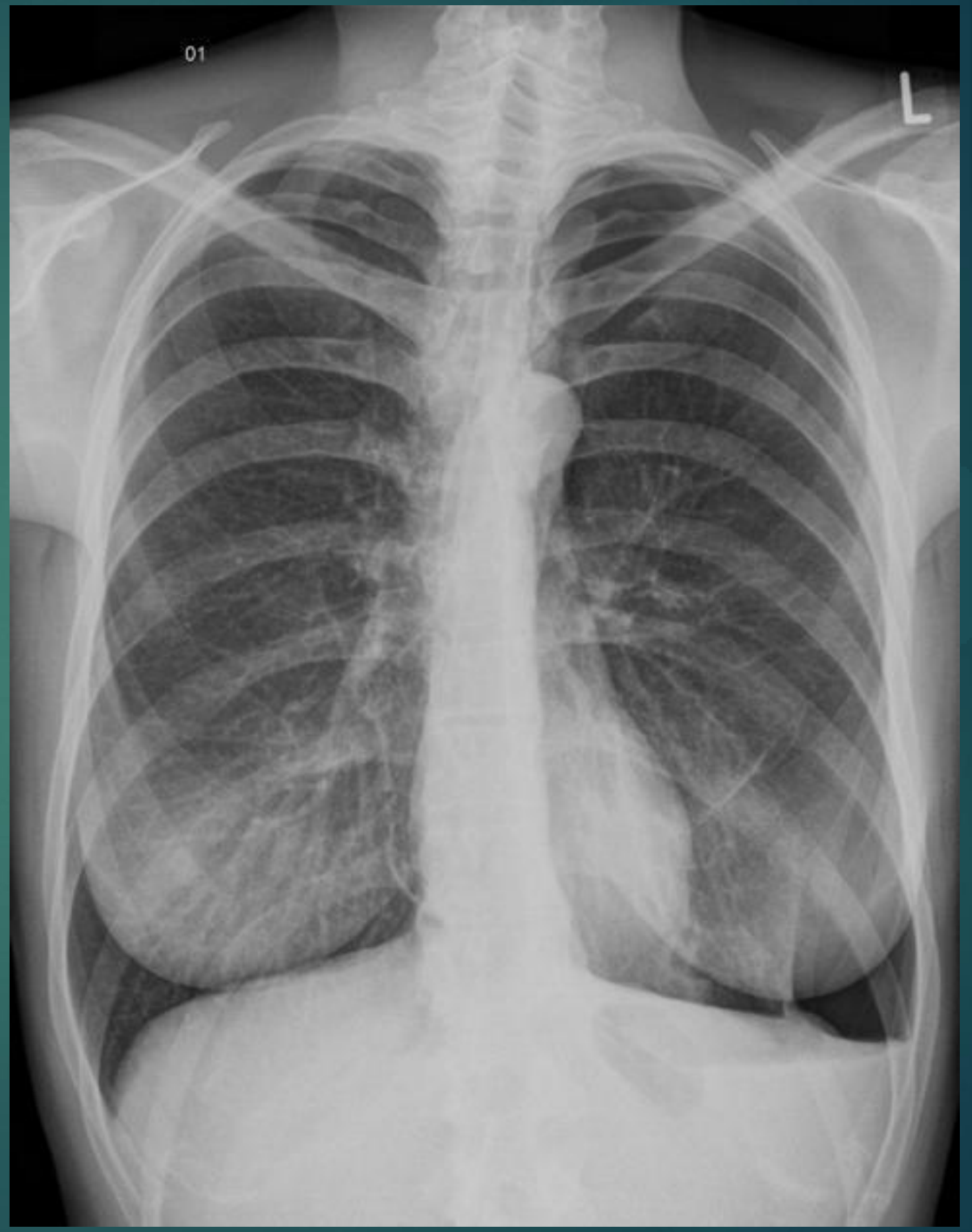


Rib Fracture



Pneumothorax

- Air in the plural space.
- Must be able to identify the visceral pleural line.
- Usually an absence of lung markings.
- Air-Fluid line in plural space is evidence of hydro-pneumothorax or



Dr Roberto Schubert, radiopaedia.org

Things That Can Be Mistaken for Pneumothorax

- Bullous Disease of the Lung
- Large Cysts
- Pulmonary Embolism.
- Skin folds.
- Scapula

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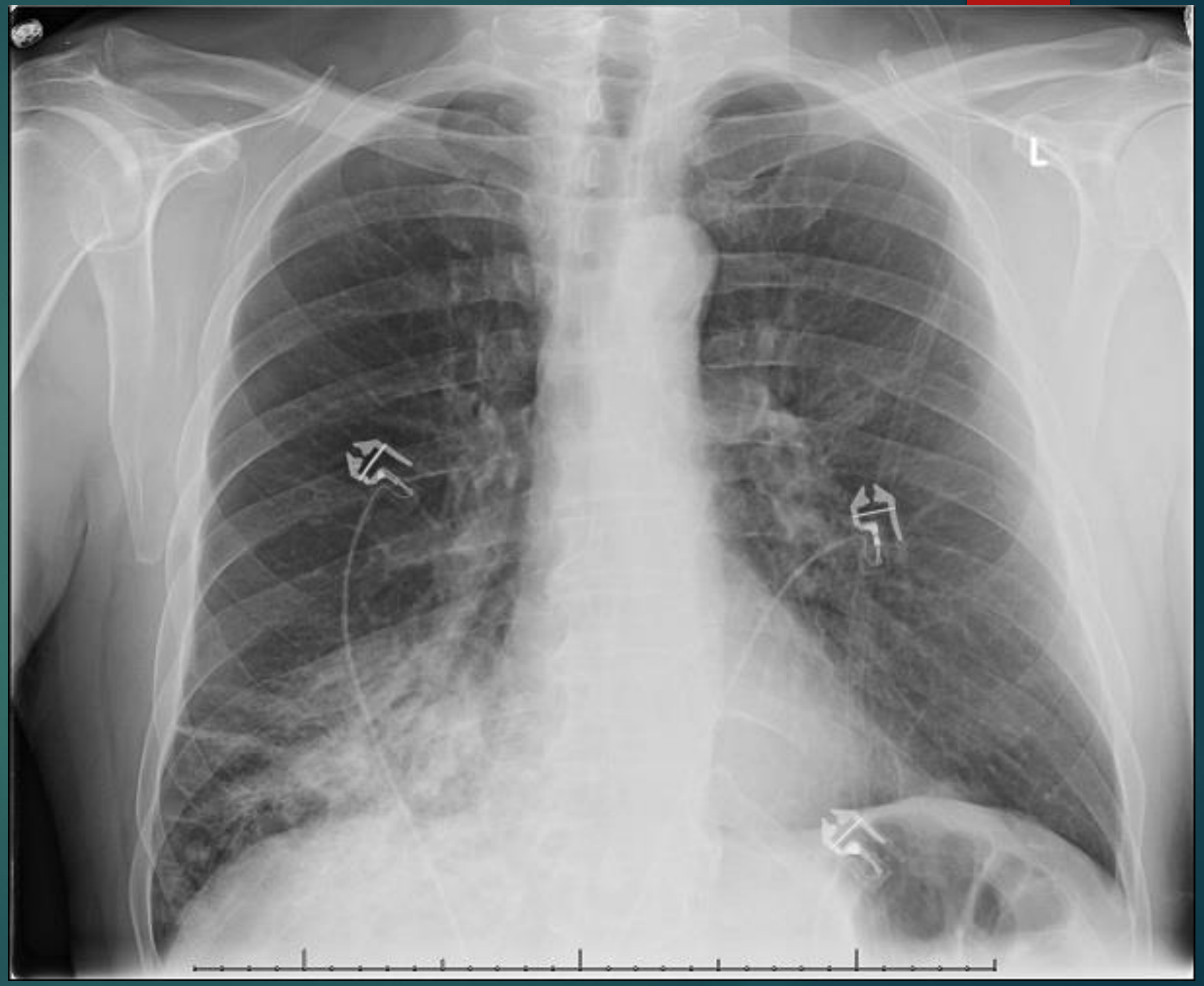
Pneumonia

