CHEST RADIOLOGY

AAPA 2020

DISCLOSURES

- NONE

OBJECTIVES

REVIEW CHEST ANATOMY AND BE ABLE TO IDENTIFY COMMON RADIOGRAPHIC LANDMARKS ON CHEST XRAYS (CXRS) AND CHEST COMPUTERIZED TOMOGRAPHY (CTS)

REVIEW PROPER PLACEMENT OF CHEST TUBES, CENTRAL VENOUS CATHETERS AND ENDOTRACHEAL TUBES ON CXRS

OUTLINE A SYSTEMATIC APPROACH FOR INTERPRETING CXRS AND CHEST CTS AND UNDERSTANDING THE DIFFERENT TYPES AND INDICATIONS FOR CHEST CTS

RECOGNIZE DIFFERENT FINDINGS ON CHEST IMAGING SUCH AS INFILTRATES, EDEMA, PLEURAL EFFUSIONS, BRONCHIECTASIS AND GROUND GLASS OPACITIES

RECOGNIZE COMMON DISEASE STATES SUCH AS PNEUMONIA, PULMONARY EDEMA, EMPHYSEMA, PULMONARY EMBOLI AND INTERSTITIAL LUNG DISEASE

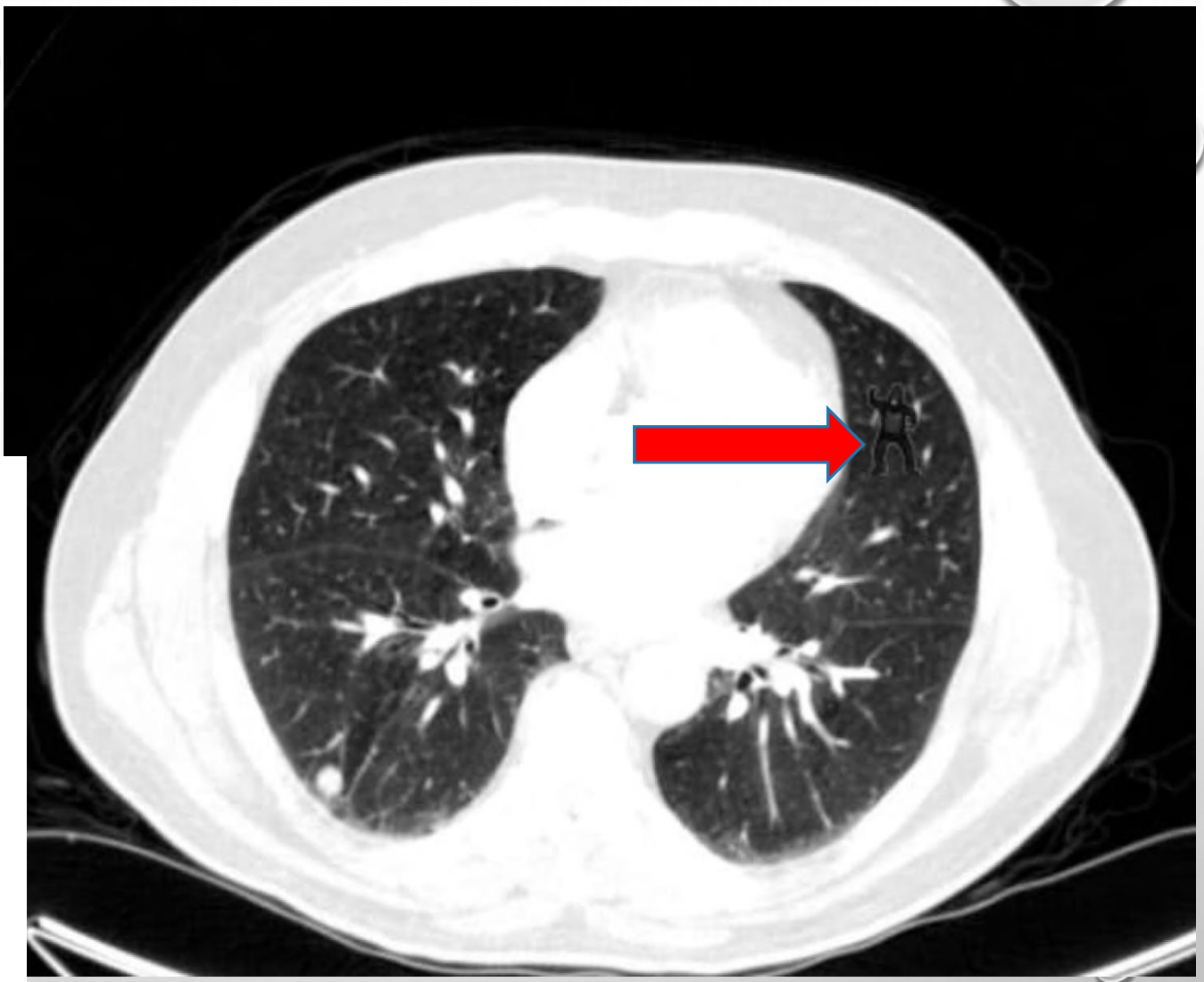
GORILLA IN THE ROOM

- 24 RADIOLOGISTS WERE ASKED TO PERFORM A FAMILIAR LUNG-NODULE DETECTION TASK.
- A GORILLA, 48X THE SIZE OF THE AVERAGE LUNG NODULE, WAS INSERTED IN THE LAST CASE
- 83% OF THE RADIOLOGISTS DID NOT SEE THE GORILLA
- EYE TRACKING REVEALED THAT THE MAJORITY OF THOSE WHO MISSED THE GORILLA LOOKED DIRECTLY AT ITS LOCATION
- CONCLUSION: "EVEN EXPERT SEARCHERS, OPERATING IN THEIR DOMAIN OF EXPERTISE, ARE VULNERABLE TO ***INATTENTIONAL BLINDNESS***."

The Invisible Gorilla Strikes Again: Sustained Inattentional Blindness in Expert Observers
Trafton Drew, Melissa L.-H. Võ, Jeremy M. Wolfe

Psychological Science
Vol 24, Issue 9, pp. 1848 - 1853

First Published July 17, 2013



CHEST X-RAYS

Types

- AP view / Portable – bedbound patients
- **PA and Lateral – patient is facing left on the lateral film**
  - **Preferred**
- Decubitus

INDICATIONS FOR CHEST X-RAYS

- INFECTION: EXCLUDE PNEUMONIA
- MAJOR TRAUMA: EXCLUDE WIDENED MEDIASTINUM, PNEUMOTHORAX AND HEMOTHORAX
- ACUTE CHEST PAIN: EXCLUDE PNEUMOTHORAX, PERFORATED VISCUS, AORTIC DISSECTION
- ASTHMA/BRONCHIOLITIS: WHEN DIAGNOSIS UNCLEAR AND/OR NOT RESPONDING TO USUAL THERAPY
- ACUTE DYSPNEA: EXCLUDE HEART FAILURE, PLEURAL EFFUSION
- CHRONIC DYSPNEA: EXCLUDE HEART FAILURE, EFFUSION AND INTERSTITIAL LUNG DISEASE
- HEMOPTYSIS
- SUSPECTED MASS, METASTASIS OR LYMPHADENOPATHY

Guide to thoracic imaging
Volume 44, No.8, August 2015 Pages 558-562

STEPS TO READING A CXR:

PLACEMENT OF CXR

VERIFY THE XR

- Name
- Date
- Position markers
- Type of CXR
- Patient History is very important (review first!)
- View side by side with previous films

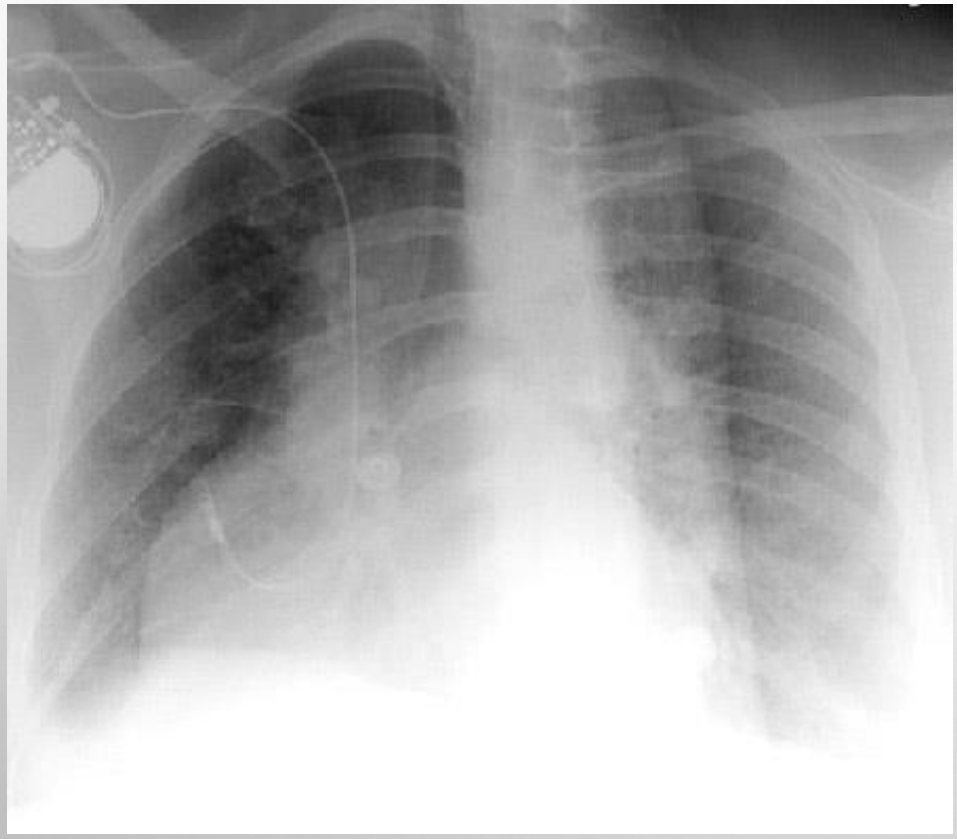
STEPS TO INTERPRETING CXR

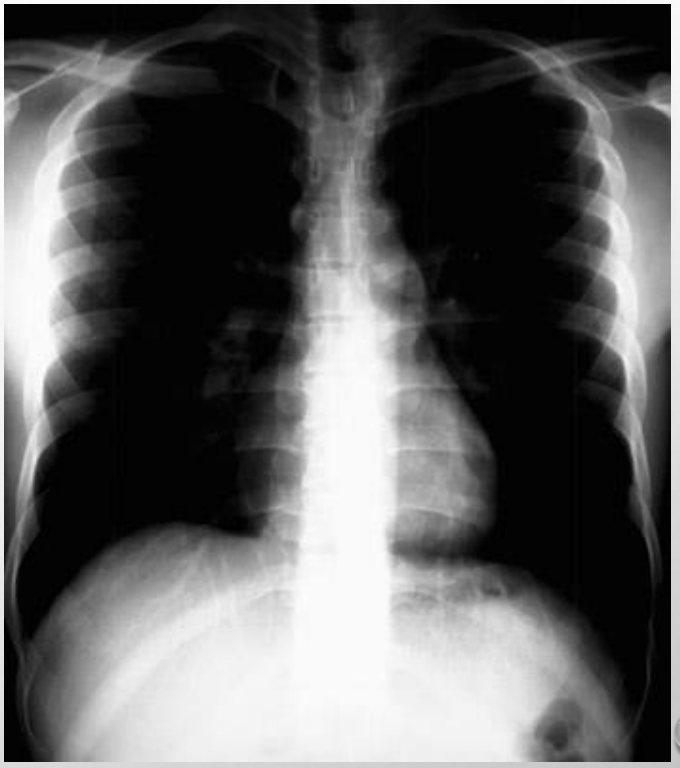
- TYPE OF EXAM / IMAGE
- CLINICAL HISTORY
- COMPARISON
- TECHNIQUE
- FINDINGS
- IMPRESSION

WHAT MAKES A GOOD CXR?

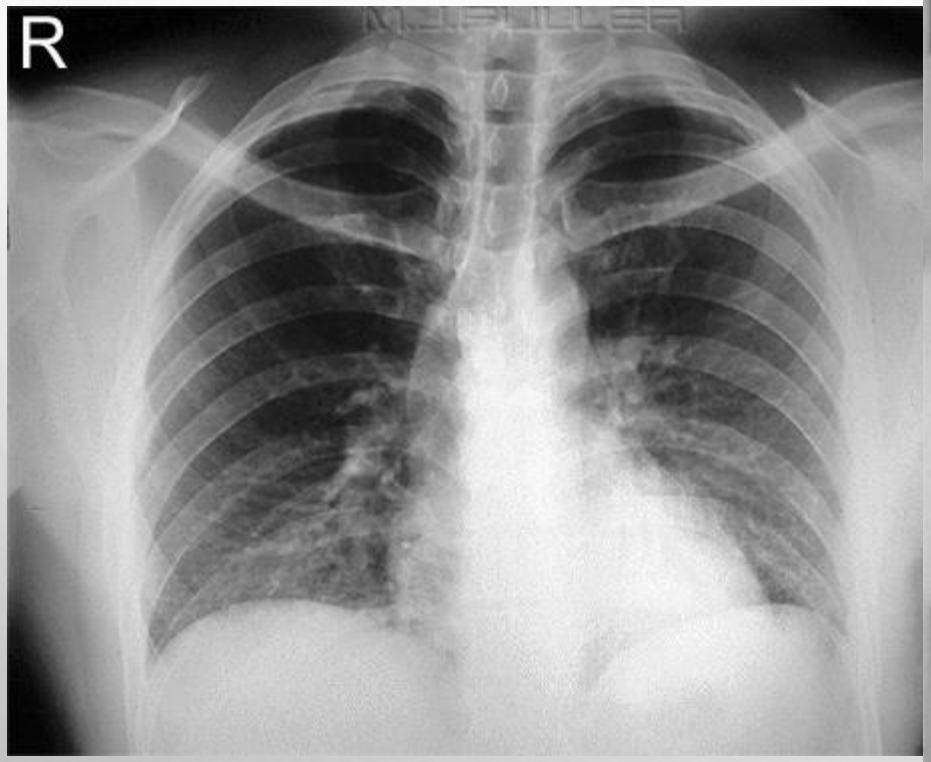
- RIPE
  - ROTATION
    - MEDIAL CLAVICLE ENDS EQUIDISTANT FROM SPINOUS PROCESS
  - INSPIRATION
    - 8-10 POSTERIOR RIBS
  - PICTURE
    - STRAIGHT / FULL LUNG FIELDS
  - EXPOSURE
    - OVER OR UNDER PENETRATED

