【111年影像判讀繼續教育課程(南區)】

肺實質化病變與肺塌陷

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【日期】111年 08月07日 (星期日)

【時間】14:10-15:00

【地點】高雄榮民總醫院

急診大樓六樓 第五會議室

OUTLINES

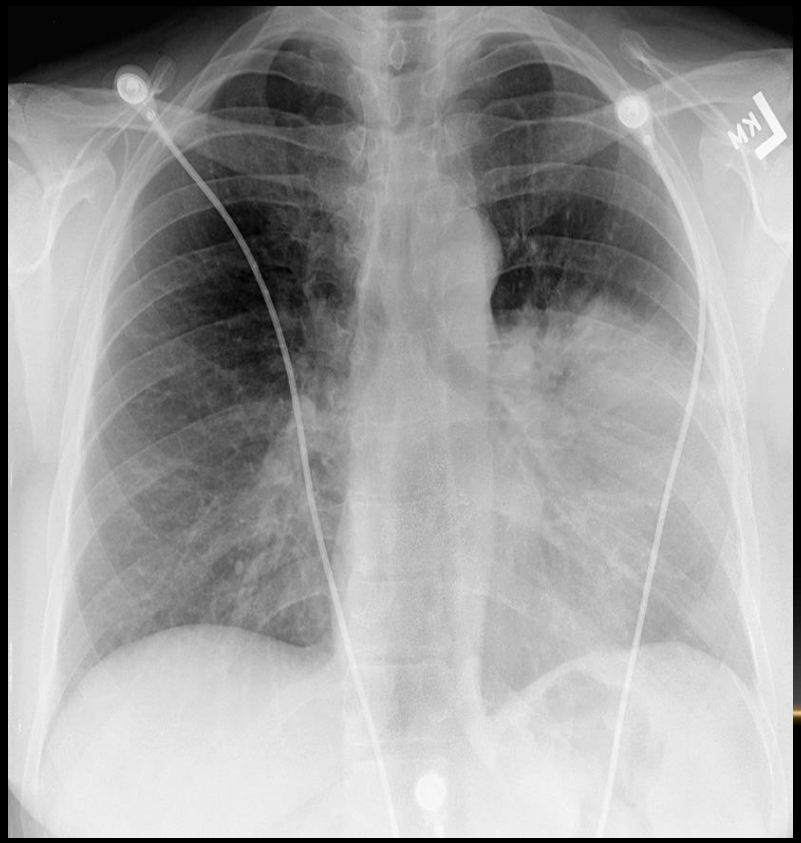
- Lobar/Segmental consolidation
- Diffuse air space opacity
- Multifocal ill-defined opacities
- Atelectasis

LOBAR/SEGMENTAL CONSOLIDATION

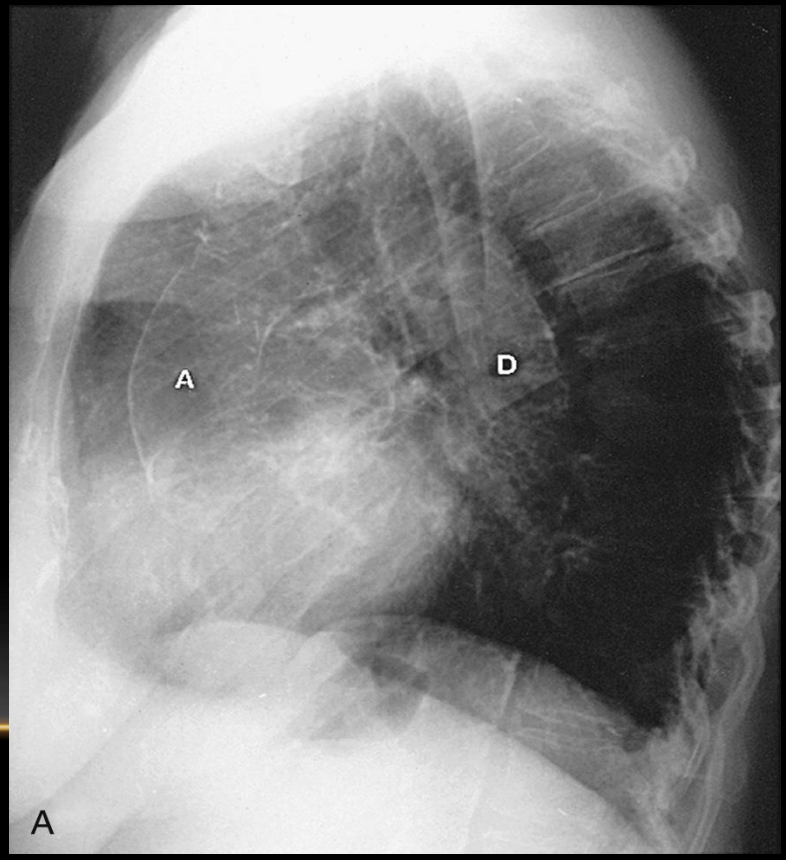
- results from alveolar filling with fluid, exudate, or tumor that solidifies the lung:
  - water (e.g., edema), blood (e.g., pulmonary hemorrhage), pus (e.g., pneumonia), cells (e.g., adenocarcinoma, lymphoma, organizing pneumonia), fat (e.g., lipoid pneumonia), or protein (e.g., alveolar proteinosis).
- a homogeneous confluent opacity
  - obliterates the normal vascular markings
  - frequently bounded by the fissures
  - stretched fissures may lead to the appearance of an expanded lobe: little or no loss of volume
  - often contains bronchograms: airways are frequently air filled and surrounded by airless lung

THE SILHOUETTE SIGN

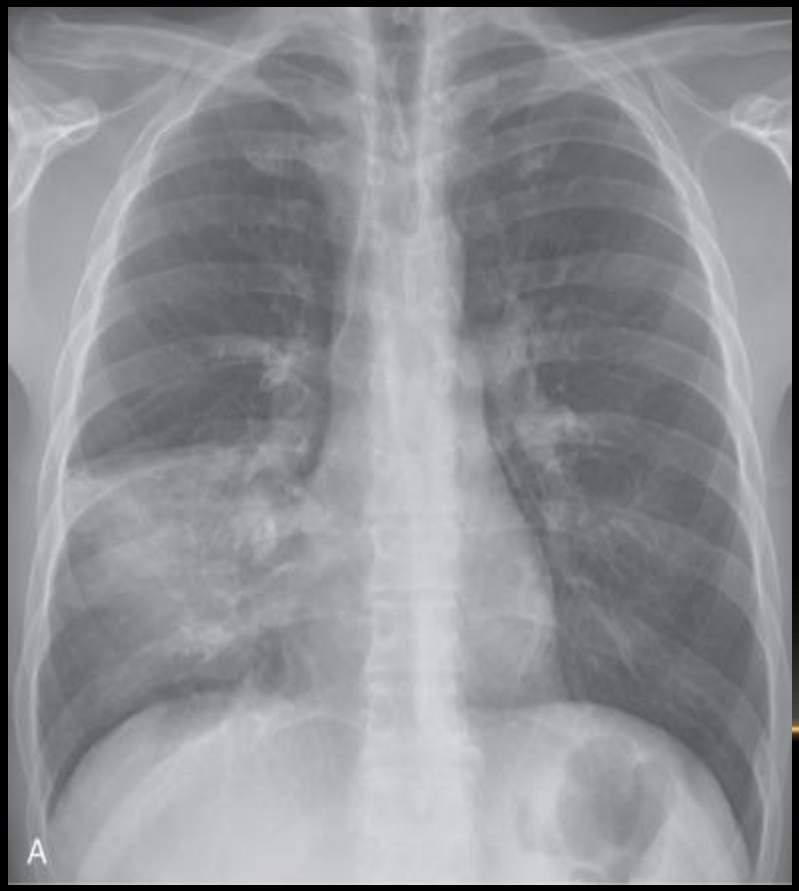
- If part of the lung is radiodense (alveolar pattern, consolidated, water density, airless), it can affect our ability to see adjacent structures.

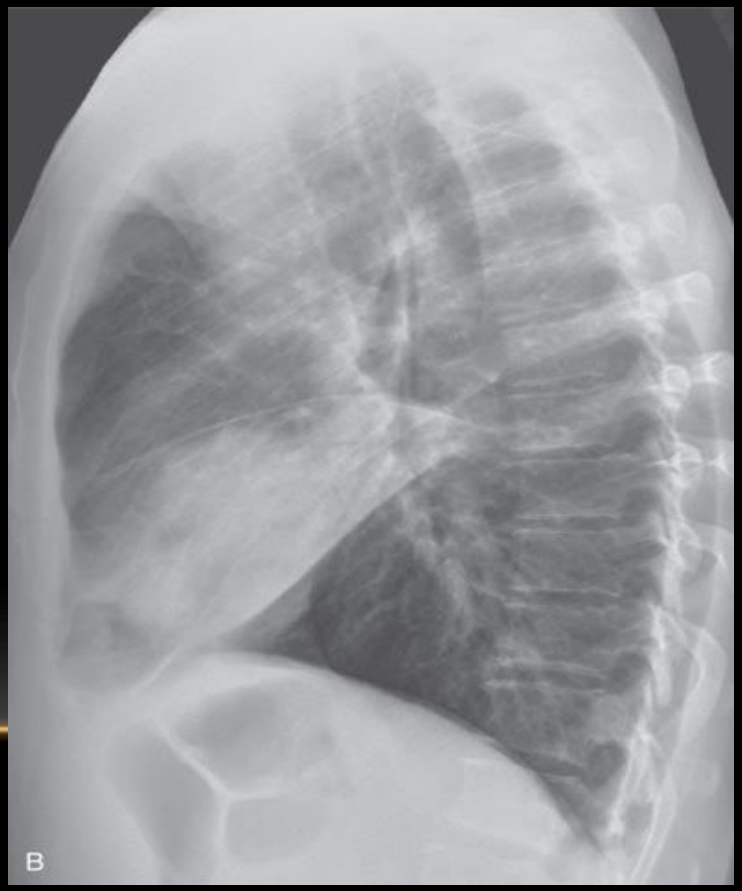


Obscuration of the silhouette of the heart, aorta, or diaphragm by an adjacent opacity is known as the silhouette sign

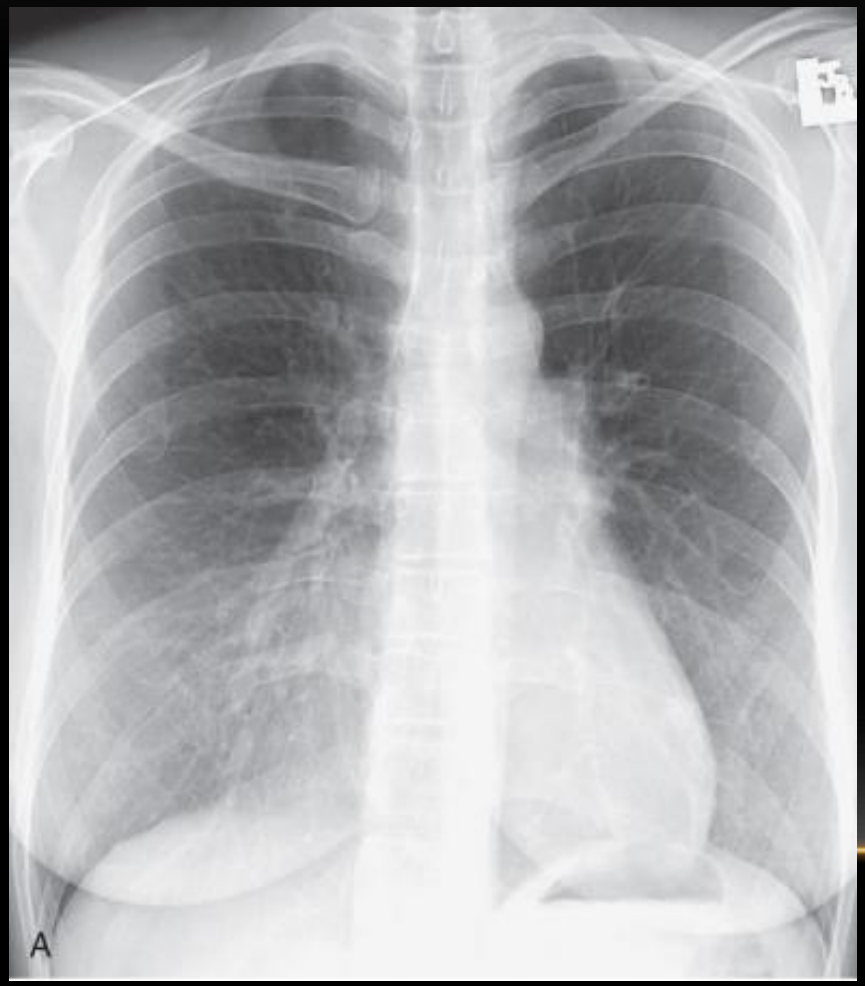


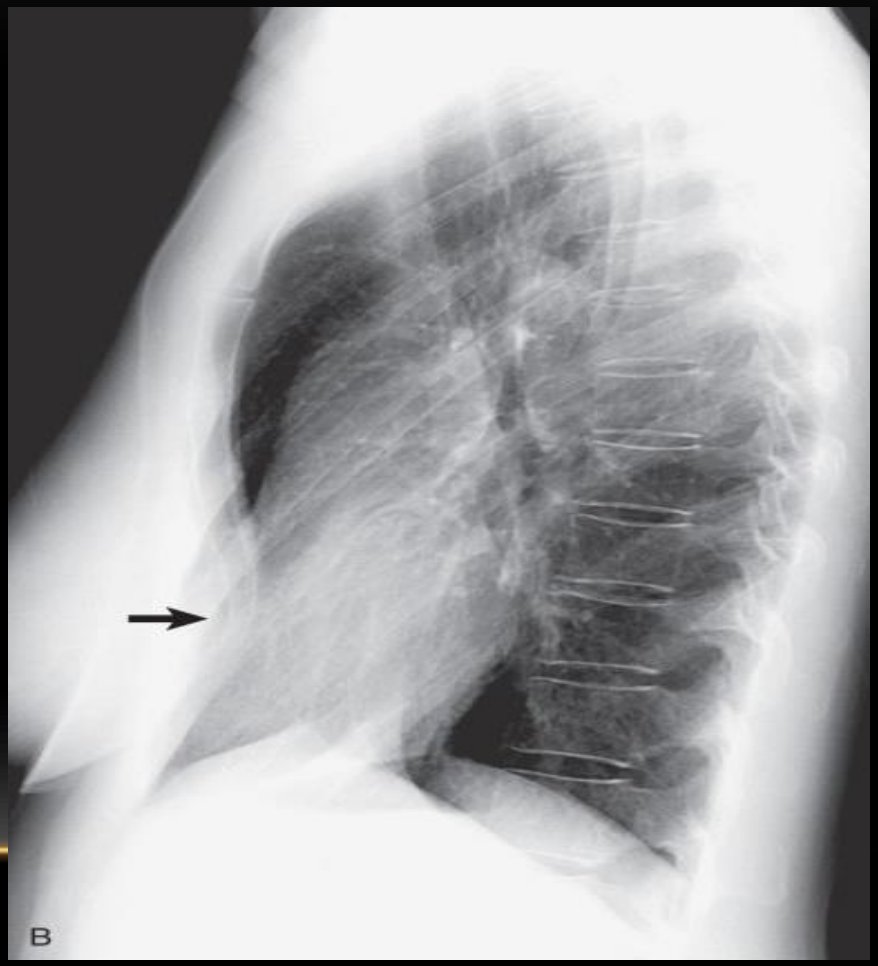
RML PNEUMONIA: NOTE OBSCURATION OF THE RIGHT HEART BORDER (SILHOUETTE SIGN), CONSISTENT WITH CONSOLIDATION IN THE RIGHT MIDDLE LOBE. THE DOME OF THE RIGHT HEMIDIAPHRAGM IS CLEARLY SEEN.





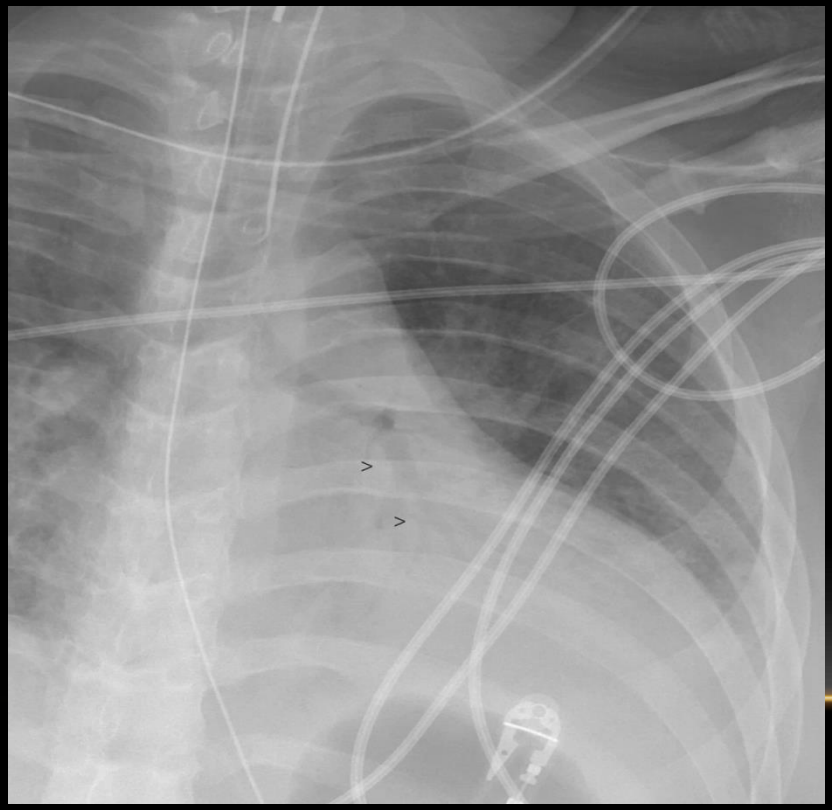
SILHOUETTE SIGN IN PECTUS EXCAVATUM. POSTEROANTERIOR CHEST RADIOGRAPH SHOWING INCREASED OPACITY IN THE RIGHT LOWER LUNG ZONE WITH OBSCURATION OF THE RIGHT HEART BORDER. SHIFT OF THE HEART TO THE LEFT, AND VERTICAL COURSE OF THE ANTERIOR RIBS.

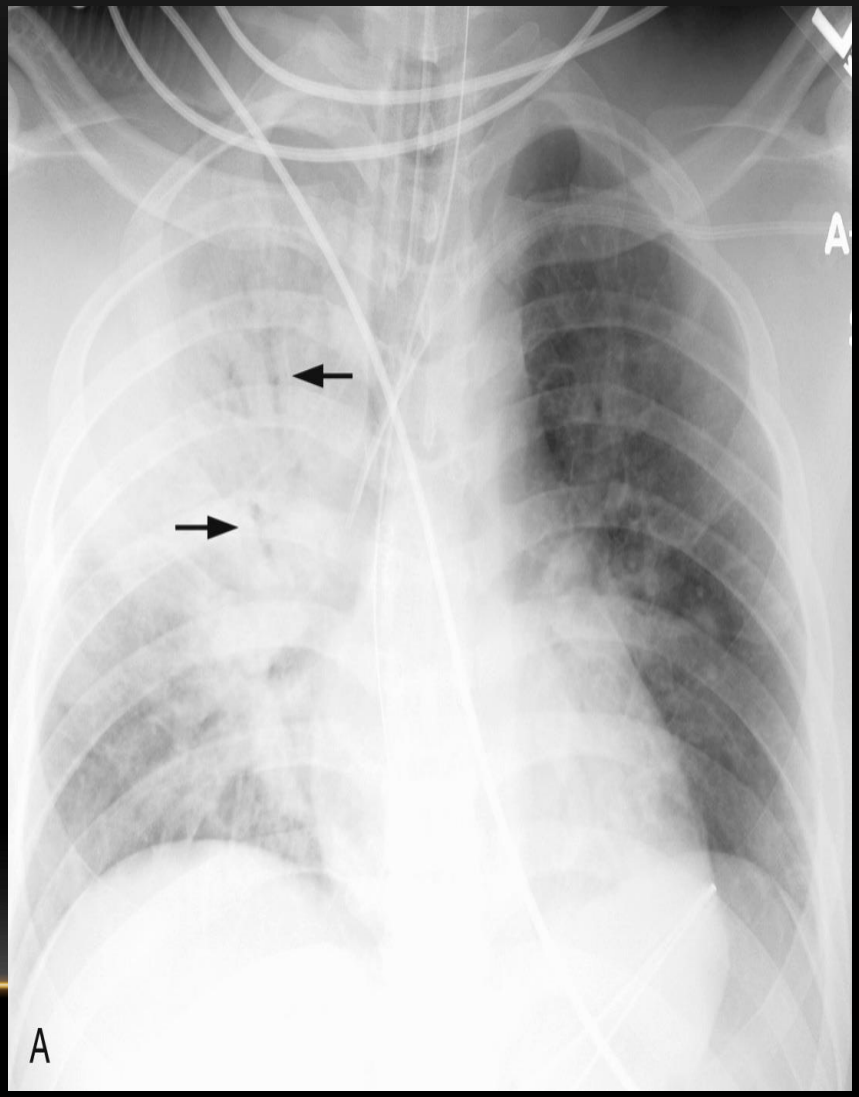




THE AIR BRONCHOGRAM SIGN.

- **When the lung is consolidated and the bronchi contain air, the dense lung delineates the air-filled bronchi.**





LOBAR/SEGMENTAL CONSOLIDATION

CHEST RADIOLOGY: PATTERNS AND DIFFERENTIAL DIAGNOSES, 14, 185-196

I. Lobar pneumonia
- A. *Streptococcus pneumoniae*
- B. *Klebsiella pneumoniae*

II. Bronchopneumonia
- A. *Pseudomonas*
- B. *K. pneumoniae*
- C. *Bacillus proteus*
- D. *Escherichia coli*
- E. Anaerobes (*Bacteroides* and *Clostridia*)
- F. *Legionella pneumophila*
- G. *Staphylococcus aureus*
- H. Nocardiosis and actinomycosis
- I. *S. pneumoniae*
- J. *Serratia*

III. Aspiration pneumonia

IV. Tuberculosis and atypical mycobacteria/Fungus

V. Pulmonary embolism
- A. Hemorrhage and edema
- B. Infarction

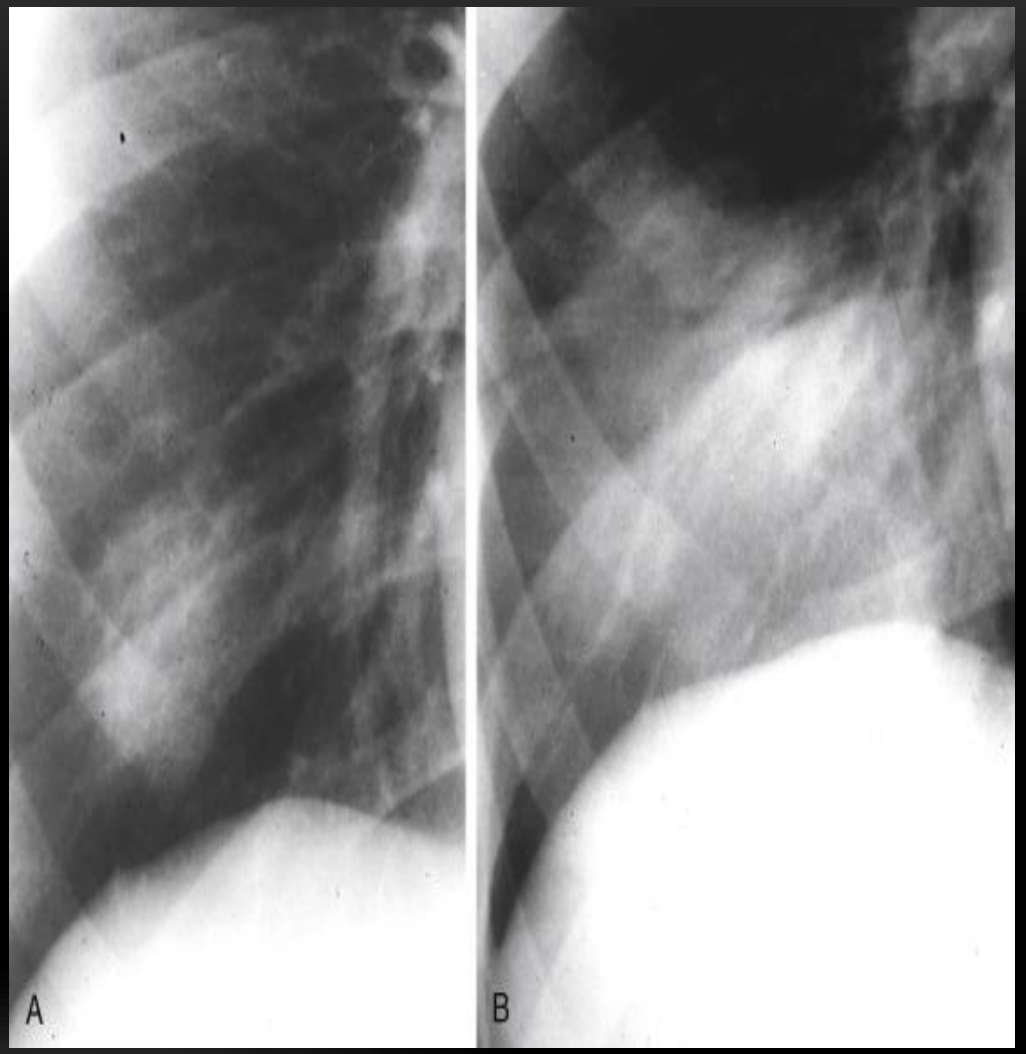
VI. Neoplasms
- A. Obstructive pneumonia (endobronchial tumor)
- B. Invasive mucinous adenocarcinoma (formerly bronchioloalveolar cell carcinoma)
- C. Lymphoma

VII. Mitral regurgitation with pulmonary edema localized to the right upper lobe

VIII. Lung torsion

LOBAR CONSOLIDATION --LOBAR PNEUMONIA

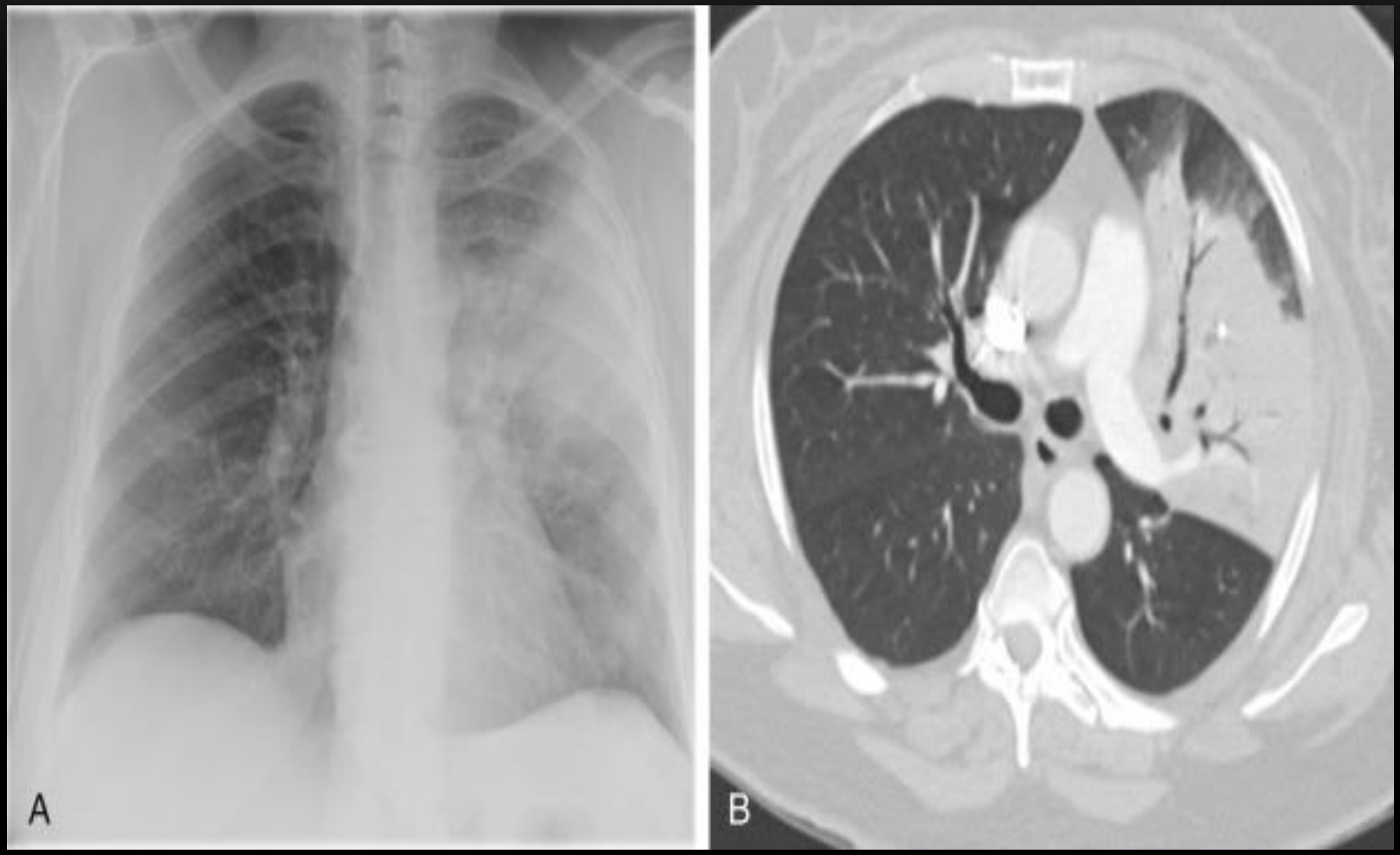
- Pathogens inhaled to the periphery of the lung,
- tissue reaction involves the exudation of watery edema fluid into alveolar spaces.
- spreads into adjacent lobules and segments via the pores of Kohn, canals of Lambert, and small airways,



round pneumonia

extensive air space Consolidation, Non-segmental distribution

HOMOGENEOUS CONSOLIDATION IN THE LEFT UPPER LOBE IS THE RESULT OF S. PNEUMONIAE.



