胸腔影像學概論
Chest imaging
【胸部X光片Ⅷ】

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學習目標：

- 各種疾病的X光特徵及其臨床issues
- 氣喘病、慢性阻塞性肺疾
- 先天性疾病
- 肺腫瘤

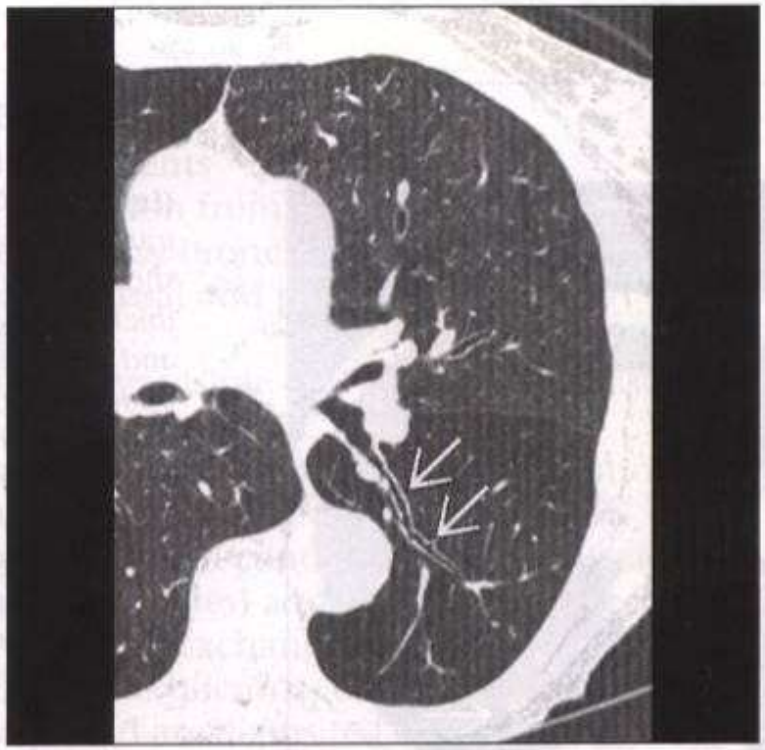
Reference

- **Jud W. Gurney ... et al. (2006). *Diagnostic imaging*. Salt Lake City, Utah: Amirsys.**
- **Jannette Collins, Eric J. Stern. (1999). *Chest radiology : the essentials* . Philadelphia : Lippincott Williams & Wilkins.**
- **Alfred P. Fishman; section editors, Jack A. Elias ... et al. (1998). *Fishman's pulmonary diseases and disorders*. New York：McGraw-Hill, Health Professions Division.**
- 江自得（**2003**）。實用胸腔**X**光診斷學。臺北：力大。
- 葉育文（譯）**(2005)**。胸部**X**光臨床判讀（原作者：**Paul F. Jenkins**）。台北：合記。

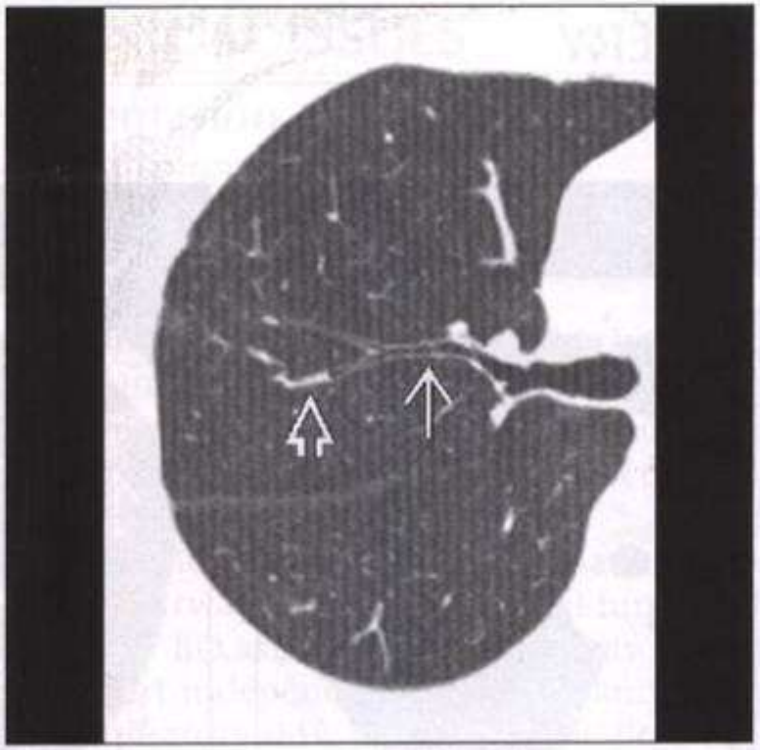
Diagostic Imaging (3)