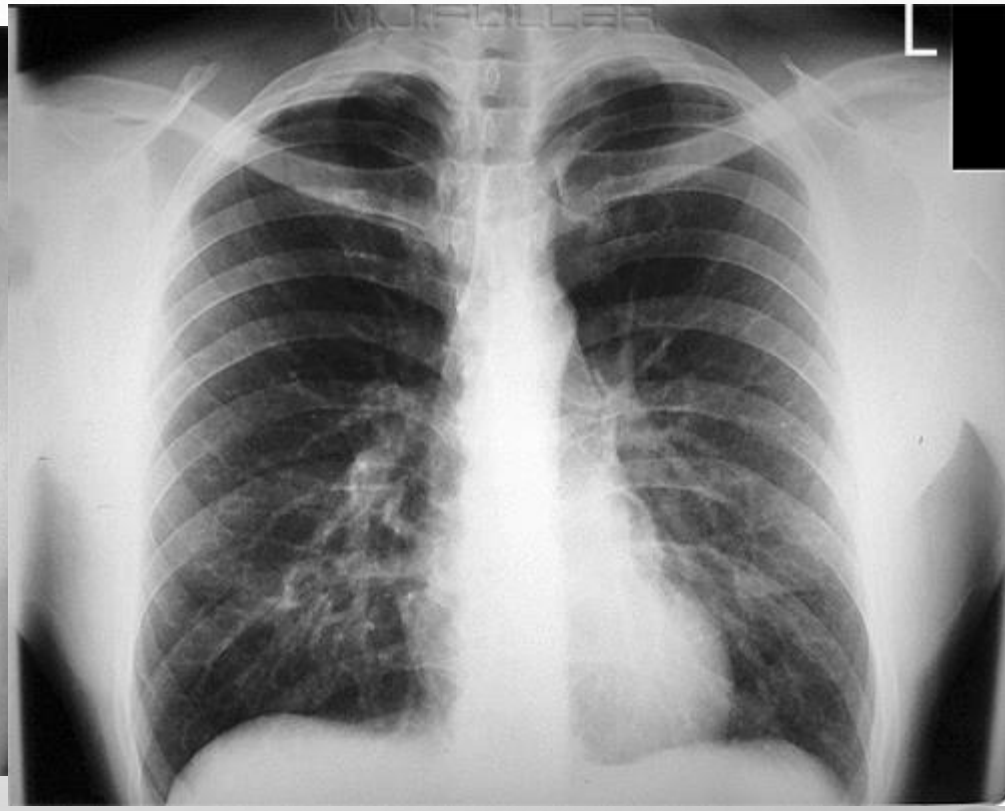
- GARBAGE IN GARBAGE OUT

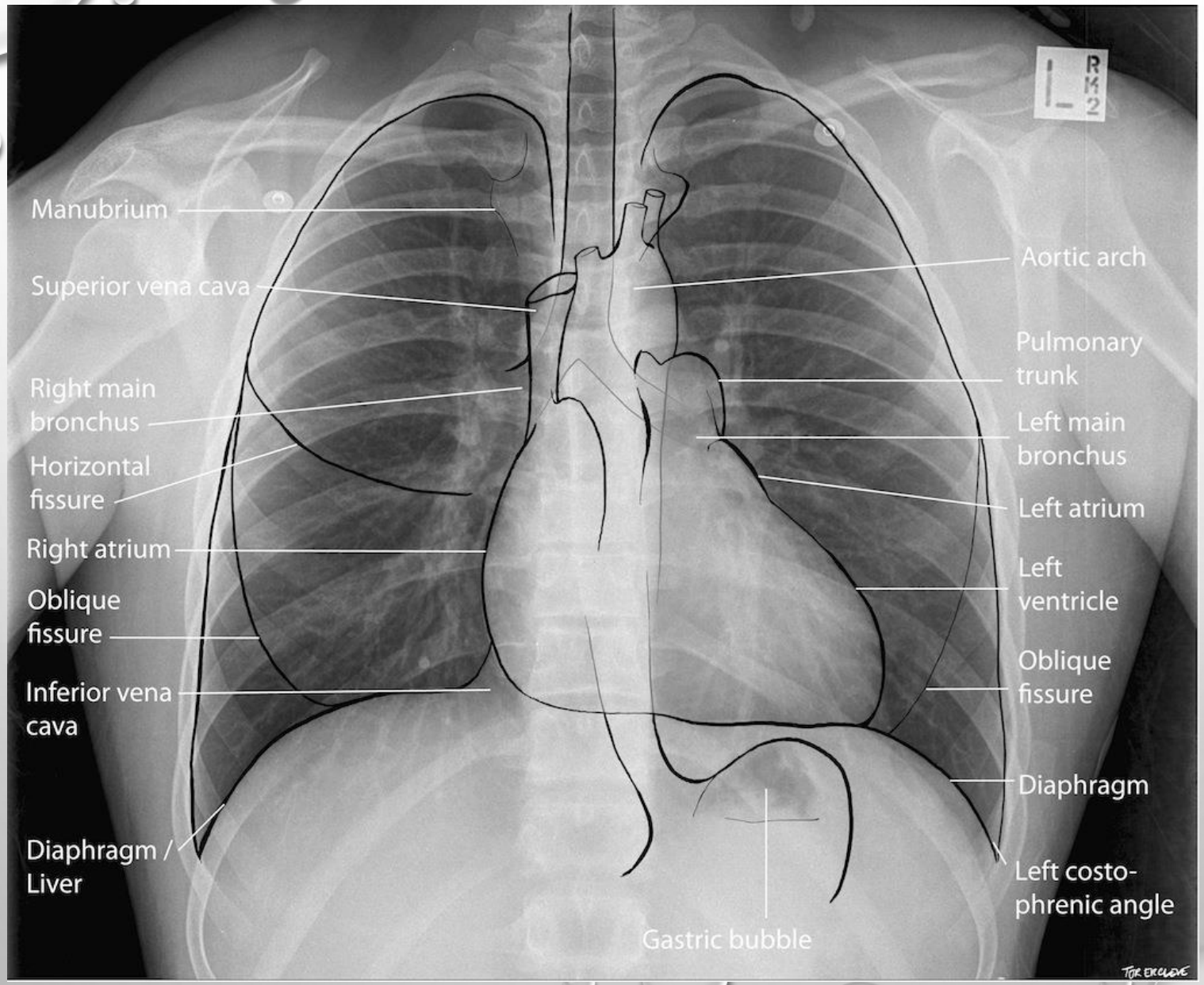




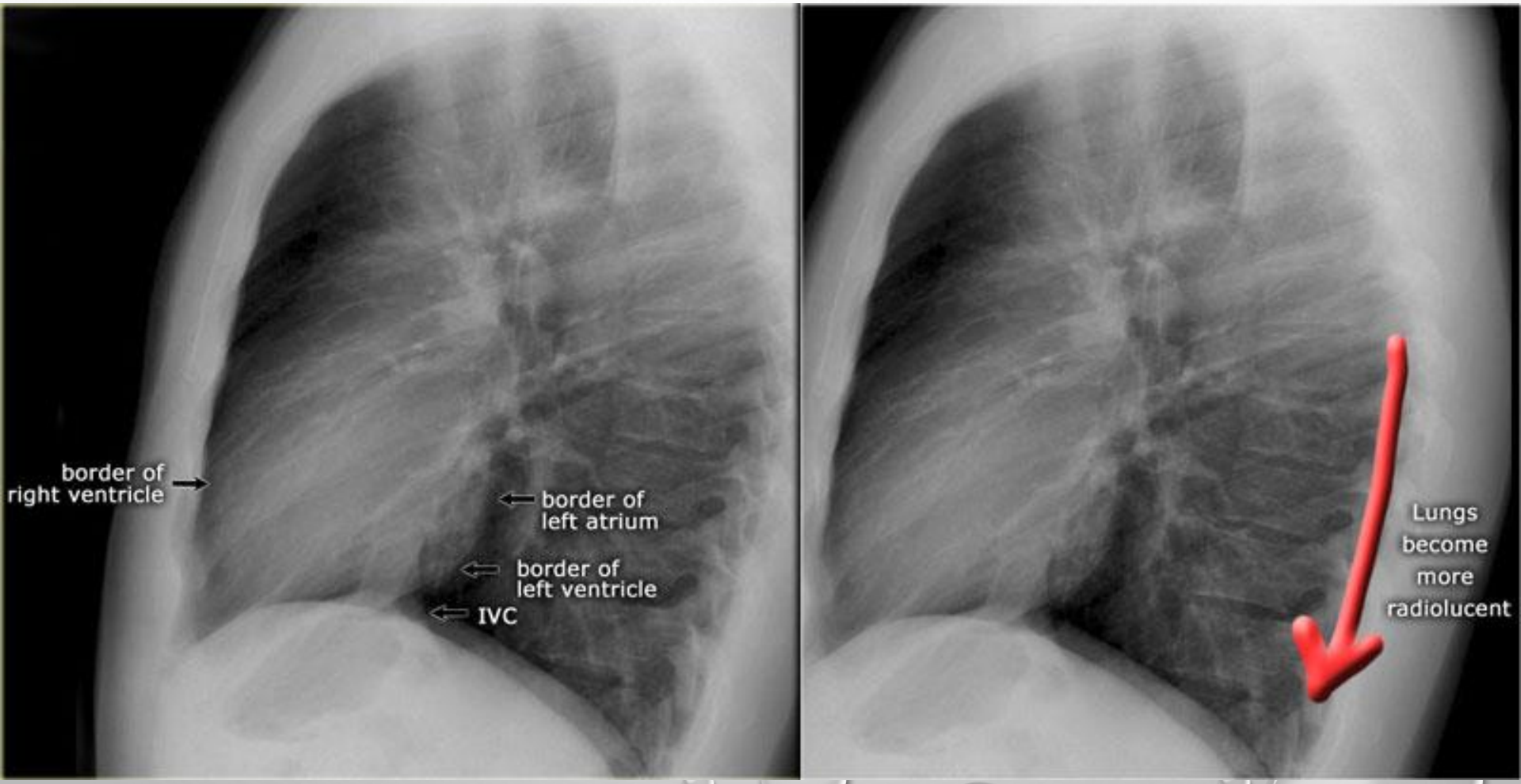
- THE VALUE OF GOOD INSPIRATION



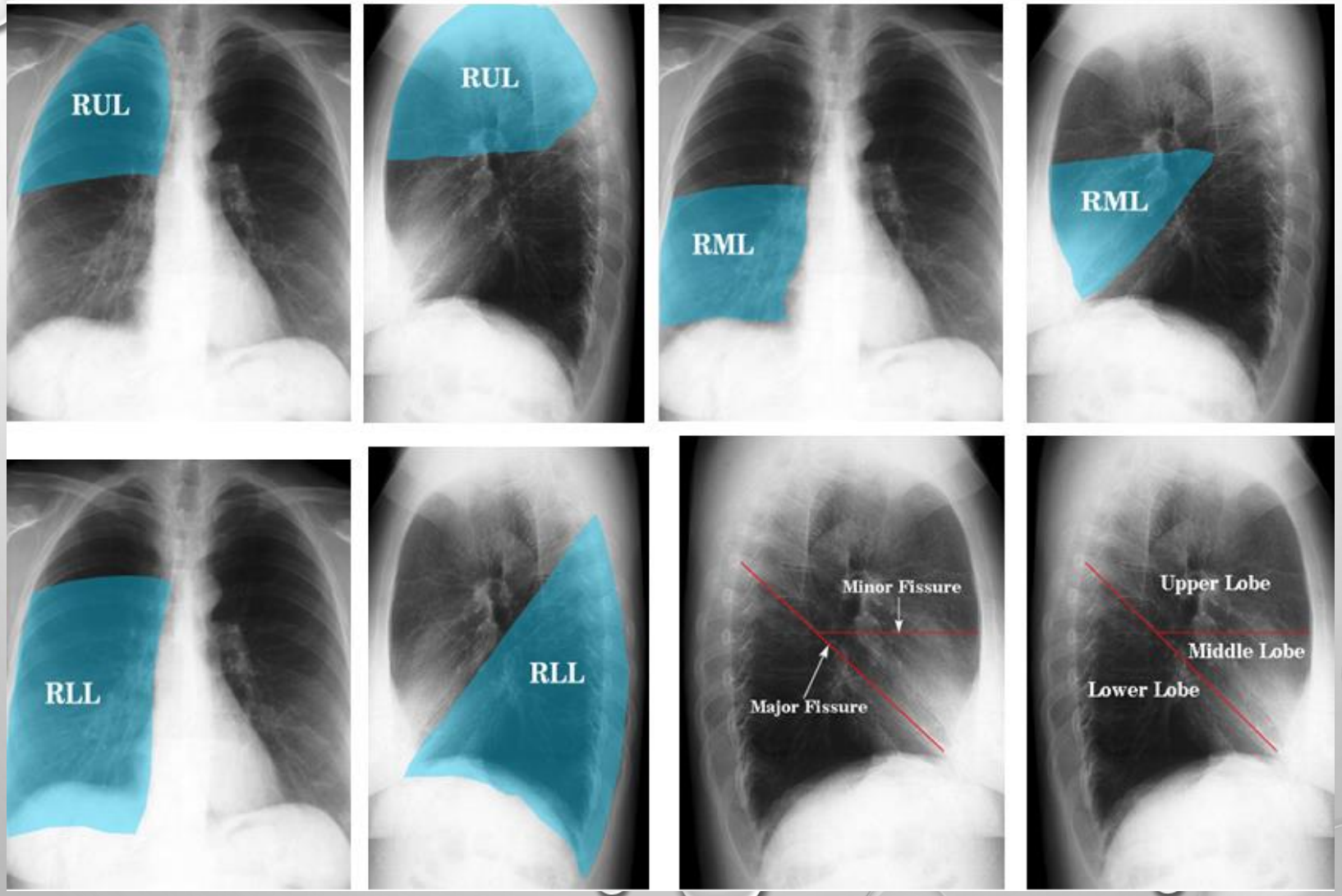



Manubrium
Superior vena cava
Right main bronchus
Horizontal fissure
Right atrium
Oblique fissure
Inferior vena cava
Diaphragm / Liver
Aortic arch
Pulmonary trunk
Left main bronchus
Left atrium
Left ventricle
Oblique fissure
Diaphragm
Left costo-phrenic angle
Gastric bubble

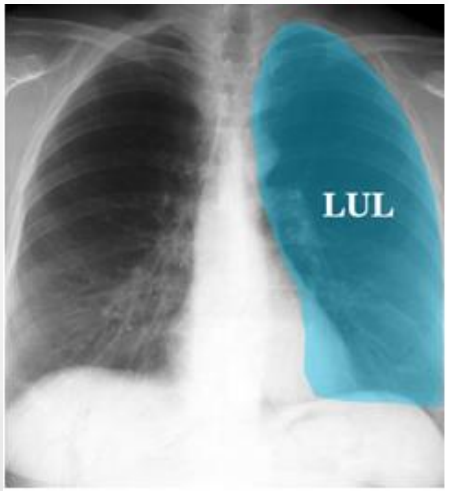
LATERAL VIEW

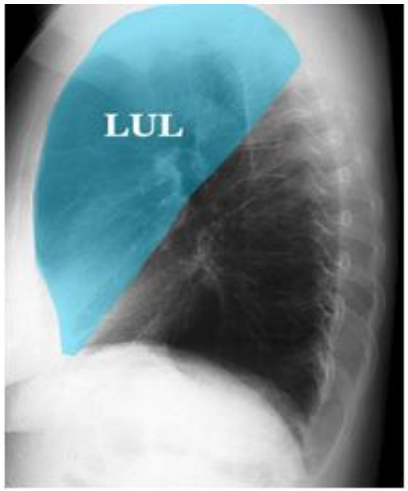


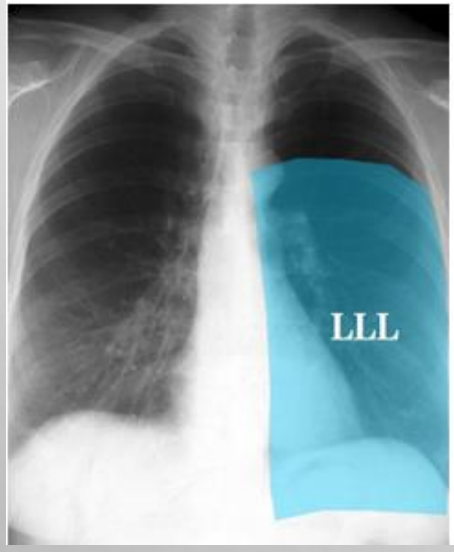
KNOW YOUR FISSURES – RIGHT LUNG

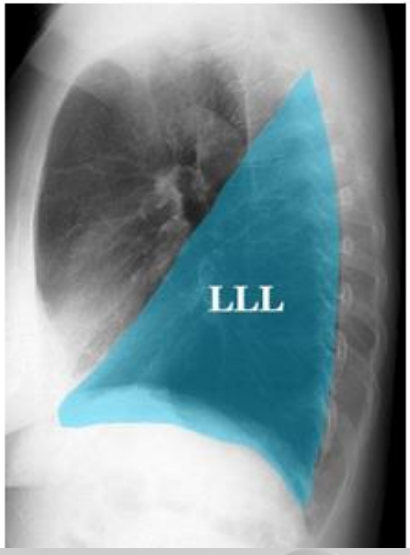


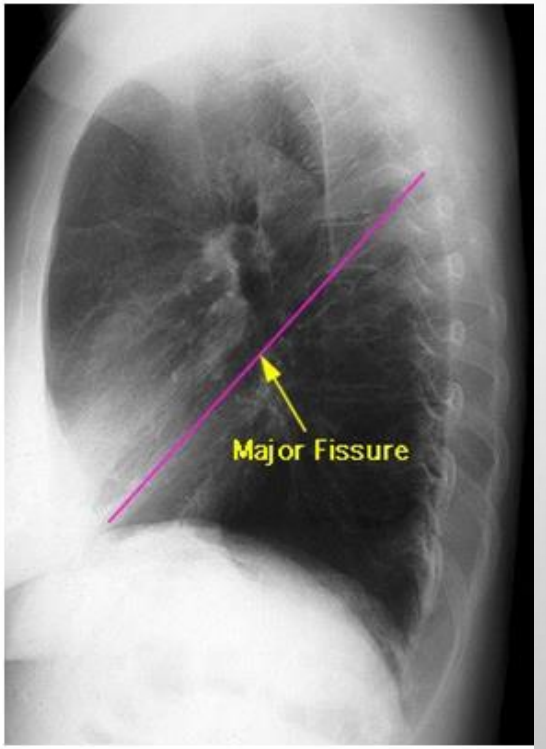
LEFT LUNG











STEPS TO READING A CXR

- HEART
- SILHOUETTE SIGN
- MEDIASTINUM
- DIAPHRAGM
- COSTOPHRENIC ANGLES / EFFUSIONS
- LUNGS
- ALVEOLAR PATTERN VS. INTERSTITIAL PATTERN
- SKELETON / BONES
- CHECK EACH RIB
- CHECK VERTEBRAL BODY HEIGHT ON LATERAL VIEW

DESCRIBING THE LUNGS

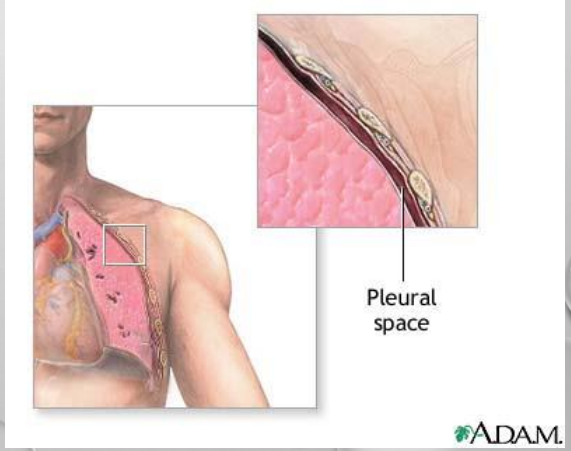
PULMONARY VASCULATURE
- Pulmonary edema

COSTOPHRENIC ANGLES
- Pleural effusions

INFLATION
- Count the ribs, look at diaphragm
  - Emphysema

MASSES/NODULES RULE OF 3

CONSOLIDATION PARENCHYMA
- Compare lung fields to each other



LUNGS

UNILATERAL VS. BILATERAL

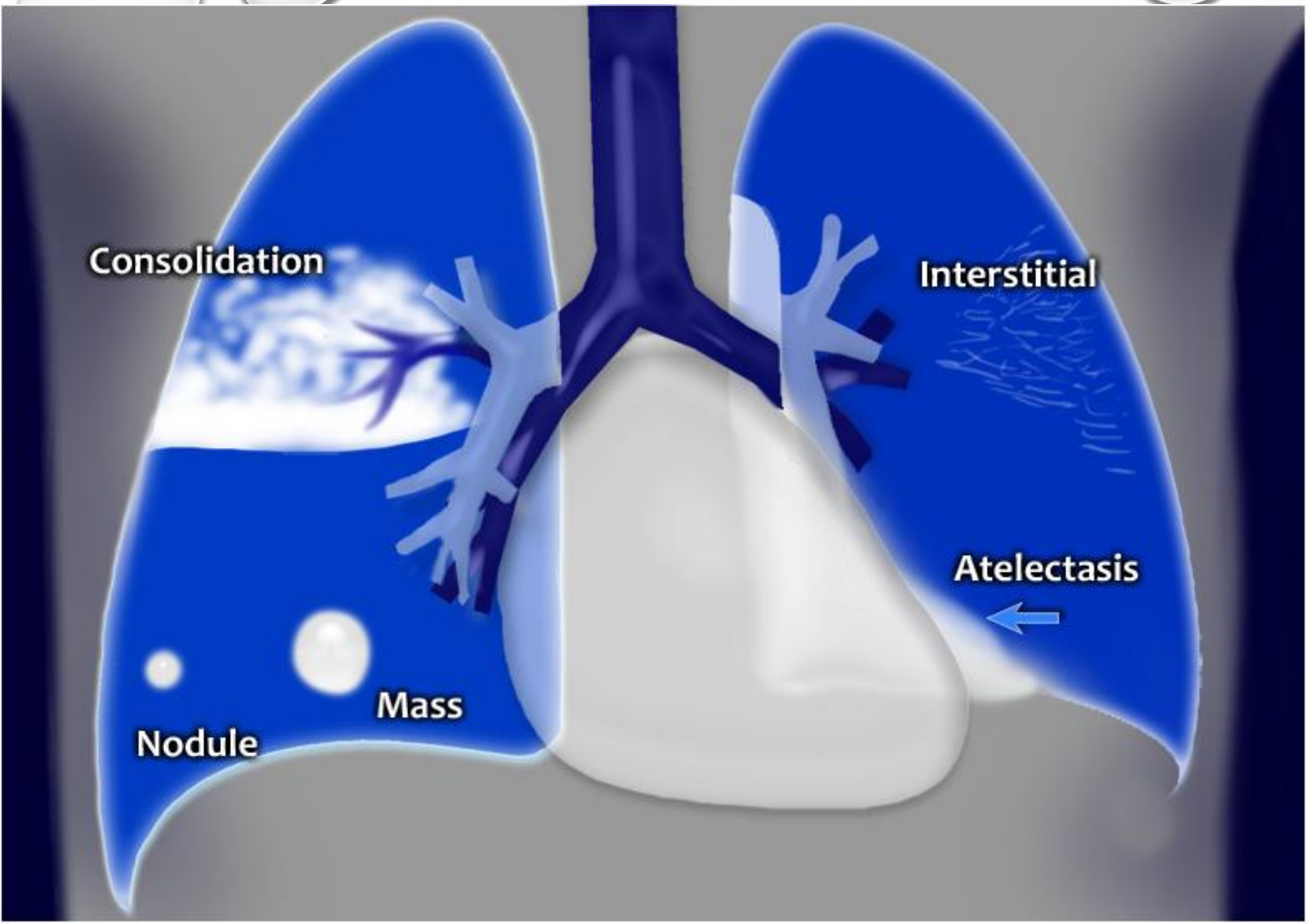
FOCAL VS. DIFFUSE

LOCATION

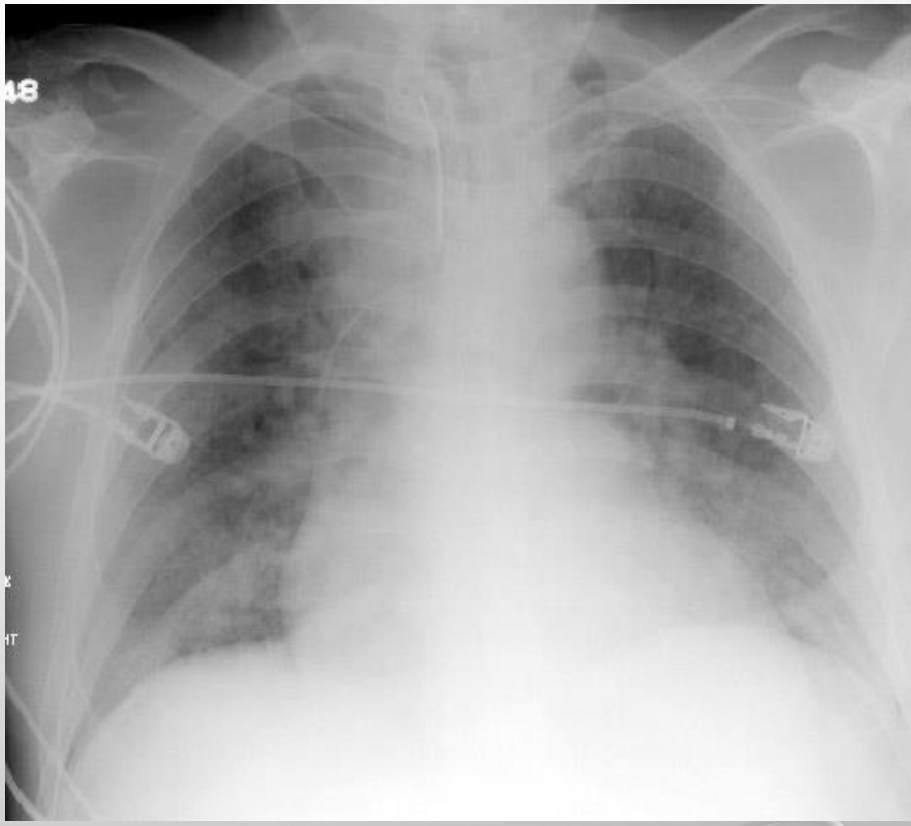
(APEX, BASE, MEDIASTINAL, HILAR REGIONS)