SEGMENTAL CONSOLIDATION -BRONCHOPNEUMONIA

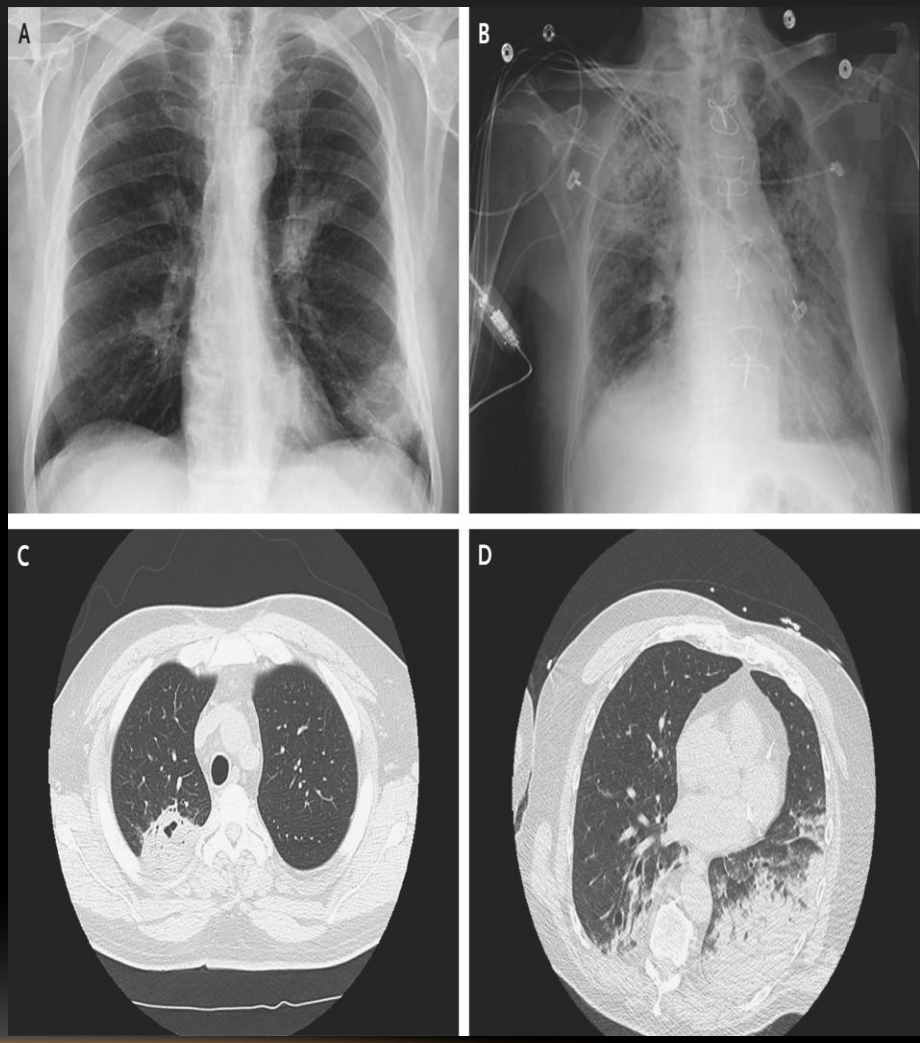
- the primary sites of injury are the terminal and respiratory bronchioles
- ulcers are formed in the large bronchi by destruction of the epithelial lining
- thrombosis of the lobular branches of the small pulmonary arteries
- exudation of fluids and inflammatory cells into the acinus to produce lobular consolidations

Multifocal consolidation in bronchopneumonia. Posteroanterior chest radiograph showing patchy consolidation in the left upper and lower lobes.

LOBAR CONSOLIDATION -ASPIRATION PNEUMONIA

- dependent portions of the lung
- a history of predisposing conditions such as alcoholism, recent anesthesia, head and neck surgery, mental retardation, seizure disorders, and esophageal motility disturbances.
- Material aspirated while the patient is in the upright position tends to go to the medial basal segments of the lung and to the right middle lobe,
- in the supine patient aspirated material tends to collect in the superior segments of the lower lobes and the posterior segments of the upper lobes.

N Engl J Med 2019; 380:651-663



bilateral infiltrates in posterior, gravity-dependent lung segments

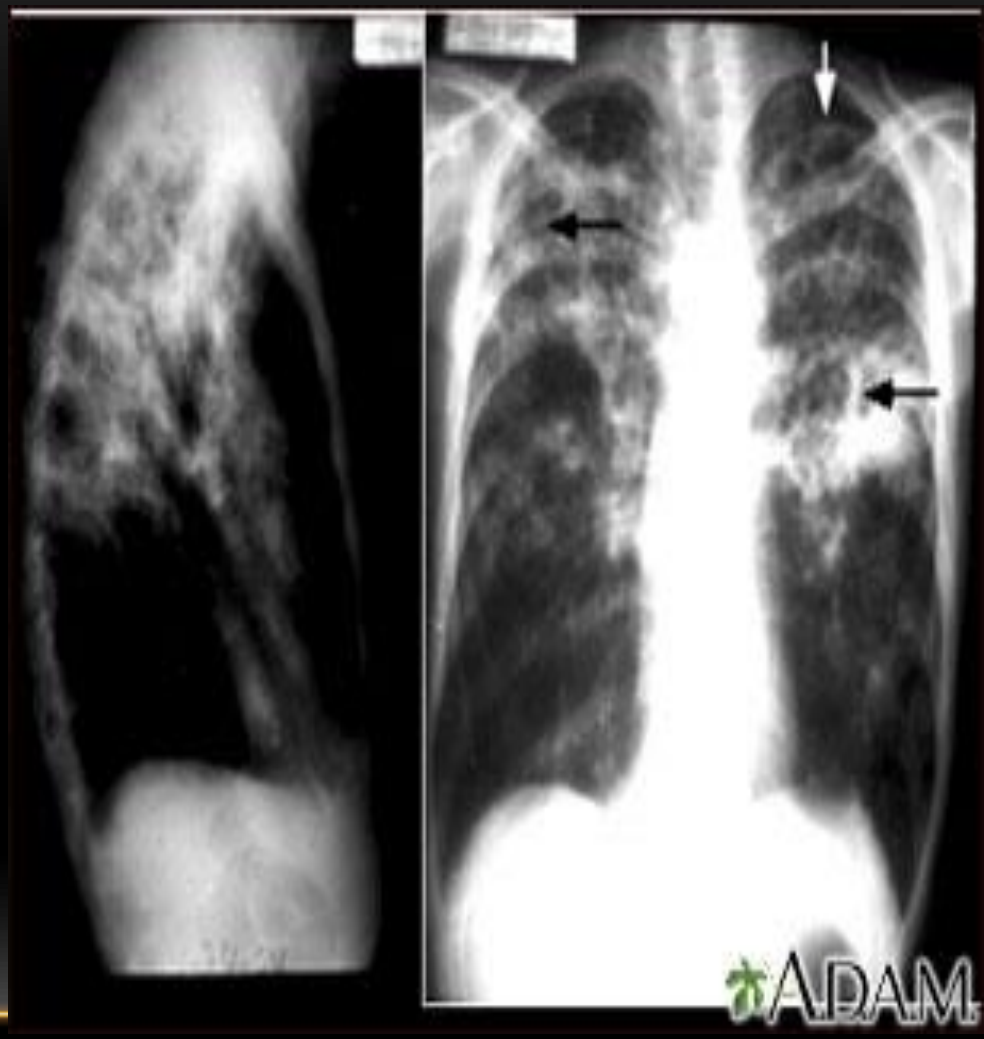
LOBAR CONSOLIDATION – TB AND MYCOBACTERIUM

- Tuberculosis
  - **Exudative**: the exudation of inflammatory cells, including macrophages and polymorphonuclear leukocytes from alveolar capillaries into the alveolar spaces.
  - **Hypersensitivity** reaction: about 1 month, the exudative reaction is gradually replaced by chronic inflammatory cells as the begins.
  - After **6 weeks**, changes typical of tuberculosis, including **caseation necrosis**, can be identified in the center of the lesion

dense homogenous opacity in right, middle and lower lobe of **primary pulmonary TB**

POST-PRIMARY ADVANCED PULMONARY TUBERCULOSIS

- Consolidation or infiltrate can be dense or patchy and might have irregular, ill-defined, or hazy borders.
- Any cavitary lesion
- Calcification, FIBROSIS
- Nodule with poorly defined margins
- Pleural effusion
- Hilar or mediastinal lymphadenopathy
- Miliary nodules of millet size (1 to 2 millimeters)



multiple light areas (opacities) of varying size that run together (coalesce).

LOBAR CONSOLIDATION – PULMONARY ASPERGILLOSIS

- aspergilloma: the most common form
- allergic bronchopulmonary aspergillosis (ABPA)
- invasive aspergillosis: ACUTE
- obstructive bronchopulmonary aspergillosis
- chronic pulmonary aspergillosis
  - chronic cavitary pulmonary aspergillosis
  - chronic fibrosing pulmonary aspergillosis

consolidation in the right upper lobe with gas-fluid levels inside,

ASPERGILLOMA

- round or oval mass with the opacity of that of a soft-tissue mass.
- Often, an adjacent crescent-shaped air space (ie, the air-crescent sign) separates the fungal ball from the cavity wall

CHRONIC NECROTIZING ASPERGILLOSIS

- unilateral or bilateral segmental areas of consolidation that are predominant in the upper lobes; frequently, these progress to cavitation

chronic, cavitating, upper lobe consolidation

A 64 Y/O MAN WITH A HISTORY OF ALCOHOLISM, LIVER CIRRHOSIS AND HCC PRESENTED WITH RIGHT CHEST PAIN FOR 1 MONTH

20220525 Aspergi.Ag(BAL, RB6):8.36 Index

20220525 Aspergi.Ag(BAL, LB1):8.00 Index

20220602 2019 nCoV: Positive

A 53/Y/O MAN WITH HEAVY SMOKING HISTORY PRESENTED WITH BWL FOR 1 MONTH

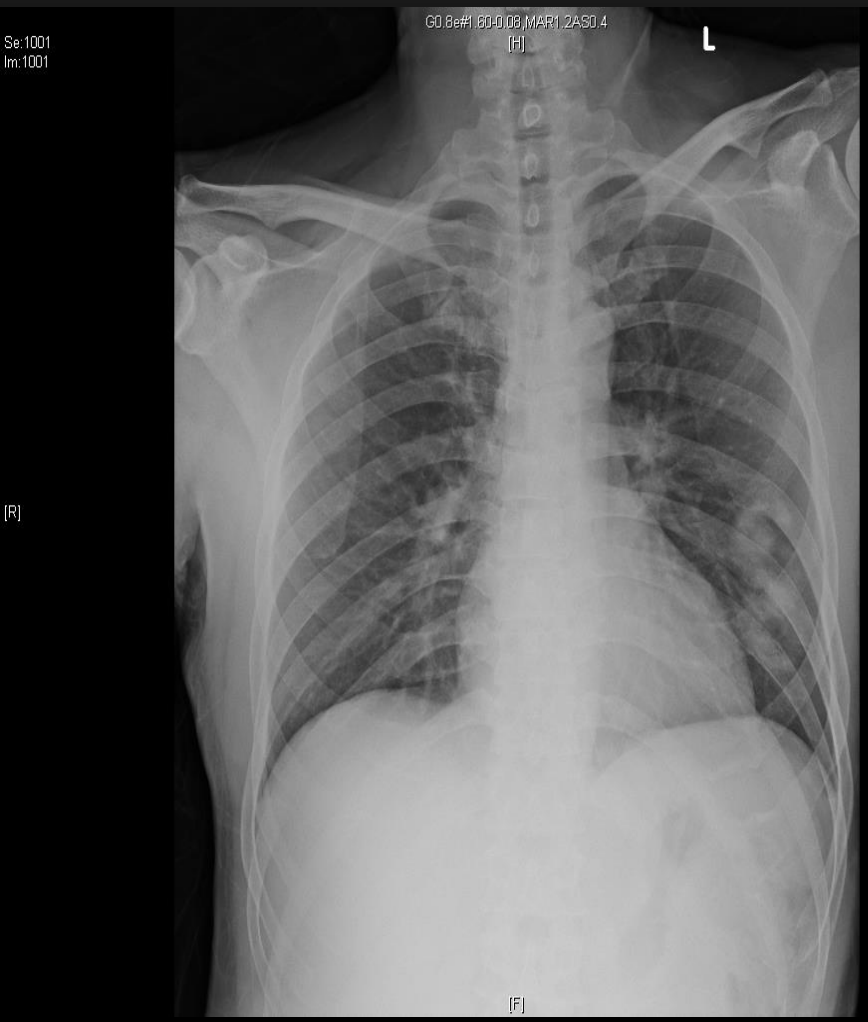
20210705 Aspergi.Ag(BAL):0.60 Index

ALLERGIC BRONCHOPULMONARY ASPERGILLOSIS (ABPA)

- (1) fleeting alveolar subsegmental or lobar infiltrates, which are usually bilateral (65%) and predominant in the upper lobes (50%);
- (2) central 1- to 2-cm ring shadows that represent varicose or cystic bronchiectasis;
- (3) tram-link bronchial walls caused by edema

branching finger-in-glove tubular opacities in the left lower lobe (ie, retrocardiac location) due to mucus plugging of ectatic bronchi.

A 53 Y/O MAN WITH LEFT CHEST PAIN FOR 3 DAYS



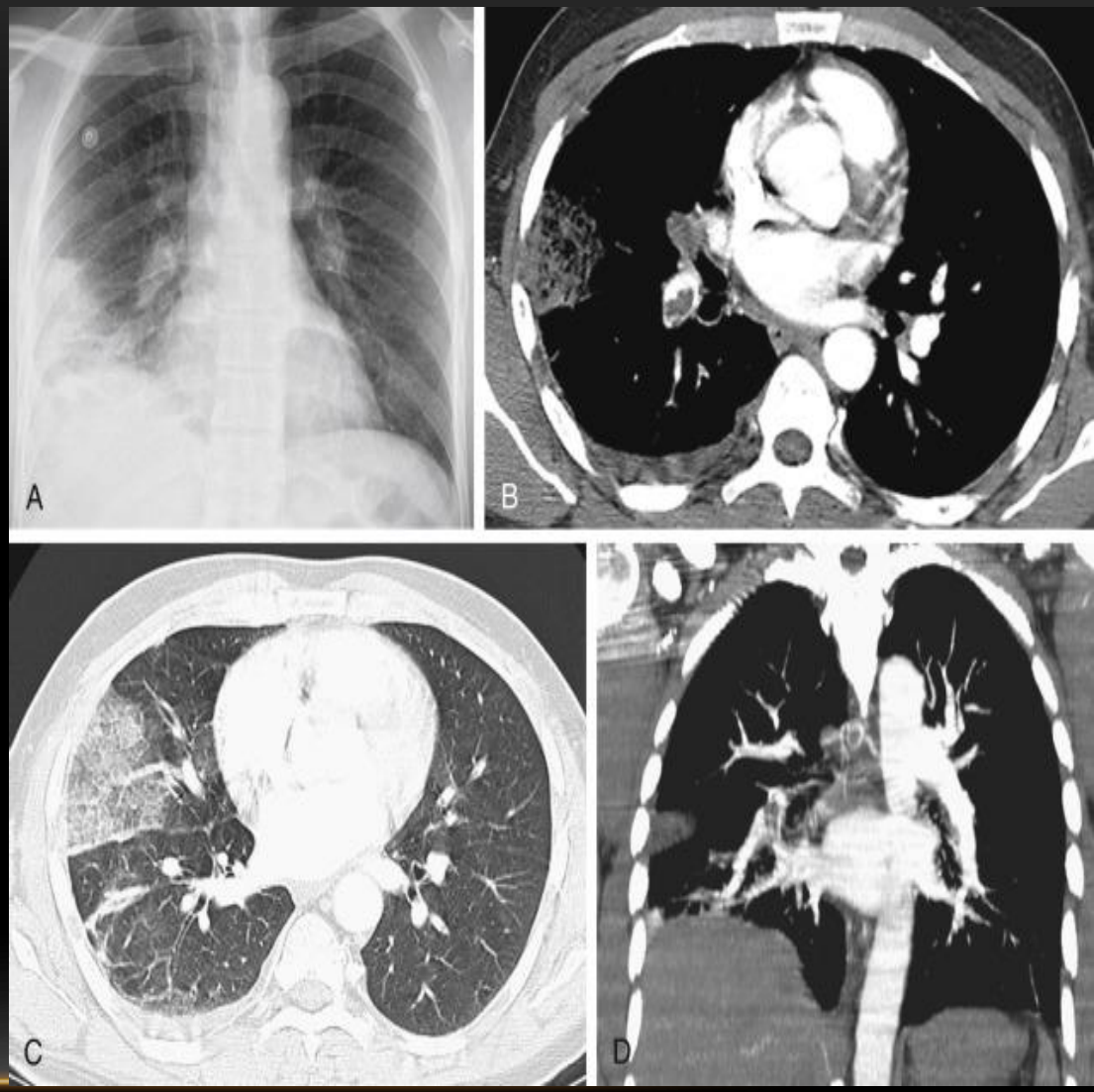
學門別:免疫　採檢日期 時間:2021/05/21 12:01

檢體別:B　醫囑日期 時間:2021/05/21 11:38

檢驗項目	檢驗值	單位	H/L 參考值
CRYPAG	Positive 1:32		H
Negative			

LOBAR CONSOLIDATION --PULMONARY EMBOLISM

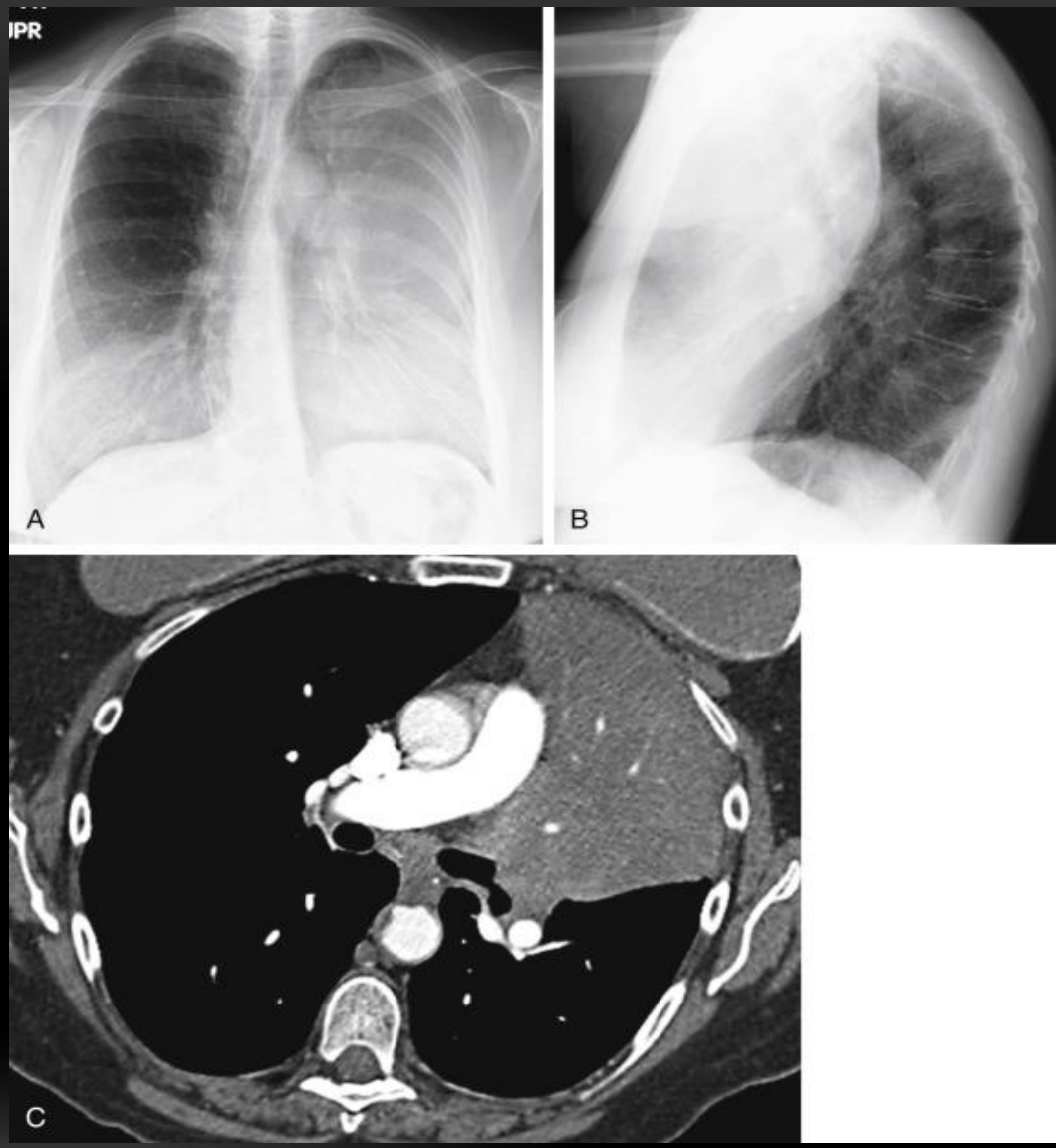
- results from **edema and hemorrhage** with or without infarction
- remarkably similar to that of lobar pneumonia
- confluent opacities with **ill-defined** borders, **peripheral acinar** opacities, and even air bronchograms.



Hampton's hump : a peripheral, **pleural-based** opacity with a nodular-appearing center, **wedge-shaped**,

LOBAR CONSOLIDATION --NEOPLASMS

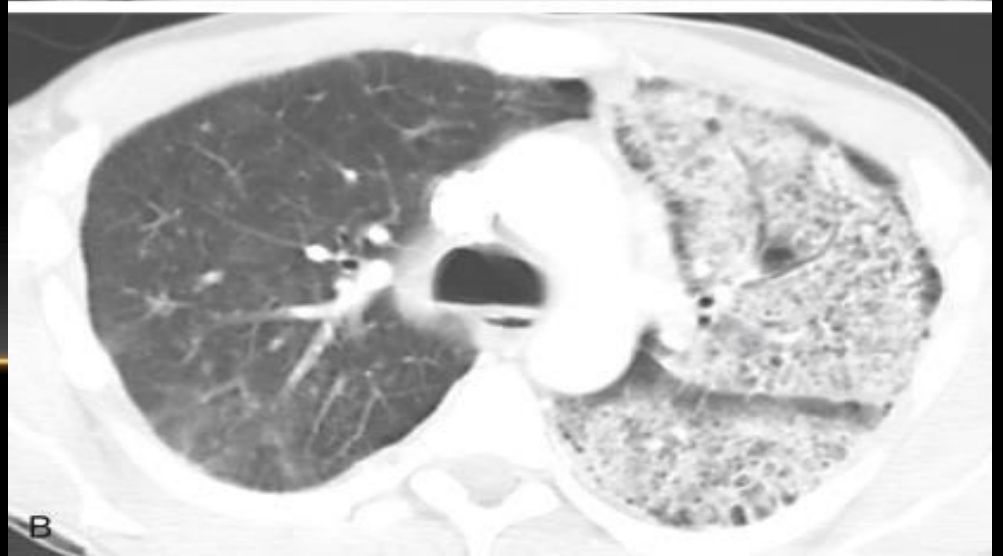
- **Obstructive pneumonia**: with chronic obstruction, the collapsed lung re-expands with edema, inflammatory cells, and cholesterol-laden macrophages.
- An associated **hilar mass**
- Cavitation
- A persistent abscess



drowned lung: consolidation of the left upper lobe with posterior bulging of the fissure. obstructed by squamous cell lung cancer.

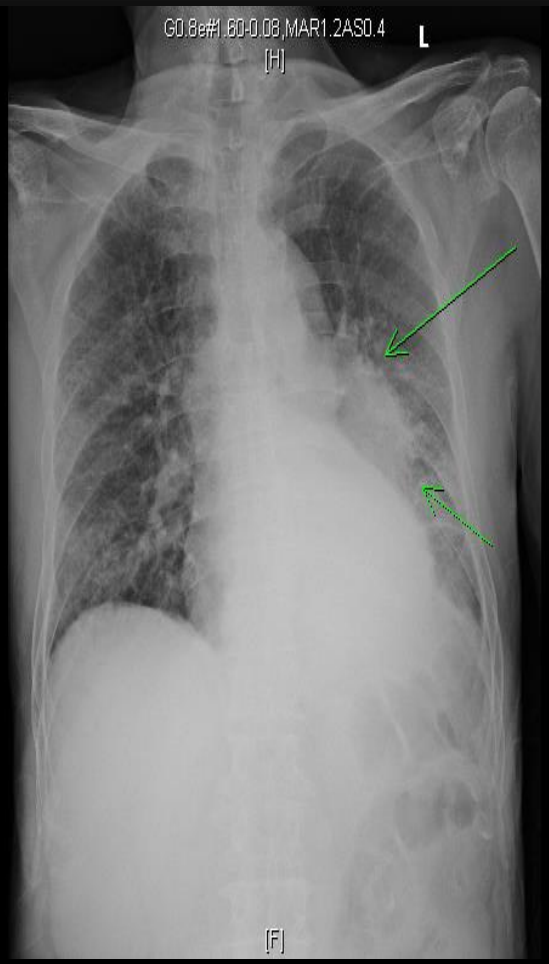
LOBAR CONSOLIDATION --NEOPLASM

- **Invasive mucinous adenocarcinoma** (formerly bronchioloalveolar cell carcinoma)
  - alveolar filling with lobar air space consolidations.
  - a large amount of mucoid secretions.



extensive air space consolidation of the left upper lobe and superior segment of the lower lobe.