- **Asthma, COPD**
- **Congenital**
- **Tumor**

Asthma (1)



Axial NECT shows airway with markedly thickened wall and irregular inner lining of the lumen (arrows) in asthmatic patient.



Axial NECT shows airway (arrow) with its distal part obstructed by a mucous plug (open arrow) in asthmatic patient.

Asthma (2)

Key Facts

Terminology
- Intermittent reversible obstruction to air flow in the lung
- Status asthmaticus: Medical emergency in which asthmatic attack refractory to bronchodilator therapy

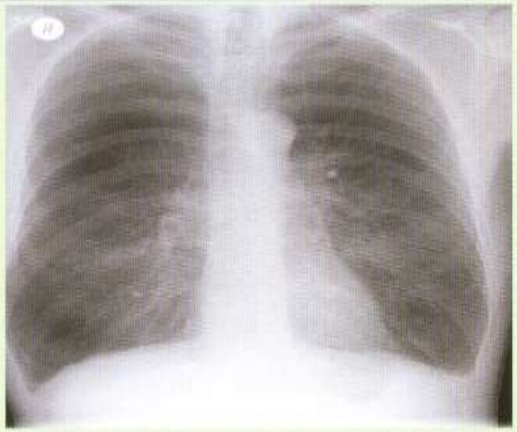
Imaging Findings
- In general, the more severe the bronchoconstriction, the more likely the chest radiograph abnormal
- Radiograph usually normal (75%)
- Status asthmaticus: Paradoxically chest radiograph often normal
- Bronchiectasis suggests development of ABPA and will change treatment

Top Differential Diagnoses
- Asthma Mimics
- Chronic upper airway obstruction
- Airway foreign bodies
- Cardiac asthma
- Recurrent pulmonary embolus
- Recurrent aspiration
- Eosinophilic pneumonia
- Polyarteritis nodosa
- Carcinoid syndrome
- Vocal cord dysfunction (factitious asthma)

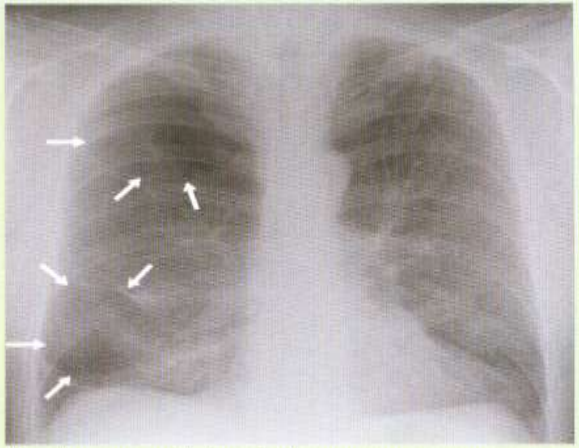
Clinical Issues
- Mortality 2 deaths per 100,000 (last 2 decades 100% increase in death rate)

Diagnostic Checklist
- Requisition for asthma common, not everything that wheezes asthma, consider the asthma mimics