PERIPHERAL VS. CENTRAL

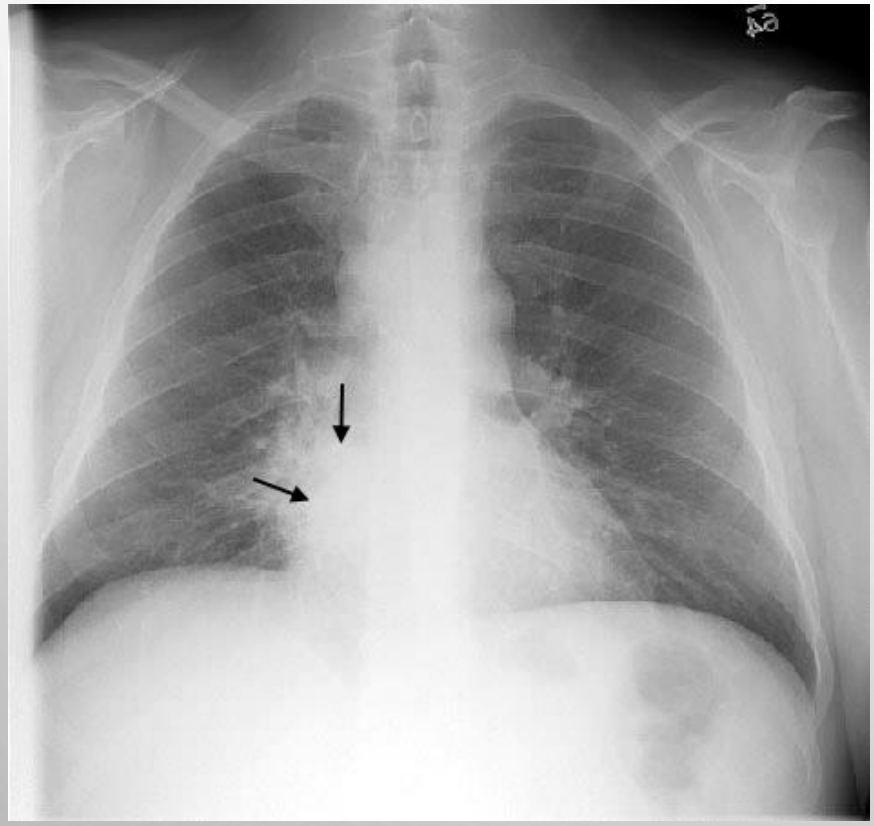
INTERSTITIAL VS. ALVEOLAR


Consolidation
Interstitial
Atelectasis
Mass
Nodule

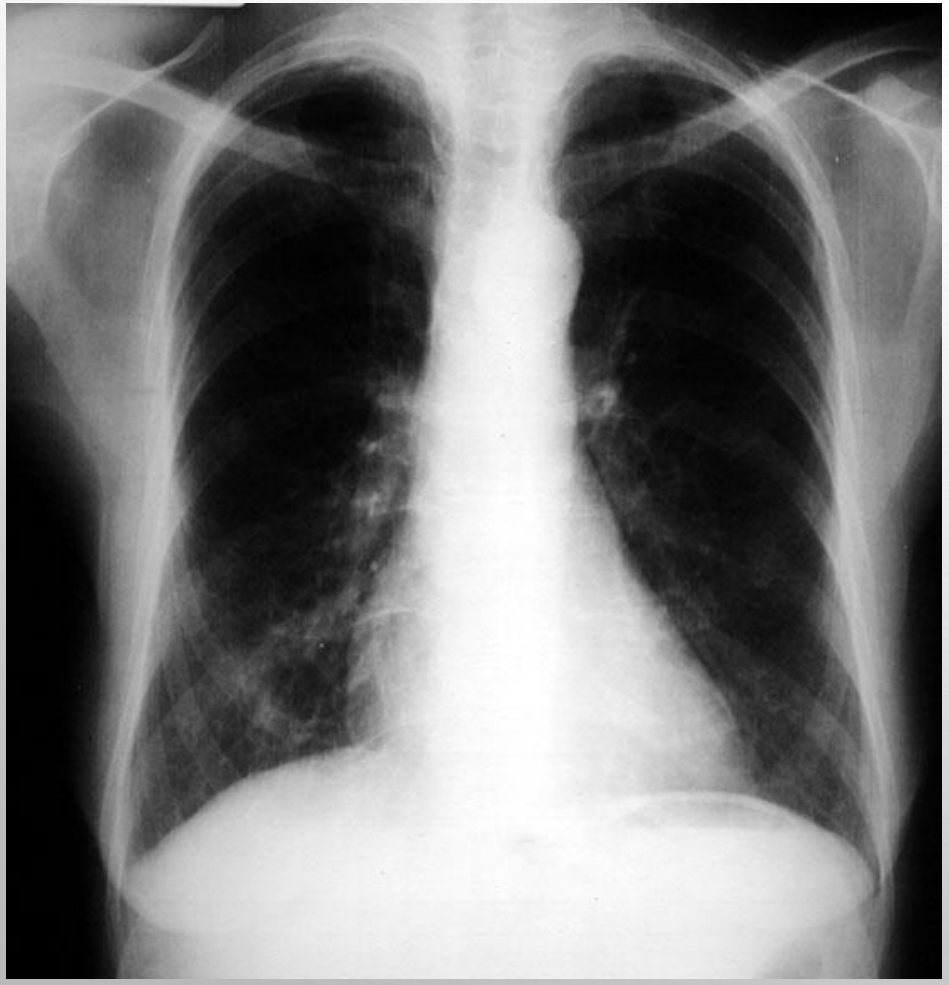
- FOCAL VS. DIFFUSE



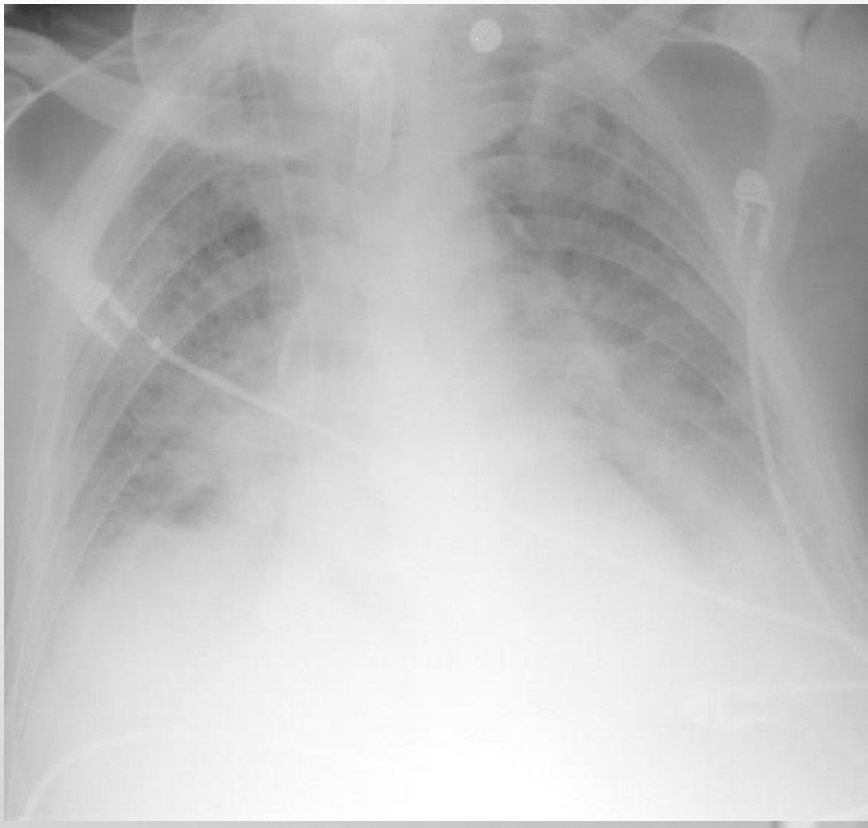
WHY THE LATERAL MATTERS



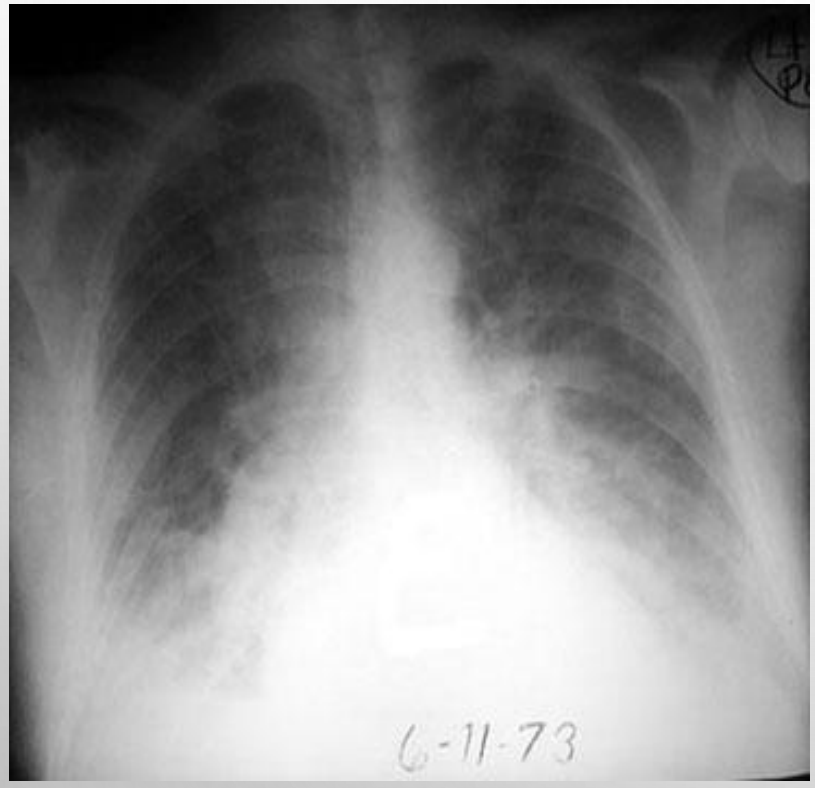
ATELECTASIS VS. PNA

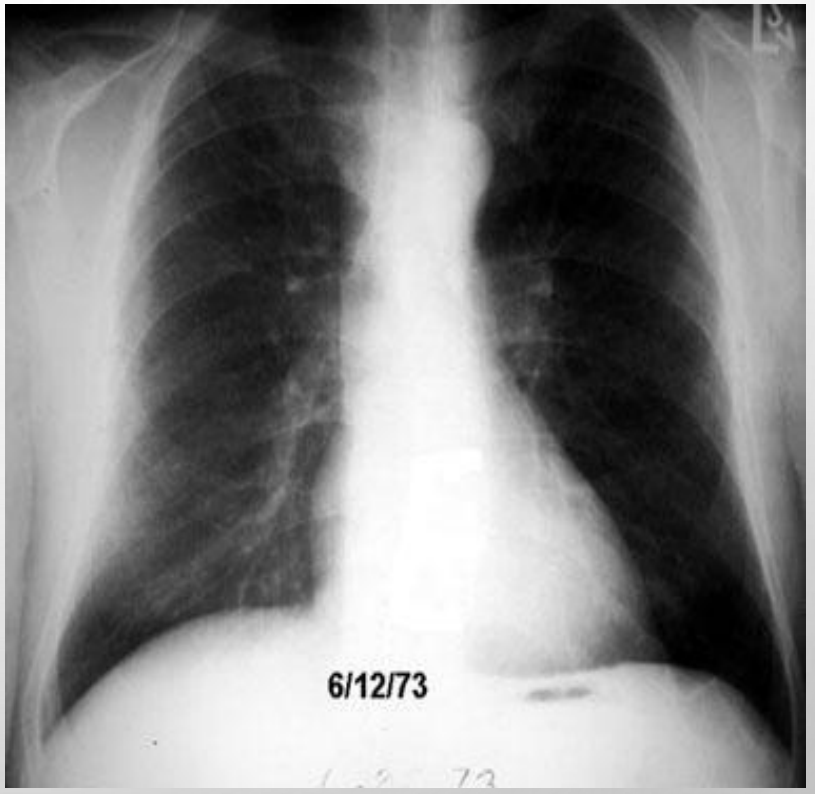


INTERSTITIAL VS. ALVEOLAR

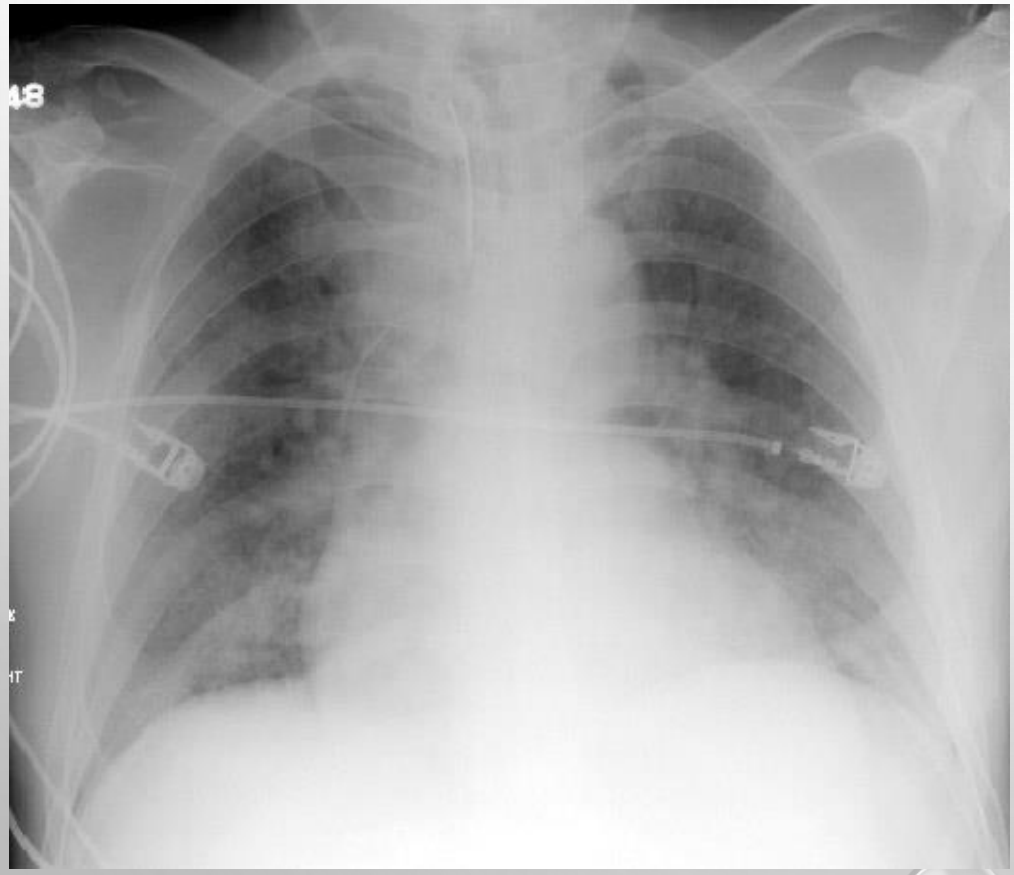


PULMONARY EDEMA





CHF PATTERN ON CXR

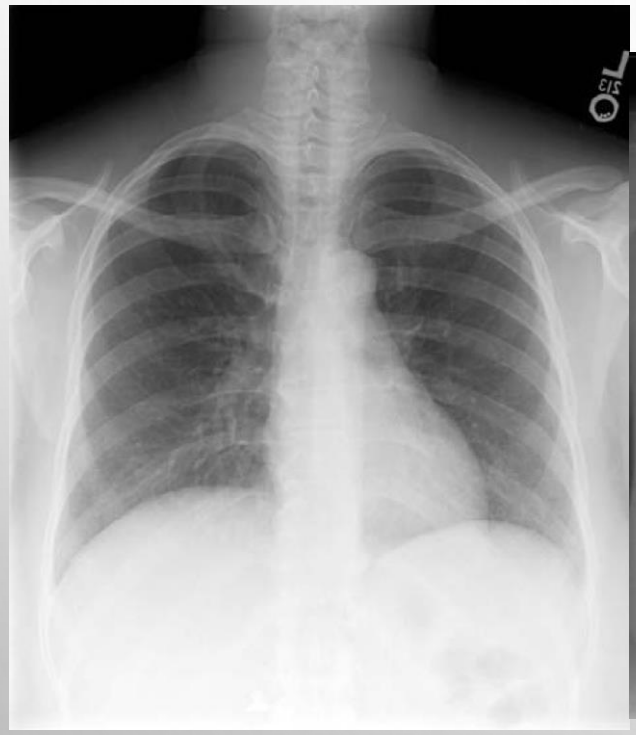


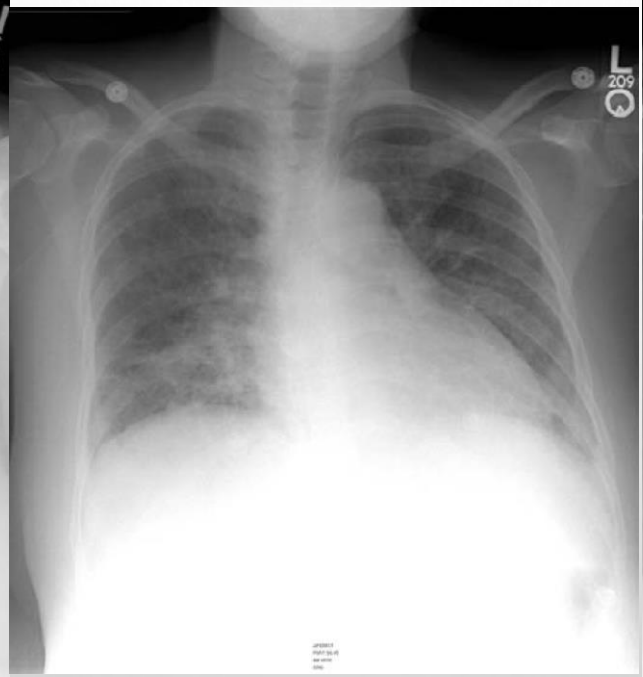
CARDIOMEGALY

ALVEOLAR INFILTRATES

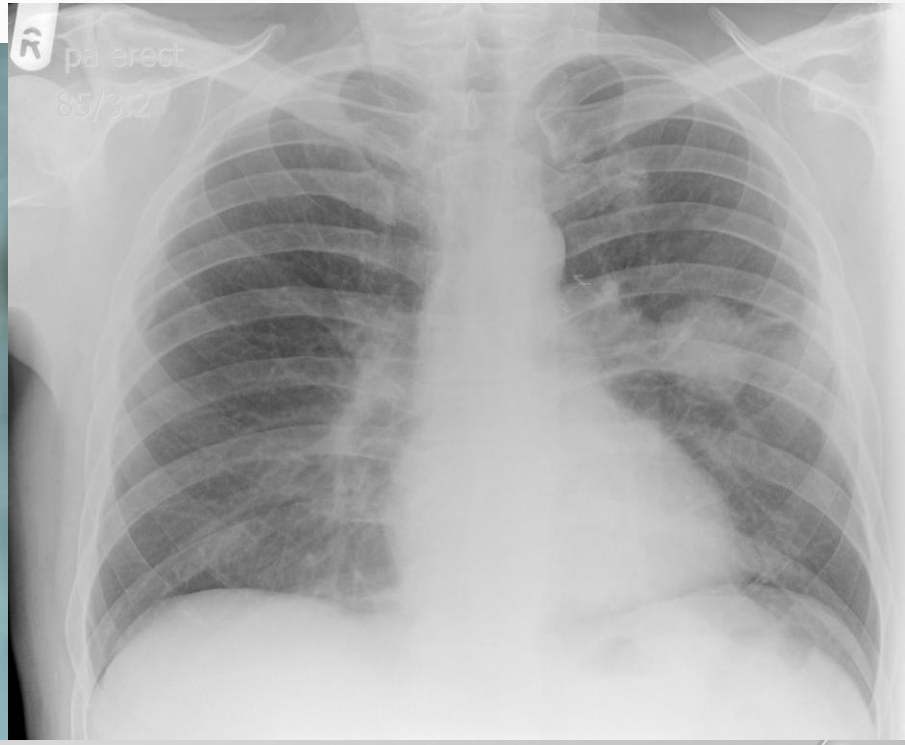
+/- PLEURAL EFFUSIONS

ARDS PROGRESSION ON CXR

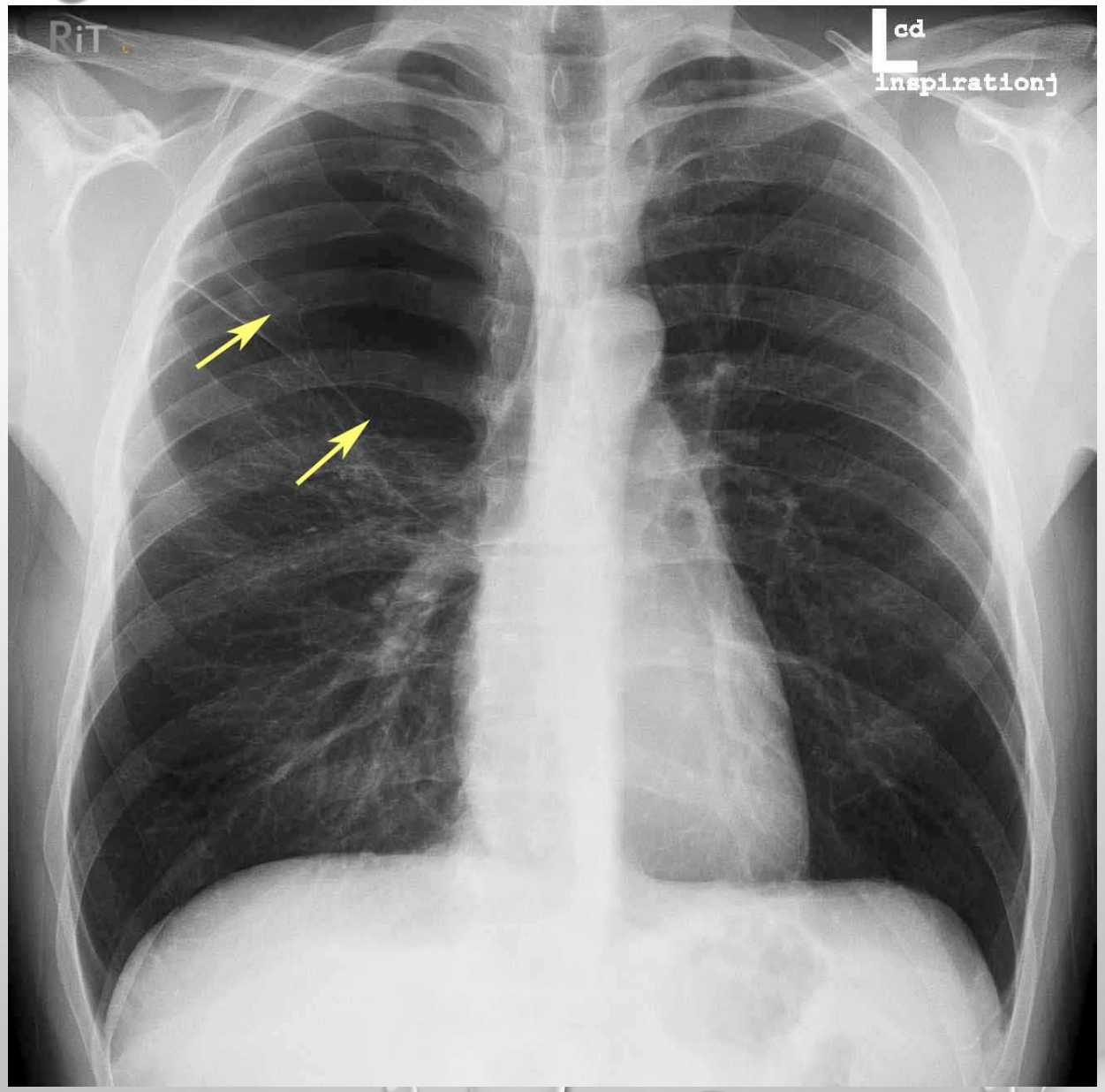




- NODULE VS. MASS



RUL MASS


RiT
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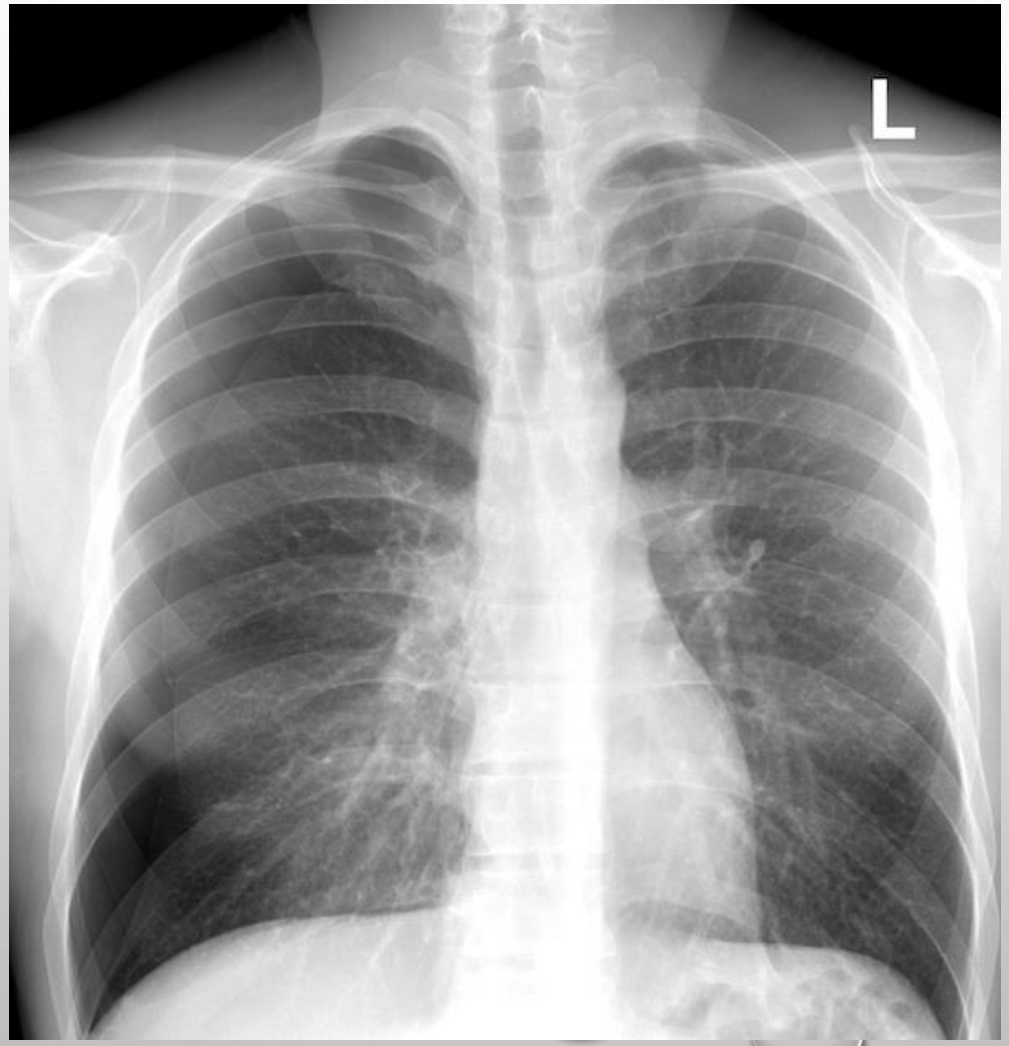
inspirationj

PNEUMOTHORAX – HOW TO FIND IT? THE OBVIOUS

. . . AND THE NOT SO OBVIOUS



- LOOK FOR THE LACK OF LUNG MARKINGS

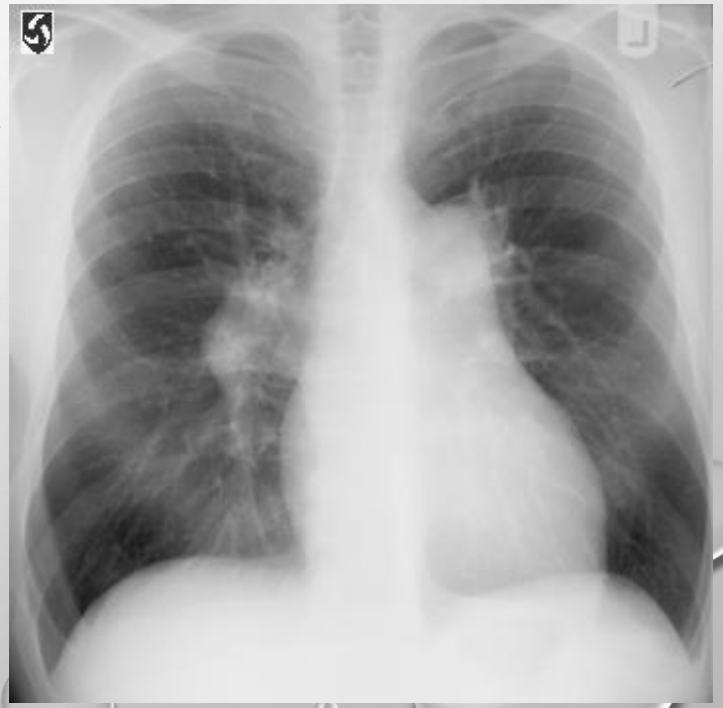
MEDIASTINAL/ HILAR REGION

DIFFERENTIAL DIAGNOSIS:

PULMONARY VESSEL ENLARGEMENT

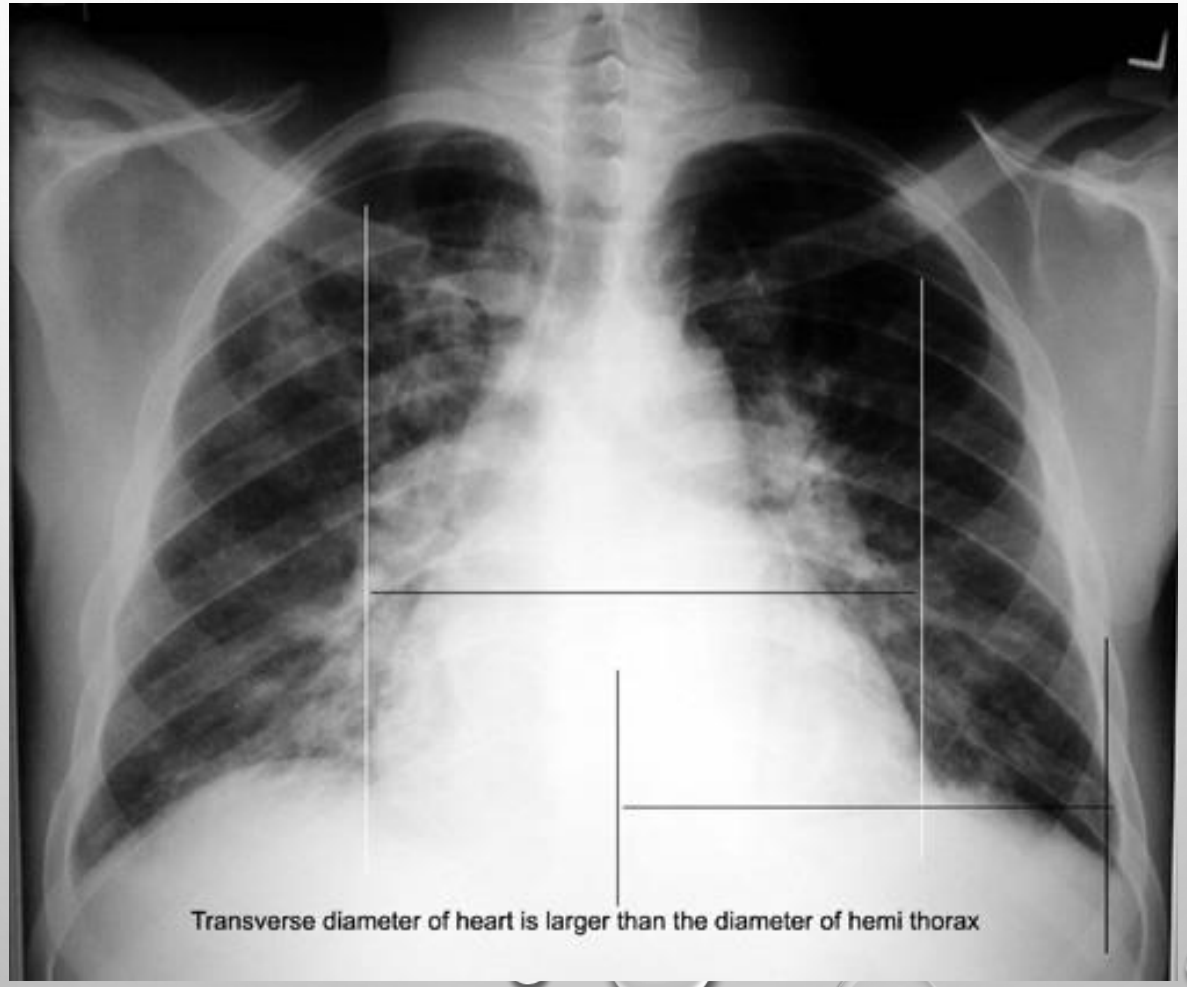
- *more "smooth" appearance*

- **HILAR ADENOPATHY**
  - *more "bumpy" appearance*
- **INFLAMMATION (SARCOIDOSIS, SILICOSIS)**
- **NEOPLASM (LYMPHOMA, METZ, BRONCOGENIC CA**
- **INFECTION (TB, HISTOPLASMOSIS, MONO)**