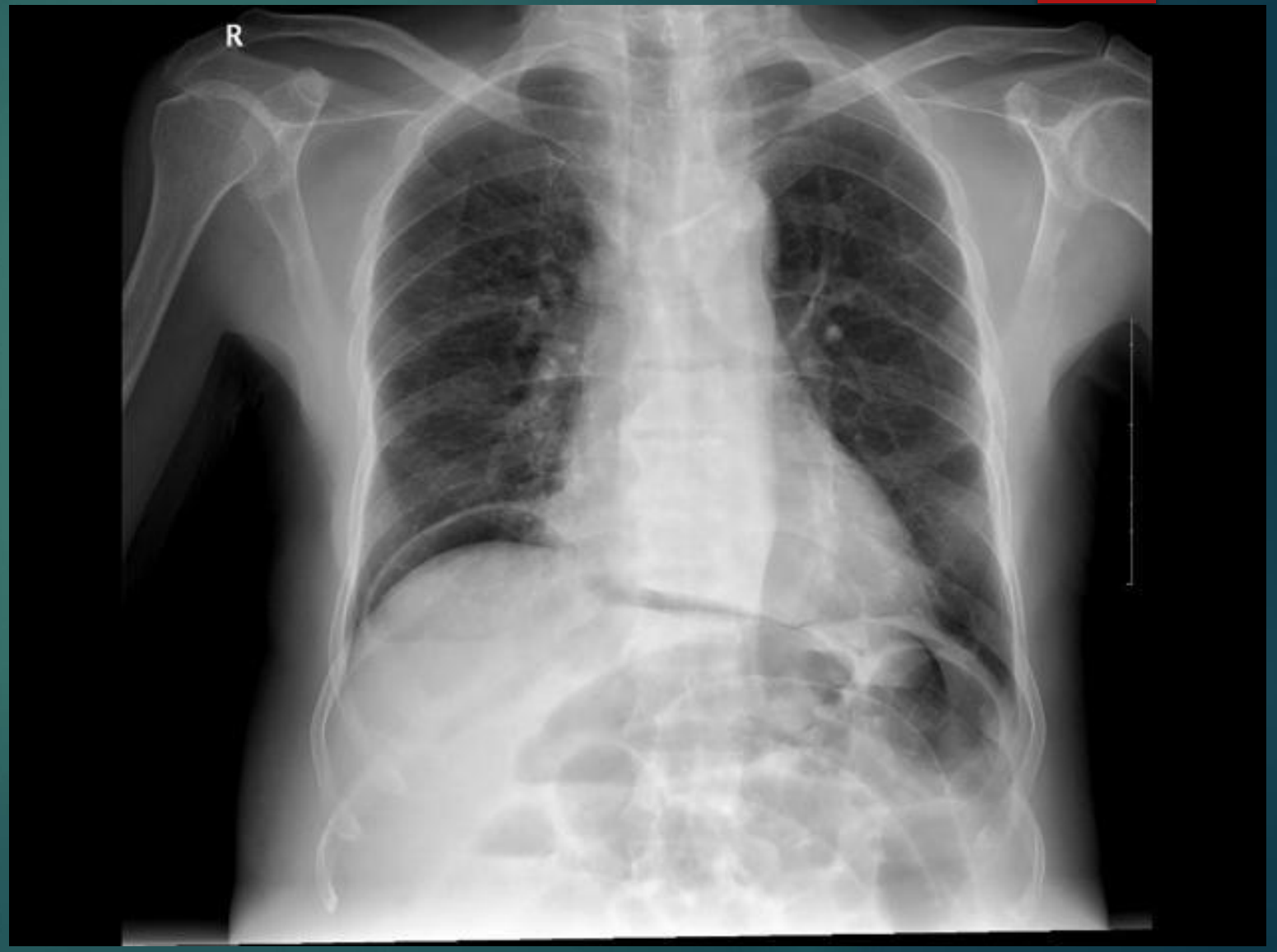
- Denser/Whiter than surrounding (aerated) Lung
- Air Bronchograms
- Fluffy with distinct margins



Pneumoperitoneum

Subdiaphragmatic Air

- Air rises to highest part of abdomen
- The “crescent” is indicative of the amount of free air.
- Best seen on under right hemidiaphragm