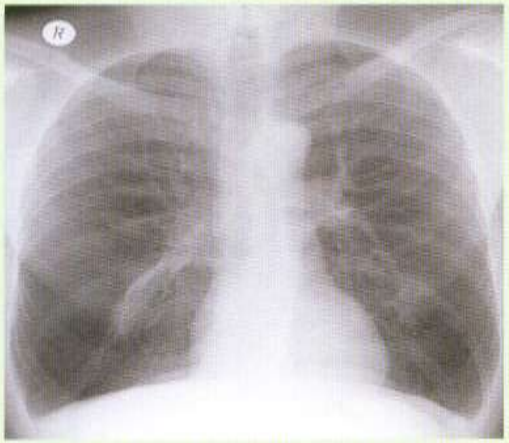
Figure 3.23 Chest X-rays in COPD



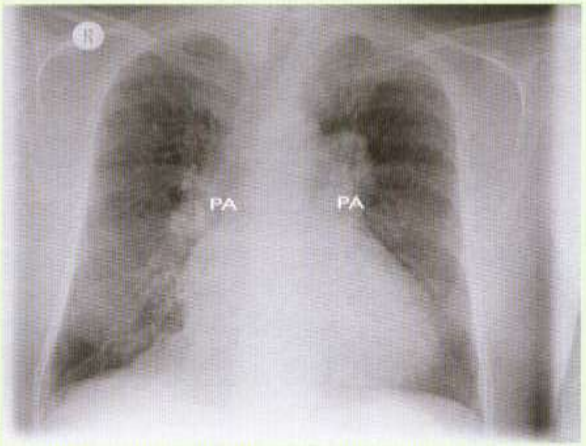
Findings typical of advanced emphysema
Large-volume lungs with thin heart shadow and flattened hemidiaphragms bilaterally. Note the increased transradiancy in the upper lobes with attenuated vascular markings.



Emphysema with two bullae
The upper bulla is seen as a transradiant avascular area in the right upper lobe with the wall visualized as a thin curvilinear inferior border (arrows). A further bulla is seen within the right lower lobe.

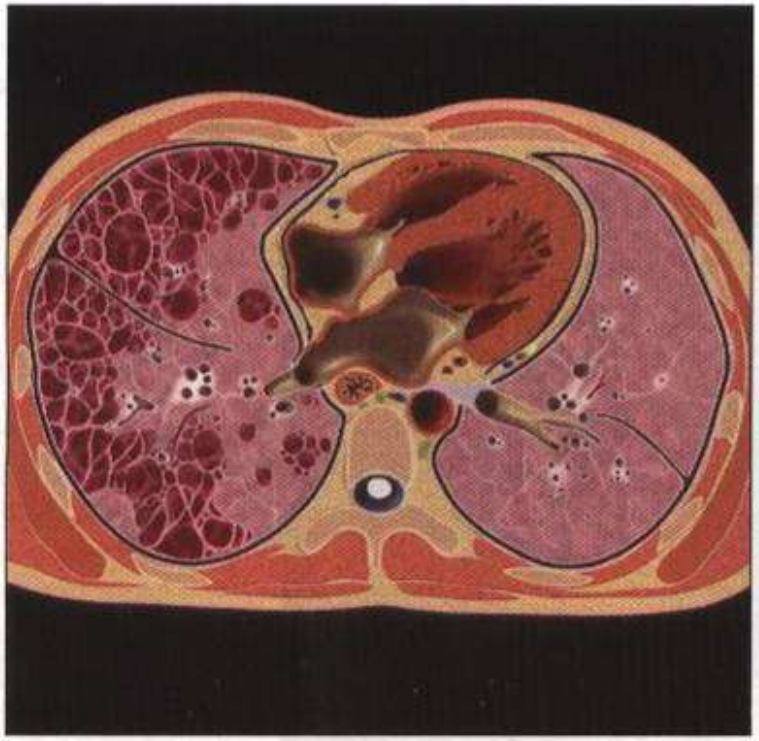


α_1- antitrypsin deficiency and panacinar emphysema
Chest X-ray shows large volume lungs with low flat diaphragms. Both lower zones are hypertransradiant and the vessels within these zones are reduced in size. Distribution of these changes is typical of panacinar emphysema.