A 69 Y/O MAN WITH A HISTORY OF HEAVY SMOKING PRESENTED WITH LEFT CHEST TIGHTNESS/SOB FOR DAYS



SNOMED:26000-A-M81403

DX: Bronchus, left lower lobe, biopsy

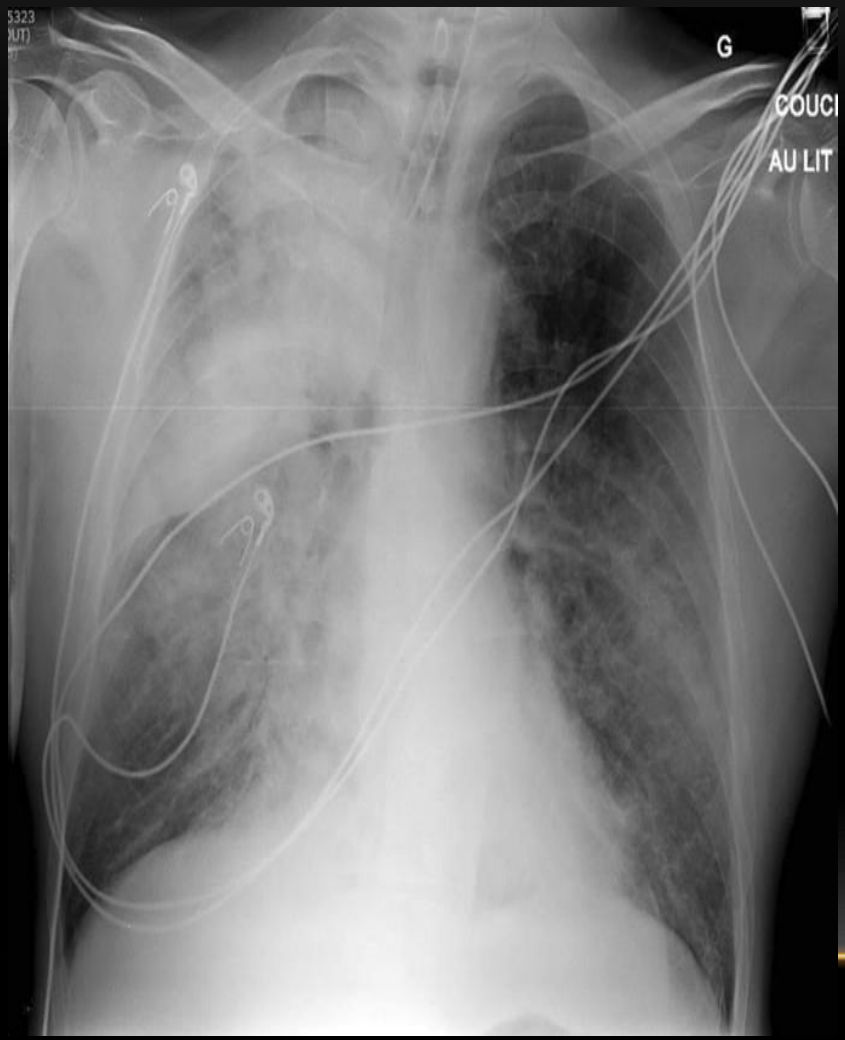
----- Mucinous adenocarcinoma, primary or metastatic

ADDENDUM:

Results of immunohistochemical stain (IP2021=5845):

Antibody:TTF-1 : (-) Napsin A: (-) NKX3.1: (-) CDX2: (-) CK7: (+) CK20: (-) LMW: (+) HMW: (+)

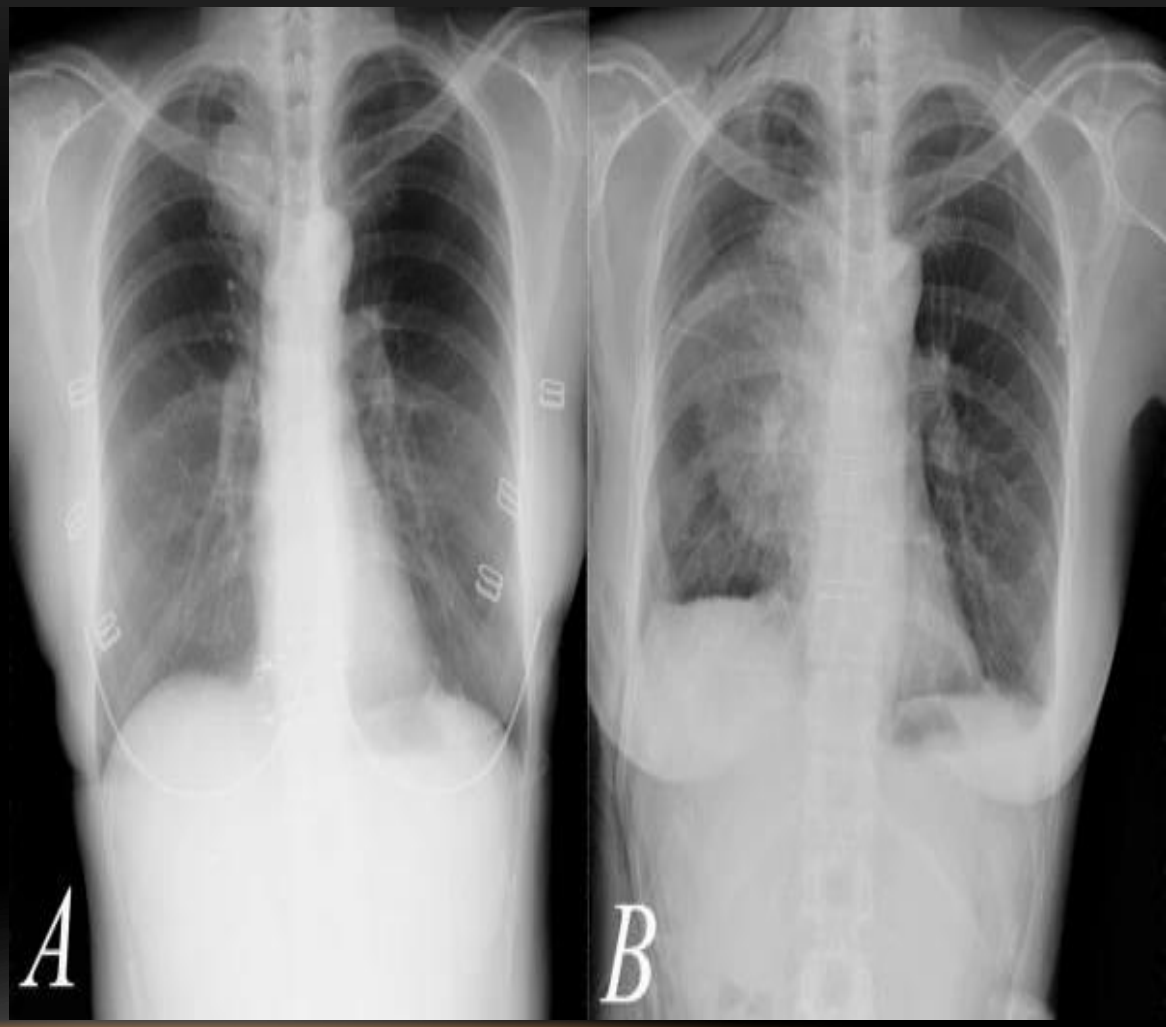
RUL PULMONARY EDEMA



- most typically with myocardial infarction, resulting in papillary muscle dysfunction or rupture.
- acute mitral regurgitation toward the orifice of the right superior pulmonary vein, causing preferential distribution of edema to the right upper lobe.

LOBAR CONSOLIDATION -LUNG TORSION

- occurred in traumatic, spontaneous and **postoperative** conditions
- risk of complicating infarction and necrosis
- lobar opacities are identified in an **unusual position** or are associated with unusual **hilar displacement**



Torsion of right middle lobe after a right upper lobectomy: a wedge-shaped opacity of large area in the middle lung field

OUTLINES

- Lobar/Segmental consolidation
- Diffuse air space opacity
- Multifocal ill-defined opacities
- Atelectasis

DIFFUSE AIR SPACE OPACITY

- diffuse air space consolidation
  - coalescent or confluent opacities with ill-defined borders;
  - butterfly-shaped perihilar distribution
  - ill-defined nodular opacities around the periphery of the process ("acinar pattern") :usually 5 to 10 mm in diameter
  - air alveologram: interspersed small lucencies.
- less opaque, diffuse, confluent opacities that fail to obliterate normal vascular shadows on chest radiographs: GROUND GLASS

Diffuse Air Space Opacities

Chest Radiology: Patterns and Differential Diagnoses, 15, 197-215

I. Edema

A. Cardiac failure B. Non-cardiac

II. Exudate (pneumonias)

A. Bacteria B. Viruses C. Mycoplasma D. Fungi

E. *Pneumocystis jiroveci* pneumonia (also known as PCP)

F. Parasites (strongyloidiasis) G. Aspiration H. *Rickettsia* (Rocky Mountain spotted fever)

I. Tuberculosis J. Severe acute respiratory syndrome (SARS)

III. Hemorrhage

A. Anticoagulation therapy B. Bleeding diathesis (e.g., leukemia)

C. Disseminated intravascular coagulation (18- to 72-hour delay)

D. Blunt trauma (pulmonary contusion, usually is not diffuse)

E. Vasculitis

1. Infections (e.g., mucormycosis, aspergillosis, Rocky Mountain spotted fever)
2. Granulomatosis with polyangiitis (formerly Wegener granulomatosis)
3. Goodpasture syndrome 4. Systemic lupus erythematosus

F. Idiopathic pulmonary hemosiderosis G. Infectious mononucleosis

IV. Other

A. Pulmonary alveolar proteinosis B. Acute respiratory distress syndrome (ARDS)

C. Acute interstitial pneumonia (AIP) D. Sarcoidosis (very unusual)

E. Mineral oil aspiration (exogenous cholesterol pneumonia)

F. Eosinophilic lung disease G. Chemical pneumonitis

H. Drug reactions

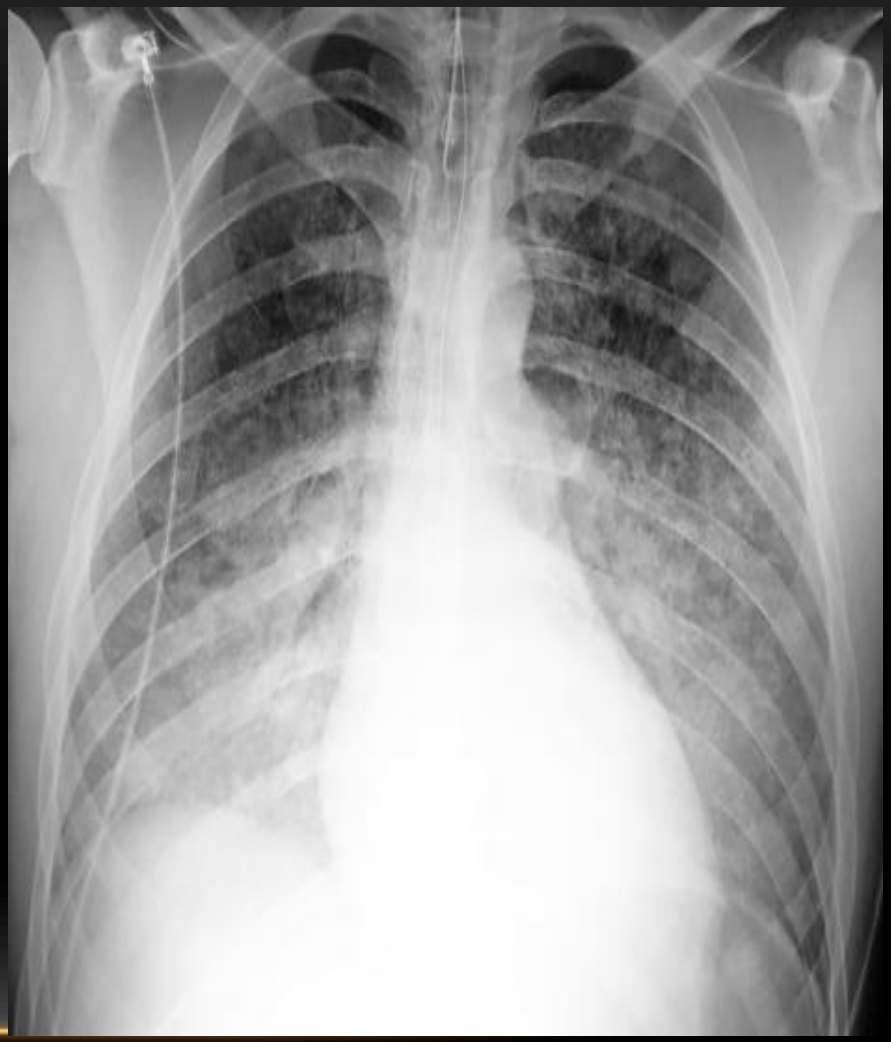
DIFFUSE AIR SPACE OPACITY-CARDIAC PULMONARY EDEMA

- always preceded by interstitial edema, but the extensive alveolar consolidation obscures the fine reticular opacities of the interstitial process.
- a perihilar distribution,
- Kerley B lines may be present in the costophrenic angles.
  - horizontal lines in the lung periphery that extend to the pleural surface.
  - thickened, edematous interlobular septa

(1)prominence of the upper lobe vessels; (2) indistinctness of vessels ; (3) peribronchial cuffing ; (4) increased width of the vascular pedicle; (5) Associated pleural effusions and (6) cardiac enlargement;

DIFFUSE AIR SPACE OPACITY- NON-CARDIAC PULMONARY EDEMA

- Acute Toxic Inhalations: nitrogen dioxide cause bilateral diffuse alveolar edema
- Smoke inhalation: delayed onset by as much as 24 to 48 hours
- Near-Drowning: a delay of 24 to 48 hours
- Acute Airway Obstruction: an aspirated object, such as a large bolus of food or a surgical sponge.
- Drug Reactions: diffuse, confluent air space opacities or patchy, multifocal, confluent opacities



Smoke inhalation produces diffuse bilateral air space opacities with a normal heart size

Non-cardiac Pulmonary Edema

Chest Radiology: Patterns and Differential Diagnoses, 15, 197-215

I. Chronic renal failure

II. Toxic inhalations

A. Nitrogen dioxide (silo filler's disease) B. Sulfur dioxide

C. Smoke D. Beryllium E. Cadmium

F. Silica (very fine particles; silicoproteinosis) G. Carbon monoxide

III. Anaphylaxis (e.g., penicillin, transfusion, radiologic contrast medium)

IV. Narcotics (e.g., morphine, methadone, cocaine, heroin)

V. Drug reaction (e.g., interleukin-2 therapy, β-adrenergic drugs)

VI. Acute airway obstruction (e.g., foreign body)

VII. Near-drowning

VIII. High altitude

IX. Fluid overload

X. Cerebral (trauma, stroke, tumor)

XI. Hypoproteinemia

XII. ARDS (early stages)

XIII. Pancreatitis

XIV. Amniotic fluid embolism

XV. Fat embolism

XVI. Re-expansion following treatment of pneumothorax or large pleural effusion

XVII. Organophosphate insecticide ingestion

XVIII. Hanta virus pulmonary syndrome

DIFFUSE AIR SPACE OPACITY- PULMONARY DRUG REACTIONS

- Acute alveolar edema may occur following administration of IV radiologic contrast, morphine, heroin, and other opiates.
- Acute **diffuse alveolar damage (**DAD) causes permeability edema , rapidly followed by cellular necrosis, inflammation, and later fibrosis.
  - Bleomycin, busulfan, and cyclophosphamide
- Eosinophilic pneumonia: Diffuse confluent air space opacities with a peripheral distribution
- **Cryptogenic organizing pneumonia (**COP), BOOP (b ronchiolitis o bliterans o rganizing p neumonia),
  - multiple areas of diffuse confluent opacity in the periphery
  - Amiodarone, bleomycin, methotrexate, and nitrofurantoin
- NSIP: minimal patchy or multifocal basilar opacities progress to interstitial fibrosis with reticular opacities, honeycombing, and traction bronchiectasis

Pulmonary Drug Reactions

Chest Radiology: Patterns and Differential Diagnoses, 15, 197-215

Modified from Rossi SE, Erasmus JJ, McAdams HP, et al. Pulmonary drug toxicity: radiologic and pathologic manifestations. *Radiographics.* 2000;20:1245-59. Used with permission.

I. Edema

A. Narcotics B. Radiologic contrast
C. Interleukin-2 therapy D. β-Adrenergic drugs

II. Hemorrhage

A. Anticoagulants B. Amphotericin B C. Cytarabine
D. Cyclophosphamide E. Penicillamine

III. Diffuse alveolar damage (DAD)

A. Bleomycin B. Busulfan C. Carmustine D. Cyclophosphamide
E. Gold F. Melphalan G. Mitomycin

IV. Eosinophilic pneumonia

A. Nitrofurantoin B. Nonsteroidal antiinflammatory drugs
C. Para-aminosalicylic acid D. Penicillamine E. Sulfasalazine

V. Cryptogenic organizing pneumonia (COP)

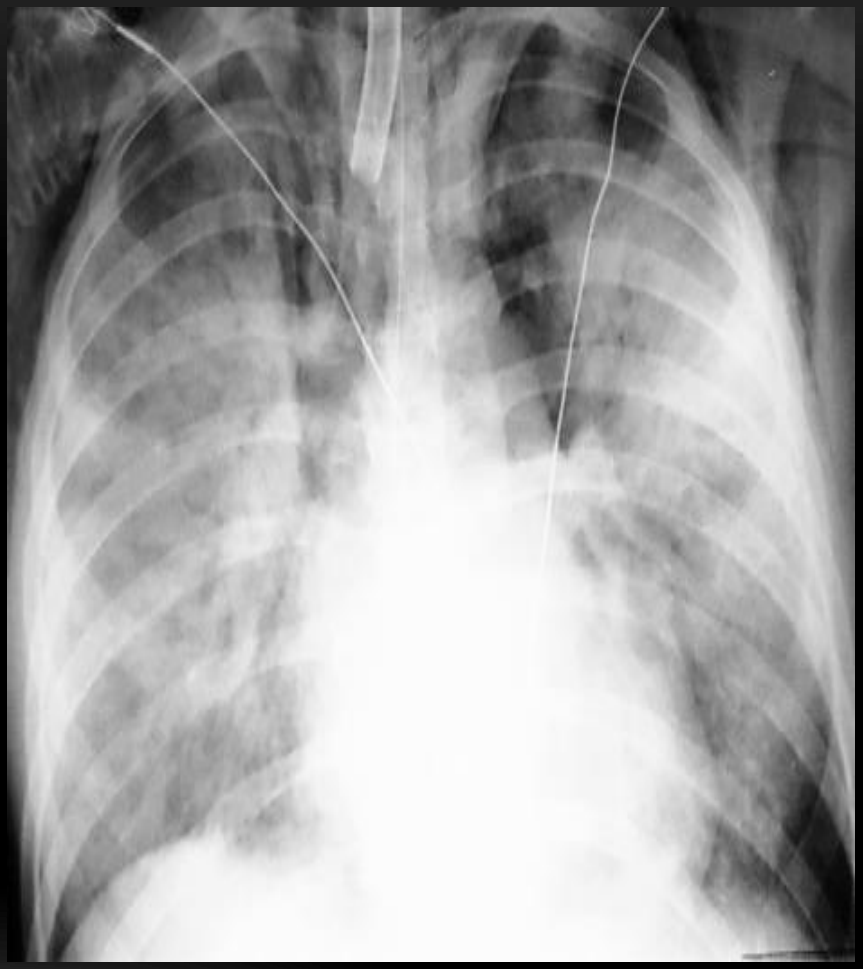
A. Amiodorone B. Bleomycin C. Cyclophosphamide D. Gold
E. Methotrexate F. Nitrofurantoin G. Penicillamine H. Sulfasalazine

VI. Nonspecific interstitial pneumonitis (NSIP)

A. Amiodarone B. Carmustine C. Chlorambucil D. Methotrexate

DIFFUSE AIR SPACE OPACITY- ACUTE RESPIRATORY DISTRESS SYNDROME

- occur after a variety of severe pulmonary injuries including trauma, shock, sepsis, severe pulmonary infection, transfusion reaction, or cardiopulmonary bypass.
- As the diffuse coalescent opacities begin to clear, an underlying reticular pattern emerges.



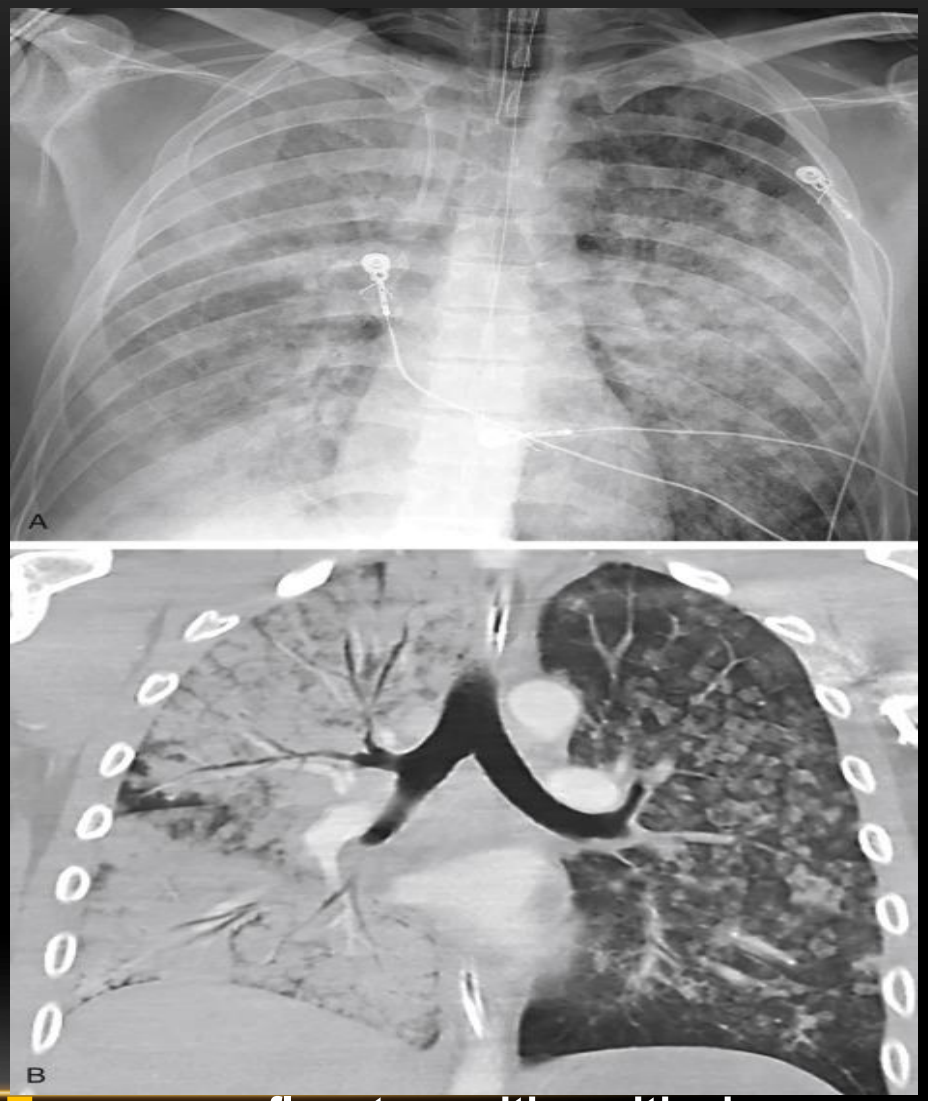
In the early stages of diffuse alveolar damage, the alveoli are filled by edema resulting from alveolar capillary leak. The pneumomediastinum is the result of barotrauma caused by positive pressure ventilation.

DIFFUSE AIR SPACE OPACITY-- RE-EXPANSION PULMONARY EDEMA

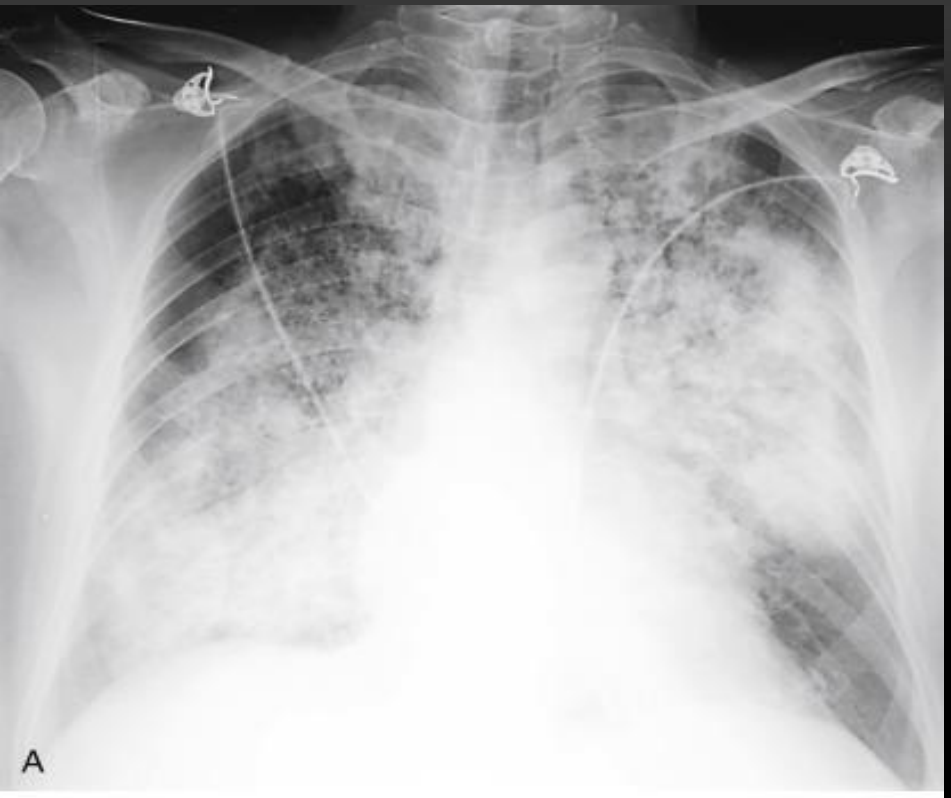
- occurs after treatment of pneumothorax or a large pleural effusion.
- Rapid reinflation of the lung probably causes alveolar capillary injury initiated by ischemia.
- when the lung has been collapsed for a prolonged period of time, more than 24 hours

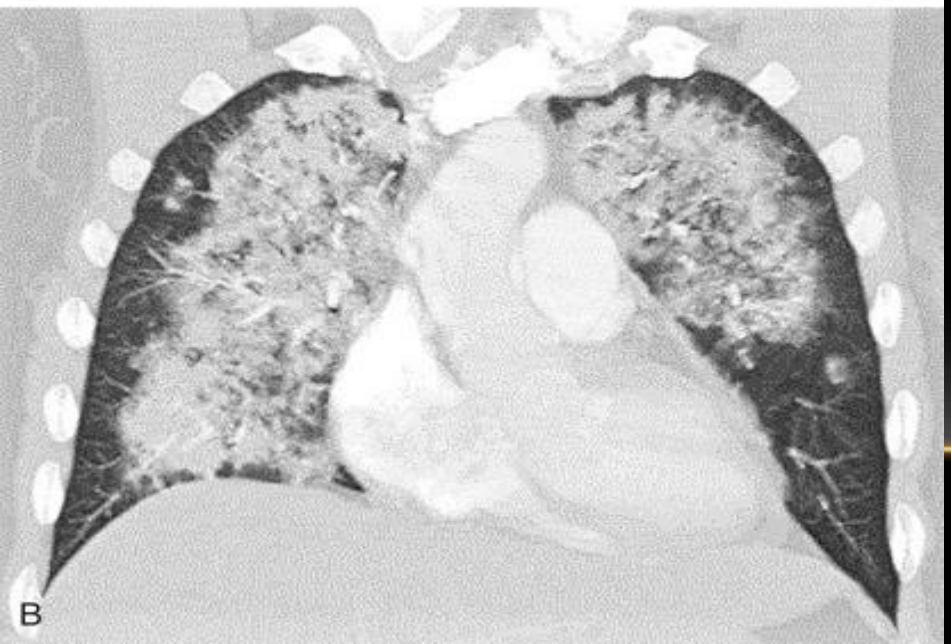
DIFFUSE AIR SPACE OPACITY—PULMONARY HEMORRHAGE

- Bleeding disorders
- Drug reactions
- Trauma: asymmetric, localized, or multifocal areas of contusion
- Idiopathic pulmonary hemosiderosis
- Autoimmune: granulomatosis with polyangiitis (GPA; Wegener granulomatosis), Goodpasture syndrome, microscopic polyangiitis, and systemic lupus erythematosus



Trauma: confluent opacities with air bronchograms on the right and lobular ground-glass opacities on the left.