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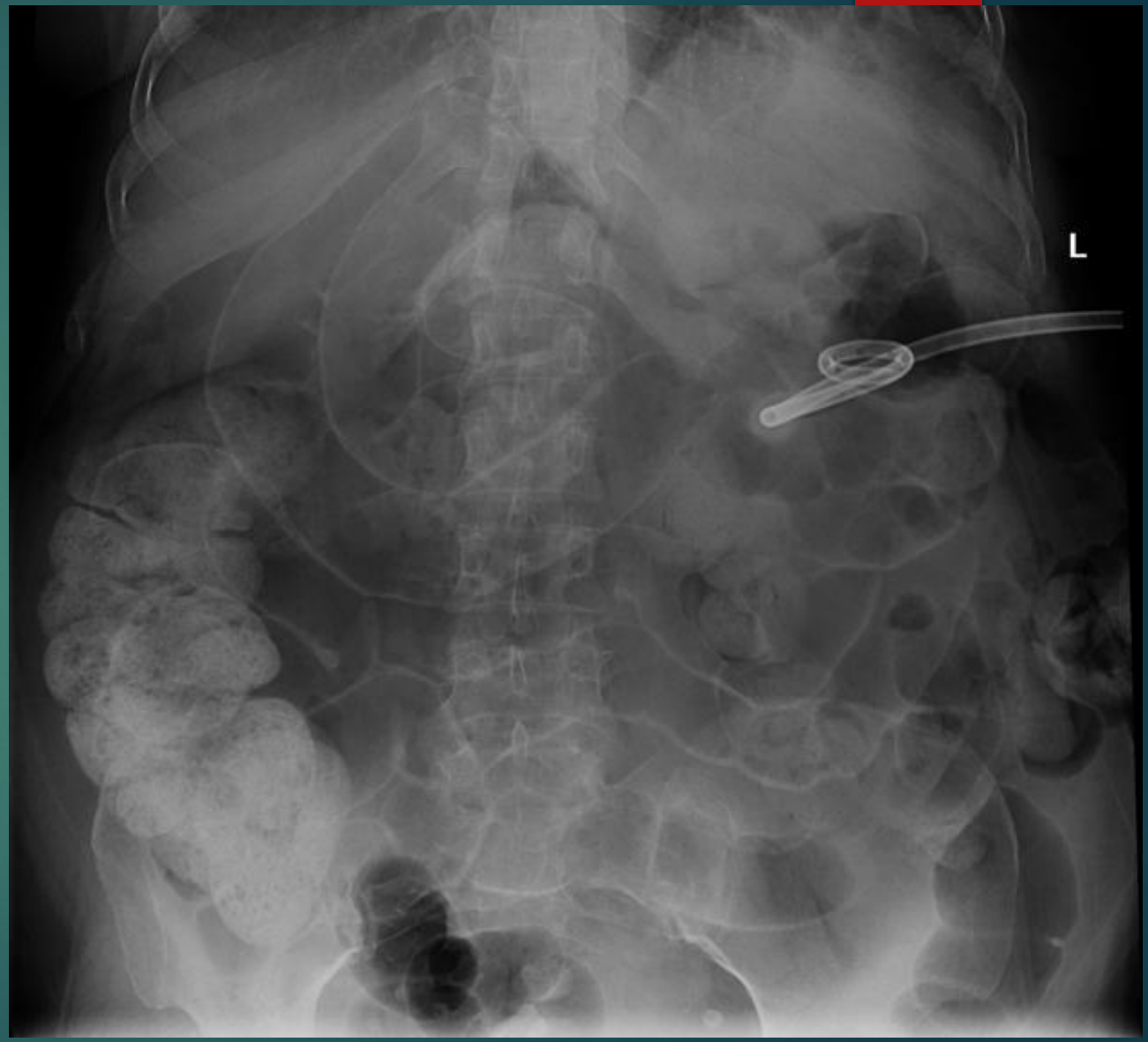
Pneumoperitoneum

Rigler's Sign

Air fills the peritoneal cavity with both sides of the bowel wall is lined with air.



Dr Hani Alsalam, Radiopaedia.org

Pneumoperitoneum

Falciform Ligament Sign

Free air surrounds
Falciform ligament

Dr MT Niknejad, Radiopaedia.org

Calcaneus Fracture

Boehler's Angle <20%

Associated Fractures

- Interarticular – subtalar joint (75%)
- Thoracolumbar Burst Fractures (Don Juan)
- Pilon Fractures