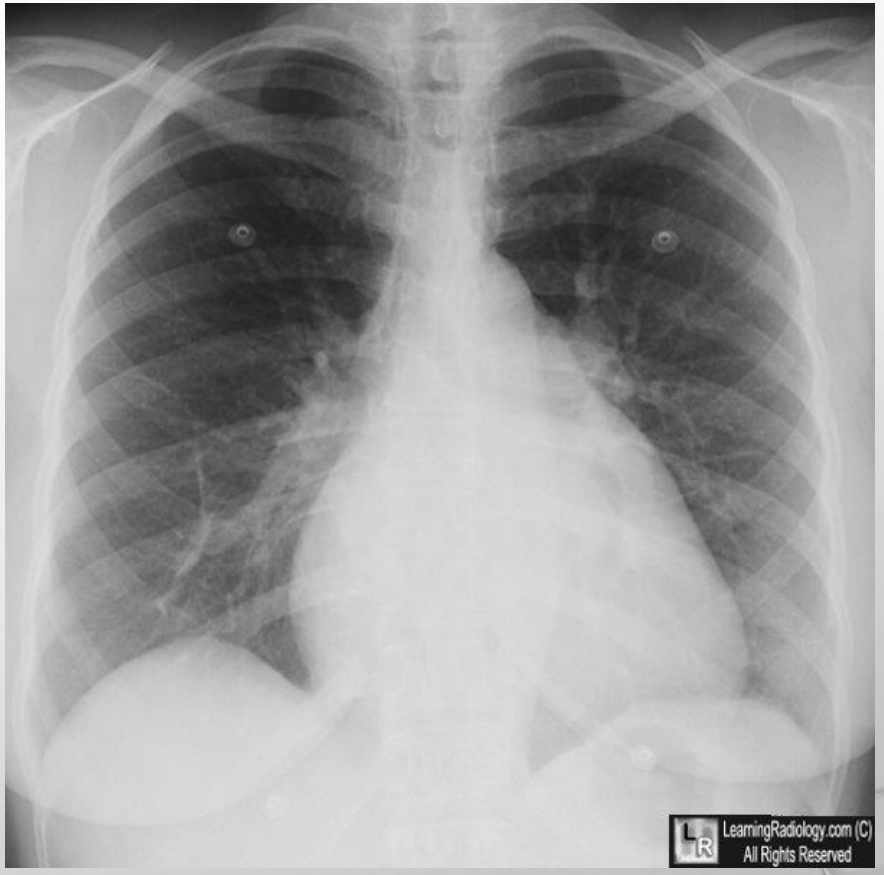


PULMONARY ARTERY ENLARGEMENT VS. LAN

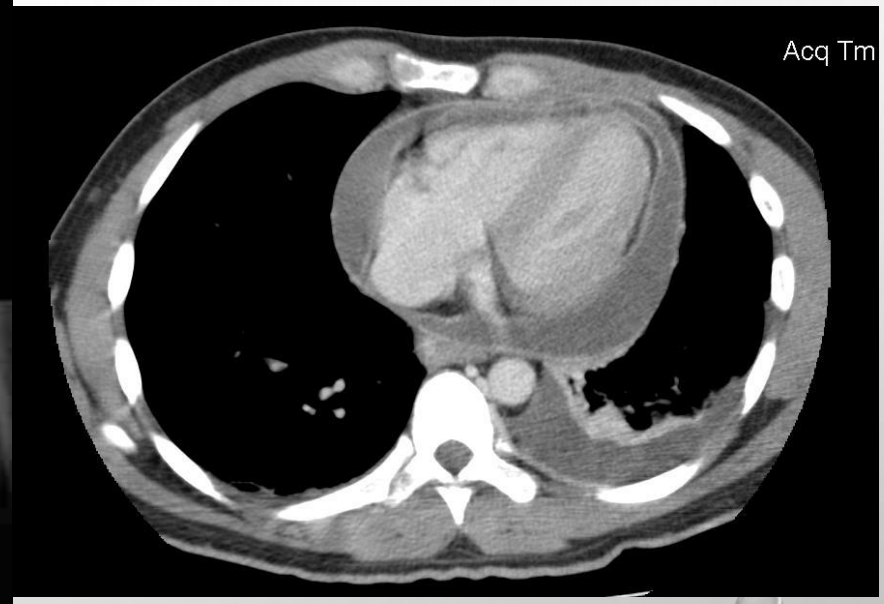
HEART / CARDIAC

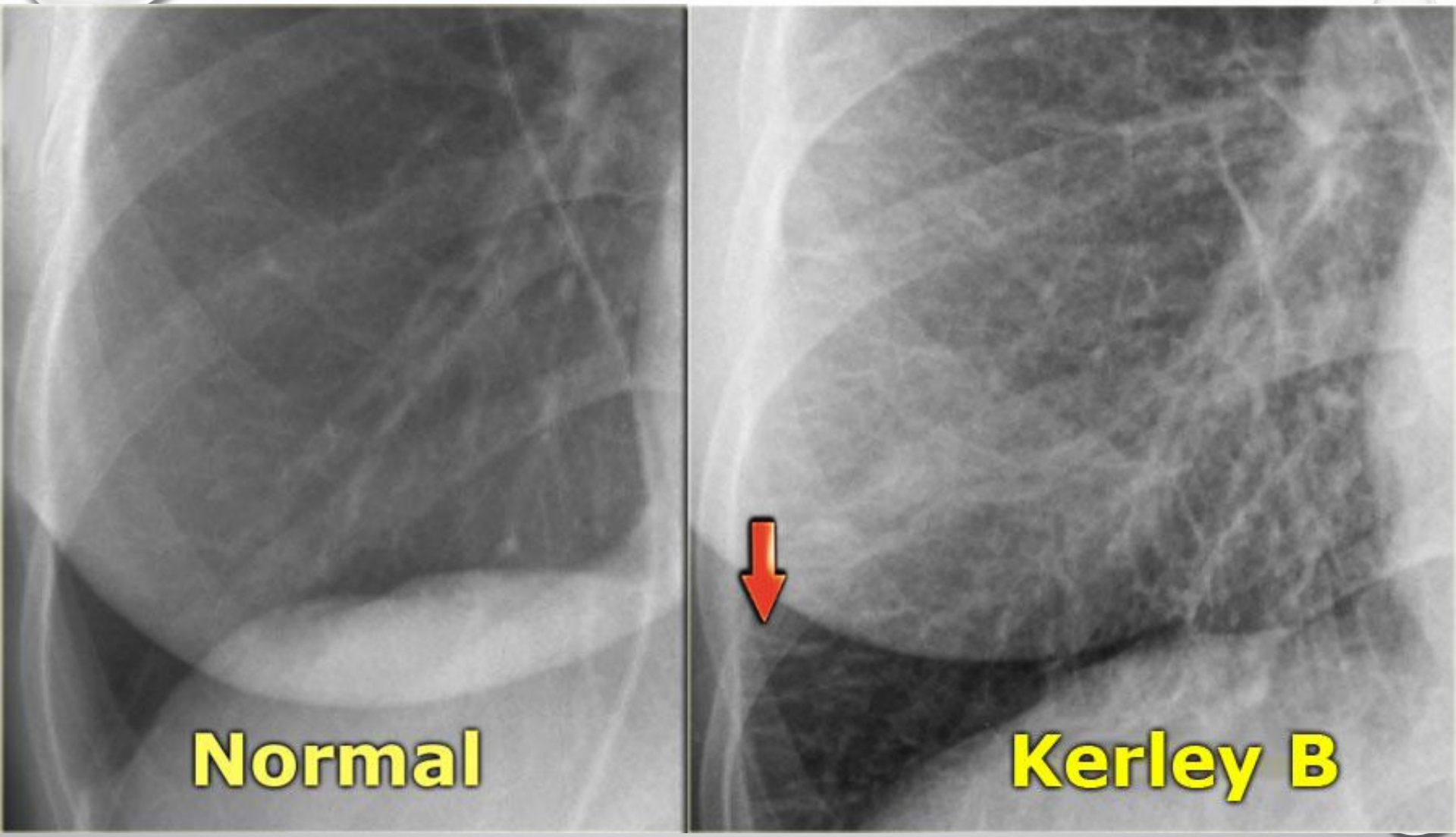


CARDIOMEGALY

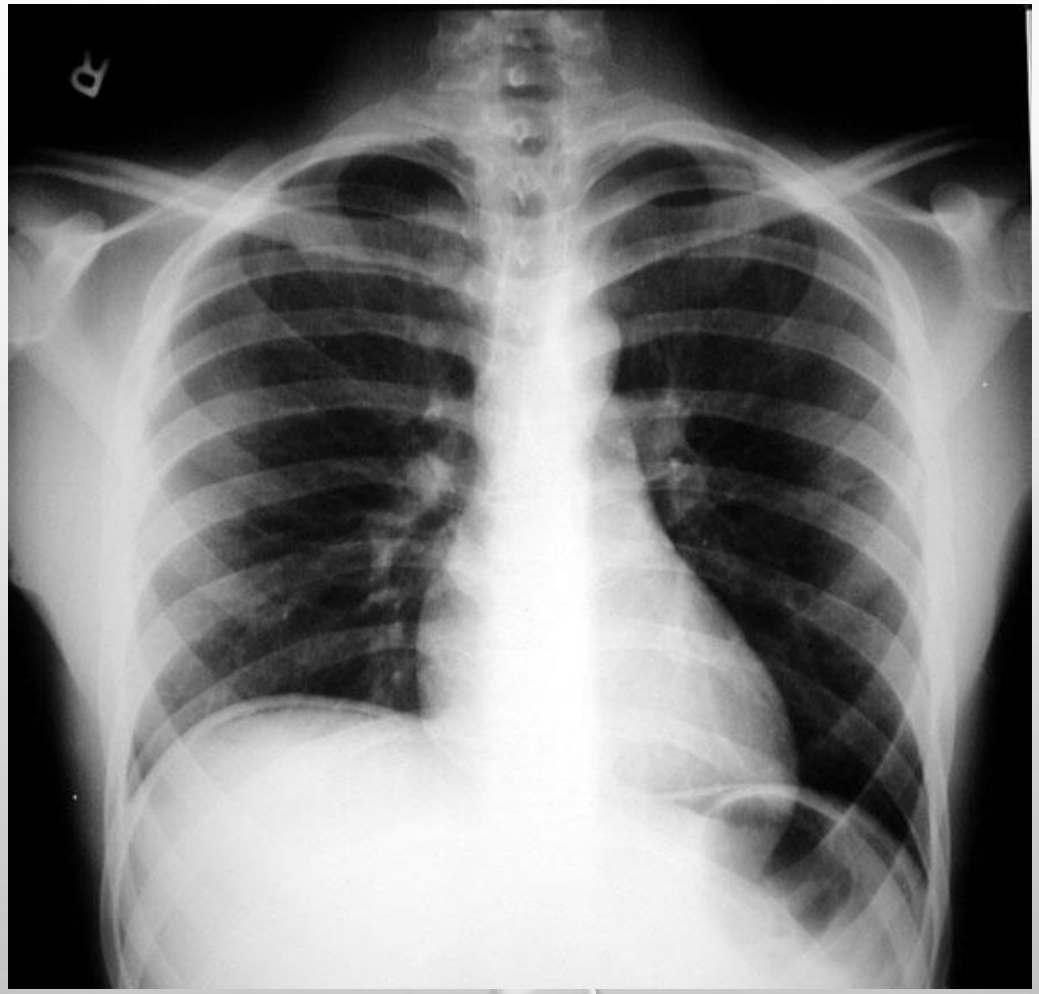


PERICARDIAL EFFUSION

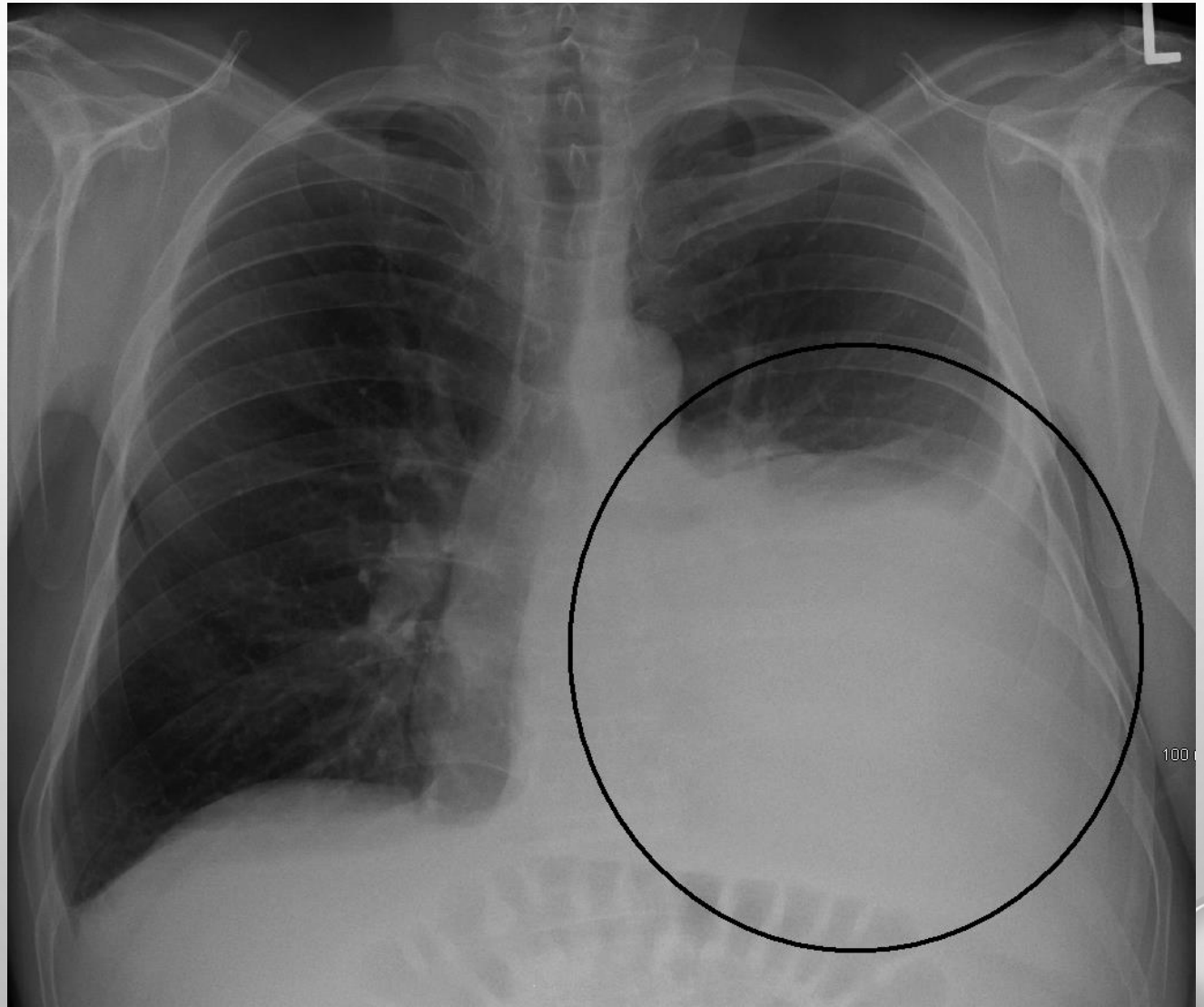



Normal
Kerley B

PNEUMOPERITONEUM

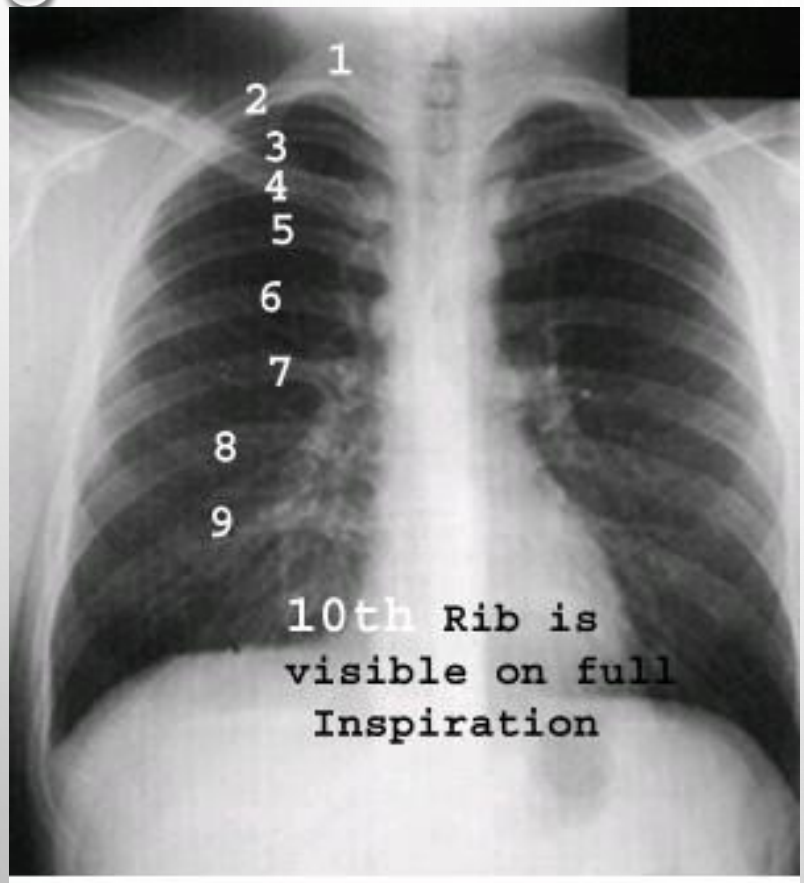


PLEURAL EFFUSION

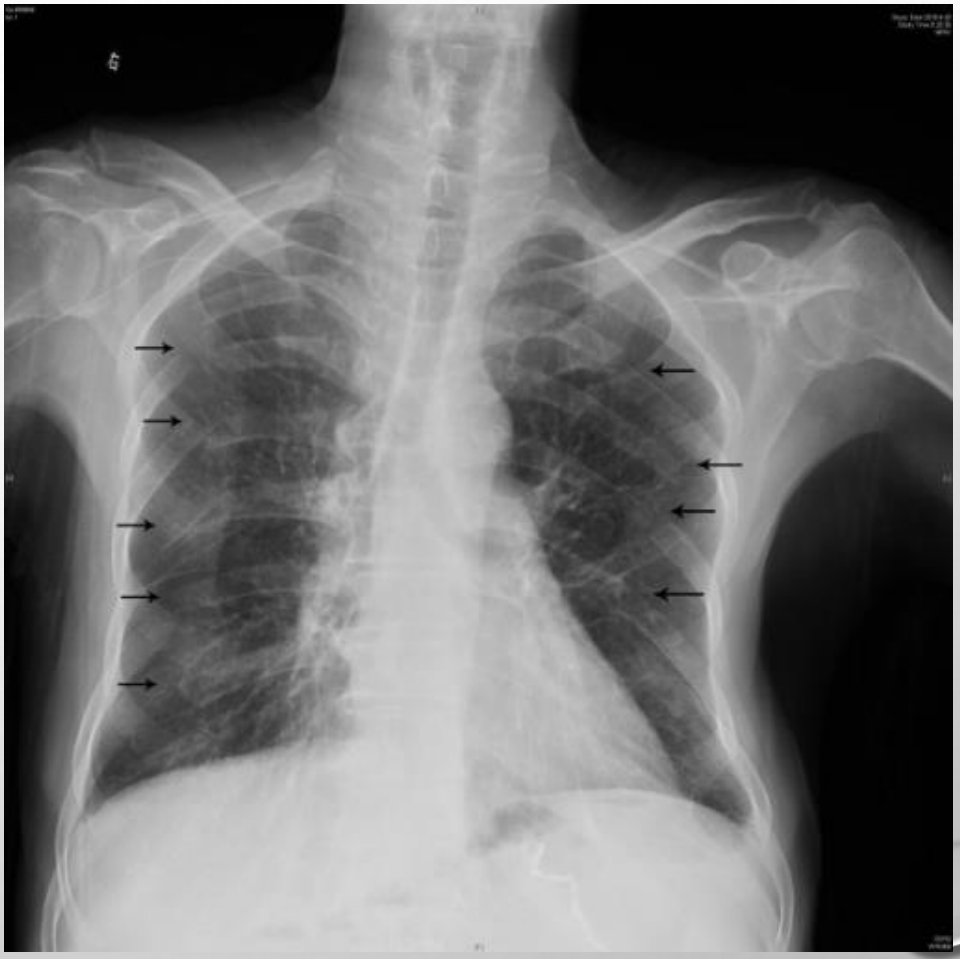


LOCULATED EFFUSION

COUNTING THE RIBS/ FRACTURES

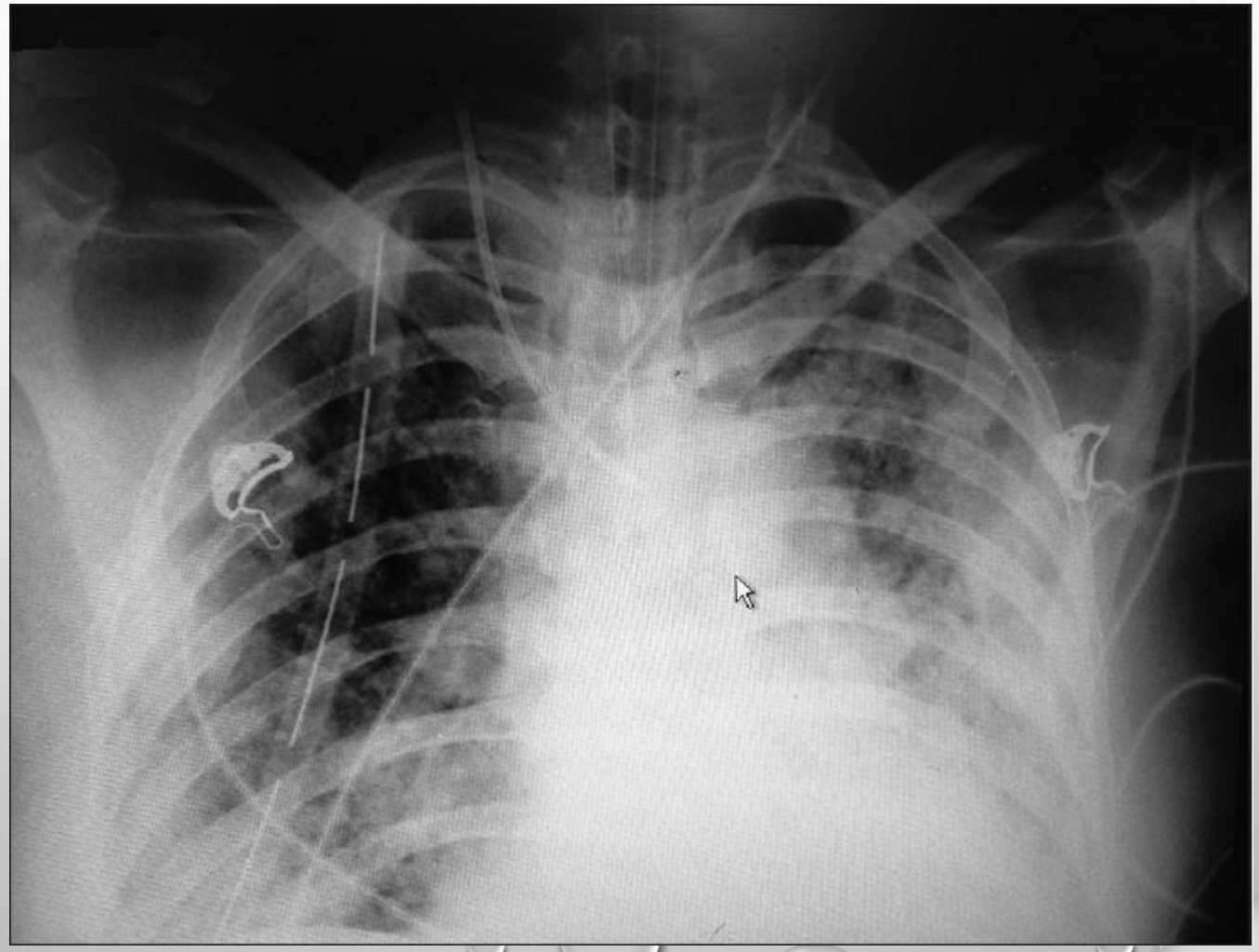


PA view on full inspiration. Image courtesy of Dr. Naveed Ahmad.

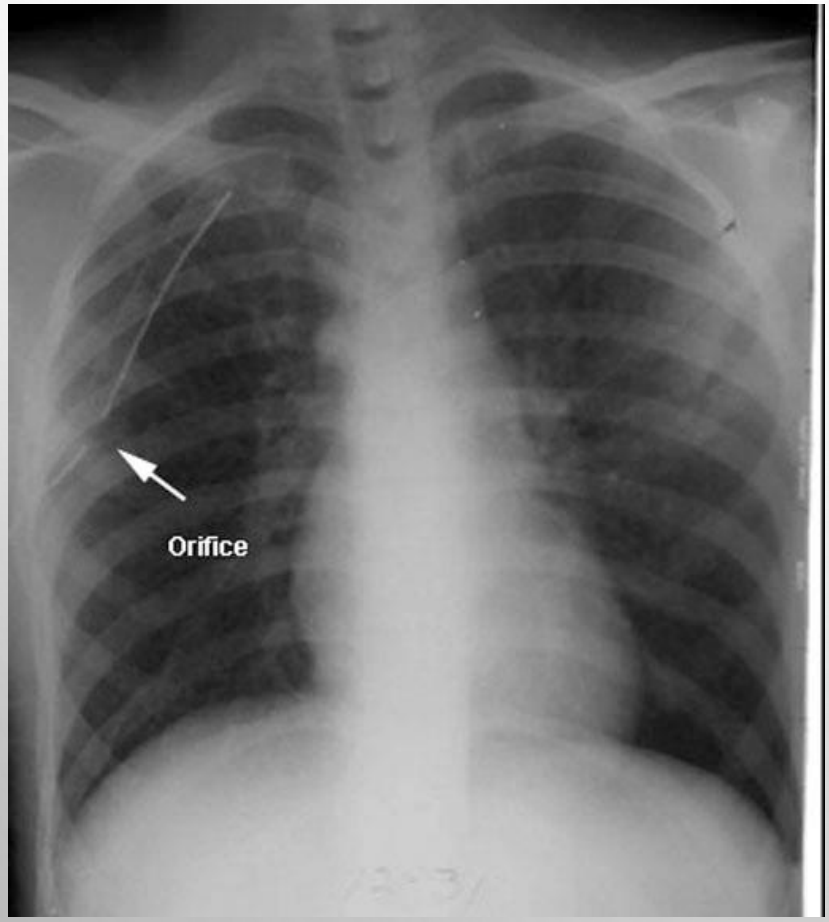


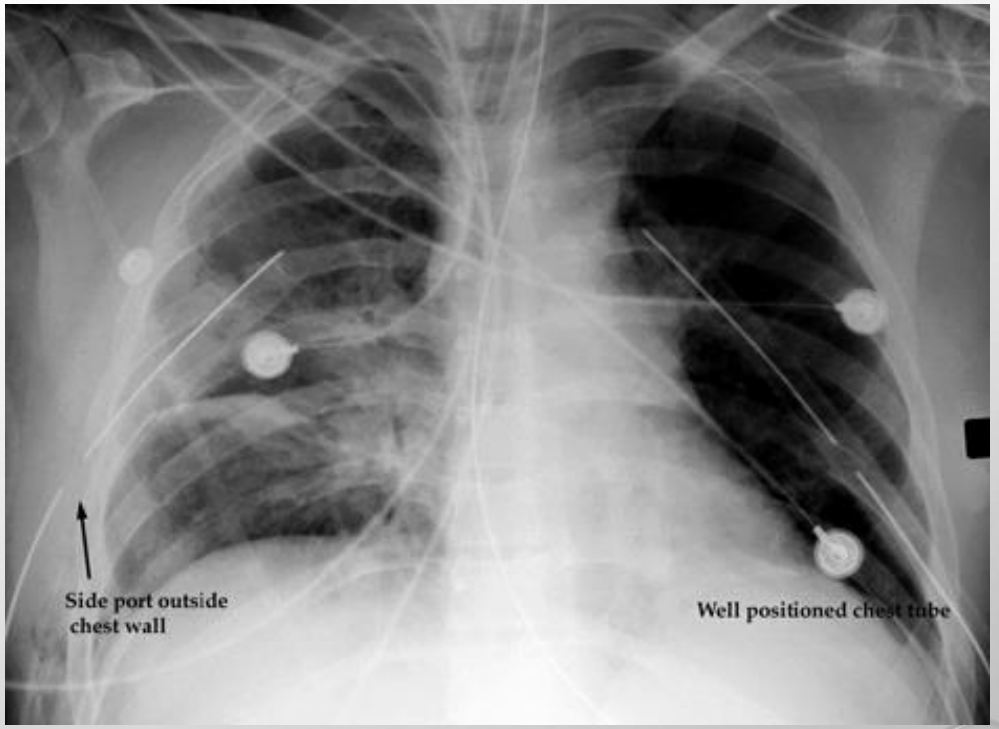
SOFT TISSUE

APPLIANCES AND FOREIGN BODIES



CHEST TUBE PLACEMENT





CT OF CHEST

TYPES OF CT CHEST

STANDARD:

- - 3-10 mm, Full lungs, +/- contrast

HIGH RESOLUTION:

- 0.625 – 1.5 mm every 10 mm
- High definition of lung parenchyma, vessels, airspaces, airways, interstitial
- Prone and supine

FLEISCHNER GUIDELINES 2017:

CT PULMONARY ANGIOGRAM:

- BOLUS OF CONTRAST
- INDICATIONS: PE, AORTIC ANEURYSM, AORTIC DISSECTION

LDCT:

- Screening tool

OTHER INDICATIONS FOR CT CHEST

- **EVALUATION OF AN ABNORMALITY DETECTED ON A CHEST X-RAY**
  - PULMONARY / MEDIASTINAL MASS OR NODULE
- **EVALUATION OF AORTIC DISEASE**
  - AORTIC ANEURYSM/DISSECTION
  - TRAUMA
- **MALIGNANT DISEASE**
  - STAGING OF PRIMARY TUMOR EXTENT AND ITS RELATIONSHIP TO ADJACENT STRUCTURES
  - LYMPHADENOPATHY AND METASTATIC DISEASE
  - ASSESS SUITABILITY FOR BIOPSY
- **EVALUATION OF PLEURAL DISEASE**
- SUSPECTED PULMONARY EMBOLUS

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Volume 44, No.8, August 2015 Pages 558-562

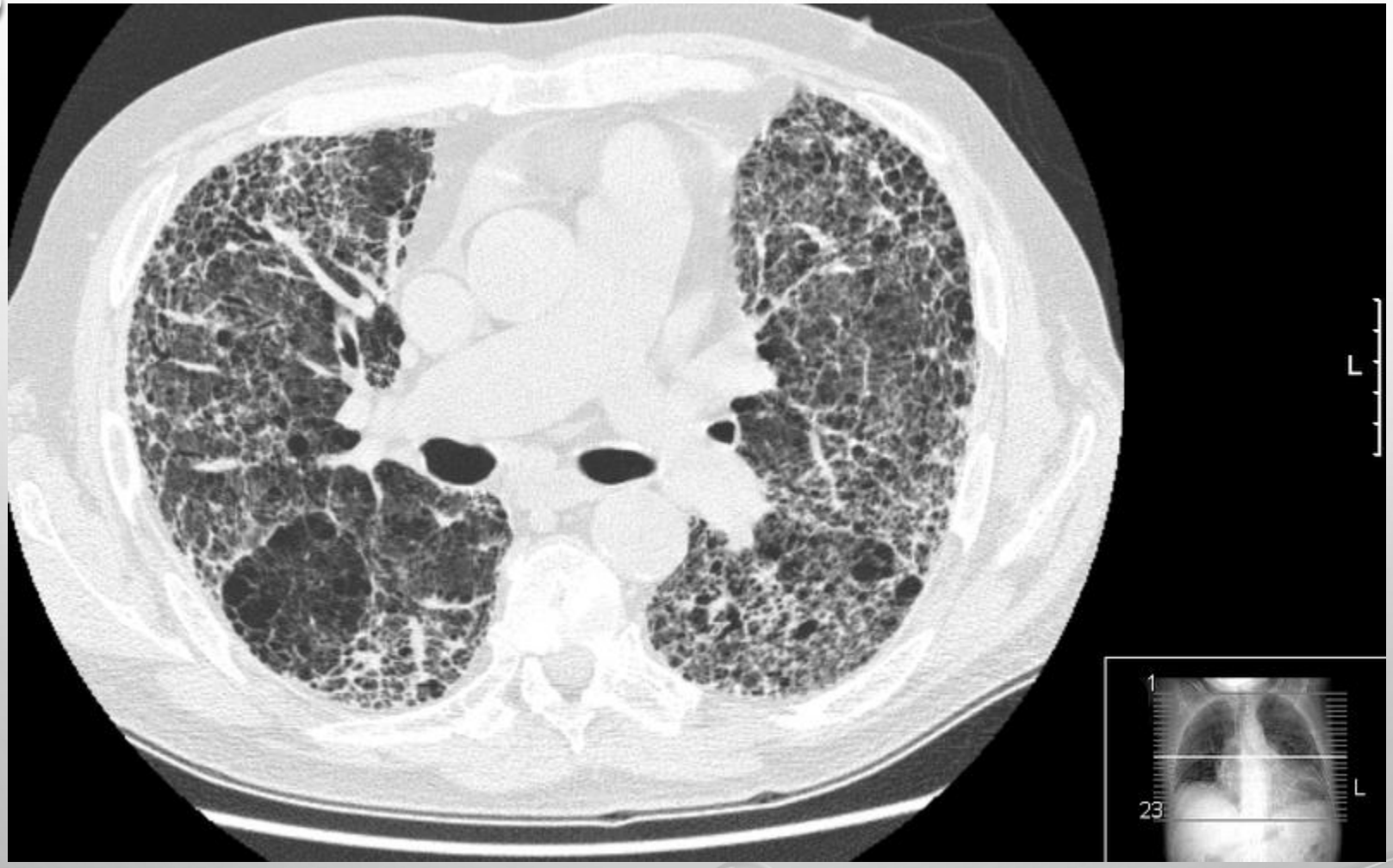
HRCT INDICATIONS

- **BRONCHIECTASIS**
- **PULMONARY FIBROSIS**
- **ABNORMAL CXR WITH DIFFUSE CHANGES**
- **ABNORMAL PFTS WITH NORMAL CXR**
- **KNOWN DIFFUSE LUNG DISEASE / INTERSTITIAL LUNG DISEASE**
- **ASSESSMENT OF RX RESPONSE (EX: IPF (IDIOPATHIC PULMONARY FIBROSIS)**

IDIOPATHIC PULMONARY FIBROSIS

- IPF GUIDELINES FOR 2018
  - USE HRCT TO ASSIST WITH MANAGEMENT TO DETERMINE PATTERN OF UIP (USUAL INTERSTITIAL PNEUMONIA)
    - UIP PATTERN – NO FURTHER WORKUP NEEDED FOR DX IPF
    - NON UIP PATTERN NEEDS ADDITIONAL WORKUP WITH BAL / OLBX
      - PROB UIP
      - INDETERMINATE UIP
      - ALTERNATIVE DIAGNOSIS

HRCT OF IPF



LOW DOSE CT CHEST / SCREENING TOOL

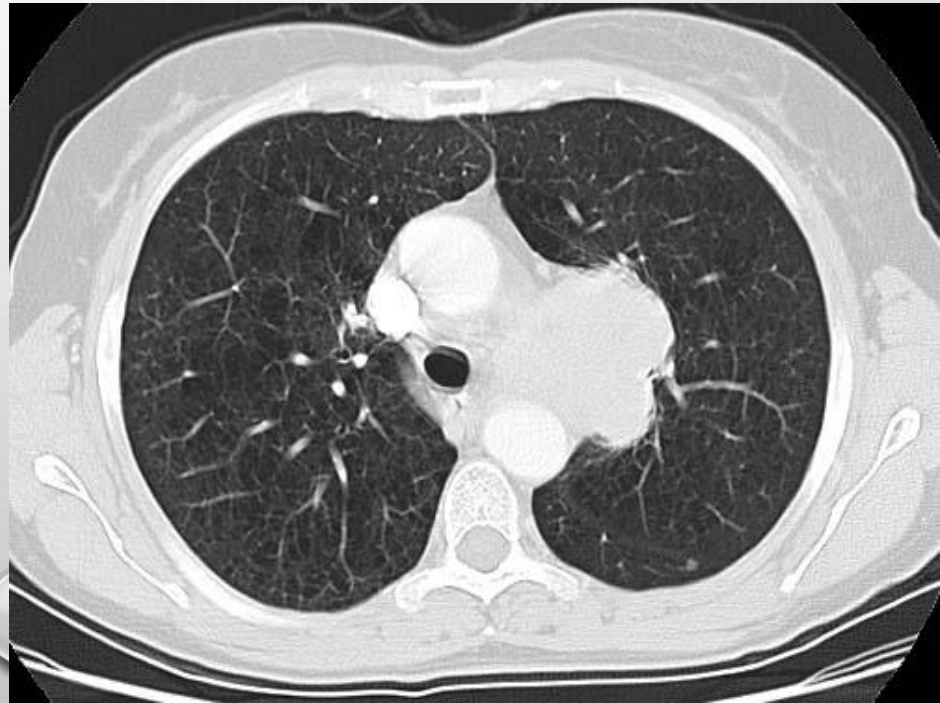
CMS GUIDELINES FOR ORDERING LDCT (LOW DOSE CT FOR LUNG CANCER SCREENING)

- Age 55-77 years old
- Asymptomatic
- Tobacco abuse of >/= 30 pack history
- Current smoker or quit within the last 15 years

- *Medicare coverage as of February 2015*
- *www.cms.gov for specifics*

LUNG WINDOWS on CT Chest

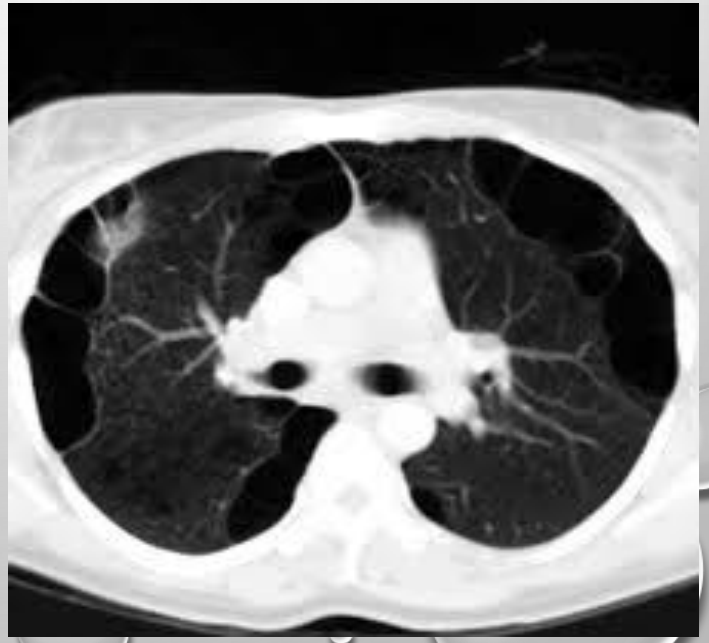
- EMPHYSEMATOUS CHANGES
- BRONCHIECTASIS
- HONEYCOMBING
- GROUND GLASS OPACITIES
- NODULES/MASSES
- AIR BRONCHOGRAMS
- TREE IN BUD PATTERN



EMPHYSEMATOUS CHANGES

- **PERMANENT ENLARGEMENT OF AIR SPACES DISTAL TO BRONCHIOLES**
- **DESTRUCTION OF ELASTIN IN THE WALLS OF THE ALVEOLI**
- **OFTEN SEE BARREL CHEST/HYPERINFLATION/ FLATTENED DIAPHRAGMS**

- ***DIFFERENTIAL DIAGNOSIS:***
- COPD
- Hx smoking
- Alpha 1 antitrypsin def.



EMPHYSEMA

3 TYPES:

CENTRILOBULAR:

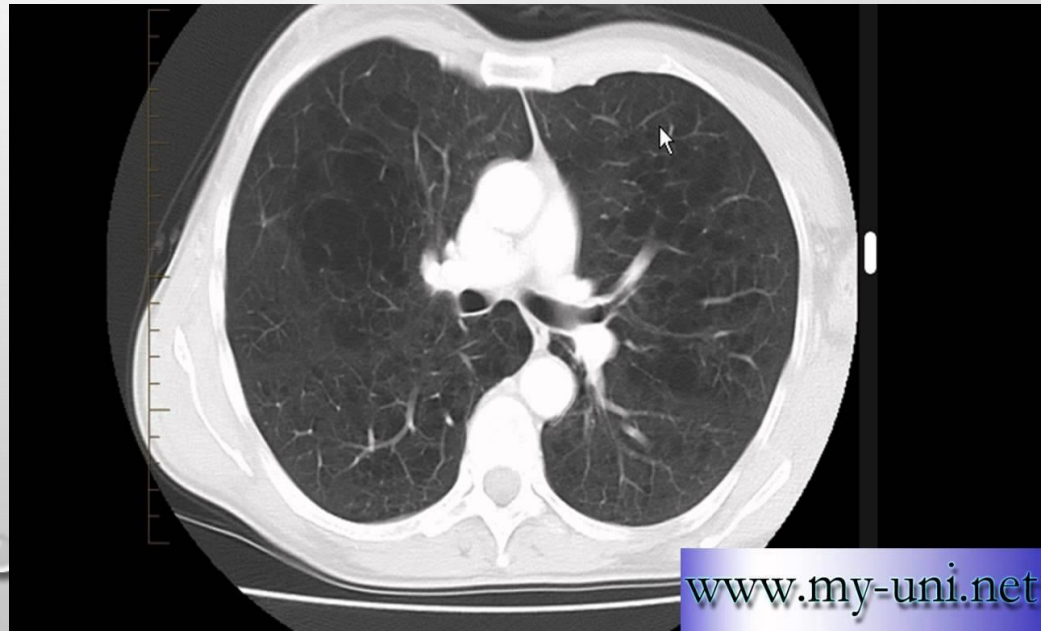
FROM SMOKING/UPPER HALF OF THE LUNGS, MOST COMMON

PANACINAR:

DESTROYS ENTIRE ALVEOLUS/ LOWER HALF OF LUNGS/A1AT DEF.