Pulmonary hemorrhage: pulmonary vasculitis from granulomatosis with polyangiitis (GPA).

a predominantly perihilar distribution and typically spares the lung apices and the region of the costophrenic angles

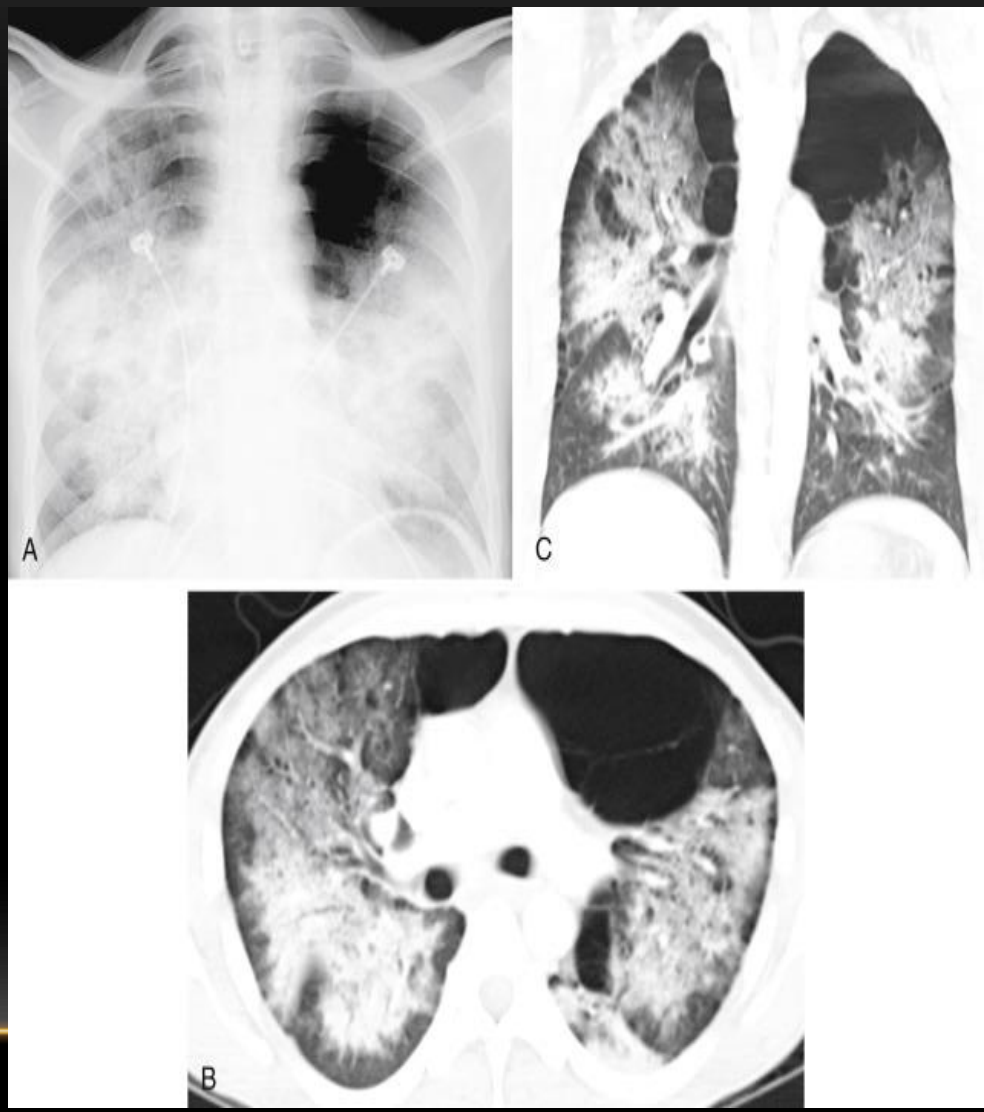
DIFFUSE AIR SPACE OPACITY—INFLAMMATORY DISEASES

- Bronchopneumonia: asymmetric, patchy, or even unilateral
- Viral Pneumonia: SARS, Chickenpox, COVID
- Aspiration Pneumonia
- Chronic aspiration : exogenous lipoid pneumonia—mineral oil aspiration, esophageal motility, obstructive lesions of the esophagus, and head or neck tumors

Bronchopneumonia has caused consolidation of the entire right lung.

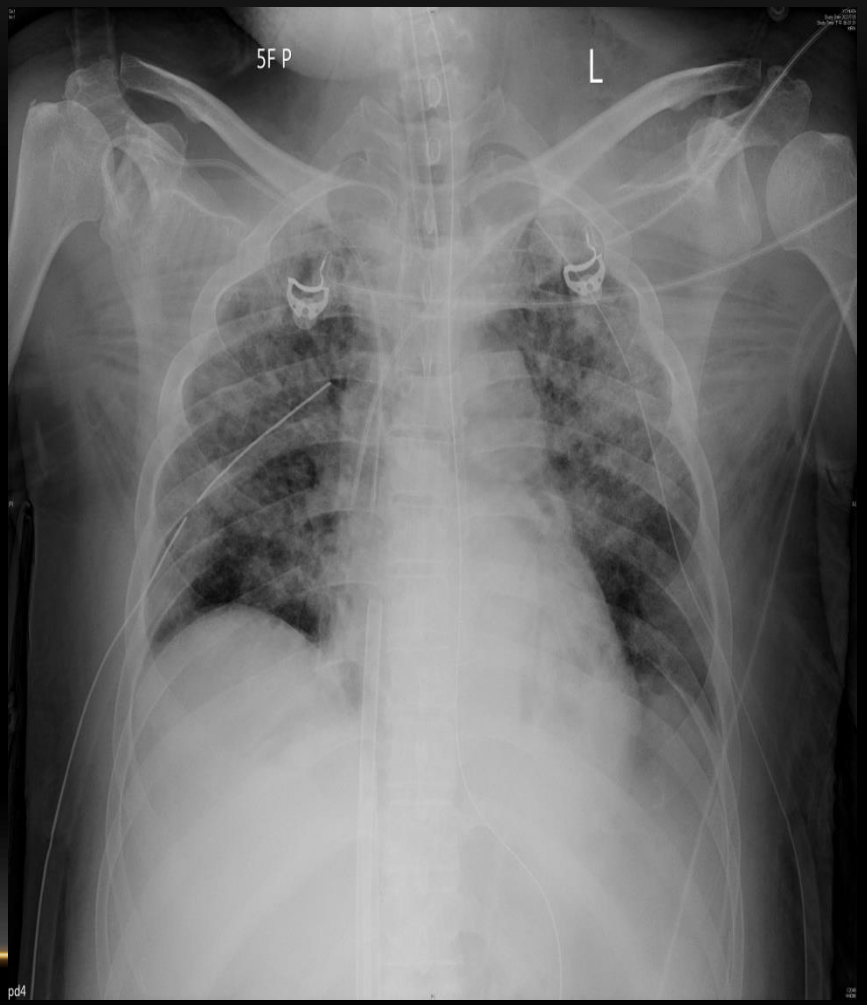
DIFFUSE AIR SPACE OPACITY—OPPORTUNISTIC PNEUMONIA

- Pneumocystis jirovecii pneumonia (PJP):
  - CD4 cell count has dropped to less than 200 cells/μl.
  - a subtle, fine, reticular pattern
  - rapid development of diffuse symmetric coalescent opacities
- Pathogenic fungi include Aspergillus, Candida, Cryptococcus, Phycomycetes (mucormycosis), histoplasma



pneumocystis pneumonia.

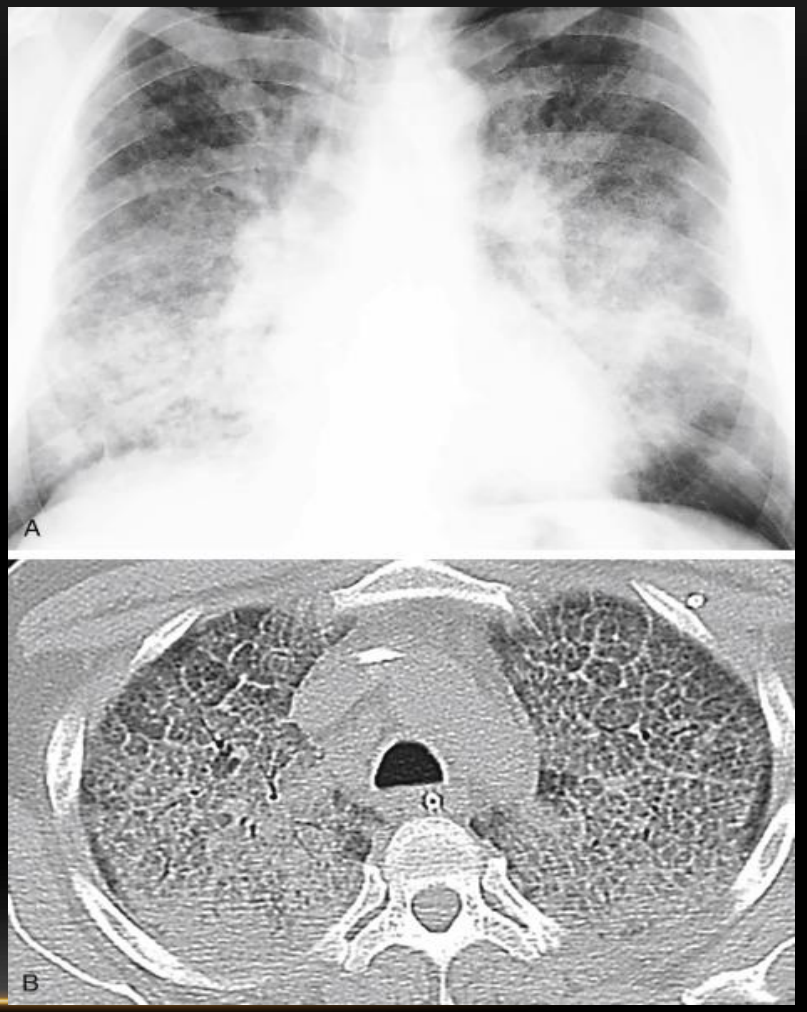
A 46 Y/O MAN WITH A HISTORY OF RENAL TRANSPLANT PRESENTED WITH ACUTE DYSPNEA AND COUGH SCANTY WHITISH SPUTUM FOR 1 WEEK



BAL fluid PJP+, Ct 20

DIFFUSE AIR SPACE OPACITY- CHRONIC DIFFUSE CONSOLIDATIONS

- Chronic **Granulomatous** Diseases
- **Sarcoidosis**: multifocal ill-defined opacities
- **Alveolar Proteinosis**
  - diffuse bilateral confluent opacities
  - acinar nodules around the periphery
- chronic **eosinophilic** pneumonia



pulmonary alveolar proteinosis: chronic and relapsing
Diffuse bibasilar confluent opacities

OUTLINES

- Lobar/Segmental consolidation
- Diffuse air space opacity
- Multifocal ill-defined opacities
- Atelectasis

MULTIFOCAL ILL-DEFINED OPACITIES

- primarily interstitial diseases
- opacities that are larger than 1 to 2 cm in diameter,
- multiple larger nodules and masses.

Multifocal Ill-Defined Opacities

I. Infectious diseases

A. Bacterial pneumonias (*Staphylococcus, Streptococcus, Pseudomonas, Legionella, Klebsiella, Haemophilus influenzae, Escherichia coli* , other gram-negative bacteria, *Nocardia*)

B. Fungal pneumonias (histoplasmosis, blastomycosis, candidiases, actinomycosis, coccidioidomycosis, aspergillosis, cryptococcosis, mucormycosis, sporotrichosis)

C. Tuberculosis

D. Viral and mycoplasma pneumonias

E. Rocky Mountain spotted fever

F. *Pneumocystis jiroveci* pneumonia

G. Paragonimiasis

H. Q fever

I. Atypical mycobacteria in patients with acquired immunodeficiency syndrome (AIDS)

J. Severe acute respiratory syndrome (SARS)

K. Septic emboli

II. Autoimmune diseases

A. Sarcoidosis

B. Granulomatosis with polyangiitis

C. Goodpasture syndrome

D. Connective tissue diseases (e.g., rheumatoid arthritis, scleroderma, dermatomyositis) complicated by diffuse alveolar damage (DAD)

E. Systemic lupus erythematosus (lupus pneumonitis or hemorrhage)

III. Neoplasms

A. Invasive mucinous adenocarcinoma (bronchioloalveolar cell carcinoma)

B. Metastases (e.g., vascular tumors, malignant hemangiomas, choriocarcinoma, adenocarcinoma)

C. Kaposi sarcoma in patients with AIDS

IV. Lymphoproliferative disorders
- A. Non-Hodgkin lymphoma (mucosa-associated lymphoid tissue [MALT] lymphoma is most common)
- B. Hodgkin lymphoma (rarely primary in lung)
- C. Lymphomatoid granulomatosis
- D. Posttransplant lymphoproliferative disorder
- E. Mycosis fungoides
- F. Waldenström macroglobulinemia

V. Environmental diseases
- A. Hypersensitivity pneumonitis (allergic alveolitis)
- B. Coal worker's pneumoconiosis
- C. Silicosis

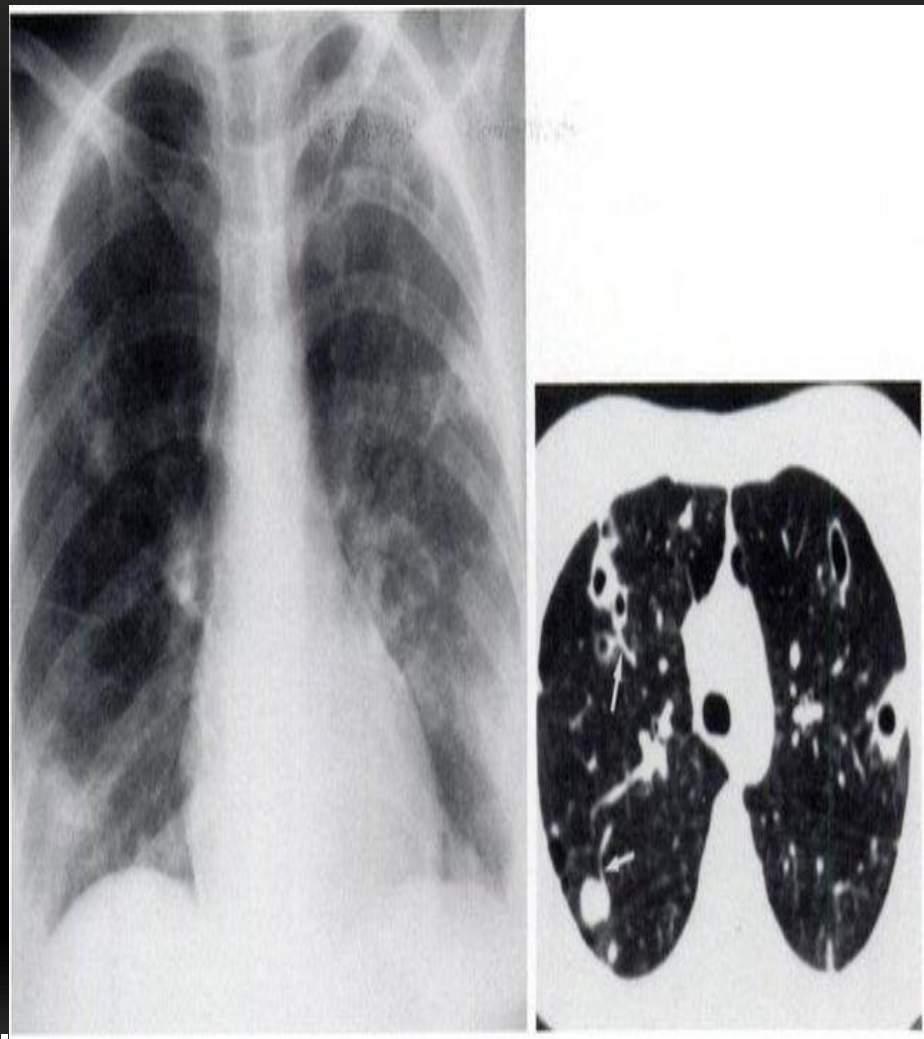
VI. Smoking-related diseases
- A. Langerhans cell histiocytosis
- B. Desquamative interstitial pneumonitis (DIP)

VII. Idiopathic
- A. Amyloid
- B. Acute interstitial pneumonitis (AIP)
- C. Cryptogenic organizing pneumonia (COP)
- D. Eosinophilic pneumonitis (idiopathic, drug reaction, or secondary to parasites)

VIII. Other disorders
- A. Drug reactions
- B. Radiation pneumonitis
- C. Metastatic pulmonary calcification (secondary to hypercalcemia)
- D. Fat emboli

MULTIFOCAL ILL-DEFINED OPACITIES--INFECTIOUS DISEASES

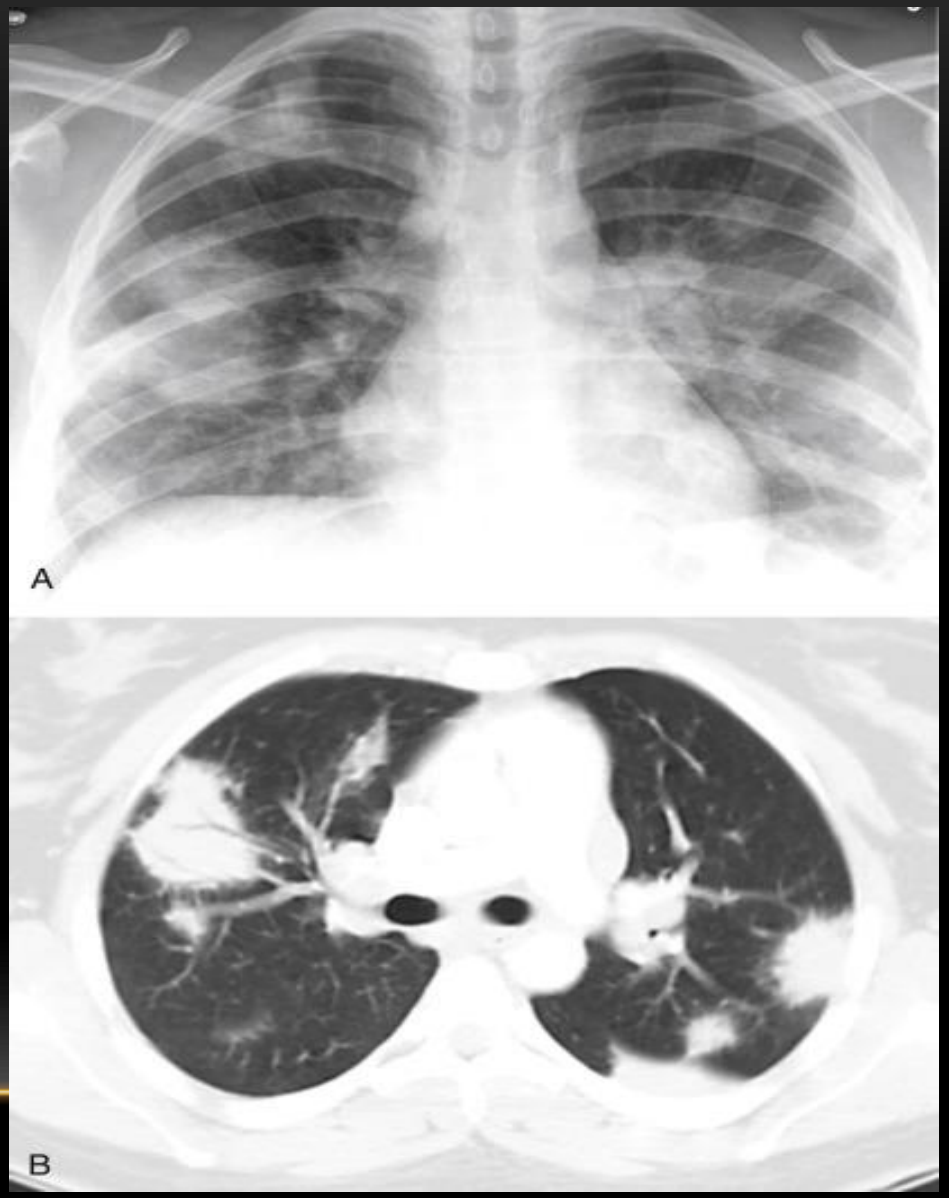
- **Bacterial** Bronchopneumonia
- **Septic Emboli**
- **Viral** Pneumonia:
  - peribronchial thickening, air trapping.
  - reticular, interlobular septal lines
  - a fine nodular pattern
  - coalesce into diffuse consolidation
  - Varicella, Rubeola (measles), Cytomegalic inclusion disease, Rickettsial
- Invasive **fungal** infections:
  - Aspergillosis and mucormycosis,
  - pulmonary hemorrhage and infarction.
  - air crescent sign
- **Tuberculosis**



Septic emboli: scattered thin-walled cavities throughout both lungs, associated with ill-defined areas of consolidation in peripheral portions of both lower lobes.

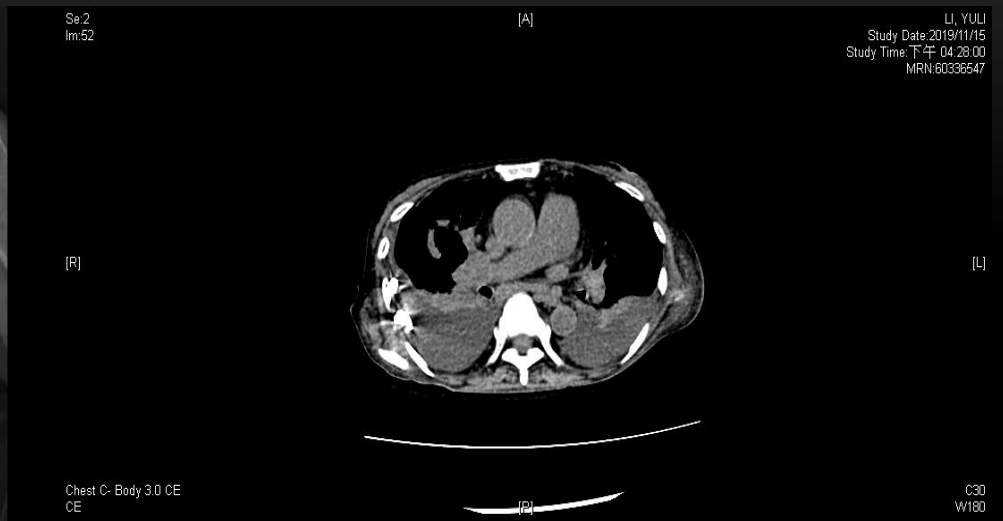
MULTIFOCAL ILL-DEFINED OPACITIES--AUTOIMMUNE DISEASES

- Sarcoidosis:
  - bilateral nodular or mass-like foci, ill-defined borders
  - bilaterally symmetric hilar adenopathy
  - opacities accumulate and disappear dramatically
- Granulomatosis with polyangiitis



multinodular manifestation of sarcoidosis

A 79 Y/O WOMAN WITH DYSPNEA FOR 1 + YEARS



* Favor sarcoidosis with LN, spleen and bone in volvement
* A hypoenhancing anterior mediastinal mass (4. 4x2.2cm), may be necrotic LN?
* Patch consolidation in RML and bil LL
* Bil pleural effusion

DX:

Lymph node, mediastinal, biopsy

----- Granulomatous inflammation

ADDENDUM:

Result of special stain:

Acid fast stain: (-) GMS stain: (-)

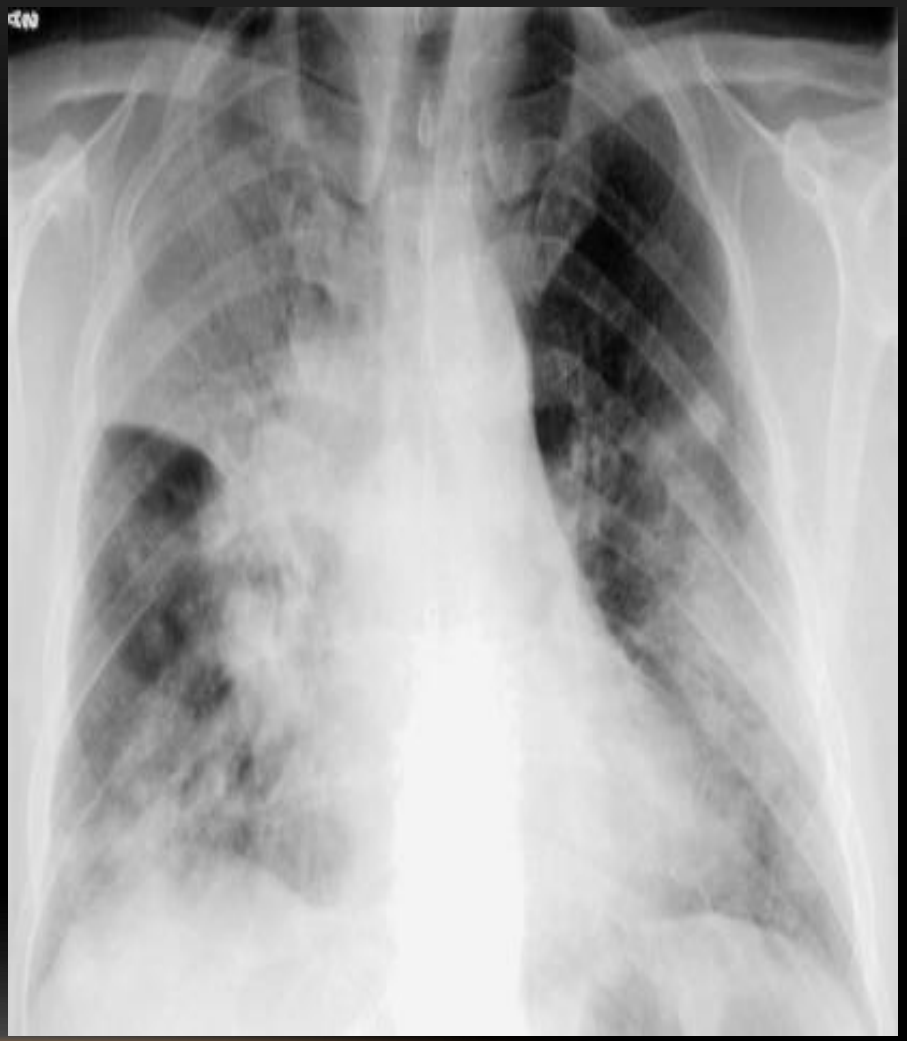
PAS stain: (-)

Comment: No acid-fast bacilli are identified by Ziehl-Neelsen stain. Neither fungal hyphae nor spores are identified by GMS and PAS stain (LPY)

multifocal ill-defined opacities in this case are very nonspecific, but the observation of enlargement of the nodes in the aortic pulmonary window (left arrows) and paratracheal lymph nodes relatively asymptomatic supports the correct diagnosis of sarcoidosis

MULTIFOCAL ILL-DEFINED OPACITIES---NEOPLASMS

- Lung Invasive mucinous adenocarcinoma
- Metastases from choriocarcinoma
  - bleeding around the periphery
- Postobstructive pneumonitis distal to endobronchial carcinoma



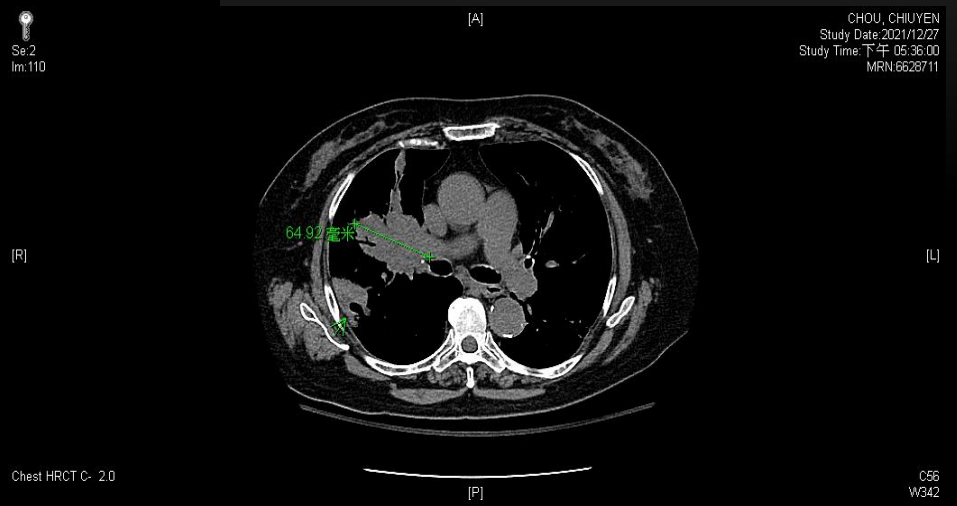
Invasive mucinous adenocarcinoma fills the air spaces with mucus and tumor cells.