Calcaneus Fracture

Boehler's Angle <20%

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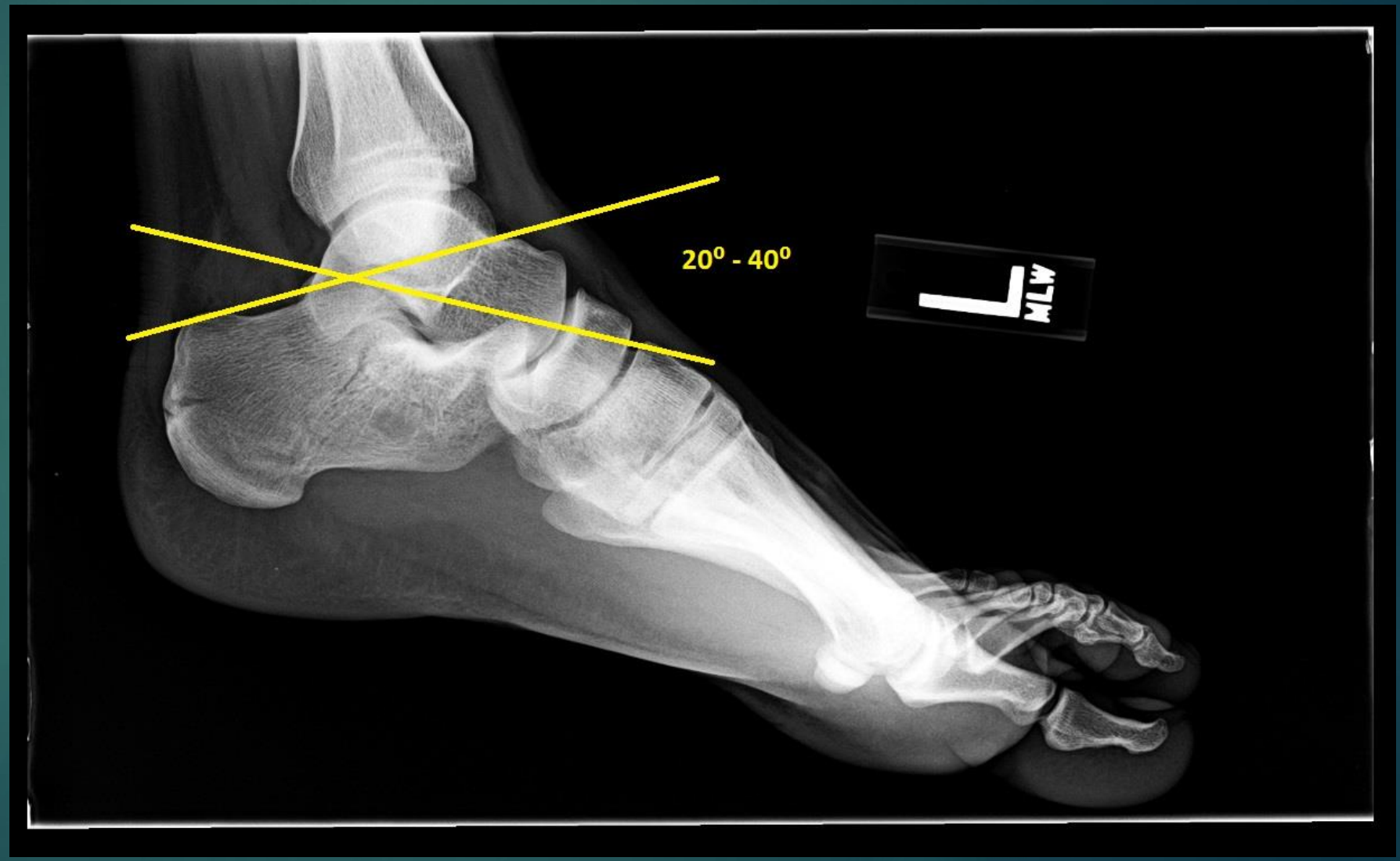
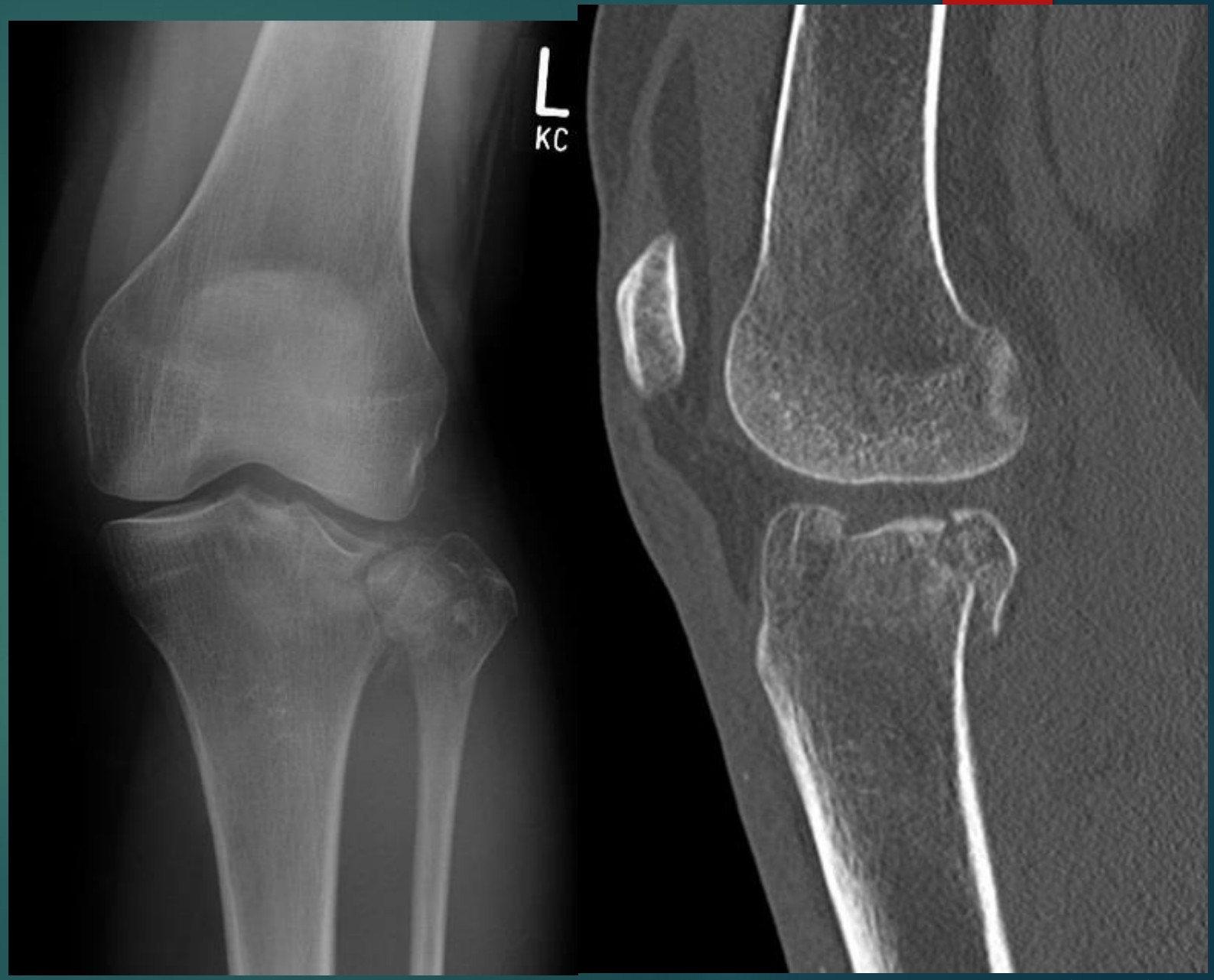


Thoracolumbar Compression Fracture

- 90% occur between T-11 and L-4
- Paraspinal Hematoma
- Wedge shaped deformity

Tibial Plateau Fracture

- Less than 1% of all fractures
- Occurs in proximal tibia.
- Affects joint stability and motion
- Effusion
- Difficulty with bearing weight
- Neurovascular exam is imperative
- High risk for compartment syndrome



Gerry Gardner, Radiopaedia.org

Patella Fracture

Hohl and Larson Classification

- Vertical Fracture
- Transverse Fracture (most common)
- Comminuted
- Avulsed

Differentiate fracture and bipartite or multipartite patella.