PARASEPTAL:

DISTAL AIRWAYS/ APICAL BULLAE



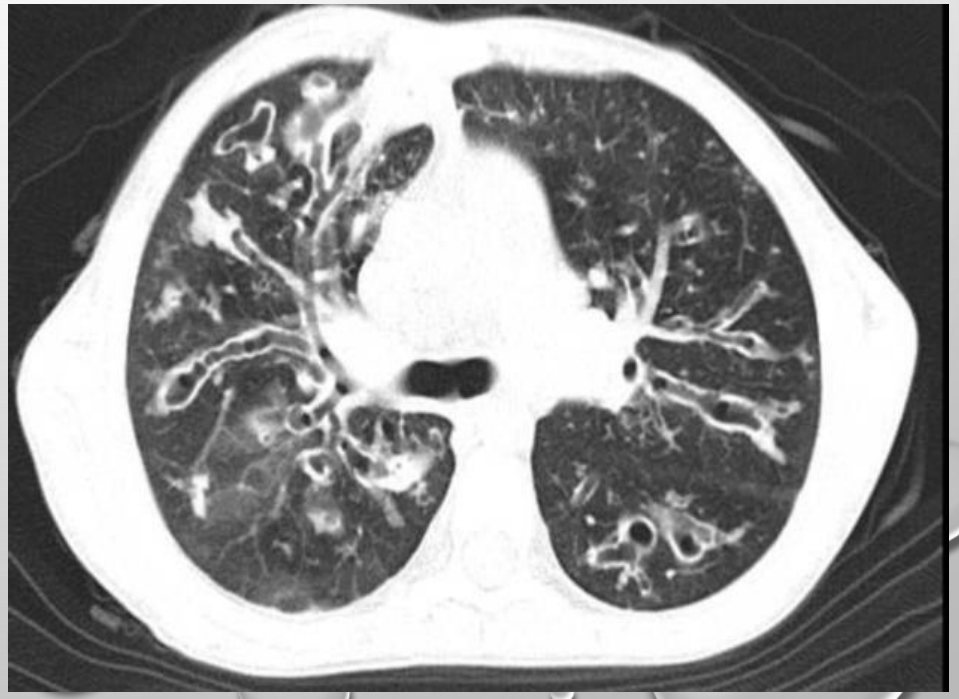
BRONCHIECTASIS

DILATION OF THE BRONCHI

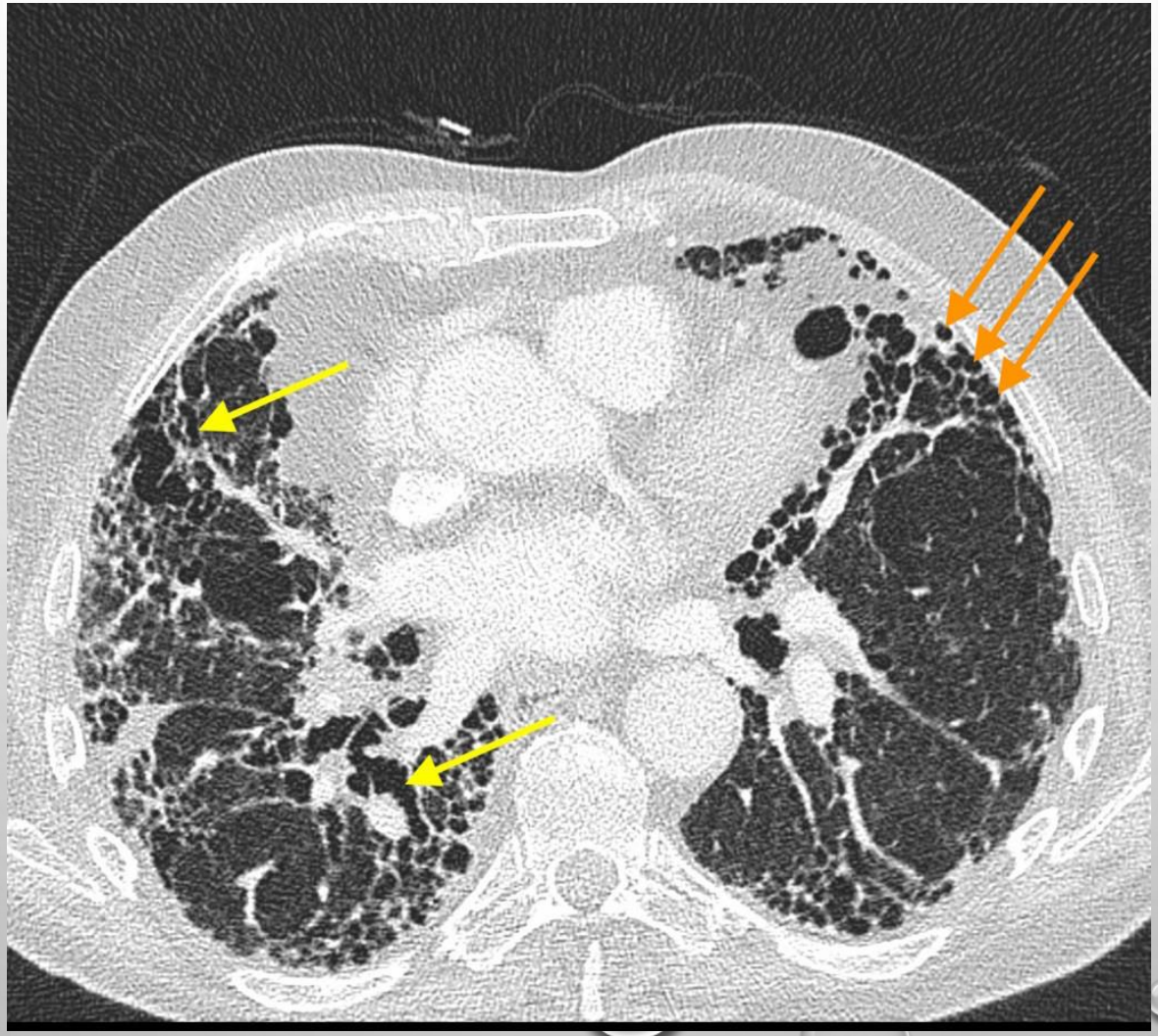
- **CAUSES IMPAIRMENT OF CLEARANCE OF AIRWAYS -> RECURRENT INFECTIONS -> BRONCHIAL DAMAGE**
- **HRCT IS BEST CT OF CHOICE**

DIFFERENTIAL DIAGNOSIS:

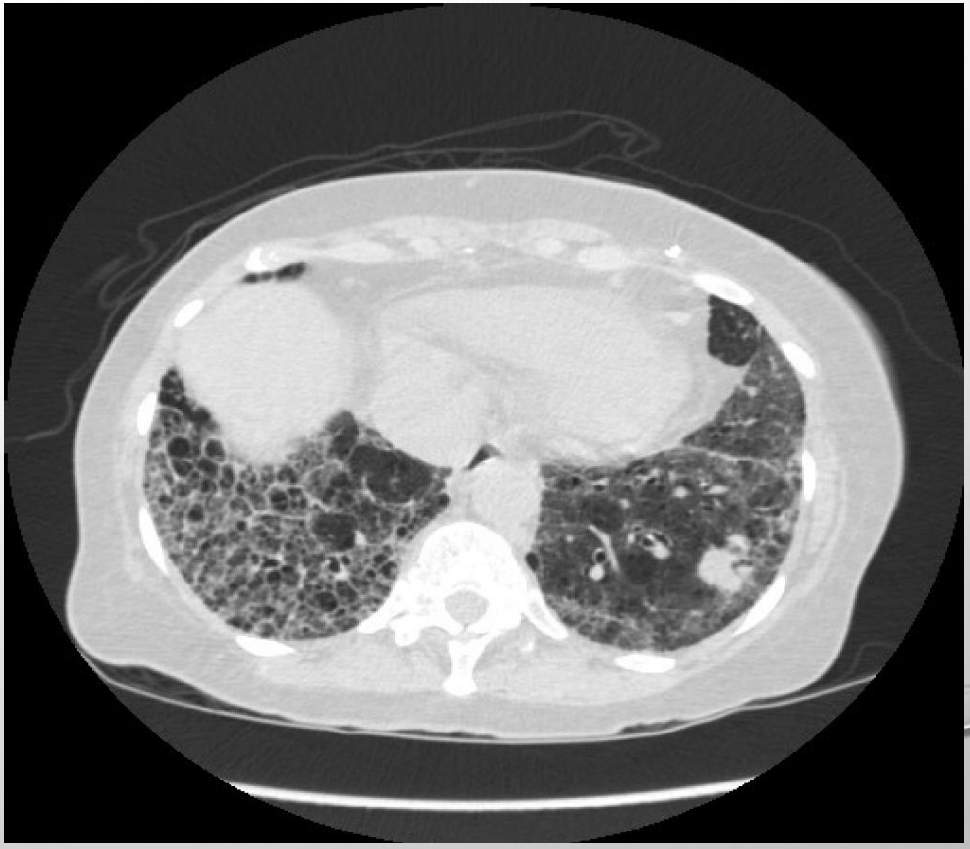
- **INFECTION**
- **BRONCHIAL**
- **CYSTIC FIBROSIS**
- **IMMUNODEFICIENCY / A1AT DEF.**
- **PULMONARY FIBROSIS**



BRONCHIECTASIS



HONEYCOMBING



HONEYCOMBING

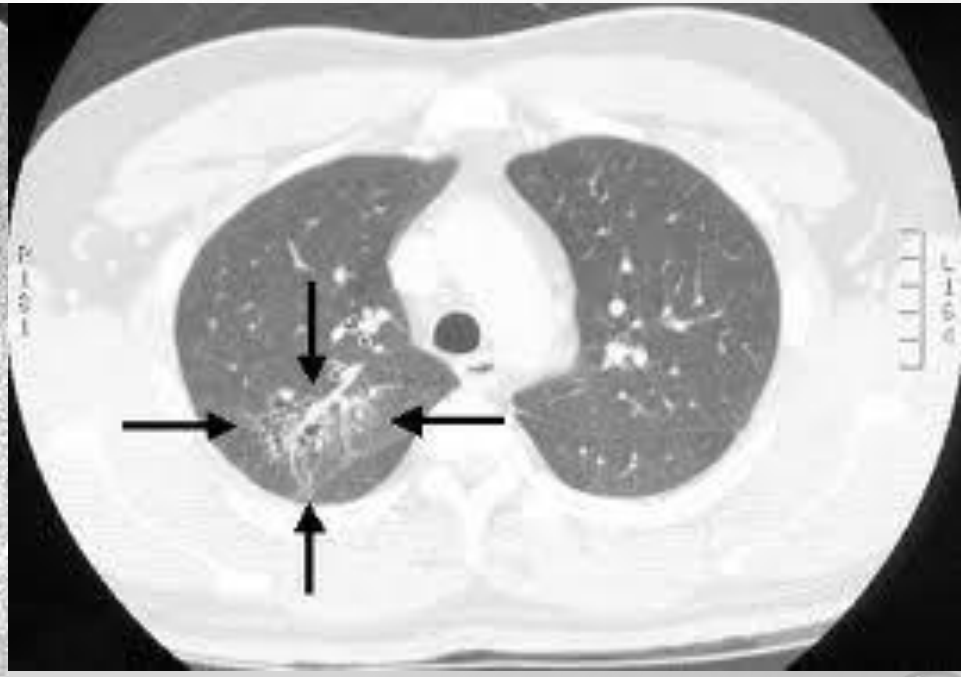
GROUND GLASS OPACITIES

- **COMMON *NON-SPECIFIC* FINDING**
- **DECREASE AIR WITHOUT COMPLETE OBILTERATION OF ALVEOLI**
- **LUNG OPACITY / INFILTRATE BUT DOESN'T OBSCURE THE PULMONARY VESSELS**

DIFFERENTIAL DIAGNOSIS:

- alveolitis / interstitial pneumonitis (HP/IPF/sarcoidosis)
- Pulmonary edema
- Resolving PNA or hemorrhage

- GROUND GLASS OPACITIES



FLEISCHNER 2017 GUIDELINE FOR PULMONARY NODULES

- UPDATED IN 2017 FROM 2005
- PURPOSE IS TO GIVE PROVIDERS GUIDELINES / MANAGEMENT RECOMMENDATIONS FOR FOLLOW UP
- PULMONARY NODULE
  - SOLID LESION
  - SUB-SOLID LESION
    - PART SOLID VS. GGO

FLEISCHNER 2017 GUIDELINE FOR PULMONARY NODULES

- FOR PATIENTS 35 YO AND OLDER
- EXCLUDES IMMUNOCOMPROMISED
- RISK STRATIFICATION FOR PATIENT **AND** NODULE CHARACTERISTICS

Probability of Malignancy		
Low (<5%)	**Intermediate (5-65%)**	**High (>65%)**
Young Less smoking No prior cancer, Small nodule size, Regular margins, Non-upper lobe	Mixture of low and high probability features	Older Heavy smoking Prior cancer Larger size Irregular margin Upper lobe location

http://www.radiologyassistant.nl/en/p5905aff4788ef/fleischner-2017-guideline-for-pulmonary-nodules.html

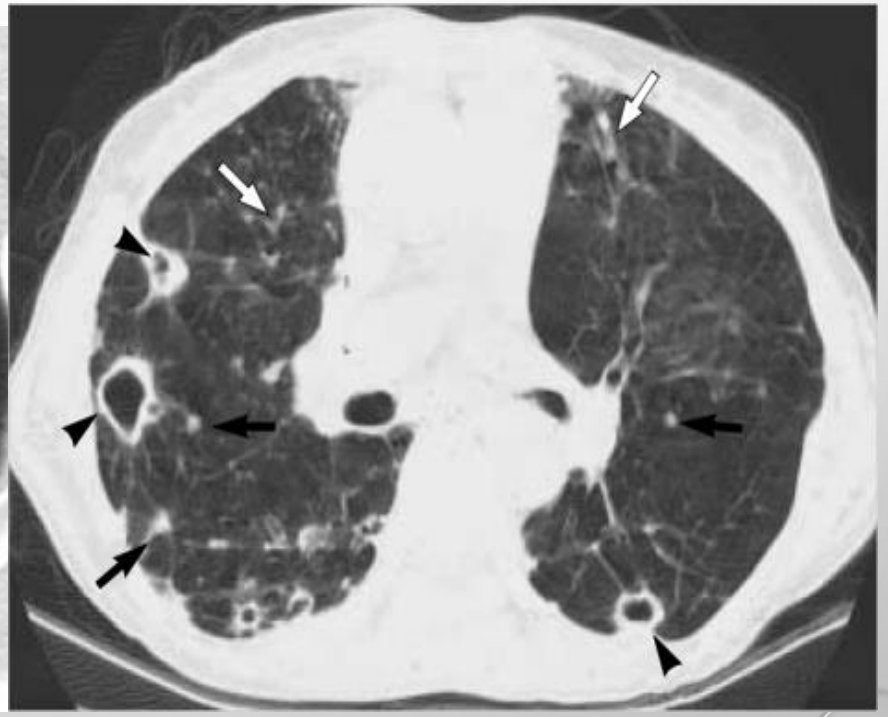
NODULES / MASSES

TYPES OF COMMON LUNG NODULES/MASSES:

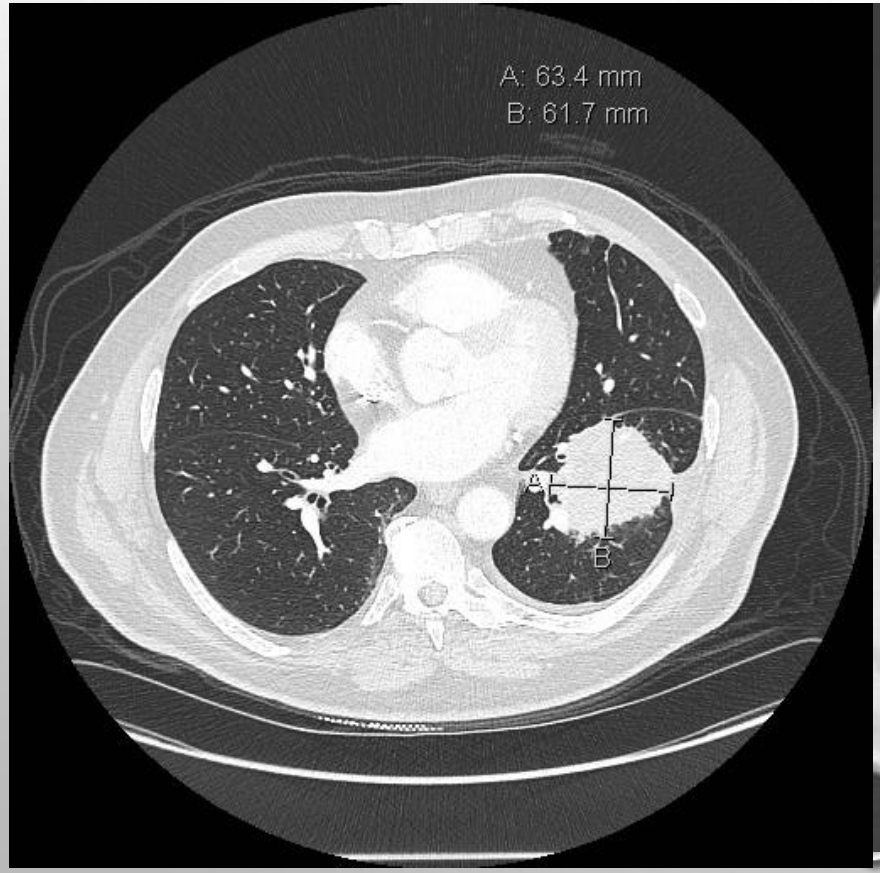
- **GRANULOMA**
- **METASTATIC DISEASE**
- **LYMPHOMA**
- **CAVITARY**
- **LUNG PRIMARY CANCER**
- **SARCOIDOSIS**

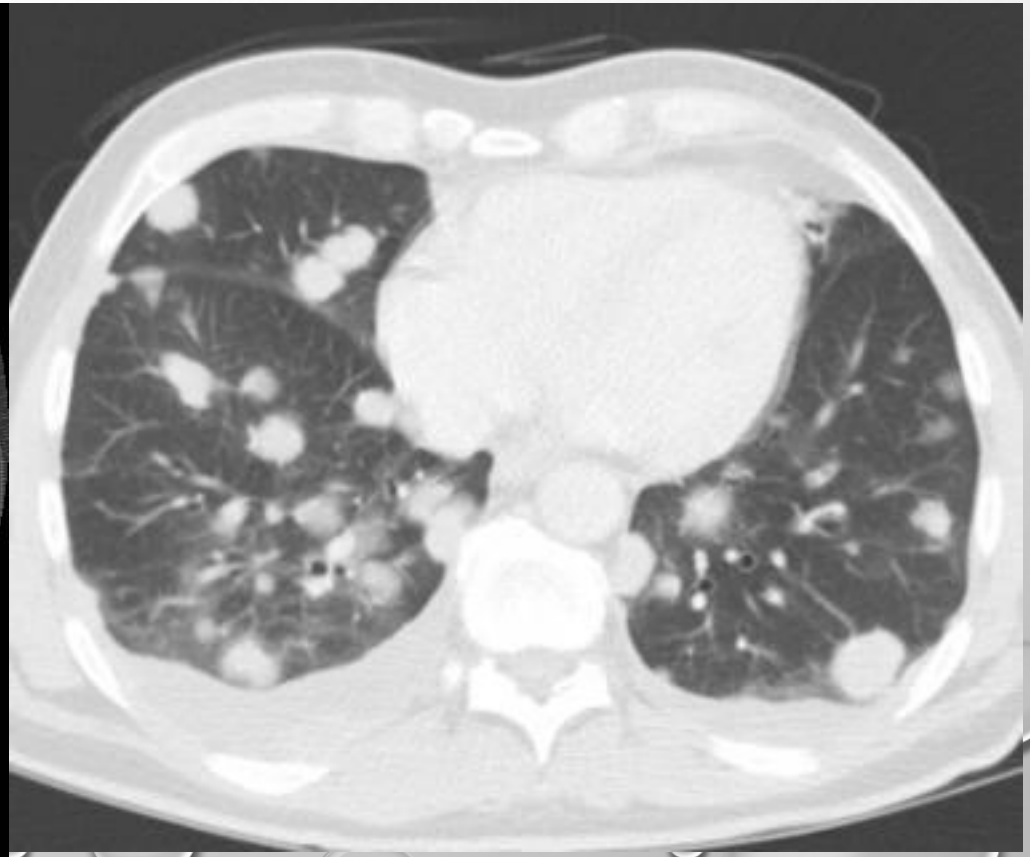
LUNG NODULES IS *LESS THAN 3 CM* IN SIZE