MULTIFOCAL ILL-DEFINED OPACITIES—LYMPHOPROLIFERATIVE DISORDERS

- Lymphoma
  - Primarily (1%) or secondarily
- Lymphomatoid granulomatosis

lymphomatous masses and interstitial infiltration

A 71 Y/O WOMAN WITH DYSPNEA AND COUGH FOR 1 + YEAR



multiple consolidation (largest 6.5 cm in RUL), ground glass opacities and nodules in the bilateral lungs.

SNOMED:

28000-B-M96993

DX:

Lung, right lower, needle biopy

----- Lymphoproliferative disorder

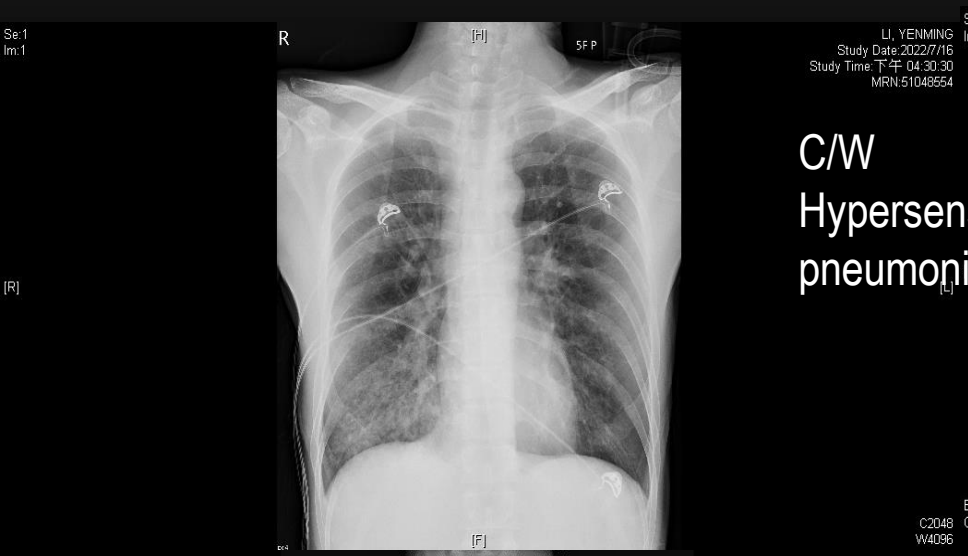
C/W Extranodal marginal zone lymphoma of mucosa-associated lymphoid tissue (MALT lymphoma)

MULTIFOCAL ILL-DEFINED OPACITIES-ENVIRONMENTAL DISEASES

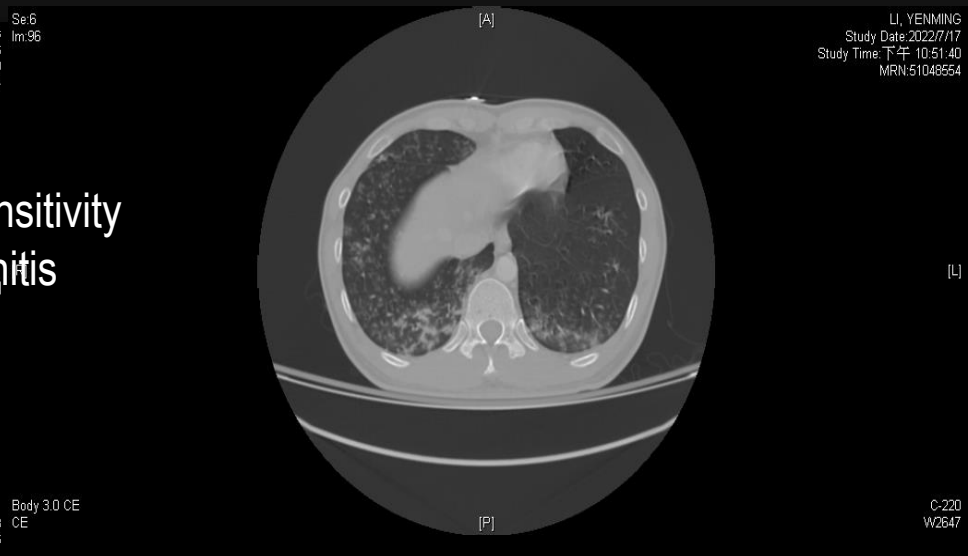
- Hypersensitivity pneumonitis
  - acute phase : multiple confluent opacities with air bronchograms
  - later stages: a nodular or even a reticular pattern
- Silicosis and coal workers' pneumoconiosis
  - borders irregular
  - opacities homogeneous
  - in the periphery of the lung with an bilateral upper lobe predominance
  - parallel the chest wall

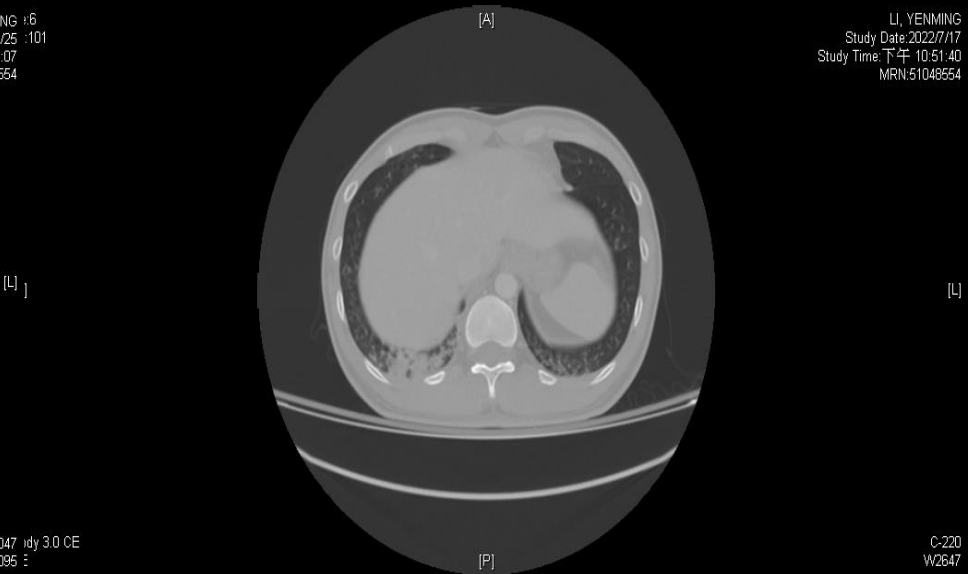
progressive massive fibrosis: bilateral upper lobe opacities associated coarse reticular opacities

A 34 Y/O MAN WITH A HISTORY OF ALLERGIC ASTHMA PRESENTED WITH DYSPNEA FOR 2 DAYS AFTER EXPOSURE TO FINISH PAINT

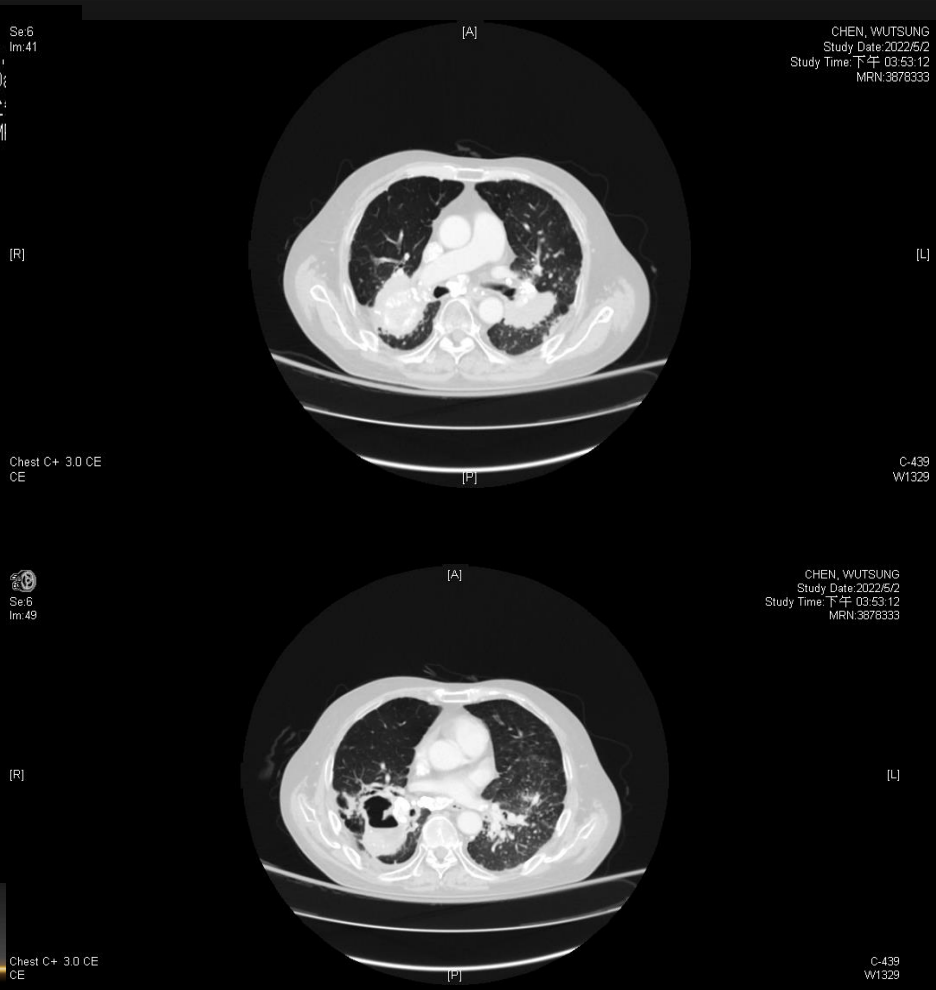


C/W Hypersensitivity pneumonitis





A 55 Y/O MALE CHISELER AND HEAVY SMOKER PRESENTED WITH PROGRESSIVE DYSPNEA FOR A FEW YEARS

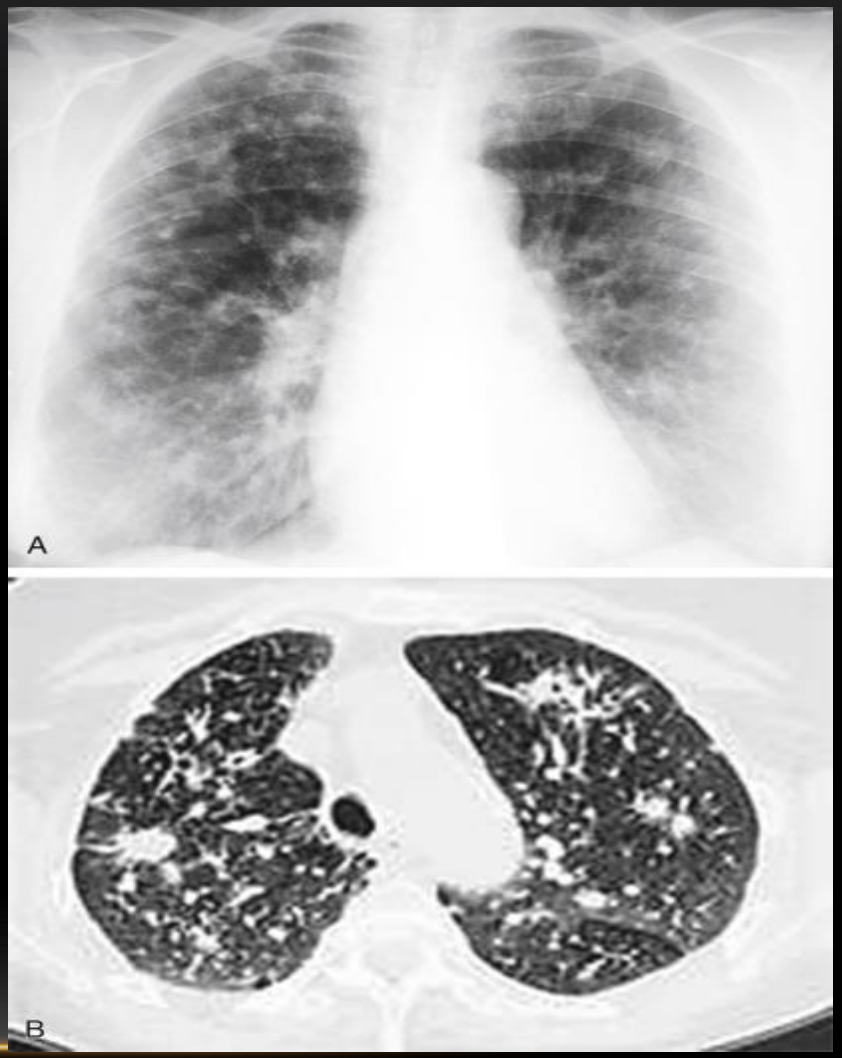


Silicosis with PMF

BAL: 20220504 1 NTM (Nontuberculous Mycobacterium):

MULTIFOCAL ILL-DEFINED OPACITIES-SMOKING-RELATED DISEASES

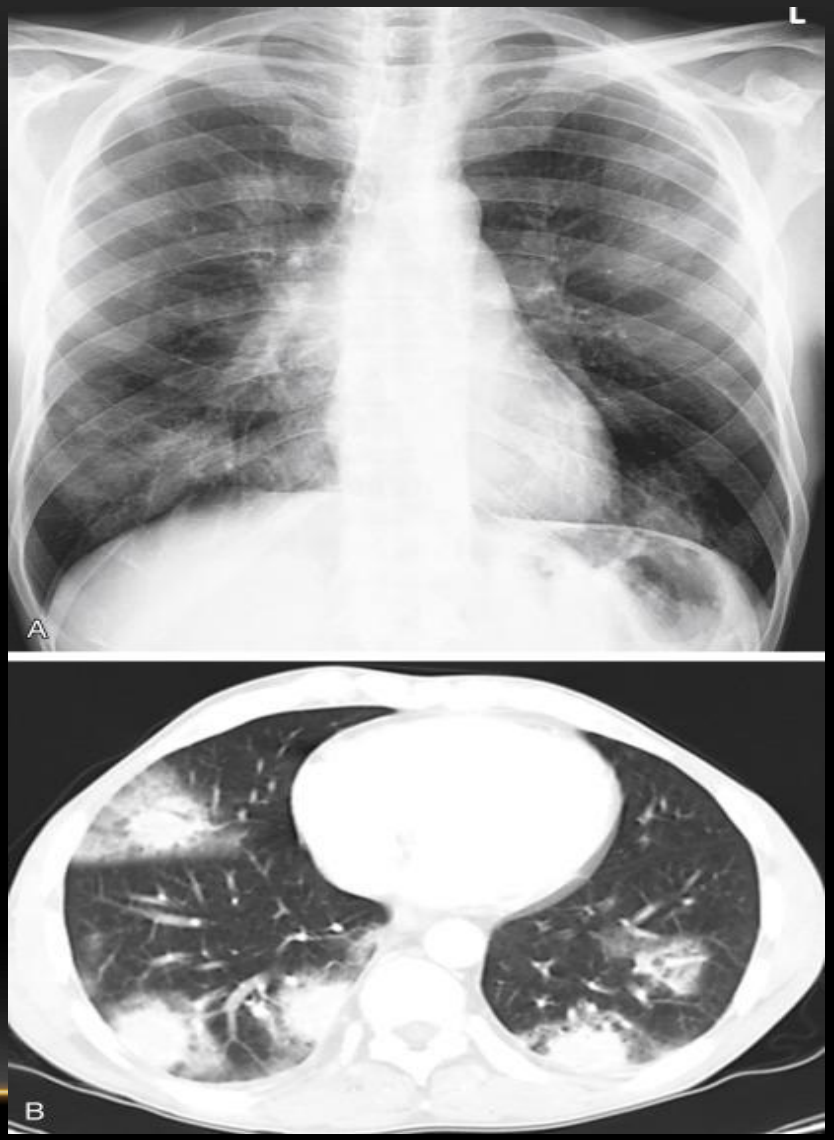
- Langerhans cell histiocytosis
  - early stage: nodules ranging in size from 1 to 10 mm
  - Later: reticular opacities, small cavities, or multiple cysts.
  - upper lobe predominance
  - most individuals are in their 20s or 30s



Langerhans cell histiocytosis is a cause of multifocal, poorly defined nodular opacities

MULTIFOCAL ILL-DEFINED OPACITIES-IDIOPATHIC DISEASES

- Cryptogenic organizing pneumonia (COP), bronchiolitis obliterans with organizing pneumonia (BOOP)
- multifocal air space opacities with normal lung volume



Cryptogenic organizing pneumonia produces multifocal ill-defined opacities that resemble bronchopneumonia

MULTIFOCAL ILL-DEFINED OPACITIES-IDIOPATHIC DISEASES

- Eosinophilic pneumonias
  - patchy areas of air space consolidation that tend to be in the periphery of the lung: outer thirds
  - upper lobes
  - Loeffler syndrome: acute
  - chronic eosinophilic pneumonia
  - parasitic conditions

photonegative of pulmonary edema. Note the peripheral opacities with a clear area between the opacities and central pulmonary arteries.

OUTLINES

- Lobar/Segmental consolidation
- Diffuse air space opacity
- Multifocal ill-defined opacities
- Atelectasis

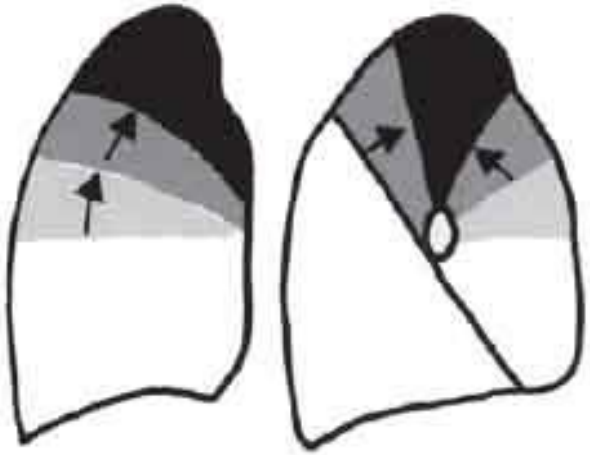
ATELECTASIS IS LOSS OF LUNG VOLUME

- (1) increased opacity;
- (2) crowding and reorientation of pulmonary vessels;
- (3) displacement of fissures : the most specific sign
- (4) elevation of the diaphragm;
- (5) displacement of the hilum;
- (6) crowding of ribs;
- (7) compensatory overinflation of the normal lung;
- (8) shift of the mediastinum;
- (9) cardiac rotation ;
- (10) bronchial rearrangement ;
- (11) juxtaphrenic peak

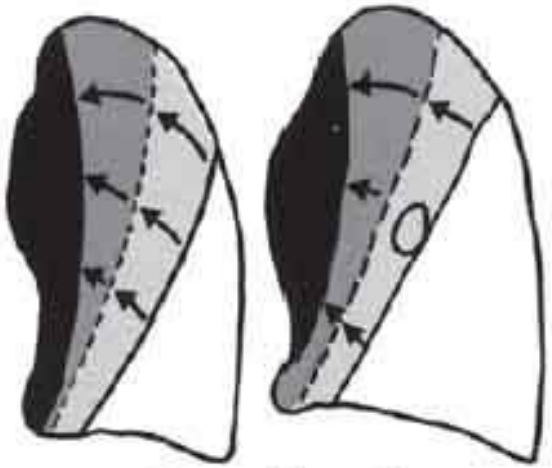
KEY POINTS: RADIOLOGIC SIGNS OF ATELECTASIS

- **Direct**
  - Displacement of interlobar fissures
  - Crowding of vessels and bronchi
- **Indirect**
  - Local increase in opacity
  - Elevation of the hemidiaphragm
  - Shift of the mediastinum
  - Compensatory overinflation of remaining lung
  - Displacement of the hila

VOLUME LOSS IN A LOBE TENDS TO HAVE A SPECIFIC RADIOGRAPHIC APPEARANCE

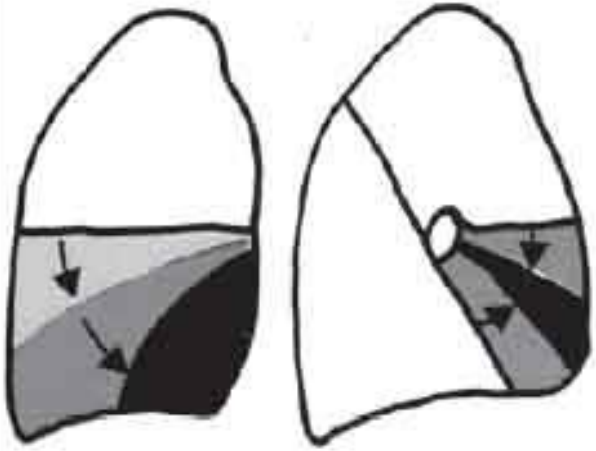


Right upper lobe atelectasis

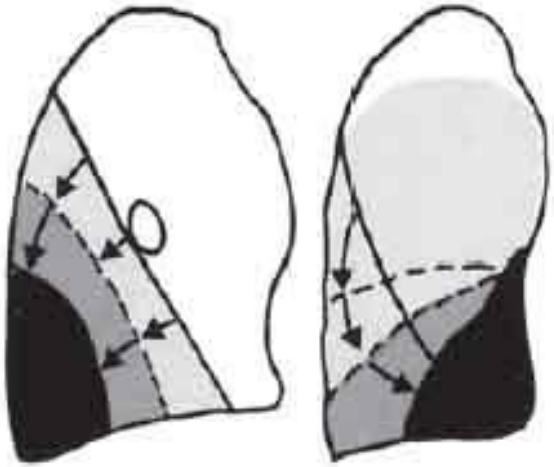


Left upper lobe atelectasis

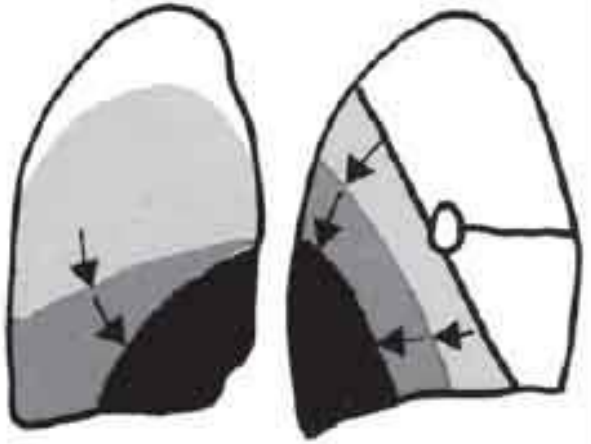
Radiology KeyFastest
Radiology Insight Engine



Right middle lobe atelectasis



Left lower lobe atelectasis



Right lower lobe atelectasis

RADIOGRAPHIC SIGNS OF LOBAR COLLAPSE

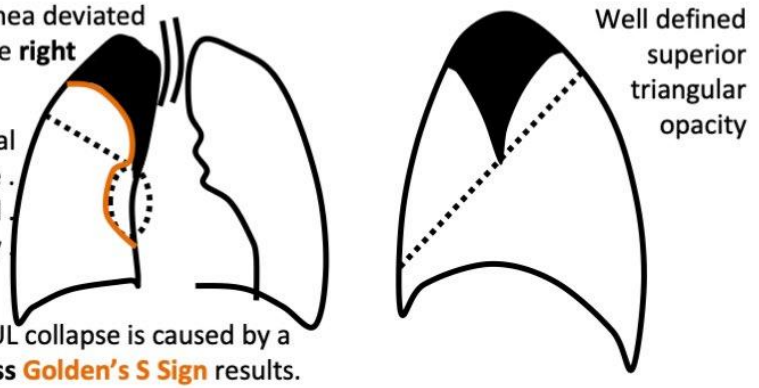
by **Nick Mark** MD

ONE onepagericu.com @nickmmark Link to the most current version →

General findings to look for:

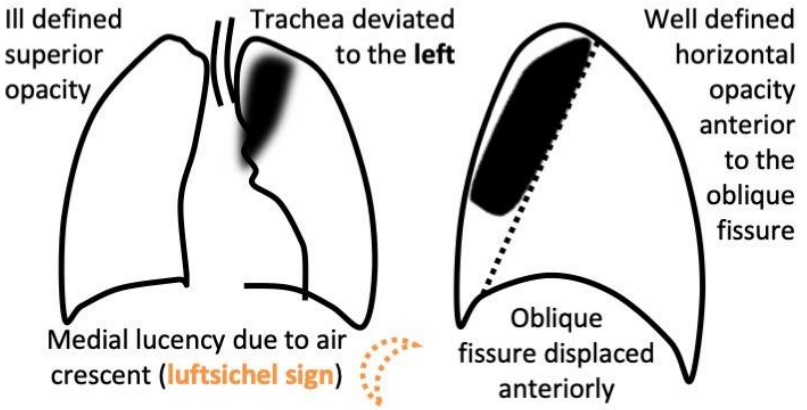
- **Crowding** of ribs near collapse
- **Hyperlucency** of other lobes
- **Mediastinal shift** towards the collapse
- Ipsilateral **hemidiaphragm elevation**

RUL

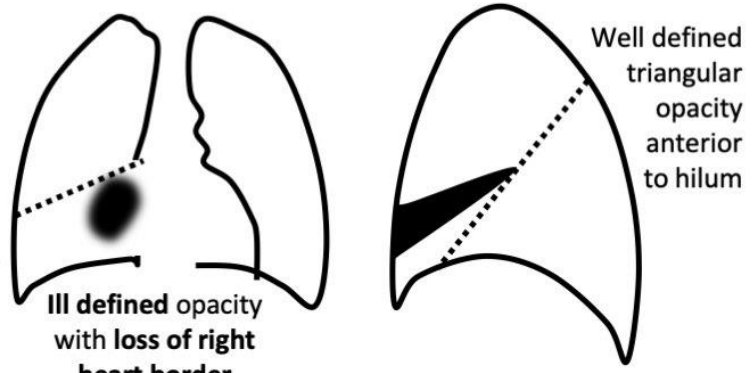


When RUL collapse is caused by a **hilar mass** **Golden's S Sign** results.