Segond Fracture

- Avulsion Fracture.
- Involves superolateral aspect of tibia
- Associated with tears of the LCL, ACL and menisci.

Dr Maulik S Patel, Radiopaedia.org

Maisonneuve Fracture

- Spiral proximal fibular fracture
- Associated with ankle injuries
- Often missed
- Suspect ligamentous ankle injury

Dr Roberto Schubert, Radiopaedia.org

Hip Dislocation

Posterior – 90 %
- Femoral head – lateral/superior to acetabulum
- Posterior rim of acetabulum is often fractured
- Sciatic nerve injury in 10% of cases

Anterior – 10%
- Femoral head – obturator, pubic or iliac

Internal –
- Always associated with acetabular fracture
- Femoral head protrudes into pelvic cavity

Dr Hani Alsalam, Radiopaedia.org

Femoral Neck Fracture

- Most often associated with osteoporosis
- Garden Classification (I-IV) – best predictor for non-union or avascular necrosis
- Avascular necrosis is usually the result in disruption of the femoral circumflex arteries.

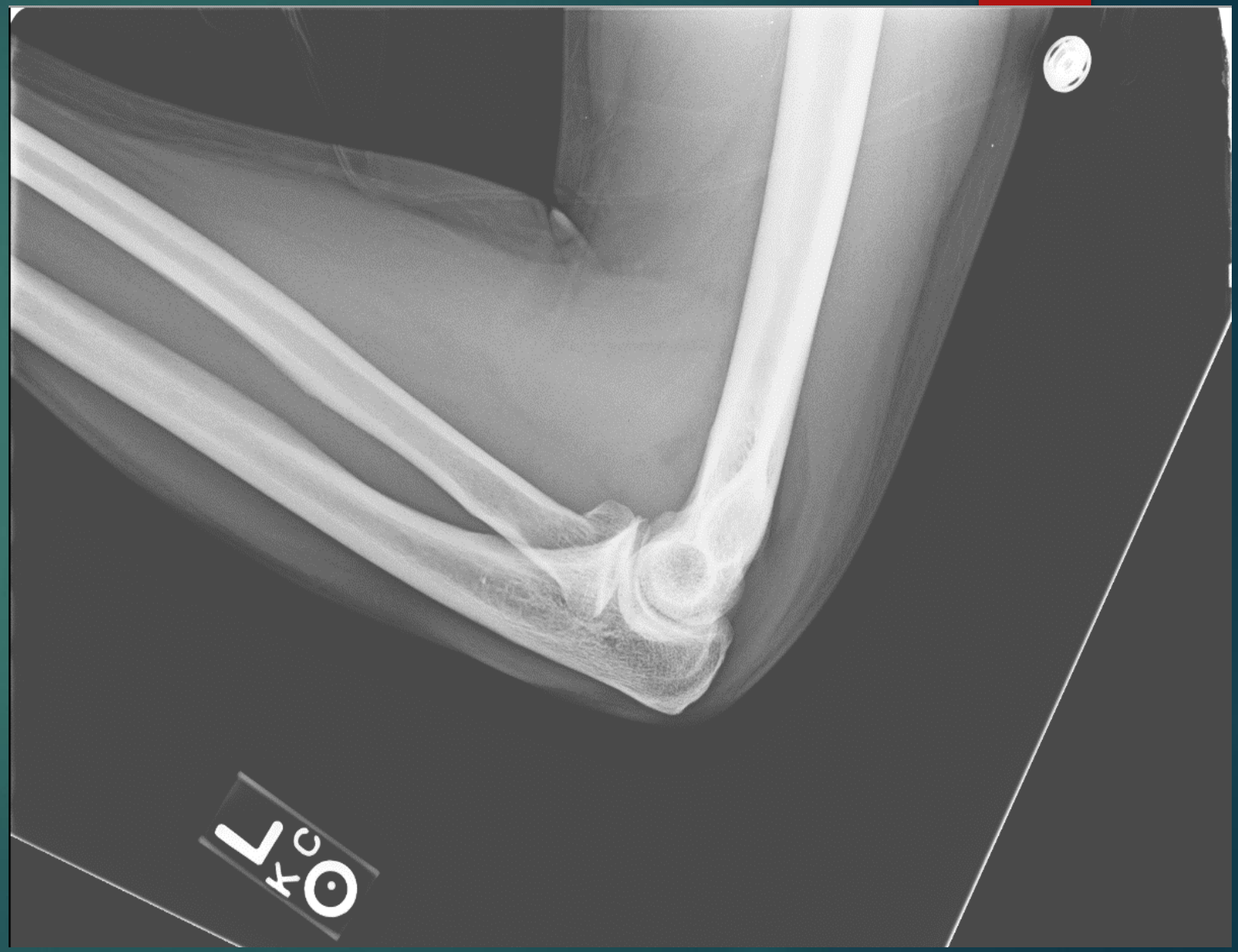
_Osama Yonso Radiopedia.org

Radial Head Fracture

Most common fracture of elbow in adults. FOOSH

Positive fat pad sign

- Anterior – “sail sign)
- Posterior – good indicator of fracture even if one is not seen.