SPICULATED NODULE / CAVITARY



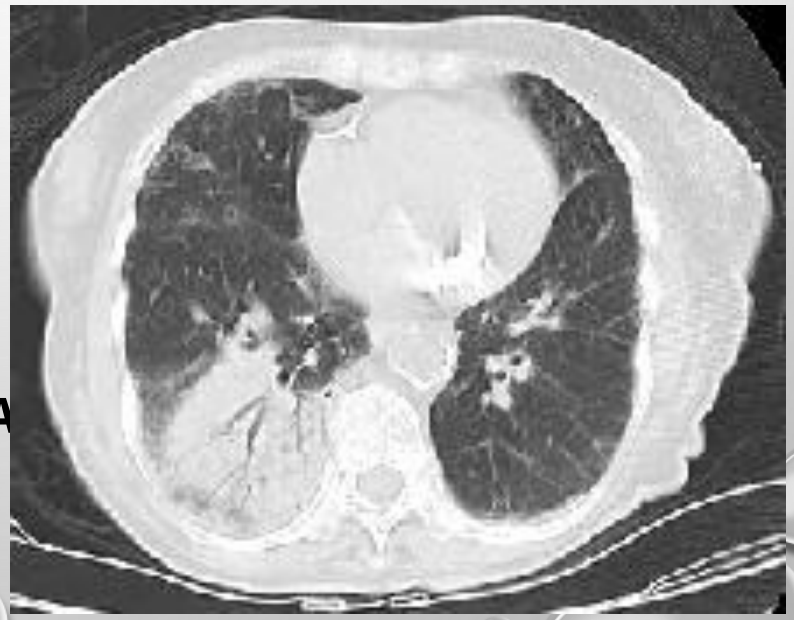
LUNG MASS OR MASSES



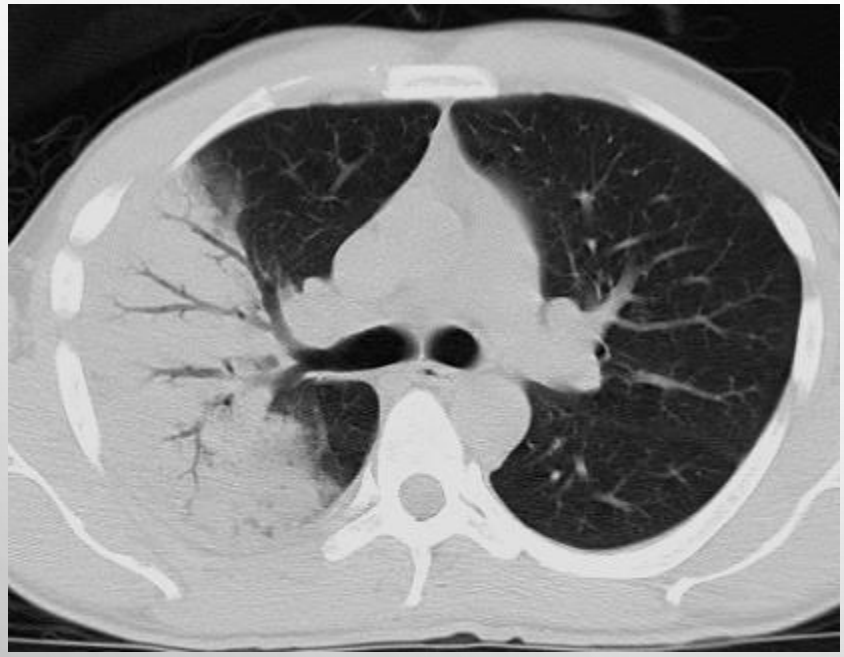


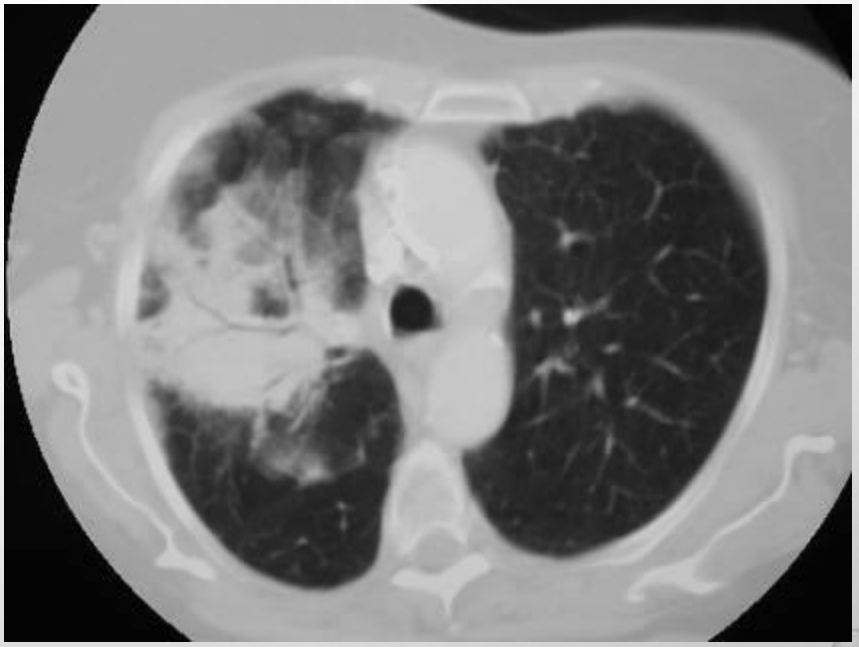
AIR BRONCHOGRAM

- **SEEN WHEN BRONCHI BECOME VISIBLE D/T INFILTRATES/ATTENUATION OF THE SURROUNDING LUNG TISSUE**
- **IF SEEN -> EXCLUDE PLEURAL OR MEDIASTINAL LESIONS**
- **DIFFERENTIAL DIAGNOSIS:**
  - **ATELECTASIS**
  - **PNEUMONIA**
  - **PULMONARY EDEMA**
  - **HEMORRHAGE**
  - **BRONCHIO-ALVEOLAR CARCINOMA**
  - **LYMPHOMA**



AIR BRONCHOGRAMS





TREE IN BUD PATTERN

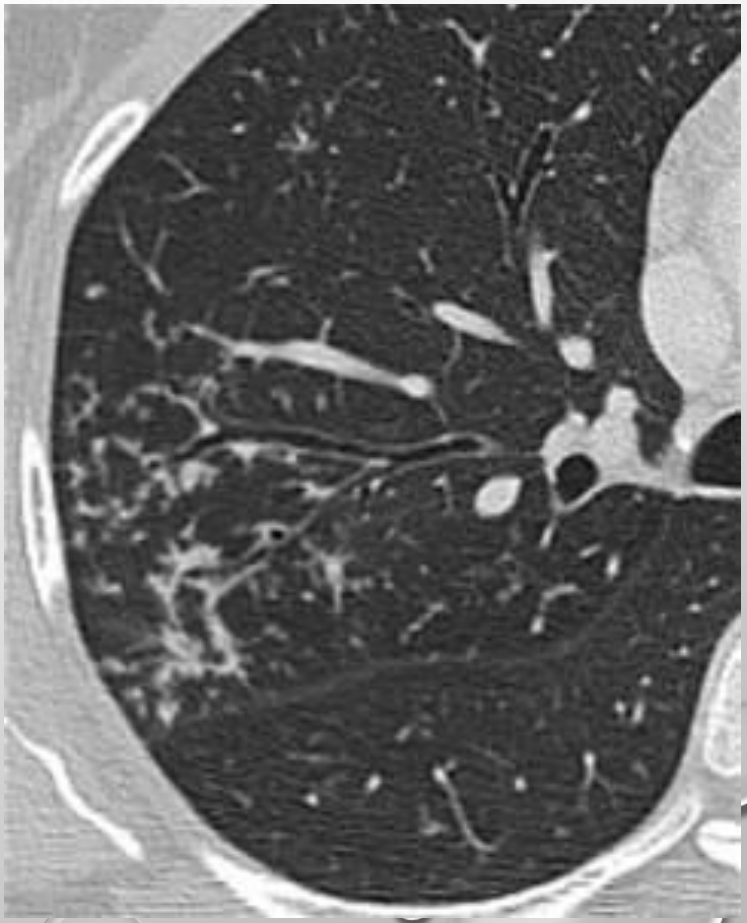
DILATED BRONCHIOLS

- USUALLY FILLED WITH FLUID OR PUS

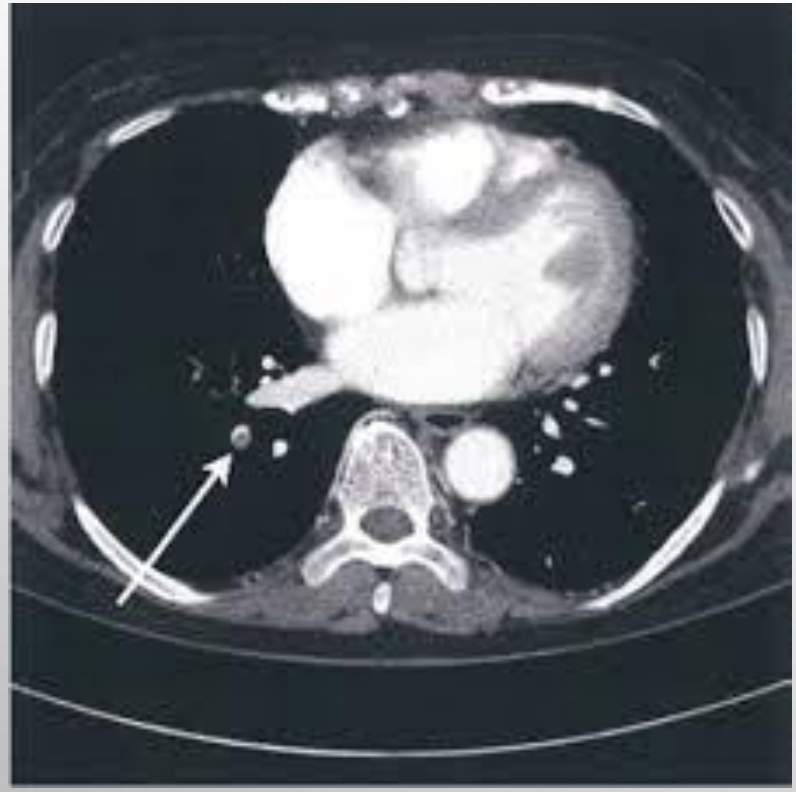
- OFTEN SEEN WITH INFECTION / ASPIRATION

DIFFERENTIAL DIAGNOSIS:

- **PULMONARY TB**
- **ASPIRATION PNEUMONIA**
- **CAN BE ASSOCIATED WITH COP / BOOP**
- **SEEN WITH BRONCIECTASIS**



PULMONARY ANGIOGRAM / CTPA



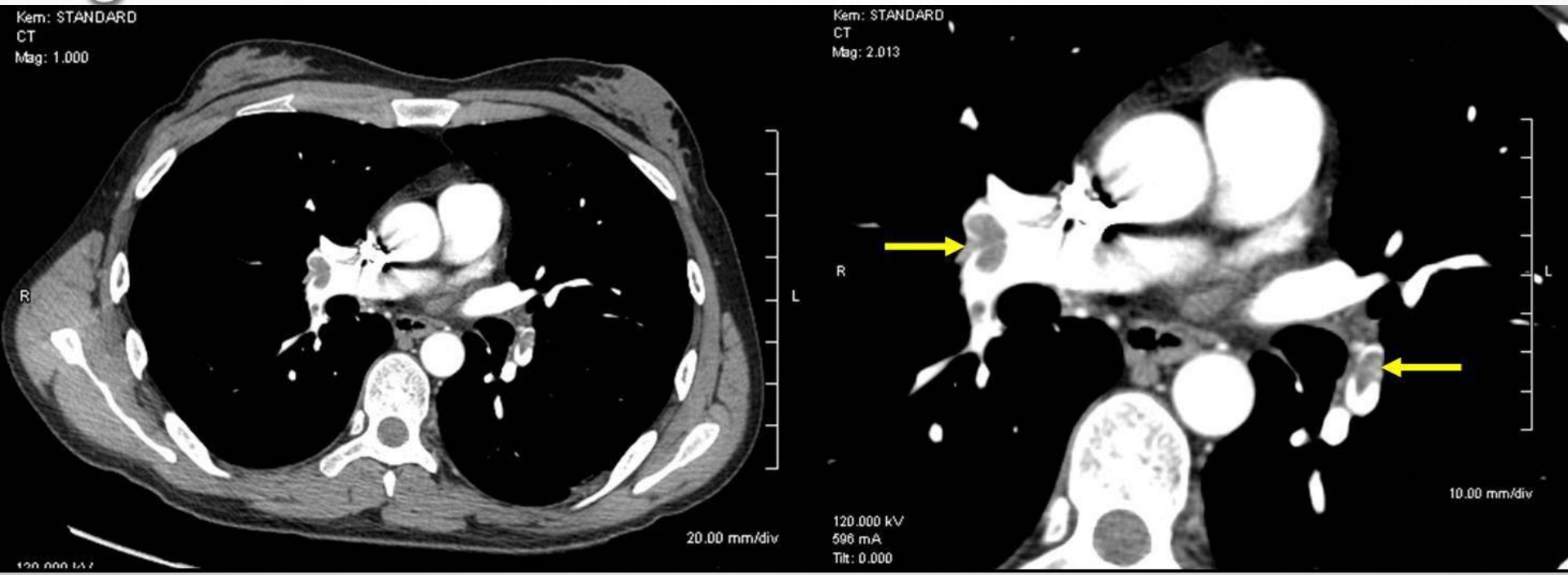
CT PULMONARY ANGIOGRAM

- **INDICATED FOR DIAGNOSING PULMONARY EMBOLI**
- **BOLUS OF IV CONTRAST (USING INJECTOR PUMP) GIVEN TO LOOK FOR CLOTS WITHIN THE PULMONARY ARTERIES**
- **IV CONTRAST WILL APPEAR WHITE WITHIN THE PULMONARY ARTERIES, ANY GRAY/DARK AREAS INDICATE FILLING DEFECTS**
- **CONTRAINDICATIONS: AKI / ALLERGY TO IODINE**

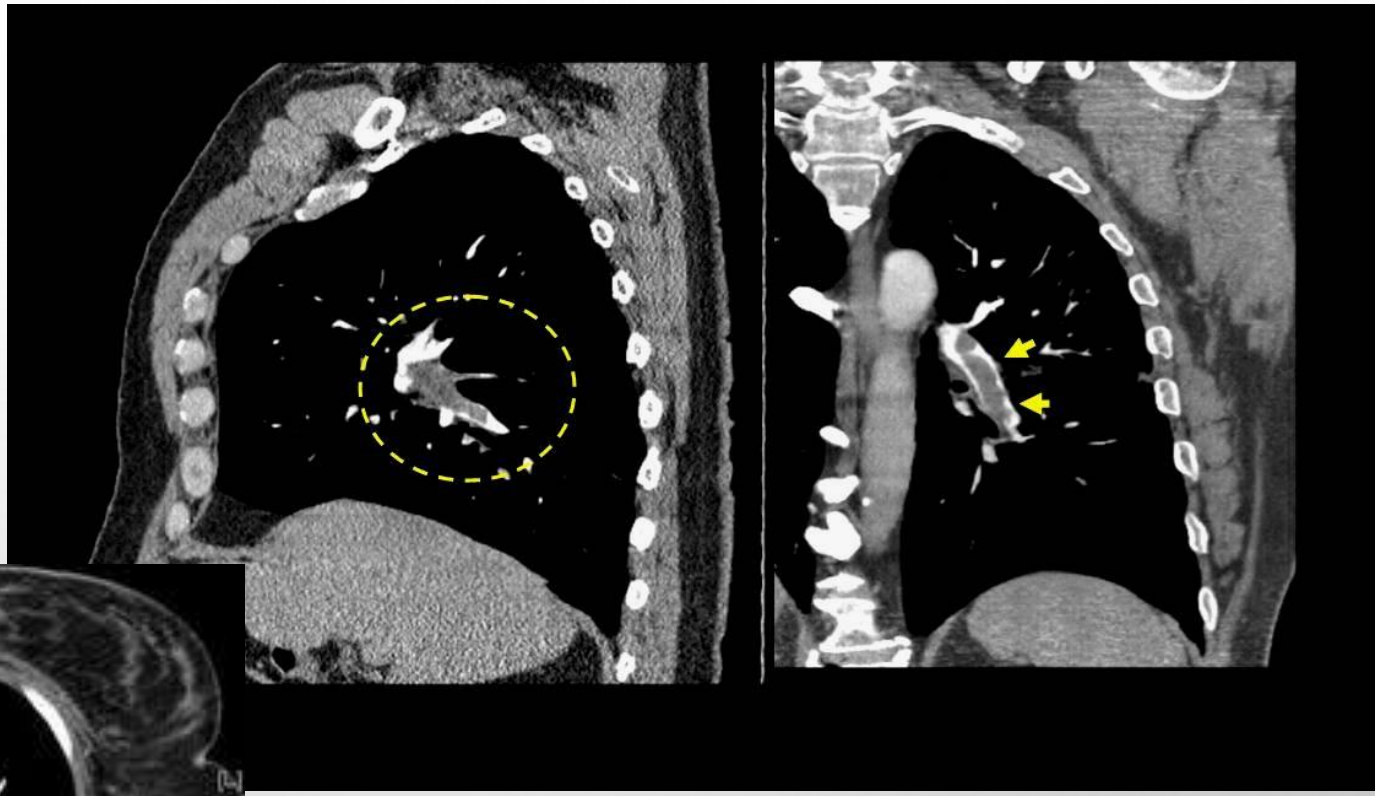
INDICATIONS:

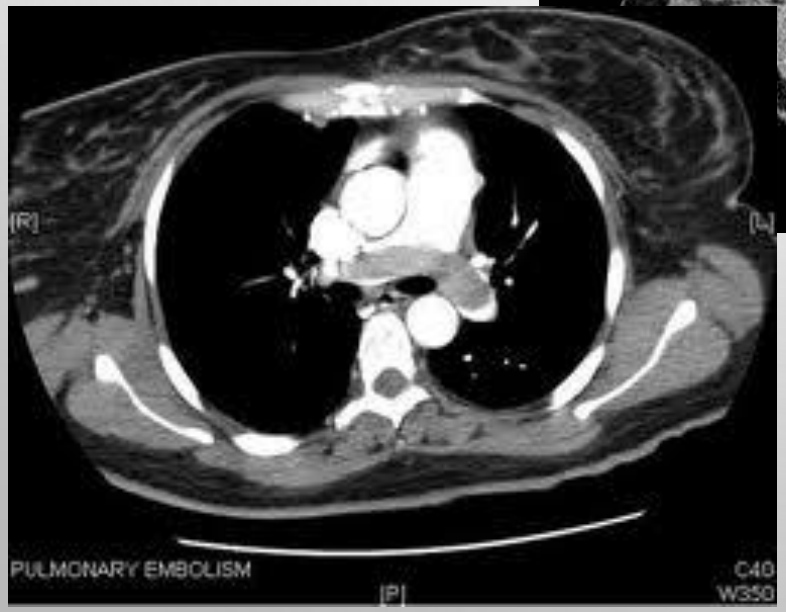
- Pulmonary emboli
- Aortic aneurysms
- Aortic dissection

CTPA


Kem: STANDARD
CT
Mag: 1.000
R
L
20.00 mm/div
Kem: STANDARD
CT
Mag: 2.013
R
L
10.00 mm/div
120.000 kV
596 mA
Tilt: 0.000

AXIAL VS. SAGITTAL VIEW





COVID 19 IMAGING

- **IMAGING PROFILE OF THE COVID-19 INFECTION: RADIOLOGIC FINDINGS AND LITERATURE REVIEW**
  - PUBLISHED FEB 13, 2020
  - HTTPS://PUBS.RSNA.ORG/DOI/FULL/10.1148/RYCT.2020200034
  - 21 COVID 19 CASES REVIEWED FROM CHINA
- **RESULTS:**
  - **IMAGING SHOWED GGO WITH OCCASIONAL CONSOLIDATION IN PERIPHERY**
  - **NO PLEURAL EFFUSIONS OR LYMPHADENOPATHY**
  - **CT WAS MORE SENSITIVE TO CXR FOR GGO / INFILTRATES**

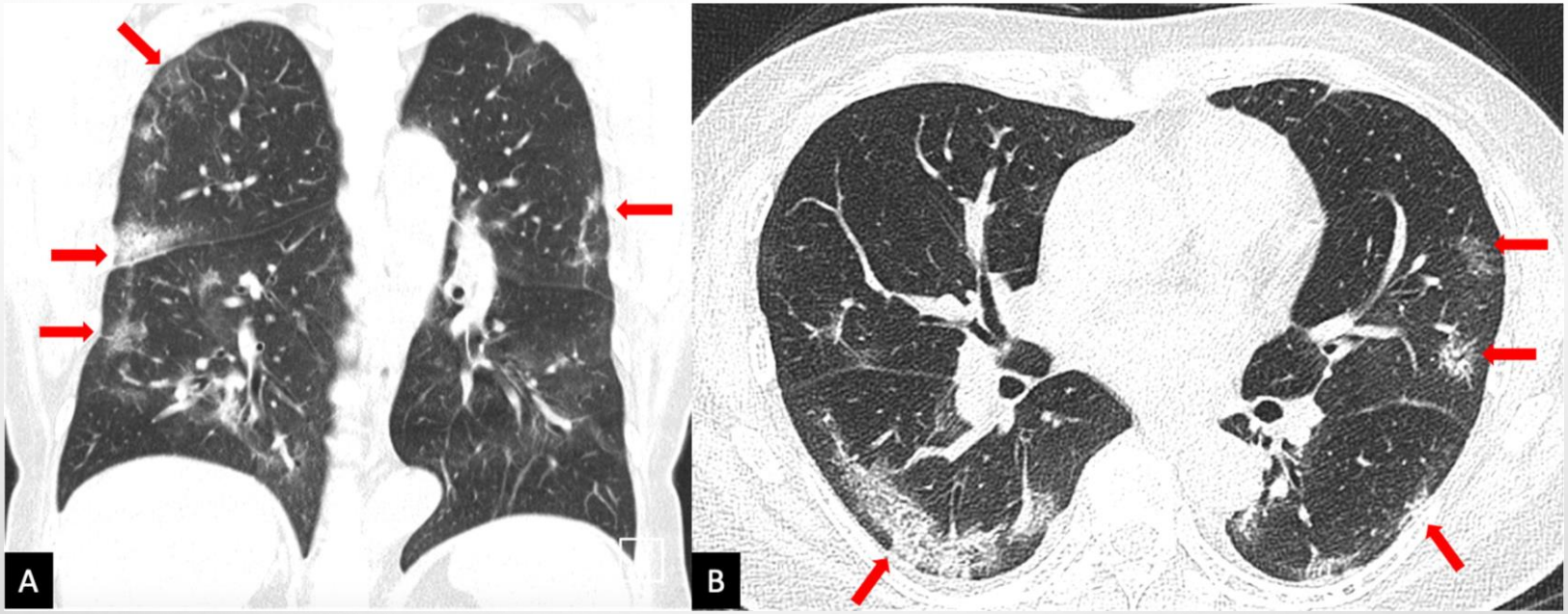


Figure 1: A 65-year-old female patient who had travelled to Wuhan, China, subsequently developing fever and cough 5 days after arrival. She subsequently returned to Shenzhen, China, and had this chest CT 7 days after symptom onset. Coronal and axial CT images (A & B) showing a mixture of ground glass and consolidation in the periphery of the lungs (red arrows), with absence of pleural effusions, which was the typical appearance of patients with confirmed COVID-19 infection.

Ng M. Published Online: February 13, 2020
https://doi.org/10.1148/ryct.2020200034

Radiology: Cardiothoracic Imaging

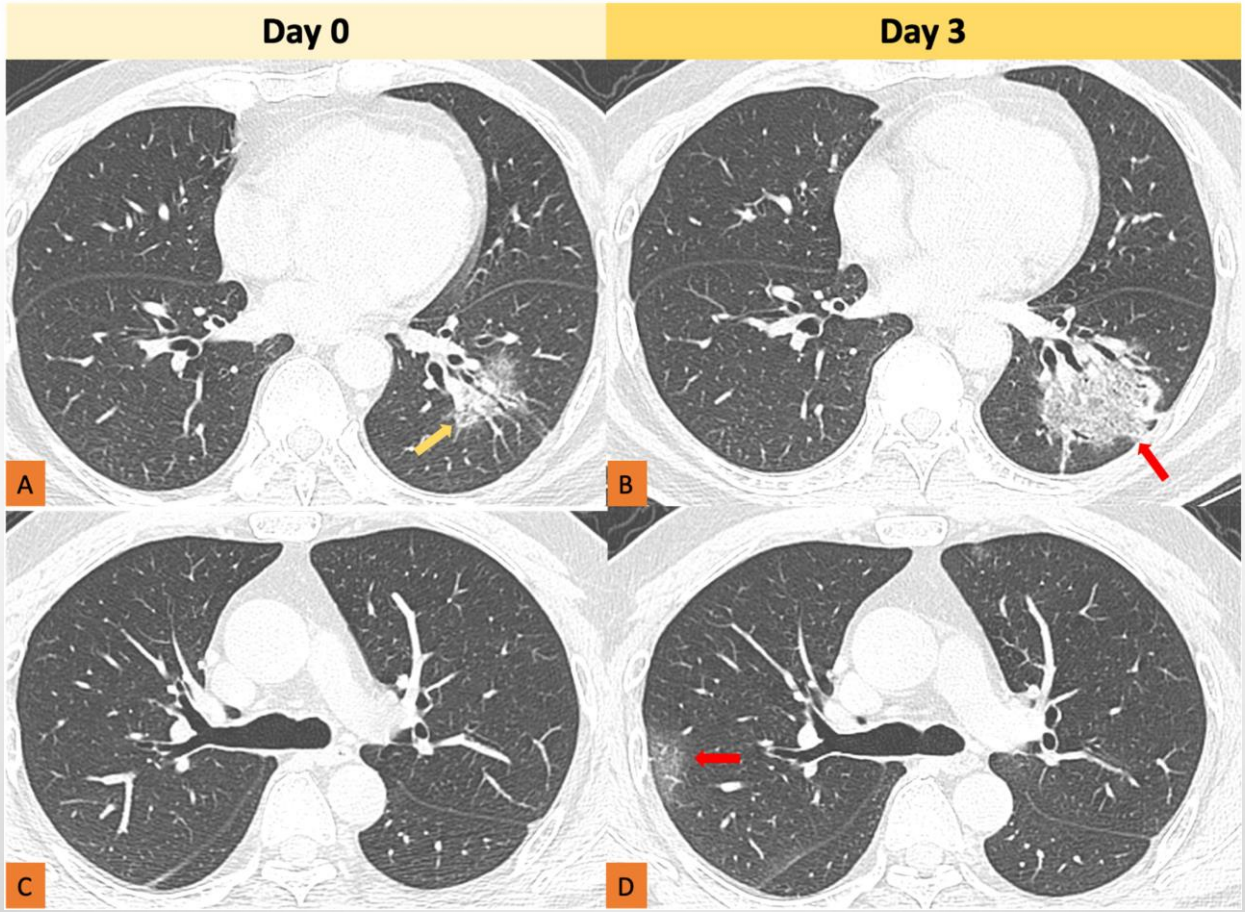


Figure 4: CT Chest follow-up in a patient who had no previous travel to Wuhan, China, but had contact with a patient with confirmed COVID-19 infection. Axial slices from day 0 of presentation to the hospital shows ground-glass opacities in the left lower lobe (image A, arrow), but not in the right upper lobe (image C). Subsequently, 3 days later, the follow-up CT showed increase in the ground glass changes with some peripheral consolidation (reversed halo, image B, arrow) and new ground-glass opacities in the right upper lobe periphery (image D, arrow).