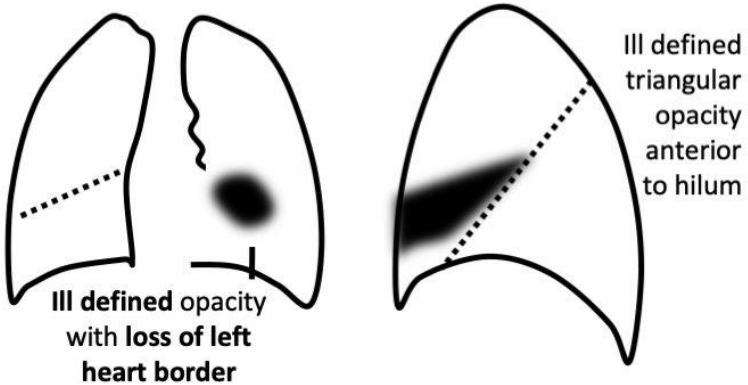
LUL



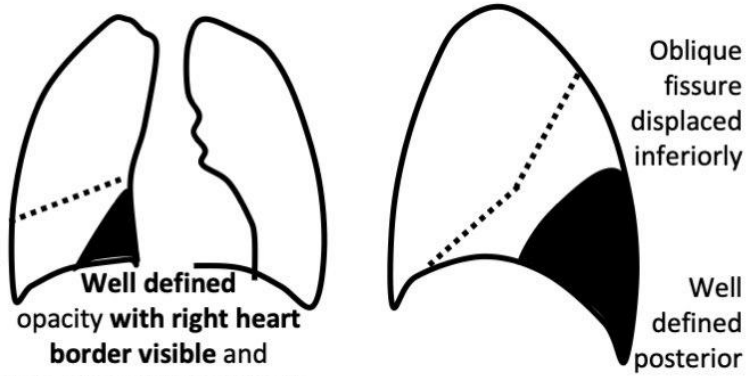
RML



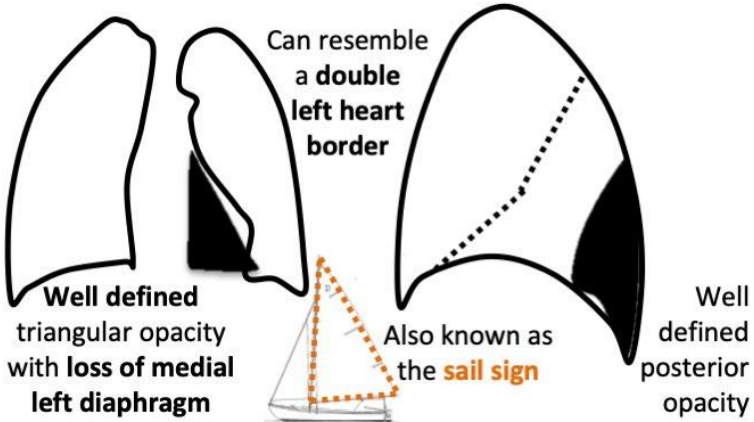
Lingula



RLL



LLL

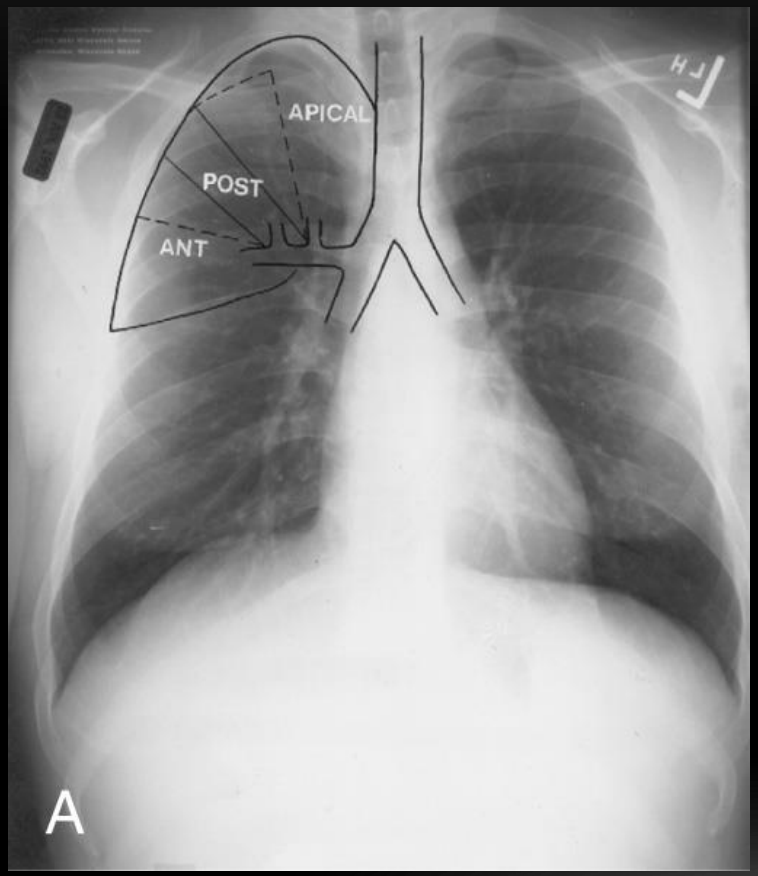


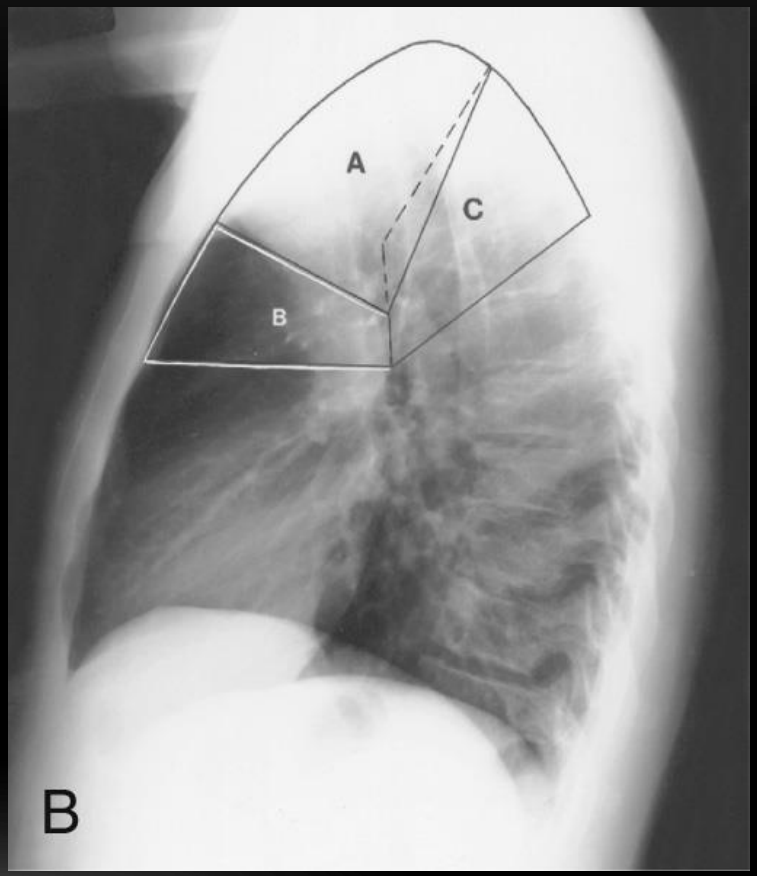
v1.1 2020-03-30

RIGHT UPPER LOBE ATELECTASIS

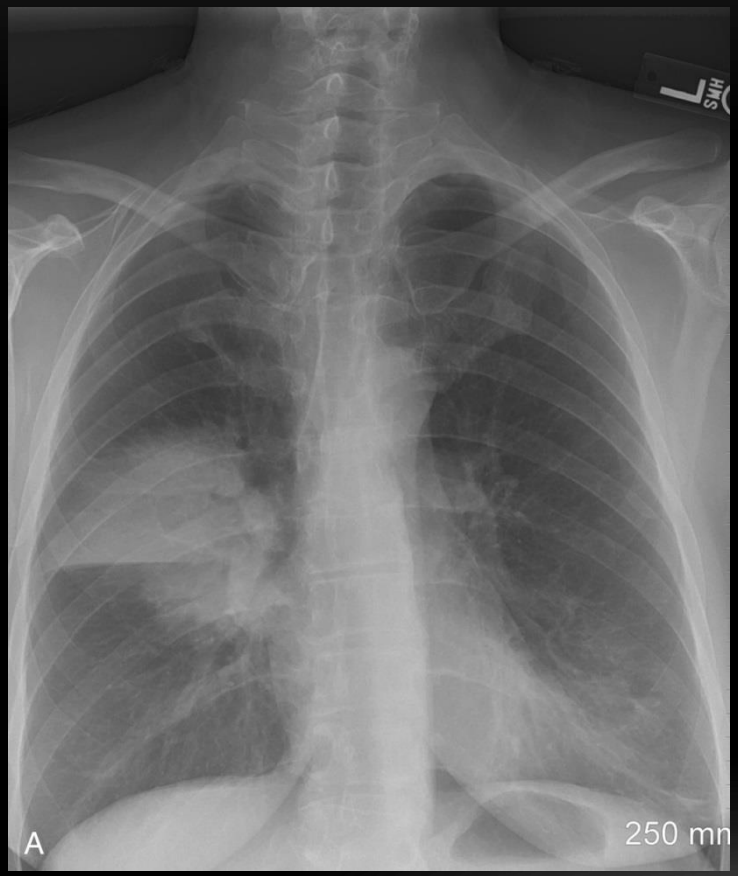
- Opacification of the right upper thorax
- is associated with elevation of the minor fissure and right hemidiaphragm with a juxtaphrenic peak.
  - The juxtaphrenic peak is a triangular opacity at the dome of the hemidiaphragm that indicates upper lobe volume loss.

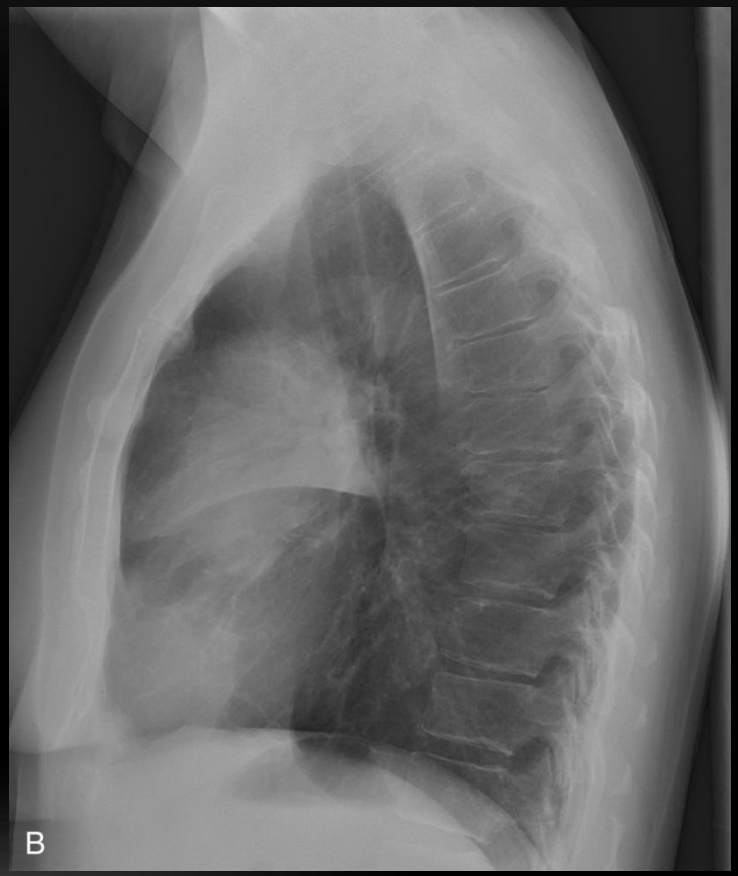
SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---RUL





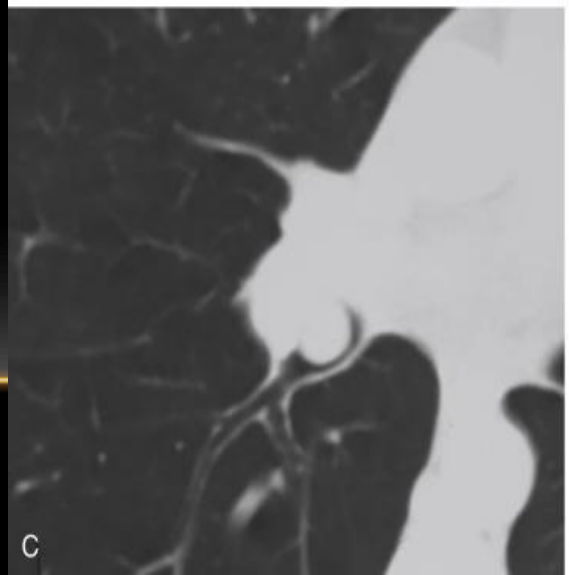
RUL-ANTERIOR SEGMENT





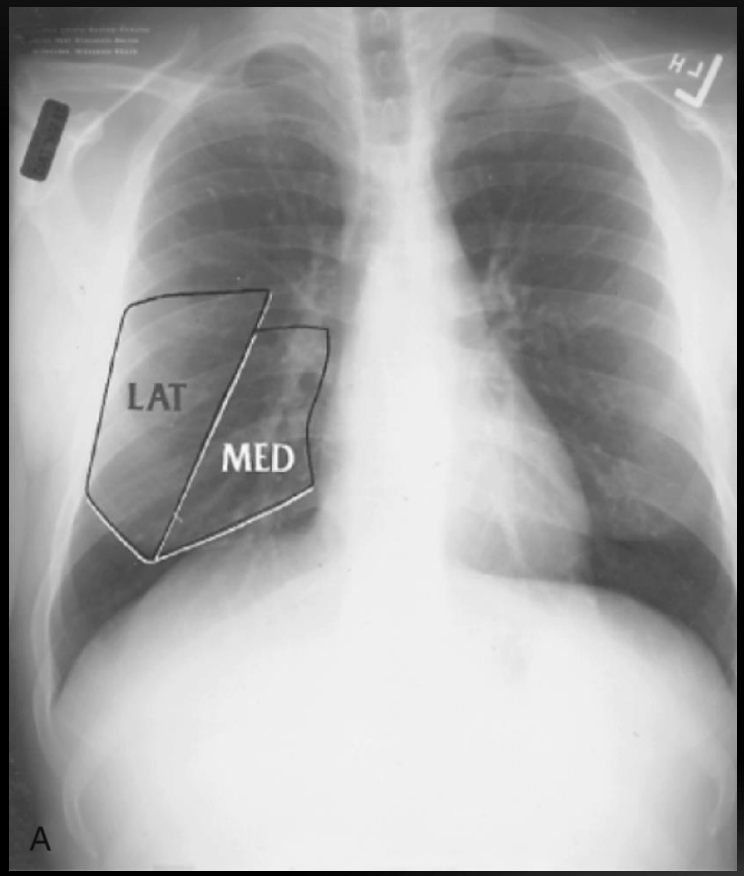
RIGHT MIDDLE LOBE ATELECTASIS

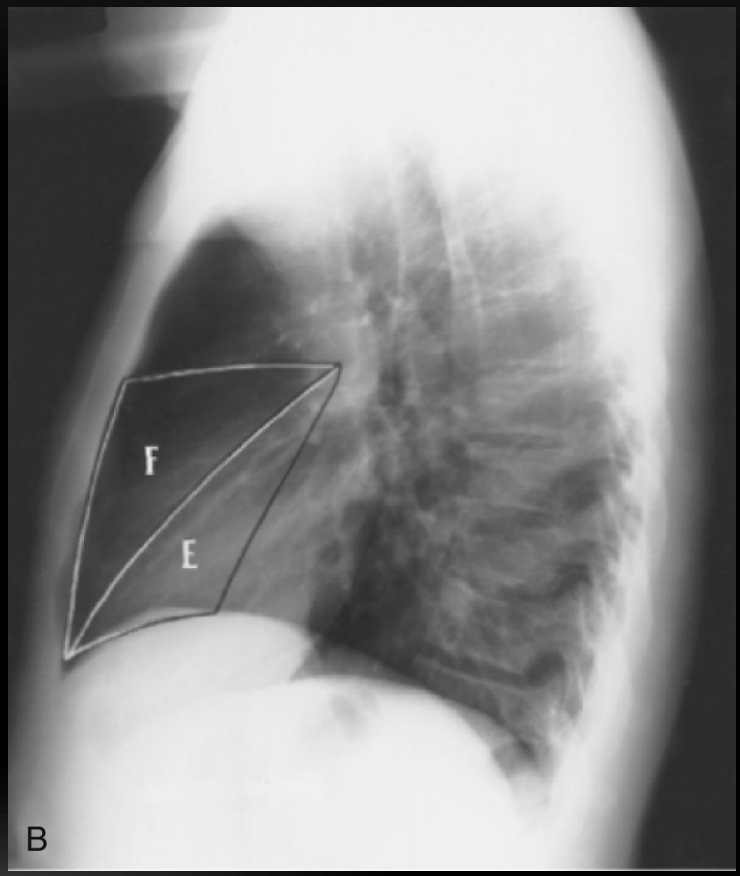
- a combination of increased opacity that silhouettes the right heart border with inferior displacement of the horizontal fissure.
- The lateral view often shows anterior shift of the lower portion of the oblique fissure



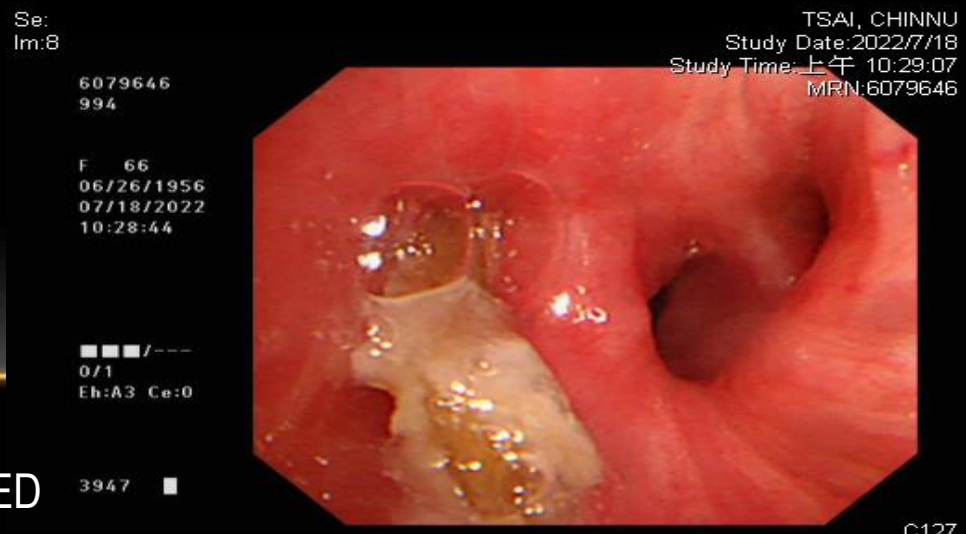
Computed tomography scan reveals an endobronchial mass, and a transbronchial biopsy made the diagnosis of carcinoid.

SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---RML





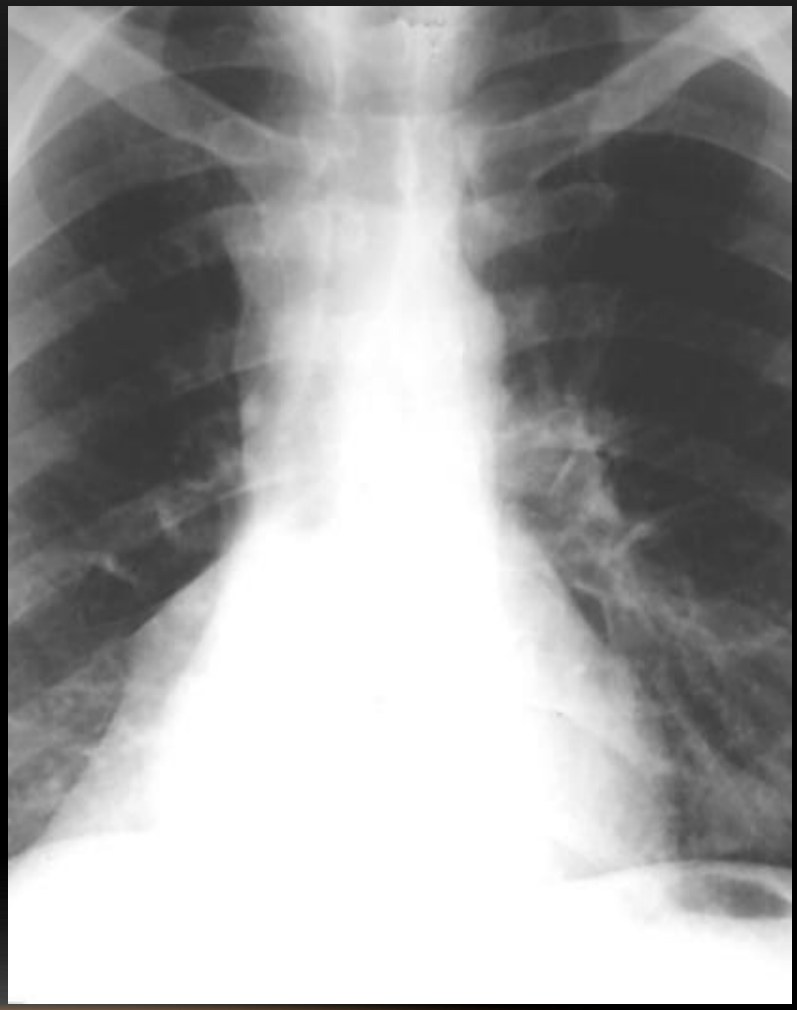
A 66 Y/O WOMAN WITH COUGH WHITISH SPUTUM FOR 6 MONTHS FOLLOWED BY FEVER FOR 3 DAYS



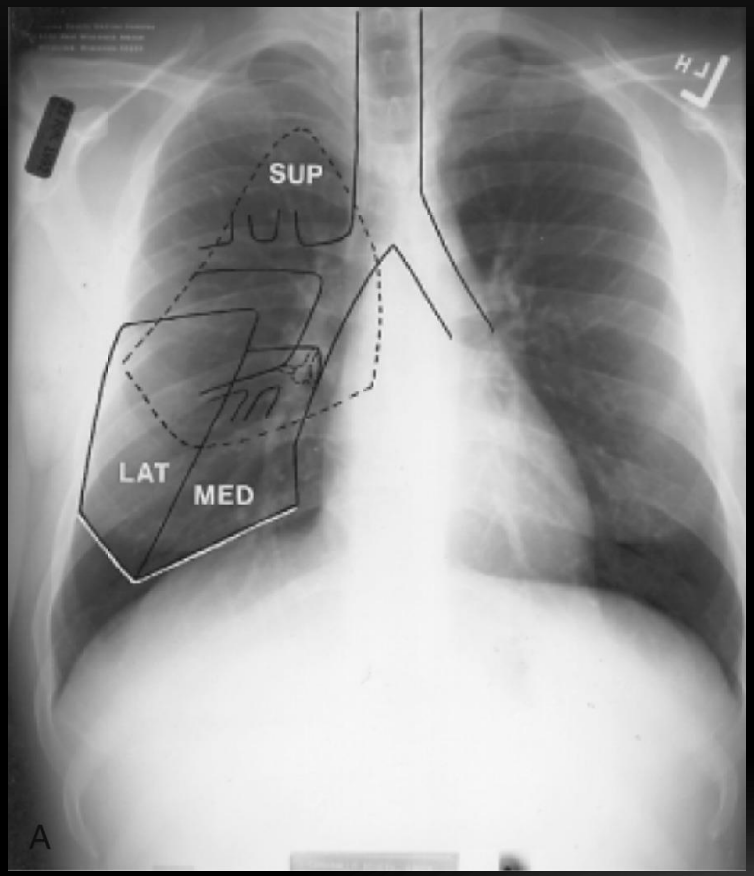
RML atelectasis due to foreign body: ORANGE SEED

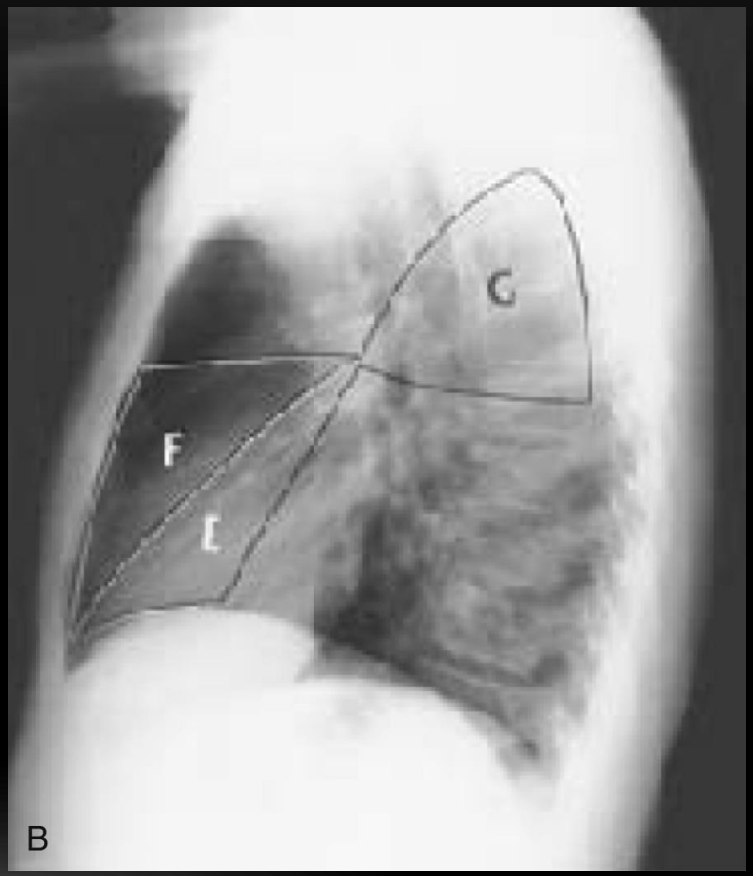
RIGHT LOWER LOBE ATELECTASIS

- inferior displacement of the major fissure so that it becomes visible on the posteroanterior chest radiograph.
- The sharp lateral border of this opaque atelectatic lower lobe is produced by the major fissure.
- Note that lower lobe atelectasis does not silhouette the heart border.