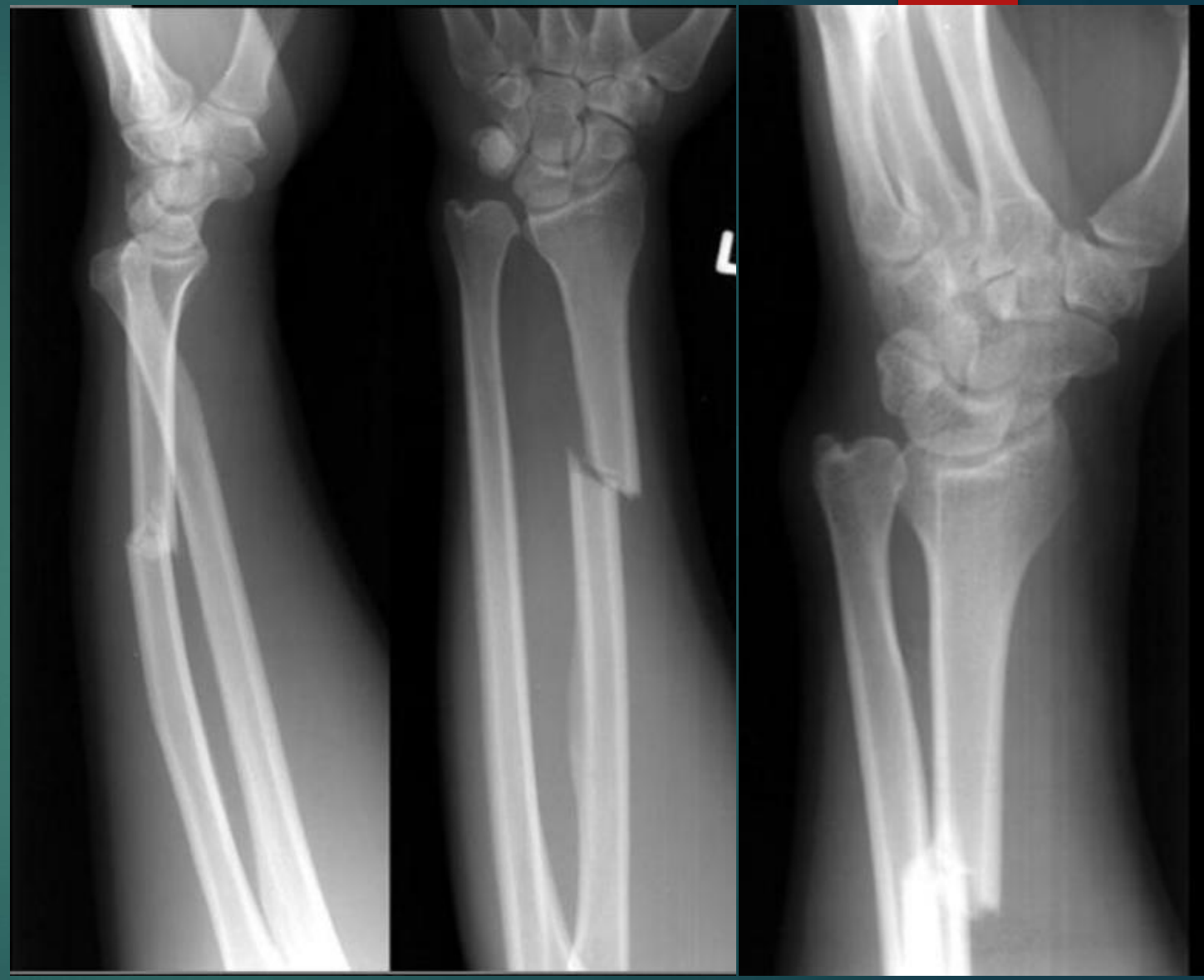
Monteggia Fracture

Ulnar shaft fracture with radial head dislocation

Image Courtesy of Dr. Frank Galliard, Radiopedia.org

Galeazzi Fracture

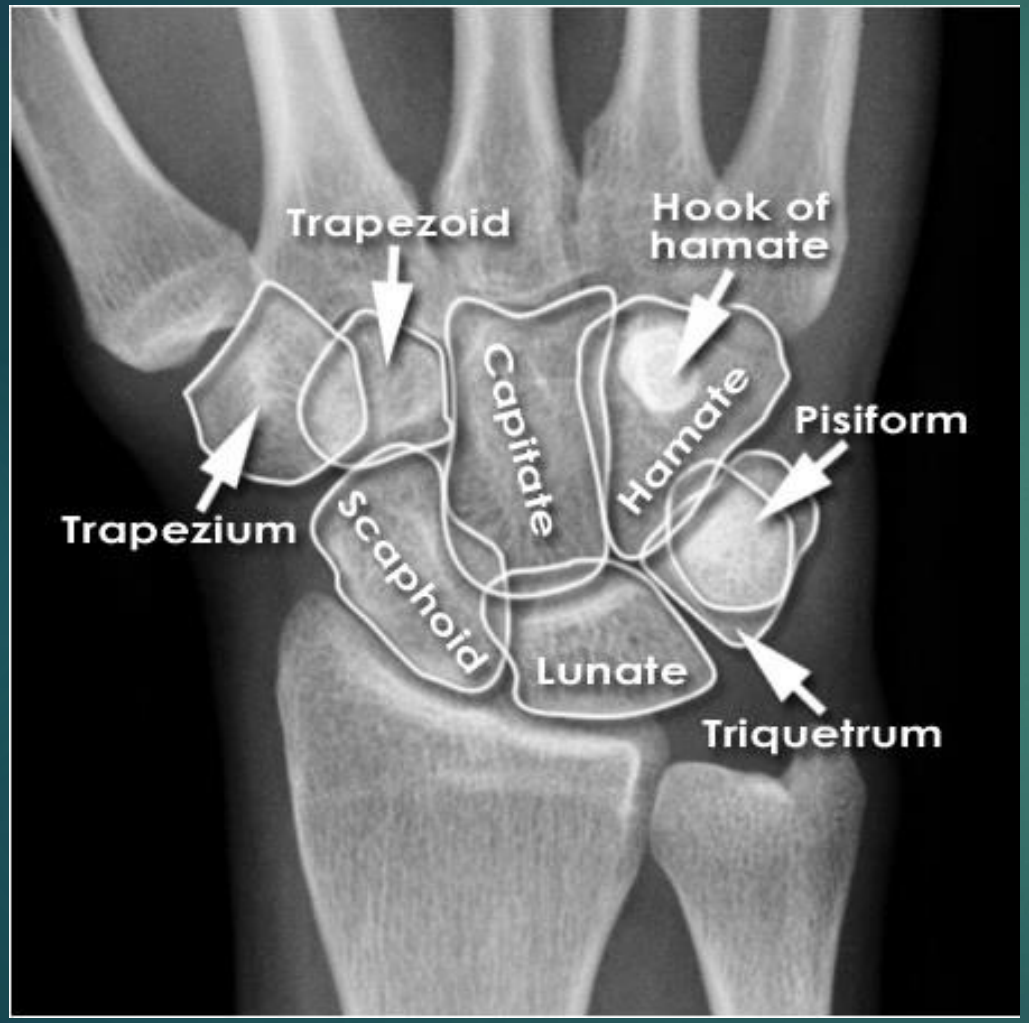
Distal radial shaft fracture with distal radioulnar dislocation