Ng M. Published Online: February 13, 2020
https://doi.org/10.1148/ryct.2020200034

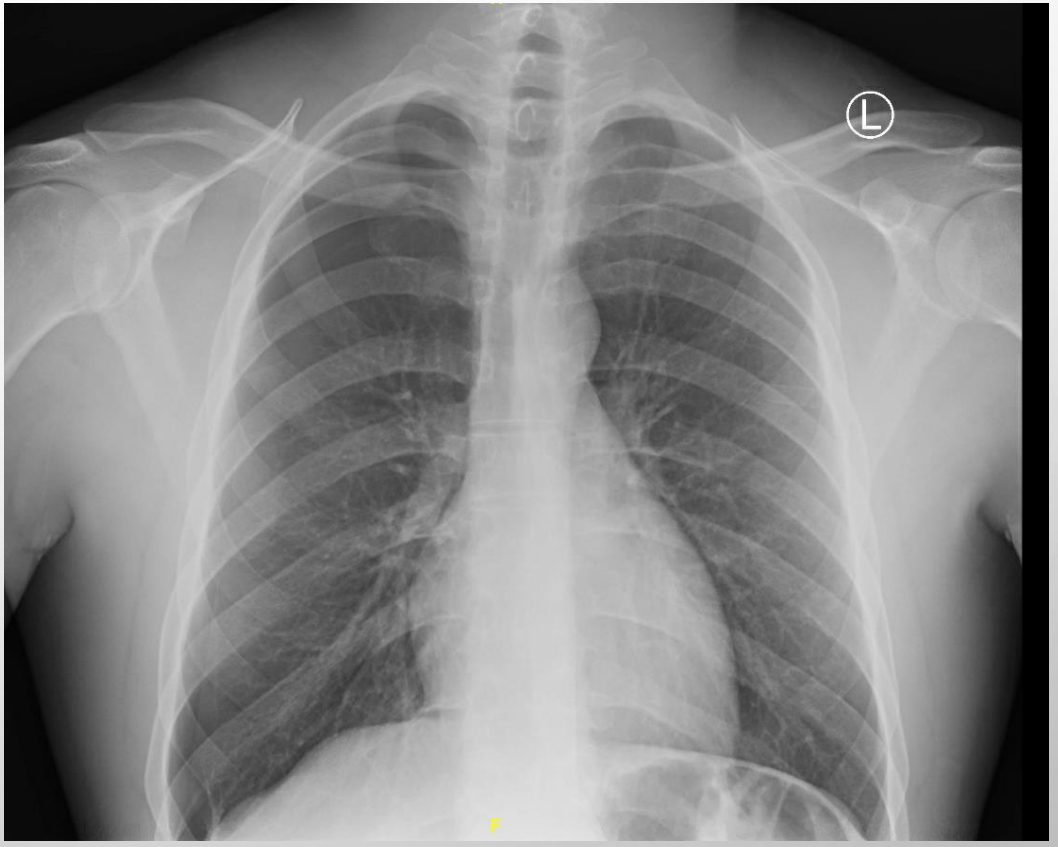
Radiology: Cardiothoracic Imaging

CASE STUDY #1: 25 YO MALE WITH CP

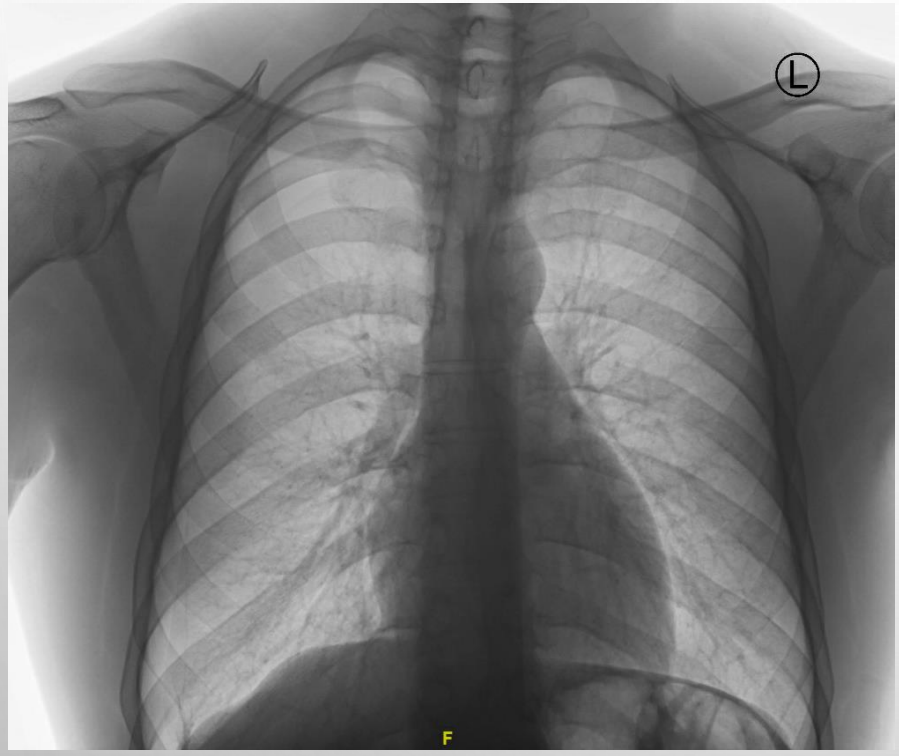
PRESENTS ER WITH SHARP R SIDE CHEST PAIN

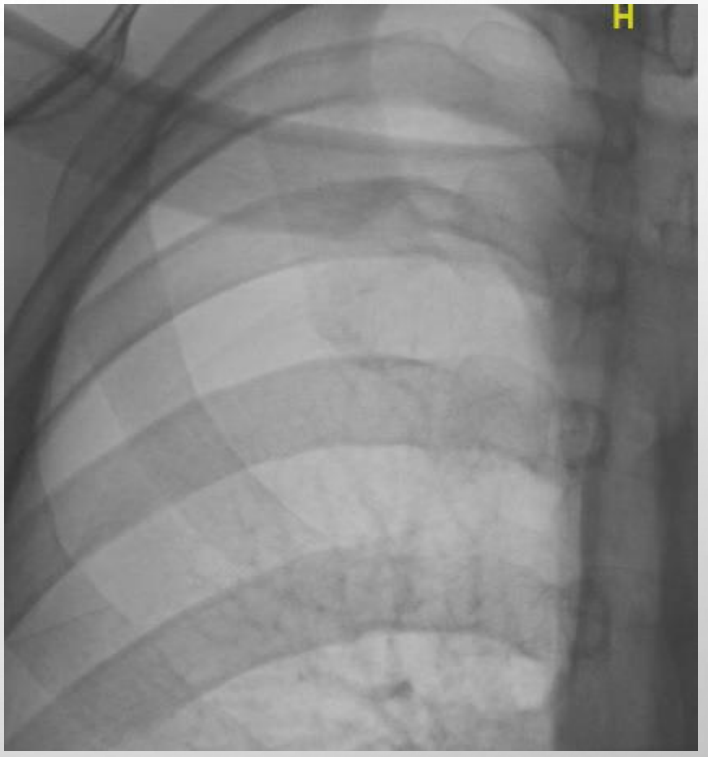
- UNREMARKABLE PMHX
- SMOKER ¼ PACK X 7 YEARS
- VAPES EVERY DAY X 2 YEARS

LOOK AT THE CXR



WHAT IS THE DIAGNOSIS?





RIGHT APICAL PNEUMOTHORAX

DESCRIPTION OF CXR

- RIGHT SIDE APICAL PNEUMOTHORAX WITH 20% DECREASE IN VOLUME
- NO MEDIASTINAL SHIFT
- NO RIB FRACTURES
- NO PLEURAL EFFUSIONS, CARDIOMEGALY OR PULMONARY INFILTRATES

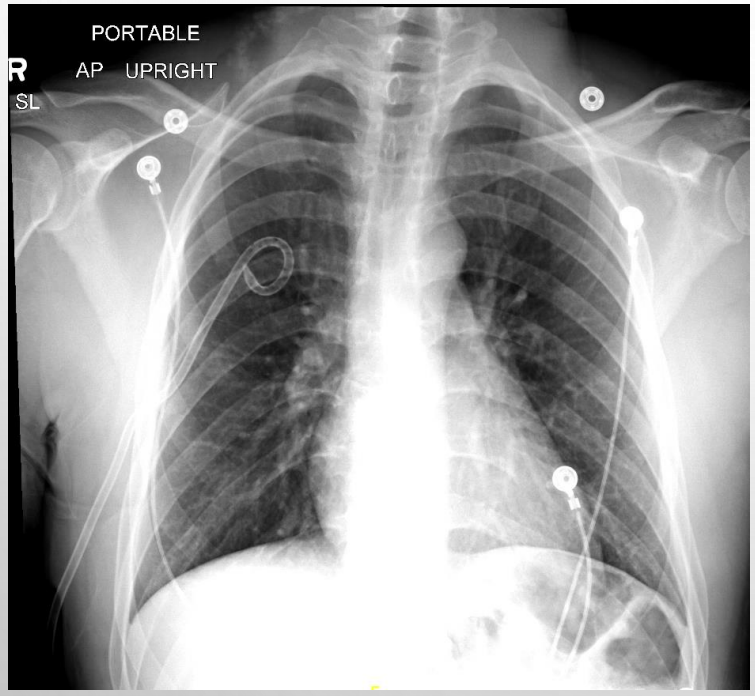
DIAGNOSIS

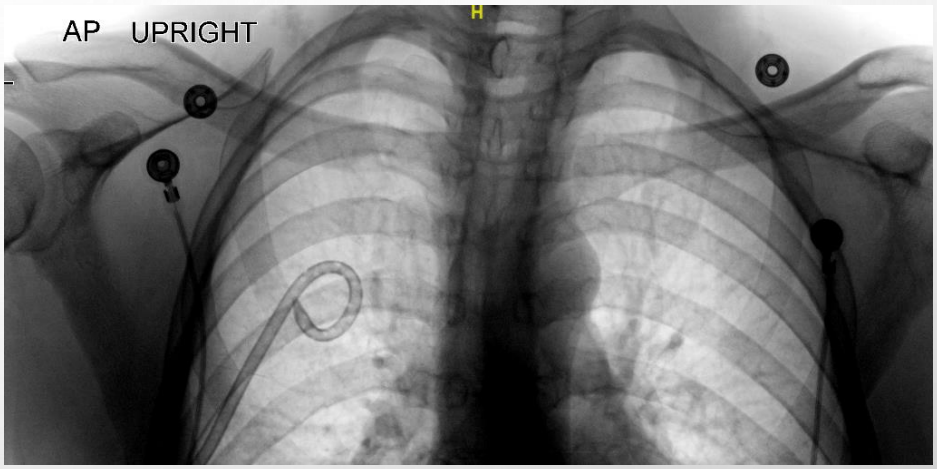
- SMALL TO MODERATE RIGHT APICAL PNEUMOTHORAX
  - IDIOPATHIC

TREATMENT: CHEST TUBE WITH SUCTION

IF NOT RESOLVED WILL NEED PLEURADESIS

IMAGING AFTER CHEST TUBE PLACEMENT



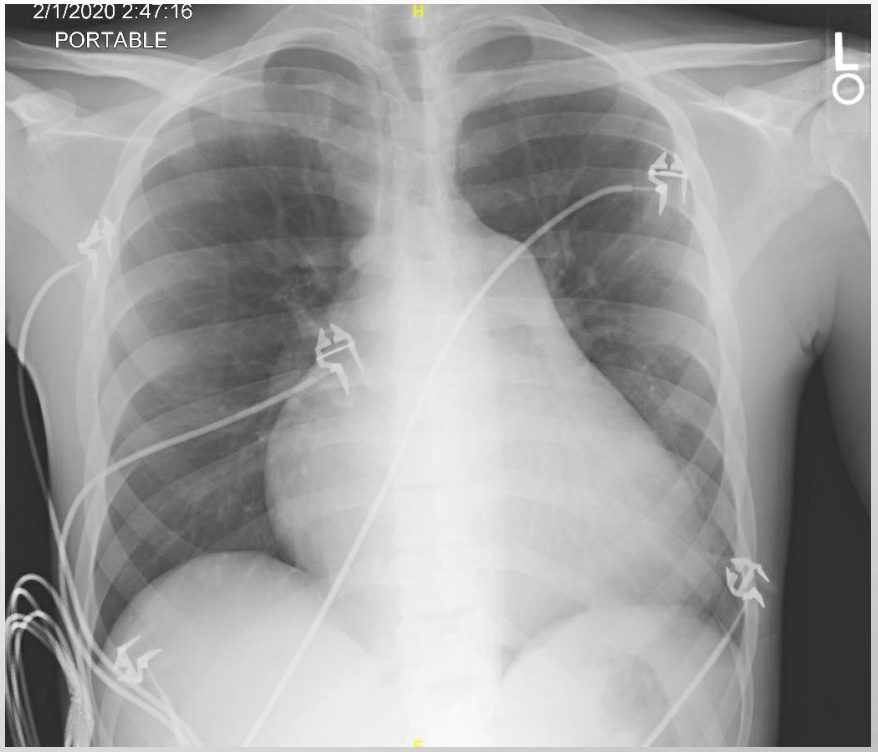


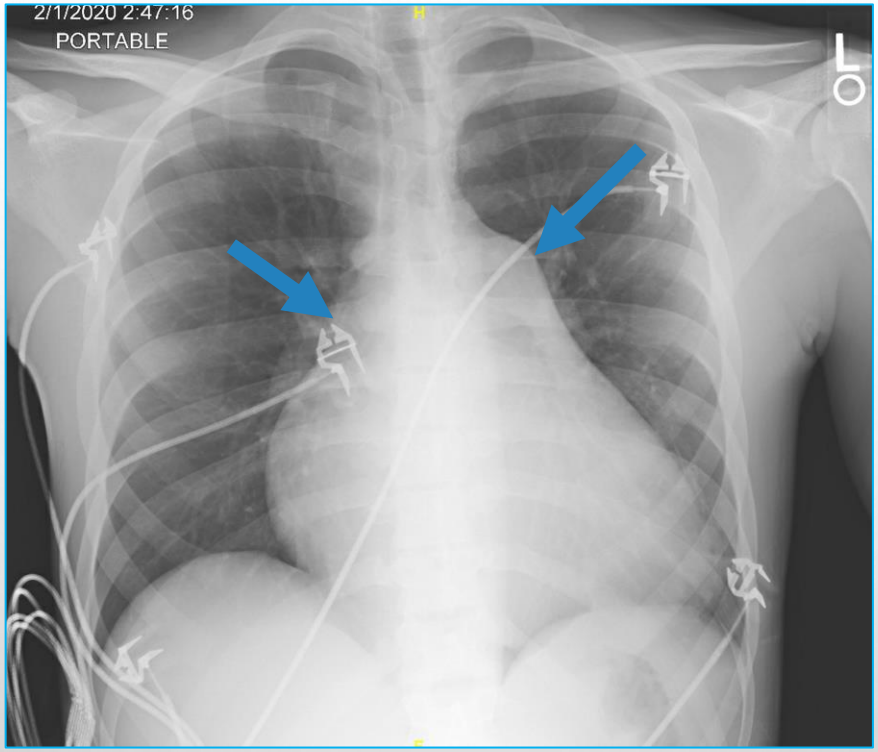
CASE STUDY #2: 21 YO WITH SYNCOPE

PORTABLE CXR

- CARDIOMEDIASTINAL ENLARGEMENT
- NO EFFUSIONS OR INFILTRATES
- NO PNEUMOTHORAX

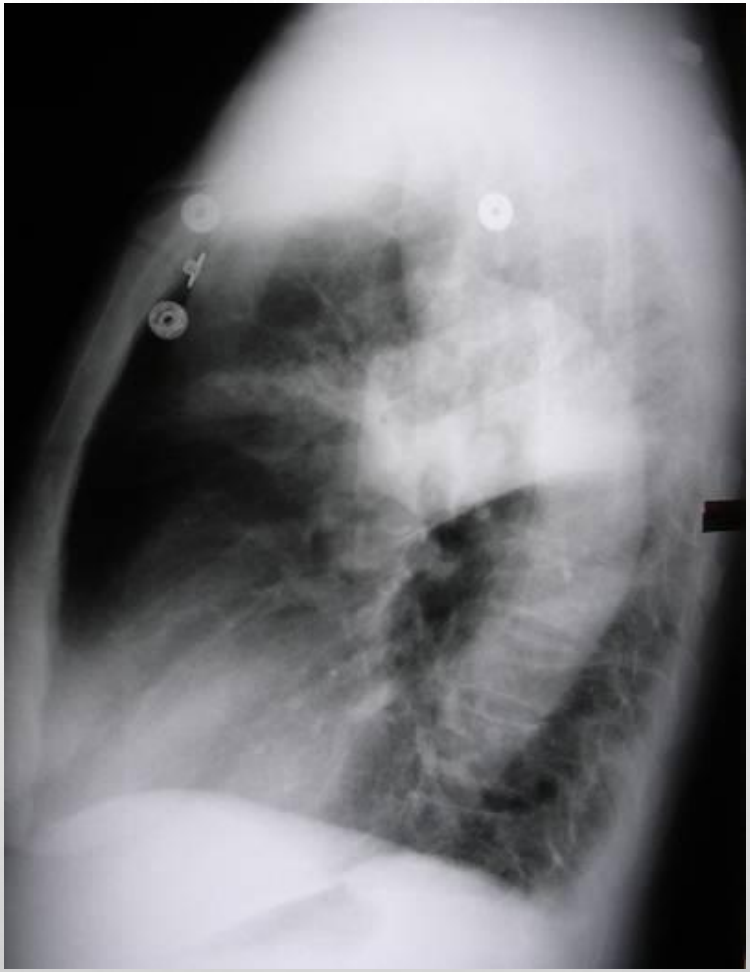
- DIAGNOSIS
  - NEWLY DIAGNOSED PULMONARY HYPERTENSION
  - MOTHER DIED OF IDIOPATHIC PAH AT AGE OF 40
- ECHO / RHC
- DISCUSSION
  - WHERE ARE THE PULMONARY ARTERIES ON CXR?




2/1/2020 2:47:16
PORTABLE

CASE 3

- ELDERLY FEMALE PATIENT PRESENTS TO ED WITH SOB AND DYSPNEA. PMHX IS SIGNIFICANT FOR PARKINSON'S DISEASE. SHE ADMITS TO PROD COUGH AND LOW GRADE FEVERS.
- DESCRIBE THE CXR:
- WHAT IS YOUR DIAGNOSIS:



CASE 3

- DESCRIPTION OF CXR:
  - RUL INFILTRATE / CONSOLIDATION WITH AIR BRONCHOGRAMS

- DIFFERENTIAL DIAGNOSIS:
  - CAP (COMMUNITY ACQUIRED PNEUMONIA)
    - ALWAYS ASK IF PT. LIVES AT HOME VS. NURSING HOME VS. ASSISTED LIVING FACILITY
  - HAP
  - CAP WITH HIGH RISK FOR MDR PATHOGENS
  - ASPIRATION PNEUMONIA
    - OBTAIN SPEECH LANGUAGE CONSULT

CURB-65

- THE CURB-65 SCORE IS BASED UPON FIVE EASILY MEASURABLE FACTORS
  - CONFUSION (BASED UPON A SPECIFIC MENTAL TEST OR NEW DISORIENTATION TO PERSON, PLACE, OR TIME)
  - UREA (BLOOD UREA NITROGEN IN THE UNITED STATES) >7 MMOL/L (20 MG/DL)
  - RESPIRATORY RATE >30 BREATHS/MINUTE
  - BLOOD PRESSURE [BP] (SYSTOLIC <90 MMHG OR DIASTOLIC <60 MMHG)
  - AGE >65 YEARS
- SCORE OF 2 OR MORE: RECOMMEND ADMITTING TO THE HOSPITAL

LESSONS FOR PRACTICE

- ALWAYS COMPARE TO PREVIOUS FILMS
- THE OBVIOUS IS NOT ALWAYS THE MOST IMPORTANT FINDING ON CHEST IMAGING
- IF ABLE ALWAYS OBTAIN A LATERAL AND PA CXR
- TRUST NO ONE / ALWAYS ”PERSONALLY” LOOK AT THE IMAGES

EXPERT ADVICE FROM ACR

- DON'T IMAGE FOR SUSPECTED PE WITHOUT MODERATE OR HIGH PRE-TEST PROBABILITY OF PE
- AVOID ADMISSION OR PREOP CXR FOR AMBULATORY PATIENTS WITH UNREMARKABLE HISTORY AND PHYSICAL EXAM

choosingwisely.org Americal college of Radiology; Ten Things Physicians and Patients Should Question; Updated June 29, 2017.

CLINICAL CITATIONS

- CHOOSINGWISELY.ORG AMERICAL COLLEGE OF RADIOLOGY; TEN THINGS PHYSICIANS AND PATIENTS SHOULD QUESTION; UPDATED JUNE 29, 2017
- HTTP://WWW.RADIOLOGYASSISTANT.NL/EN/P5905AFF4788EF/FLEISCHNER-2017-GUIDELINE-FOR-PULMONARY-NODULES.HTML
- *www.cms.gov*
- GUIDE TO THORACIC IMAGING; VOLUME 44, NO.8, AUGUST 2015 PAGES 558-562
- THE INVISIBLE GORILLA STRIKES AGAIN: SUSTAINED INATTENTIONAL BLINDNESS IN EXPERT OBSERVERS; TRAFTON DREW, MELISSA L.-H. VÕ, JEREMY M. WOLF; PSYCHOLOGICAL SCIENCE; VOL 24, ISSUE 9, PP. 1848 – 1853
- **NG M. PUBLISHED ONLINE:** FEBRUARY 13, 2020 **HTTPS://DOI.ORG/10.1148/RYCT.2020200034 Imaging Profile of the COVID-19 Infection: Radiologic Findings and Literature Review; Ming-Yen Ng et al.**