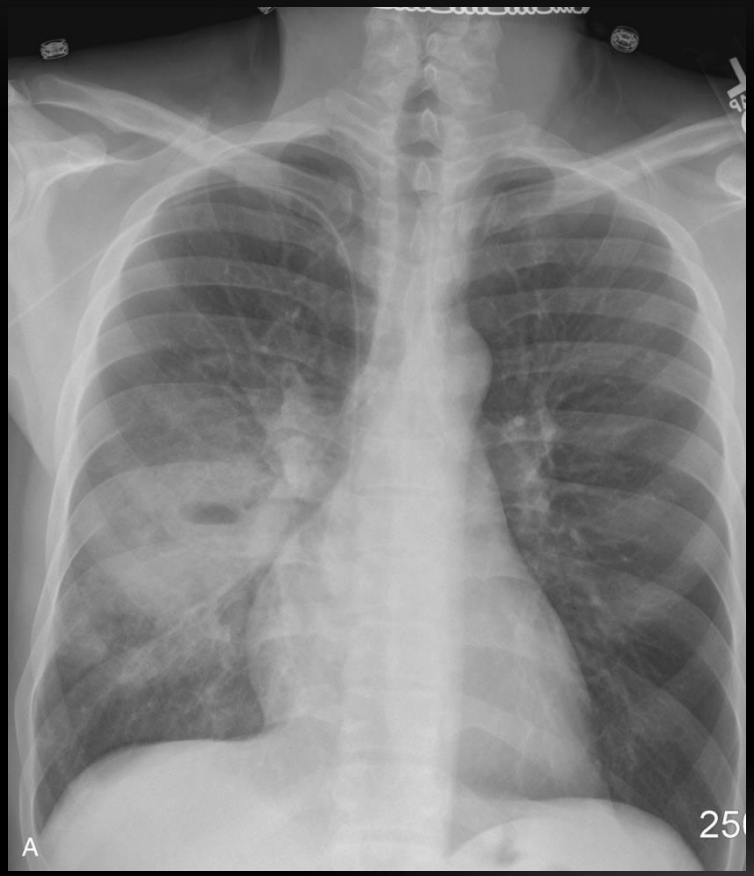


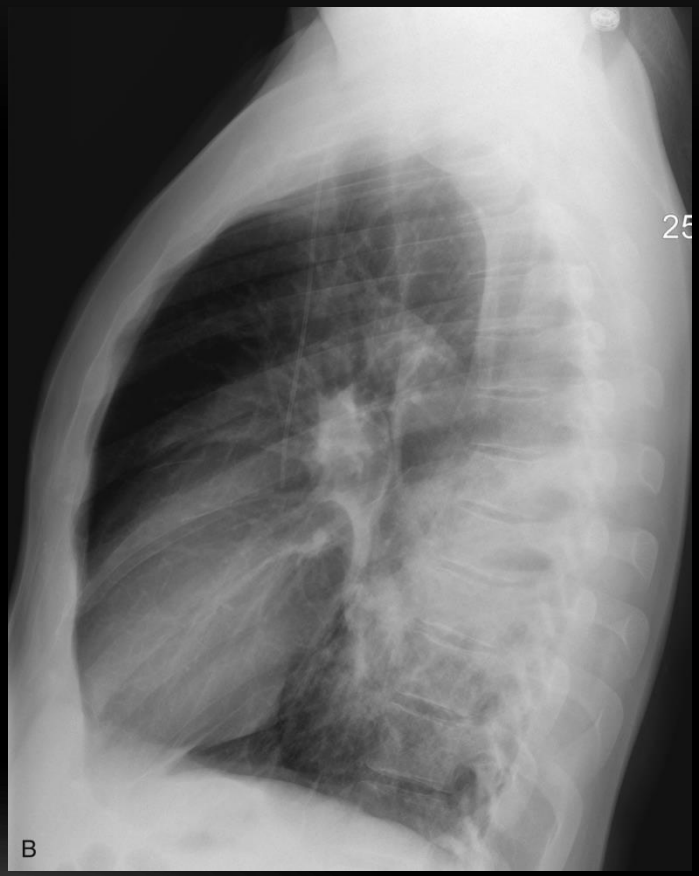
SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---RLL-SUSPERIOR



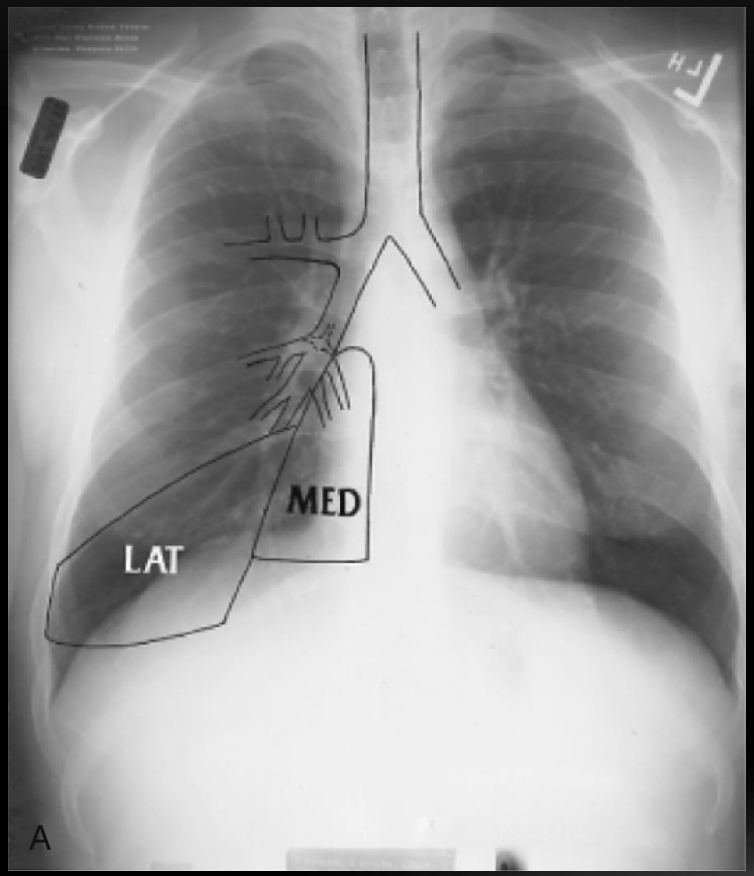


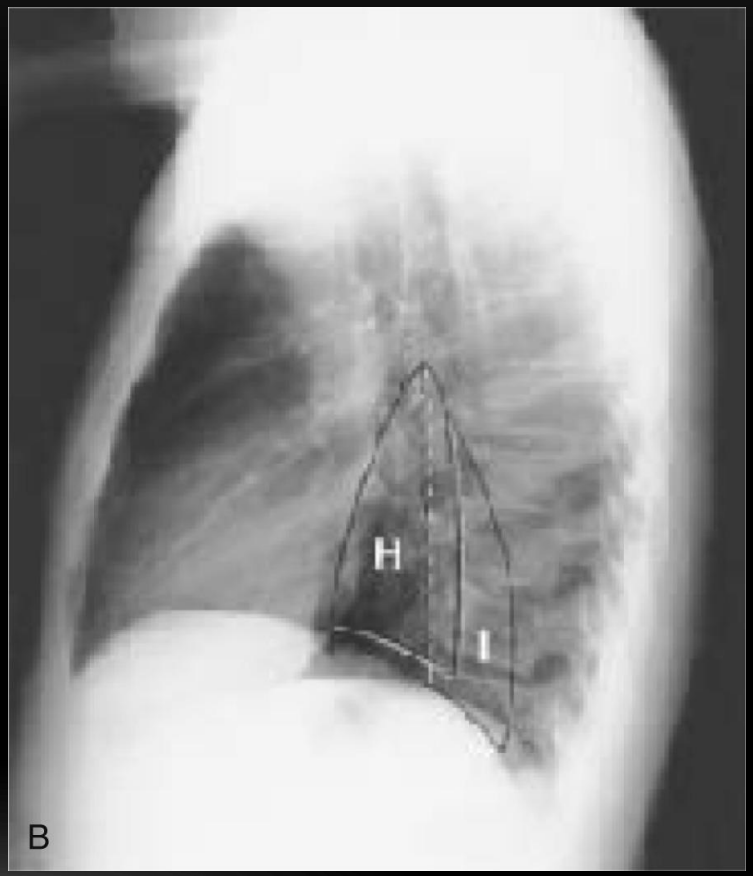
RLL-SUPERIOR SEGMENT





SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---RLL:MED/LAT





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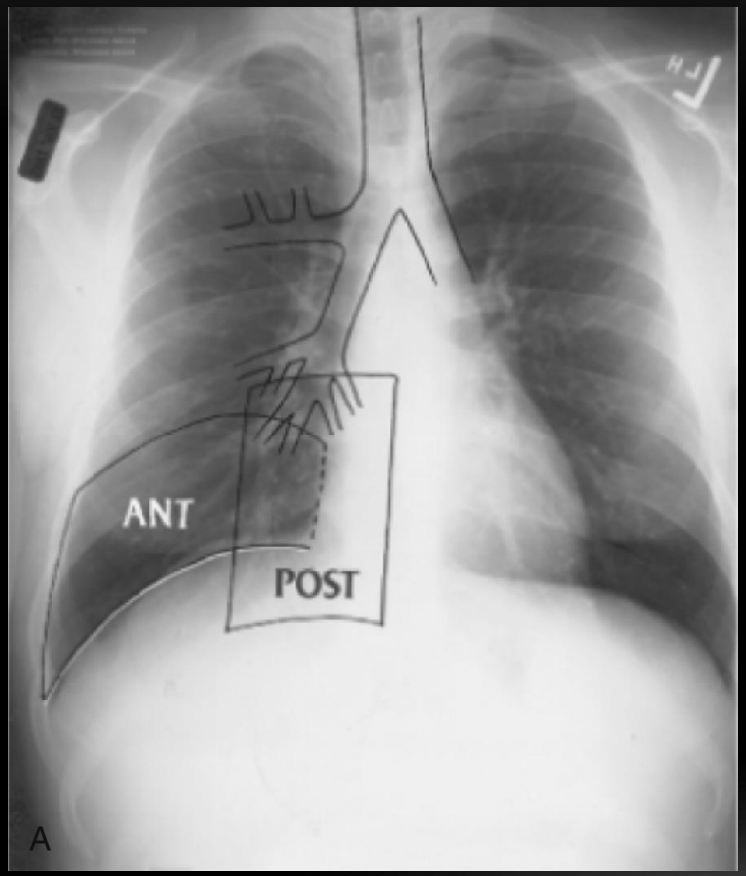
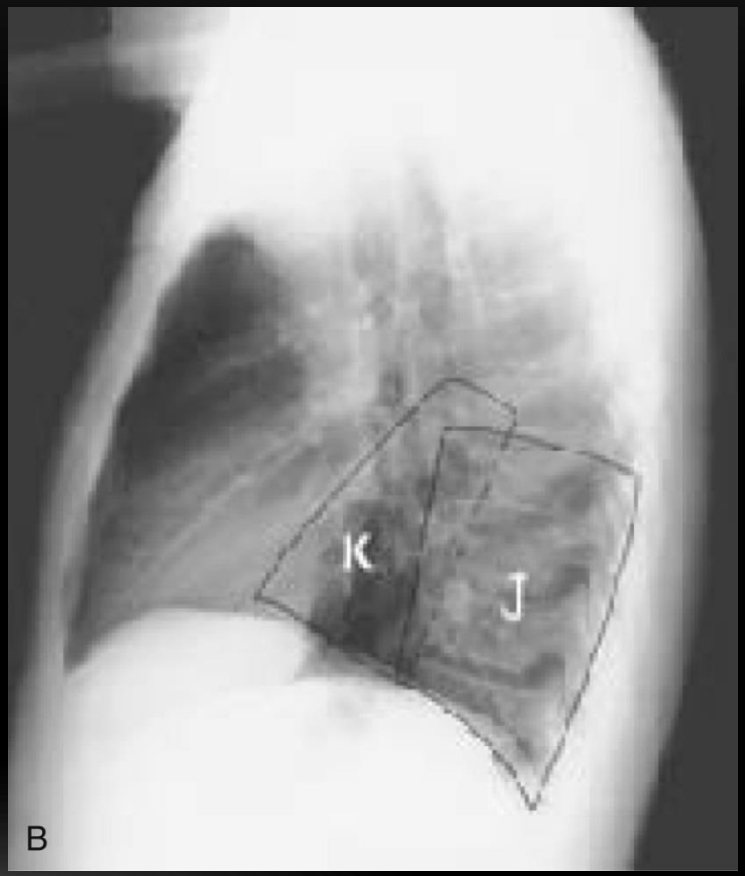
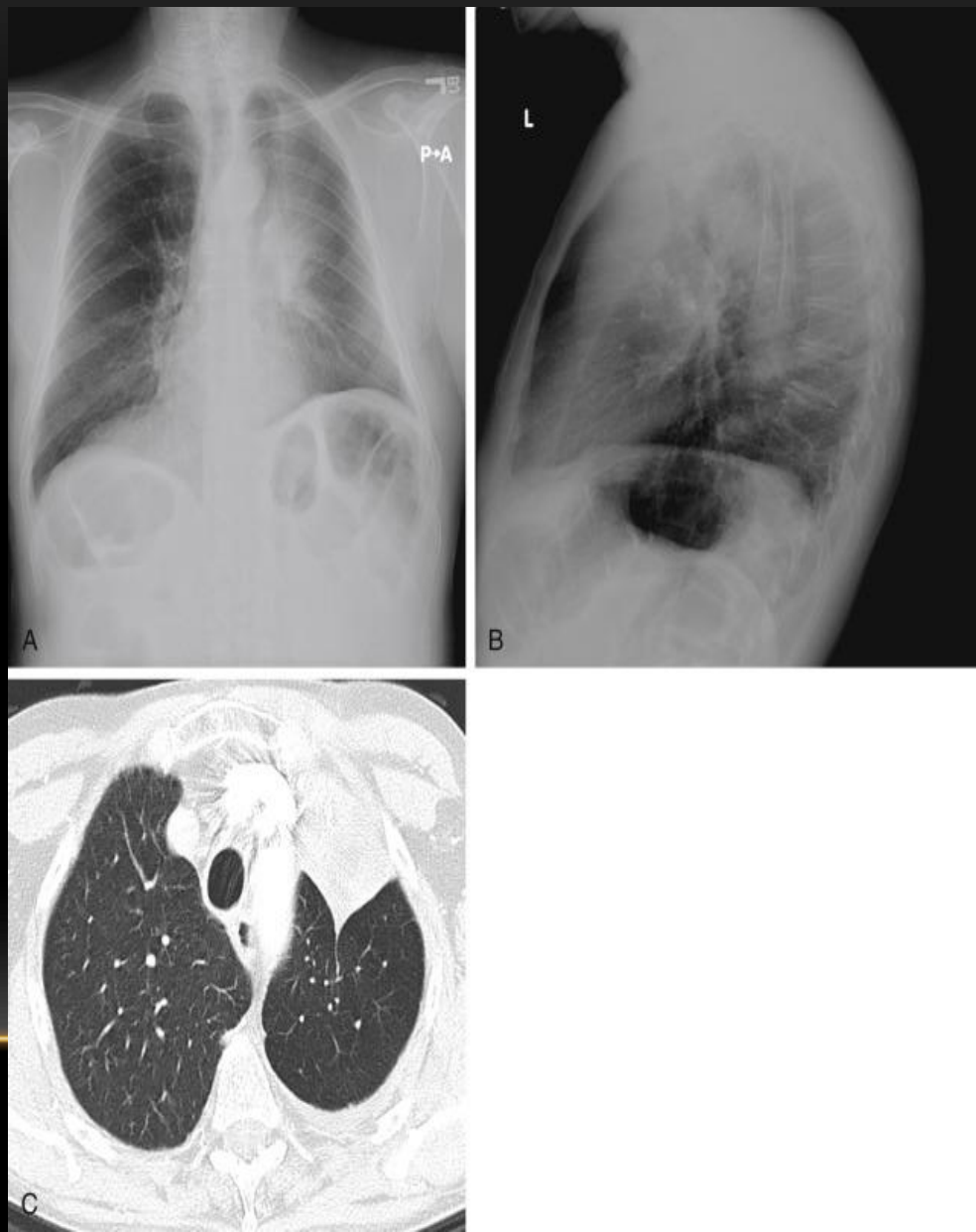


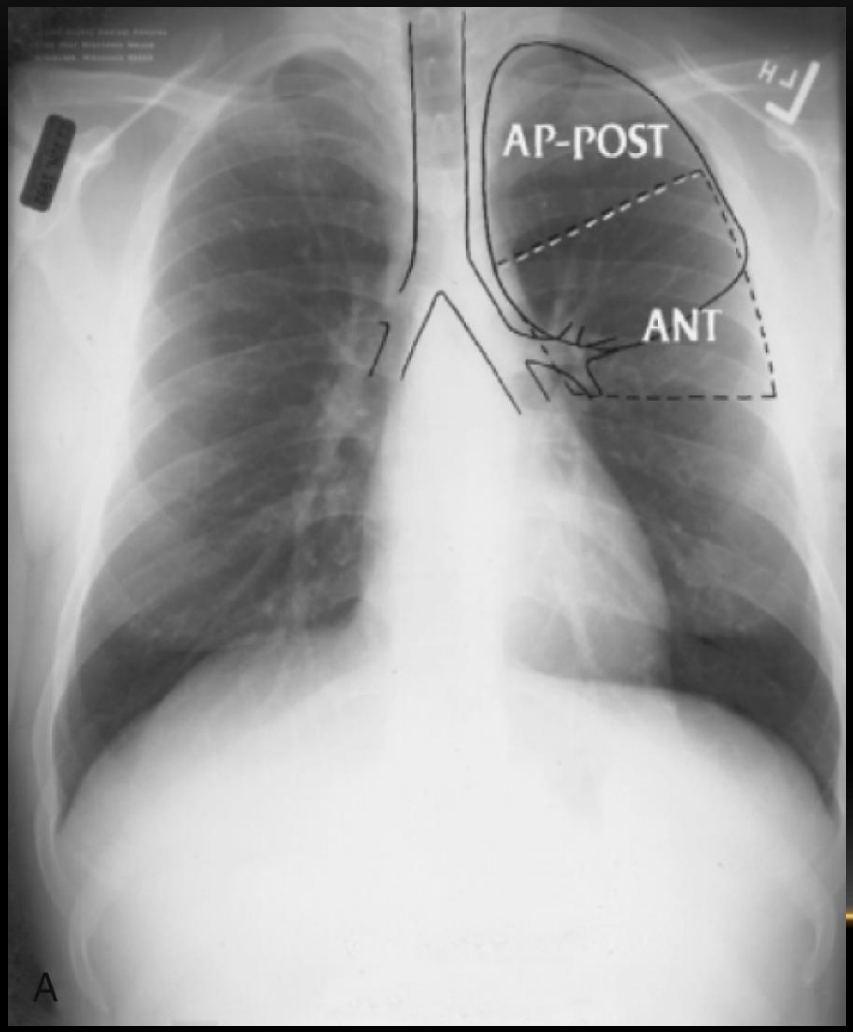


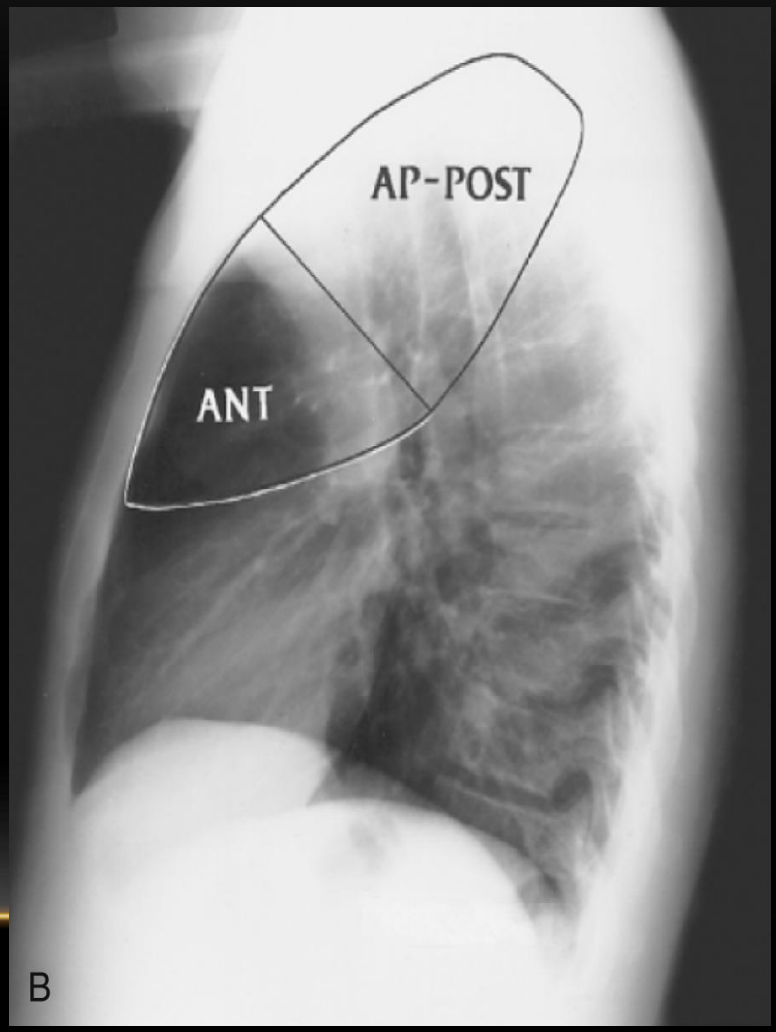
LEFT UPPER LOBE ATELECTASIS

- a poorly defined left perihilar opacity that appears to be separated from the mediastinal border by a hyperlucency or air crescent (the Luftsichel sign) that highlights the aortic arch.
- Compensatory overaeration of the superior segment of the left lower lobe
- anterior displacement of the major fissure on the lateral view

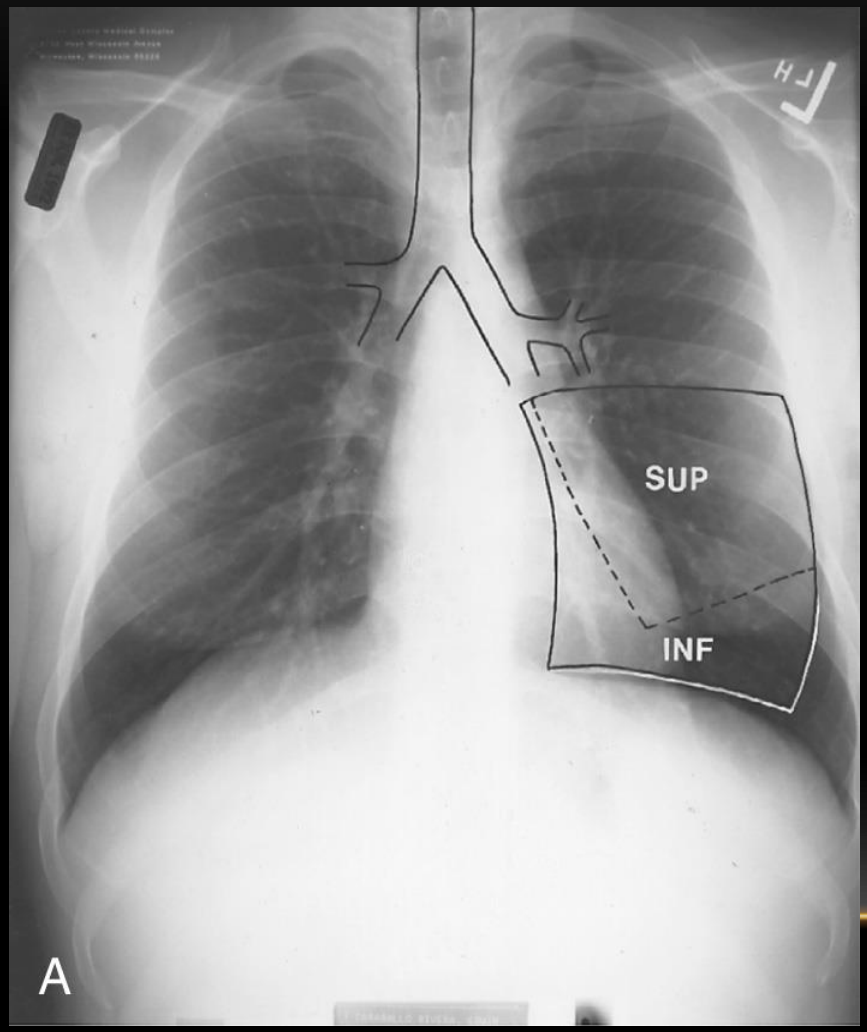


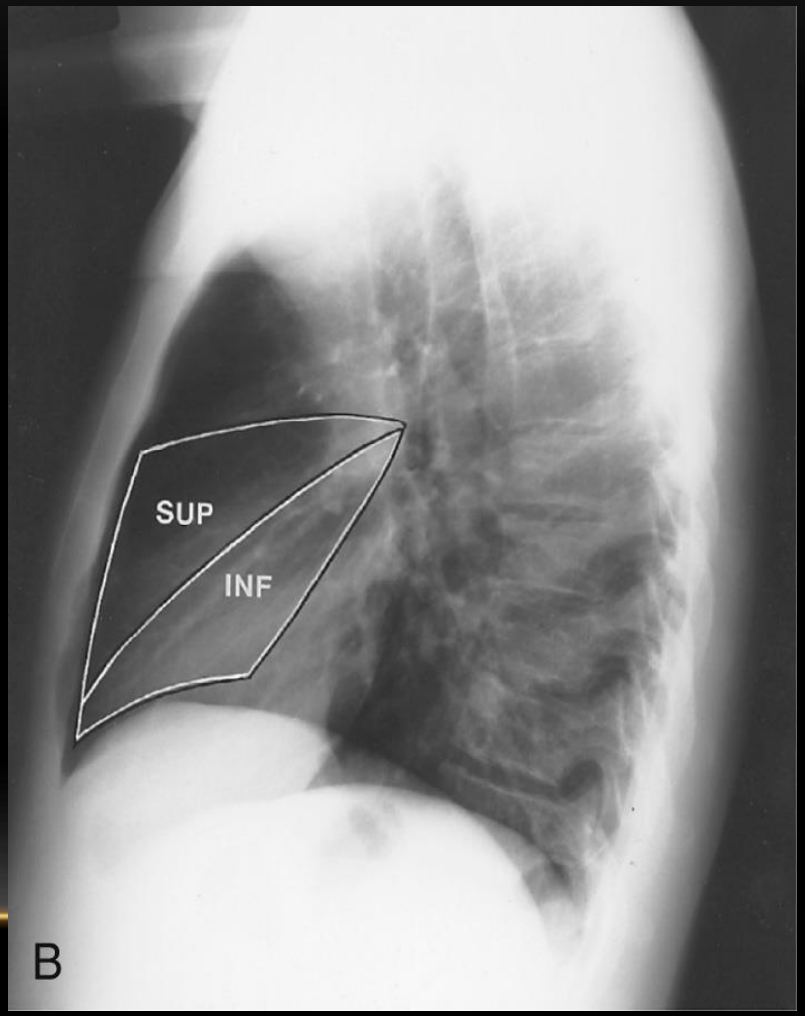
SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---LUL