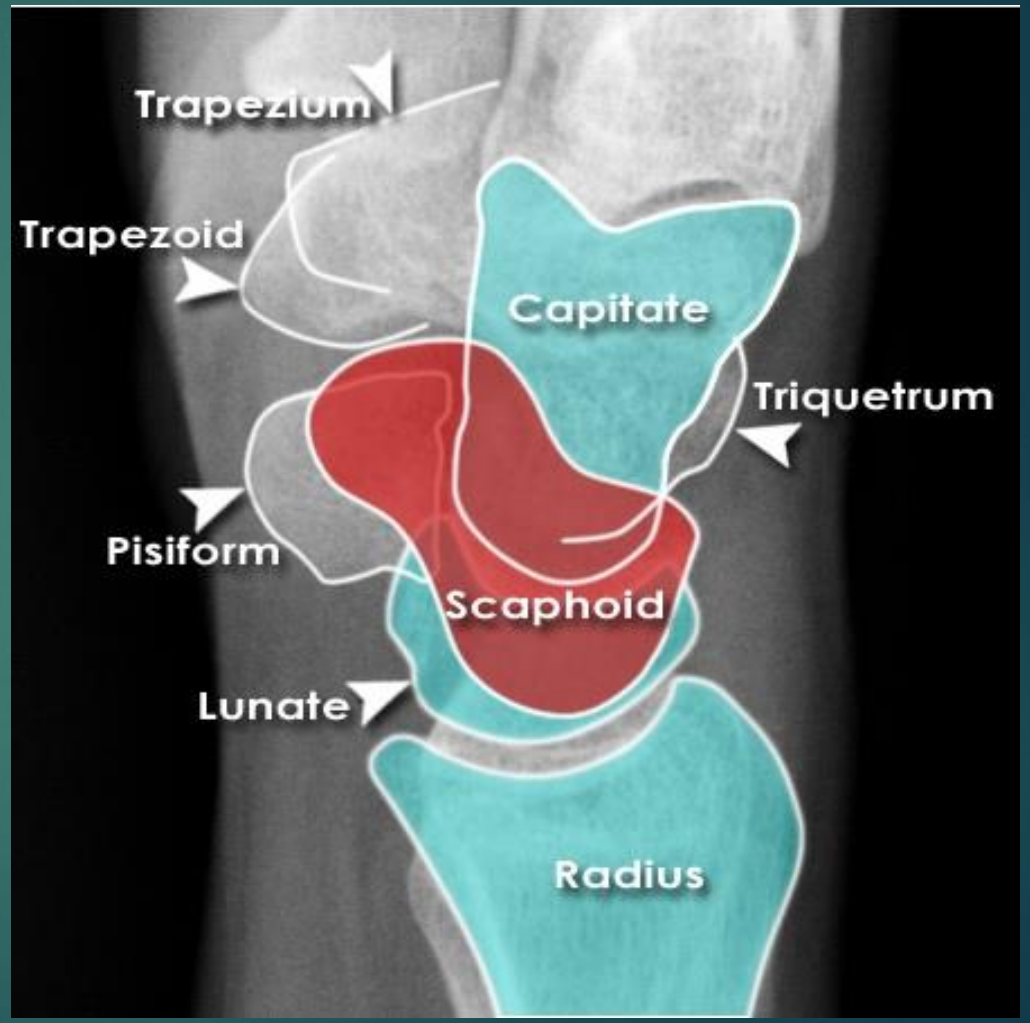


Normal Wrist

http://www.radiologymasterclass.co.uk/tutorials/musculoskeletal/x-ray_trauma_upper_limb/wrist_trauma_x-ray.html

Normal Wrist





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Scaphoid Fracture

- Difficult to see on plain film
- Dedicated scaphoid films may be beneficial
- If suspected but not detected on plain film, CT
- High incidence of nonunion or AVN

Buckle Fracture

- Also known as Torus or Incomplete Fracture
- Usually heals a lot quicker than complete fractures

Cervical Spine

- 5 Parallel Lines
  - Spinolaminar
  - Posterior aspect of vertebral bodies
  - Anterior aspect of vertebral bodies
  - Pre-vertebral soft tissue
  - Posterior spinous process line
- All 7 Cervical Vertebrae need to be seen.
- Inspect C1-C2
  - Adults <3 mm
  - Children <5 mm
- Inspect disk spaces for narrowing
- Inspect Transverse processes: C-7 points down, T-1 points up.