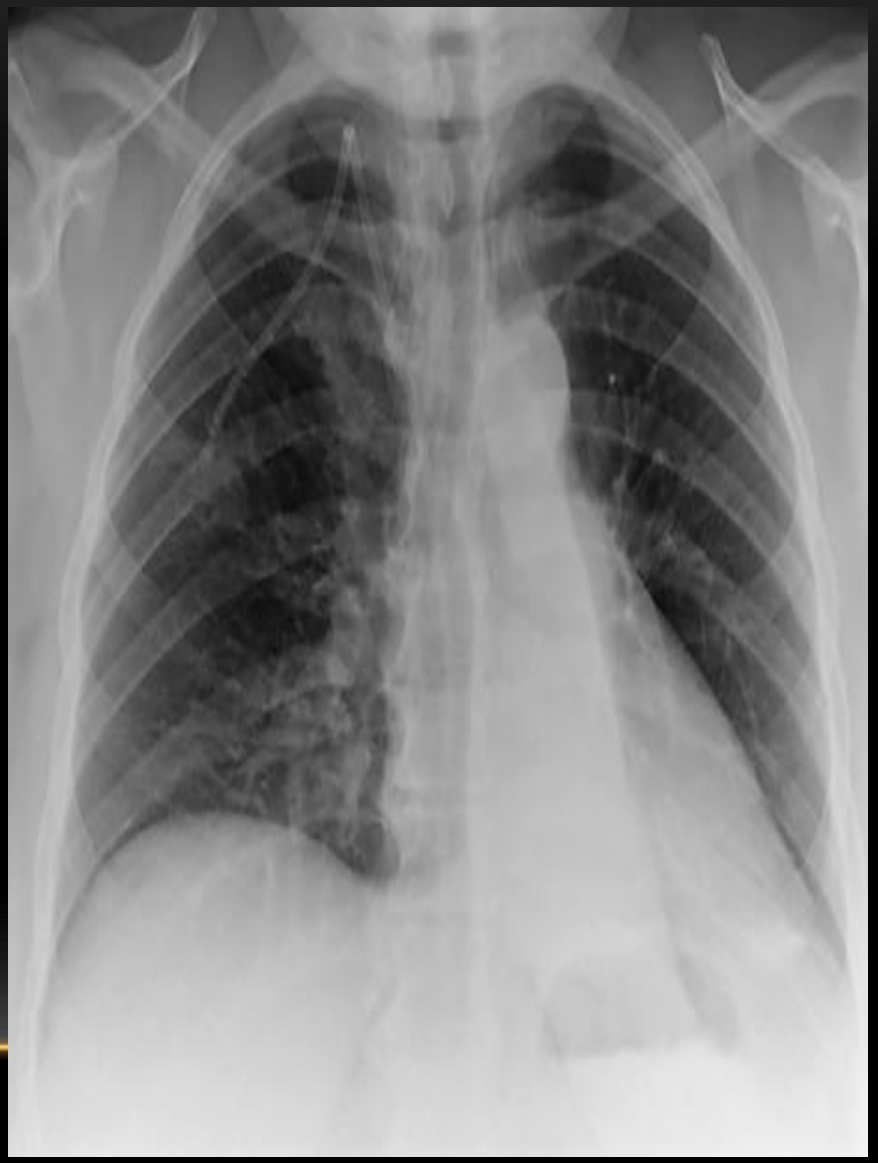
SEGMENTAL ANATOMY (FELSON'S PRINCIPLES OF CHEST ROENTGENOLOGY)---LINGULAR



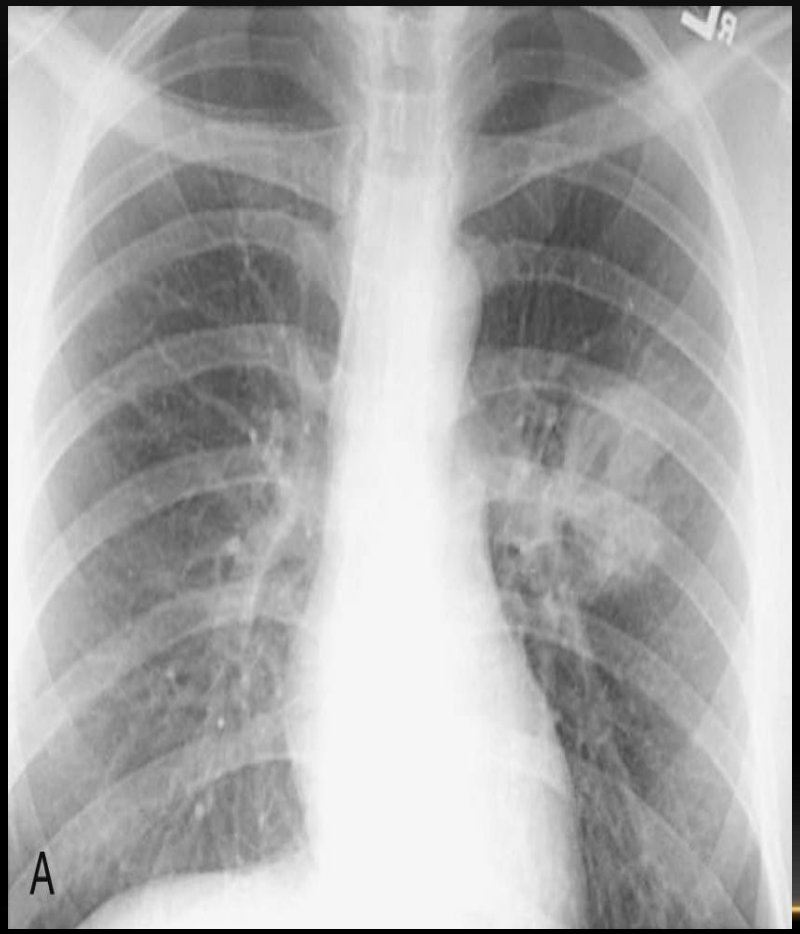


LEFT LOWER LOBE ATELECTASIS

- a triangular opacity behind the heart
- The lateral border is sharp because of the inferior medial shift of the oblique fissure.
- This often produces the appearance of a line that parallels the heart border.
- The lateral view confirms a poorly defined opacity that projects over the lower vertebral bodies and silhouettes the left leaf of the diaphragm.

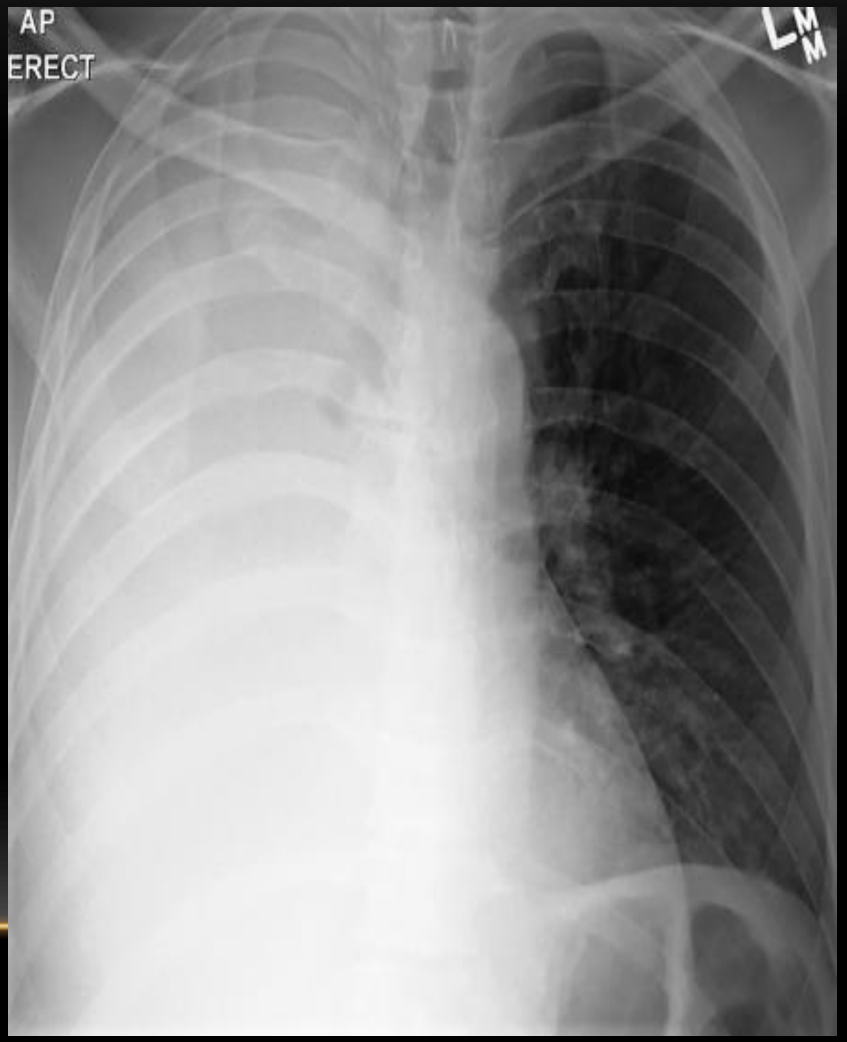


LLL-SUPERIOR SEGMENT



COMPLETE ATELECTASIS OF THE RIGHT LUNG

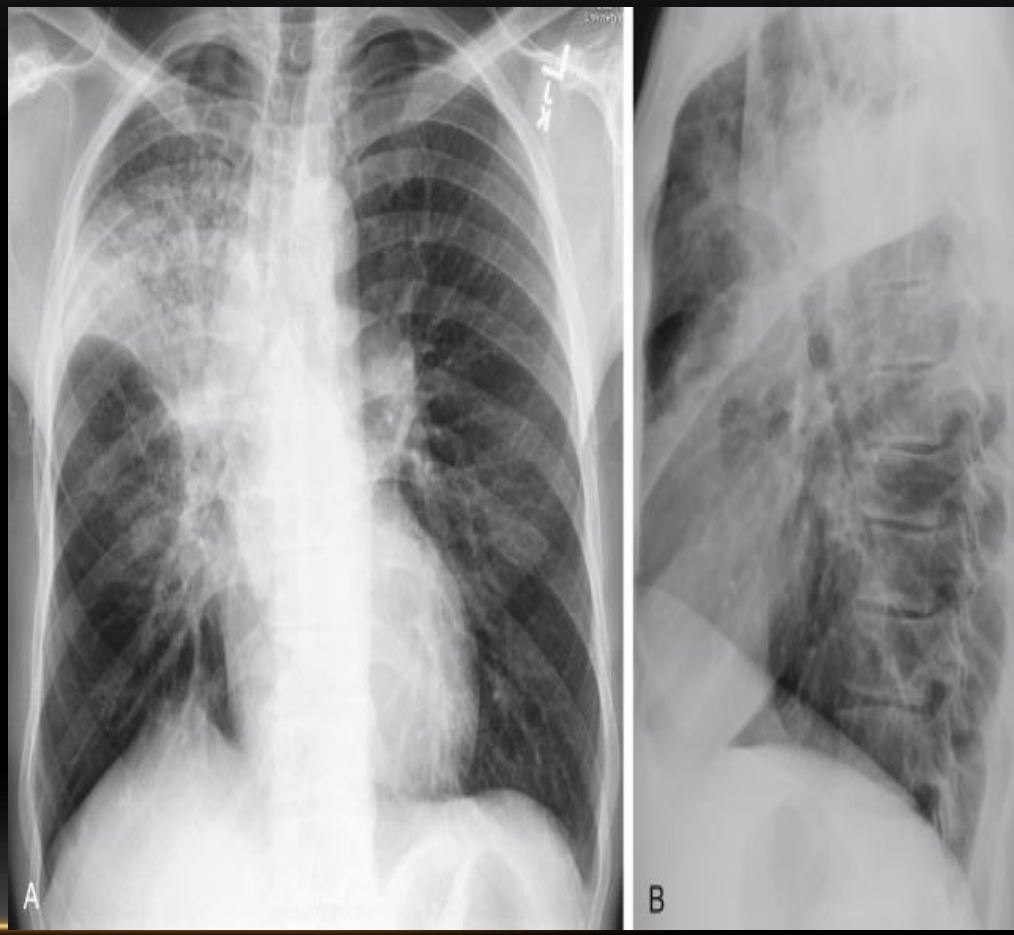
- Complete opacification of a hemithorax with a shift of the mediastinum toward the opacity



Tracheal deviation further confirms the mediastinal shift.
The abrupt termination of the trachea in this case of complete atelectasis of the right lung is the result of an endobronchial squamous cell carcinoma.

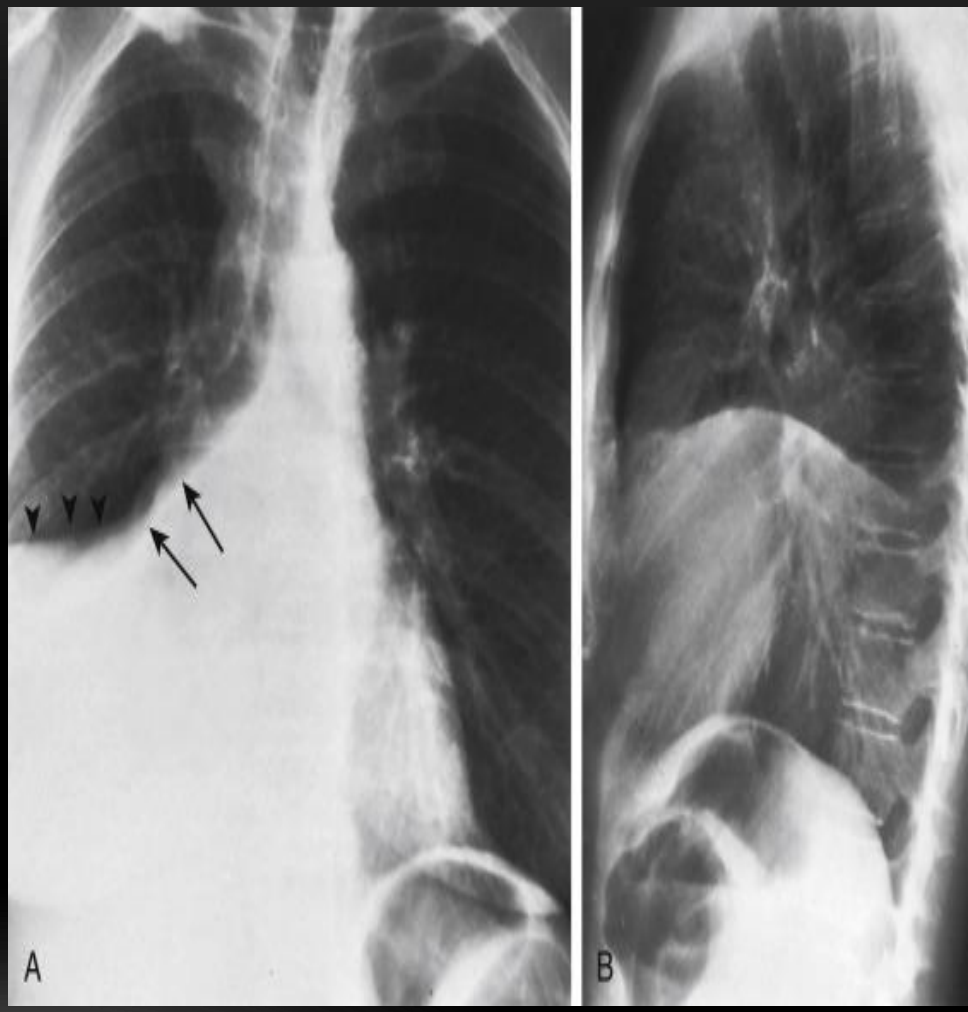
RIGHT UPPER AND RIGHT MIDDLE LOBE ATELECTASIS

- a large opacity involving the right upper thorax, obscuring the right upper lobe vessels and silhouetting the heart border,
- the diaphragm is elevated with the appearance of a juxtaphrenic peak.
- The entire oblique fissure is shifted anteriorly to resemble the left oblique fissure position in left upper lobe atelectasis.



RIGHT MIDDLE AND RIGHT LOWER LOBE ATELECTASIS

- an inferior shift of both the horizontal fissure and posterior portion of the oblique fissure.
- Compensatory overinflation of the upper lobe displaces the fissures inferiorly and produces a sharp interface with the collapsed lobes that may appear to parallel the diaphragm and thus mimic elevation of the diaphragm or even a subpulmonic effusion.
- the opacity silhouettes the pulmonary vessels



inferior-medial displacement of the major fissure (arrows) and the low position of the minor fissure (arrowheads)

SEVERAL TYPES OF ATELECTASIS

- (1) obstructive,
  - large and small airway obstructions
  - the result of a foreign body, aspiration, endobronchial tumor, or inflammatory reactions such as tuberculosis.
- (2) compressive: intrapulmonary abnormalities (e.g., a large lung mass or large bulla) that compress the surrounding lung
- (3) passive: changes in intrapleural pressure (e.g., pneumothorax).
- (4) adhesive: the luminal surfaces of the alveolar walls stick together. This occurs in surfactant deficiency
- (5) cicatrizing: scarring by fibrosis, a late sequela of tuberculosis

Atelectasis

I. Resorption atelectasis—large airway obstruction

A. Tumor

1. Lung cancer (squamous cell)
2. Carcinoid
3. Metastasis
4. Lymphoma
5. Less frequent (e.g., lipoma, leiomyoma, granular cell myoblastoma)

B. Inflammatory

1. Tuberculosis (e.g., endobronchial granuloma, bronchial stenosis, broncholith)
2. Sarcoidosis, endobronchial granuloma (rare)

C. Other

1. Large left atrium
2. Foreign body (including malpositioned endotracheal tube)
3. Amyloidosis
4. Granulomatosis with polyangiitis (formerly Wegener granulomatosis)
5. Bronchial transection

II. Resorption atelectasis—small airway obstruction

A. Mucous plugs

1. Severe chest or abdominal pain (particularly in the postoperative patient)
2. Respiratory depressant drugs (e.g., morphine)
3. Asthma
4. Cystic fibrosis

B. Inflammatory

1. Bronchopneumonia
2. Bronchitis

Atelectasis

III. Compressive atelectasis
- A. Large pulmonary masses
- B. Air trapping in adjacent lung (e.g., bullous emphysema, lobar emphysema, interstitial emphysema, bronchial obstruction by foreign body)

IV. Passive atelectasis—pleural space–occupying processes
- A. Pneumothorax
- B. Hydrothorax, hemothorax
- C. Diaphragmatic hernia
- D. Pleural masses (e.g., metastases, mesothelioma)

V. Adhesive atelectasis
- A. Surfactant deficiency disease of the newborn (respiratory distress syndrome or, formerly, hyaline membrane disease)
- B. Pulmonary embolism
- C. Intravenous injection of hydrocarbon

VI. Cicatrization atelectasis
- A. Tuberculosis
- B. Histoplasmosis
- C. Coal workers' pneumoconiosis
- D. Silicosis
- E. Scleroderma
- F. Usual interstitial pneumonia (includes scleroderma, rheumatoid and idiopathic pulmonary fibrosis)
- G. Radiation pneumonitis (late phase)

LARGE AIRWAY OBSTRUCTIVE LESIONS

- Squamous cell carcinoma of the lung
- Bronchial carcinoid tumor
- metastatic tumors to the bronchi from renal cell carcinoma, breast carcinoma, melanoma, carcinoma of the colon, and various sarcomas
- Lymphoma: hilar and mediastinal lymphadenopathy
- Infectious diseases: TB
- Left atrial enlargement from mitral stenosis: left lower lobe atelectasis
- foreign body obstruction of a bronchus
- Endotracheal intubation

Right upper lobe atelectasis with an associated hilar mass is a common presentation for primary lung cancer with bronchial obstruction.

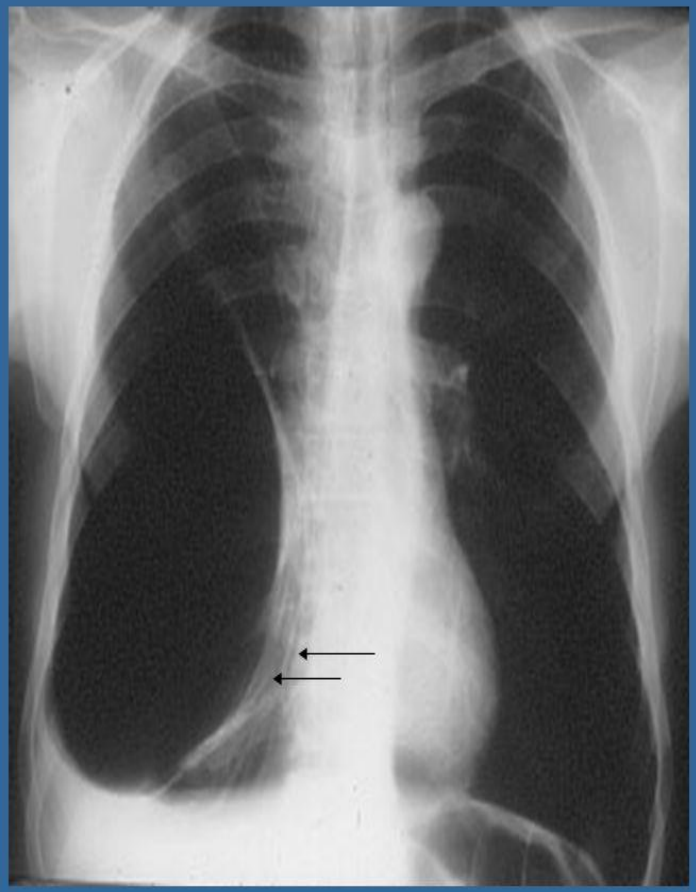
S sign of Golden

SMALL AIRWAY OBSTRUCTION

- Mucous plugging
- subsegmental atelectasis: linear opacities
- atelectatic pneumonia
- obstruction of bronchioles

COMPRESSIVE ATELECTASIS

- a secondary effect of compression of normal lung by a primary, space-occupying abnormality.
  - a large peripheral lung tumor
  - bullous emphysema
- Expiratory views that reveal persistent overexpansion of the lung
- Obstructive overinflation: acute bronchial obstruction by a foreign body



Compressive atelectasis: Chest x-ray showing a giant bulla occupying more than two thirds of the right hemithorax and compressing the underlying lung upward and toward the mediastinum. Crowded air bronchograms can be seen (arrows).

PASSIVE ATELECTASIS

- the problem is intrapleural.
- Two of the most important causes of passive atelectasis are pleural effusion and pneumothorax
- Expiration enhances the appearance of the pneumothorax

A large left pneumothorax has almost completely collapsed the left lung.

ADHESIVE ATELECTASIS

- (1) respiratory distress syndrome of the newborn (hyaline membrane disease); Surfactant deficiency disease of the newborn
- (2) pulmonary embolism.
  - edema and hemorrhage or atelectasis

Diffuse, fine, granular opacities with air bronchograms in surfactant deficiency disease

CICATRIZING ATELECTASIS

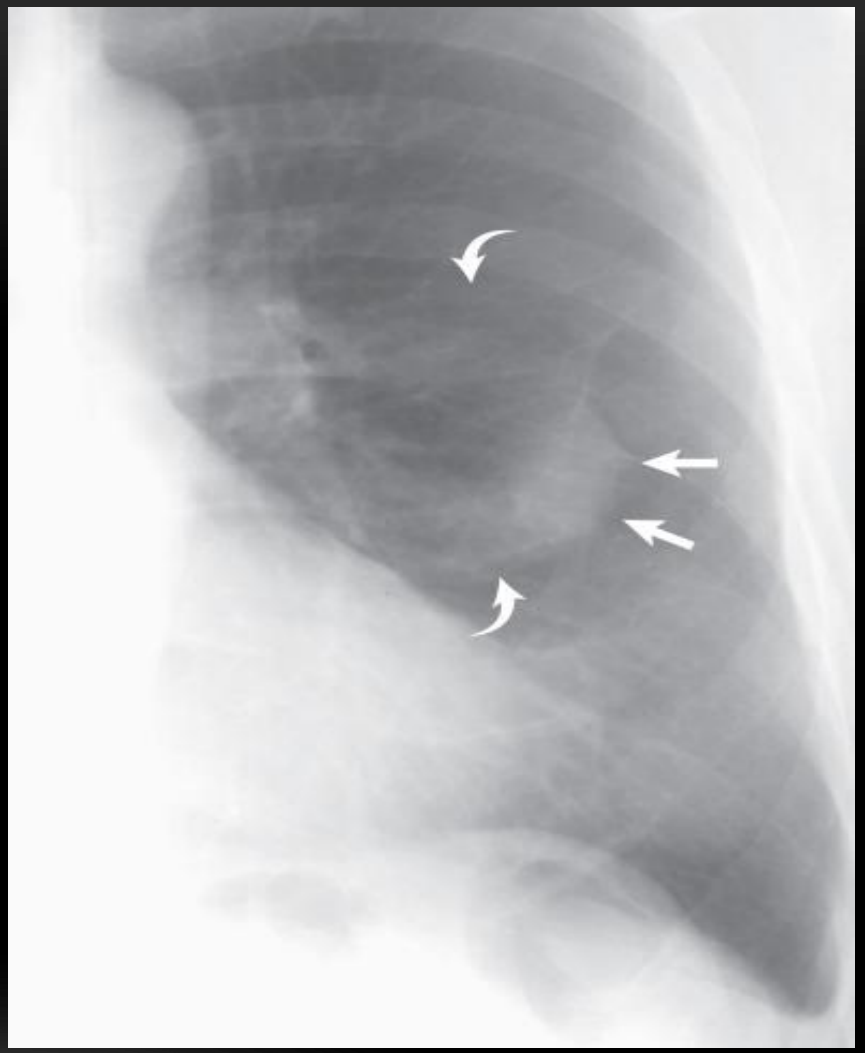
- **fibrosis and scar tissue formation** in the alveolar and interstitial spaces
- associated coarse reticular opacities and sometimes even pleural scarring
  - Tuberculosis
  - Usual interstitial pneumonitis: scleroderma, rheumatoid lung, and idiopathic pulmonary fibrosis
  - Coal worker’ s pneumoconiosis (CWP) and silicosis: retraction of both hila toward the upper lobes
  - Radiation pneumonitis: localized by sharply defined lines

This geographic shape corresponds to the portal for the patient’s prior radiation therapy.

Apical opacity with elevation of the right hilum and lateral pleural scarring has resulted from tuberculosis. Hilar elevation indicates volume loss.

ROUND ATELECTASIS

- fairly homogeneous round, oval, wedge-shaped, or irregularly shaped mass in the peripheral lung adjacent to thickened pleura
- most commonly in the lower lobes
- patients exposed to asbestos



The lateral margins (straight arrows) are well defined (where the opacity abuts the lung), and the medial margins are poorly defined (where the opacity abuts the pleura). Pulmonary vessels (curved arrows) can be seen to curve toward the opacity (comet tail sign).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