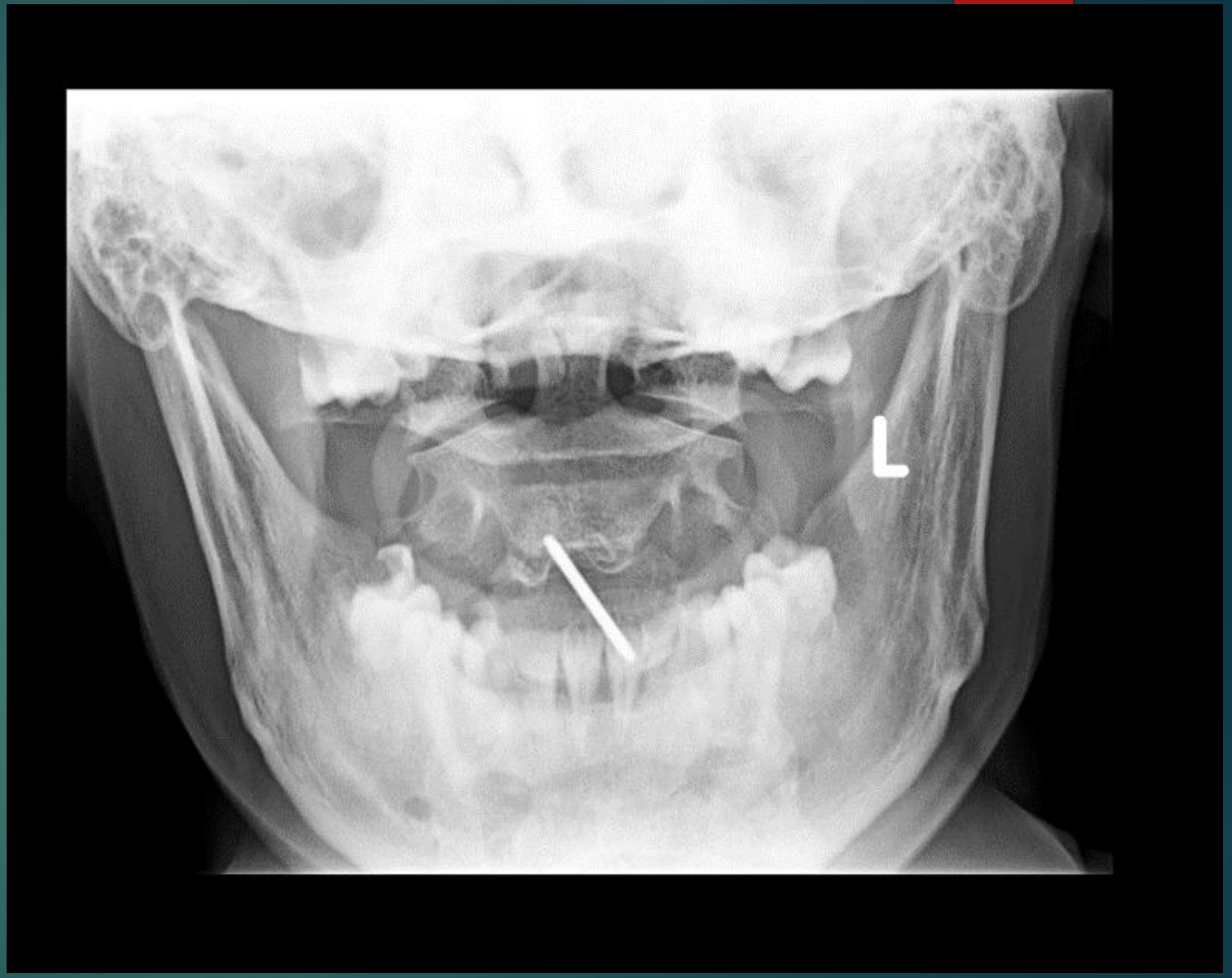
Cervical Spine Odontoid View

Evaluate for displacement of C1 Lateral Mass

- 2 mm bilateral displacement is is always abnormal
- 1-2 mm displacement that is unilateral may be rotational (but may also be abnormal)

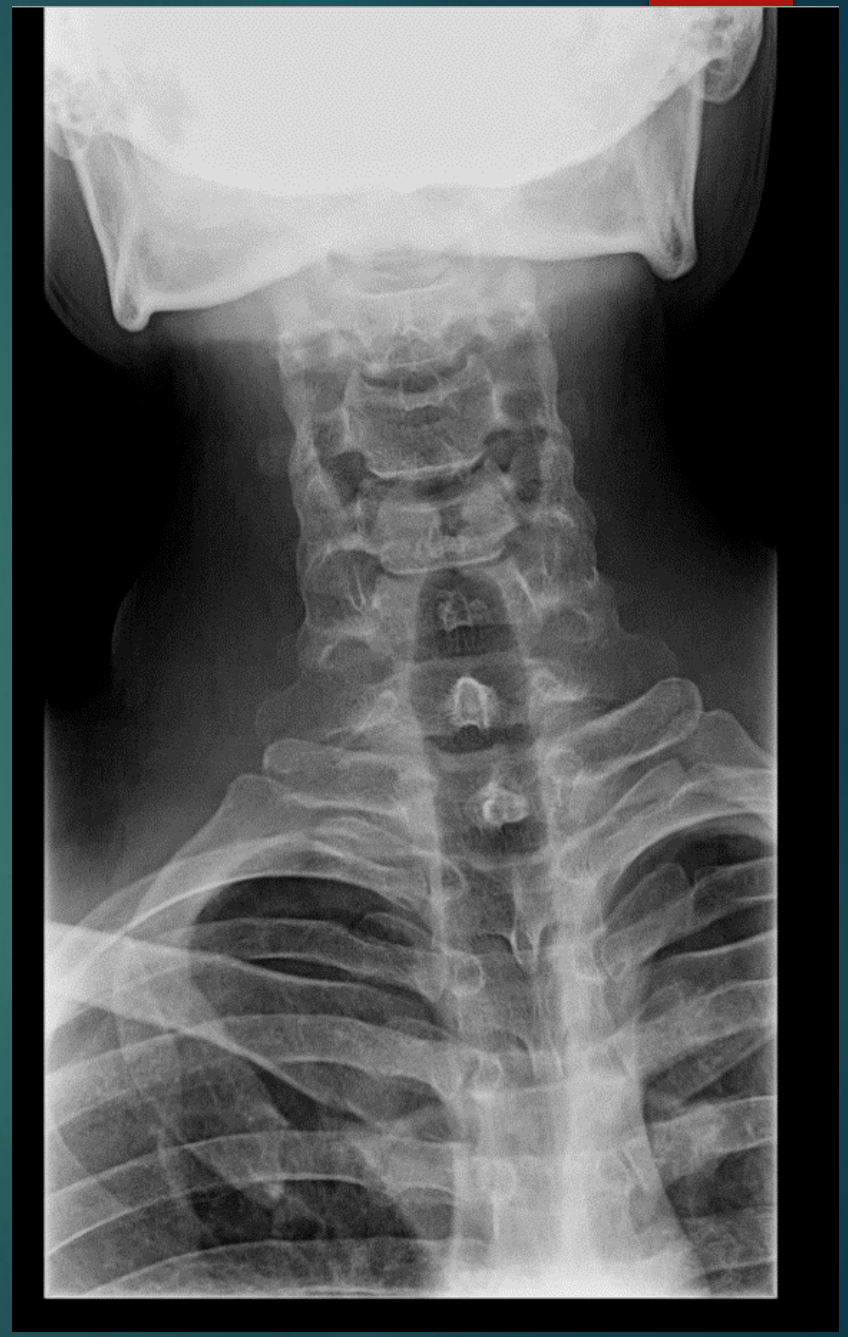
Evaluate odontoid process

- Any tilt is suggestive of fracture



Cervical Spine

- Look for Alignment
- Vertebral Body Heights
- Disk Space Heights
- Bone Density
- Pedicles (lower cervical spine)



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