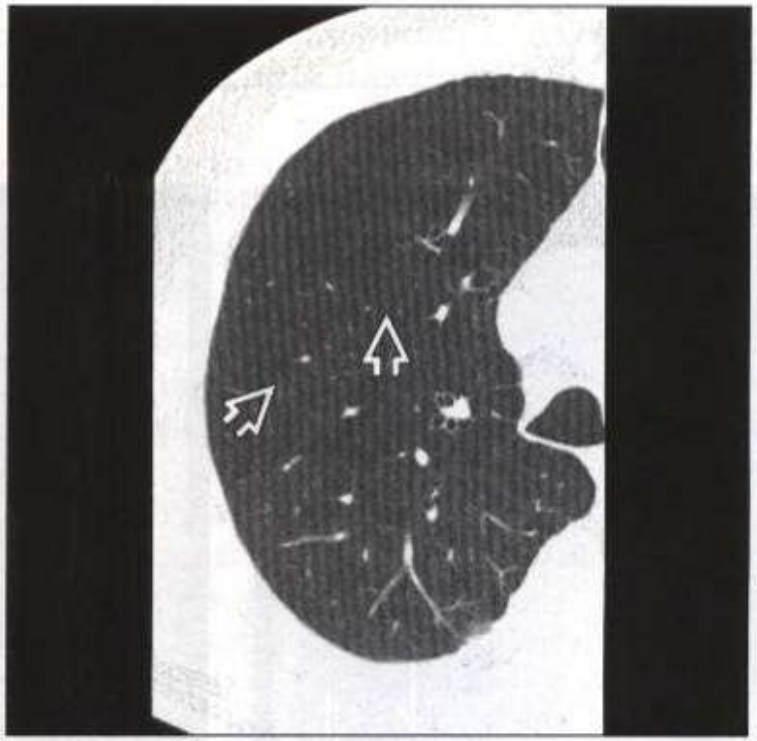


Cor pulmonale
Chronic airflow obstruction with bilateral enlarged pulmonary arteries (PA) in keeping with pulmonary hypertension. Cardiomegaly is present with the transverse cardiac dimension > 50% of the transverse lung dimension.

Panlobular Emphysema (1)



Axial graphic shows typical appearance of PLE: Unevenly and heterogeneous areas of lung destruction that transgress the structure of the secondary pulmonary lobule.

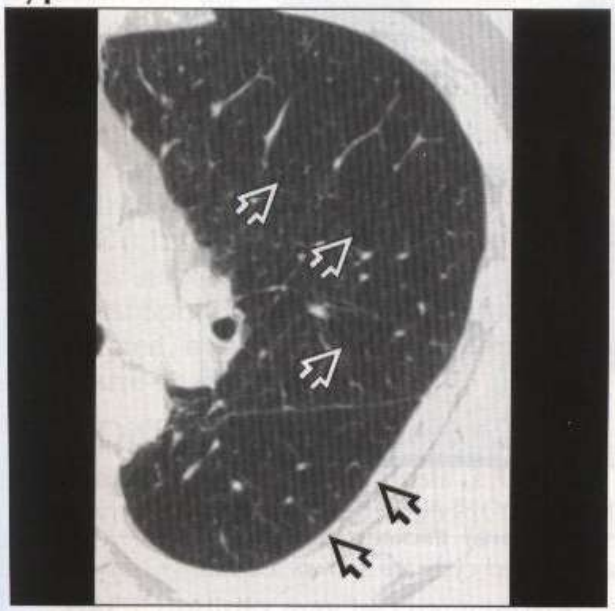


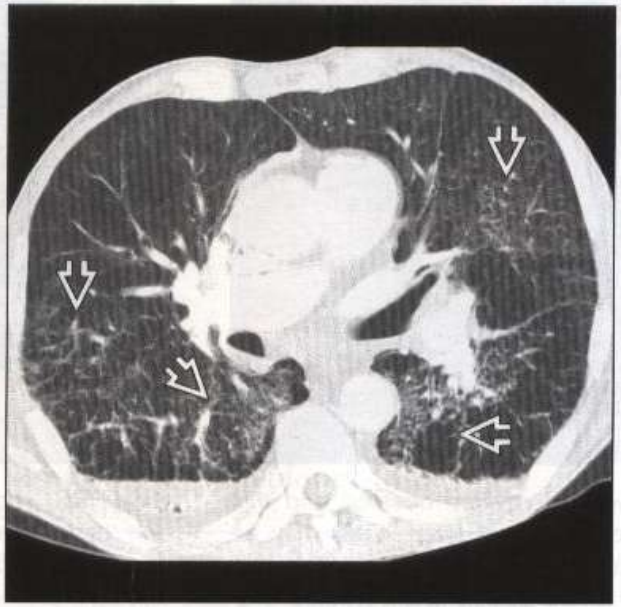
Axial HRCT shows widespread areas of parenchymal destruction (arrows). Other than in CLE, the borders of the secondary pulmonary lobule are not preserved.

Panlobular Emphysema (2)

Image Gallery

Typical



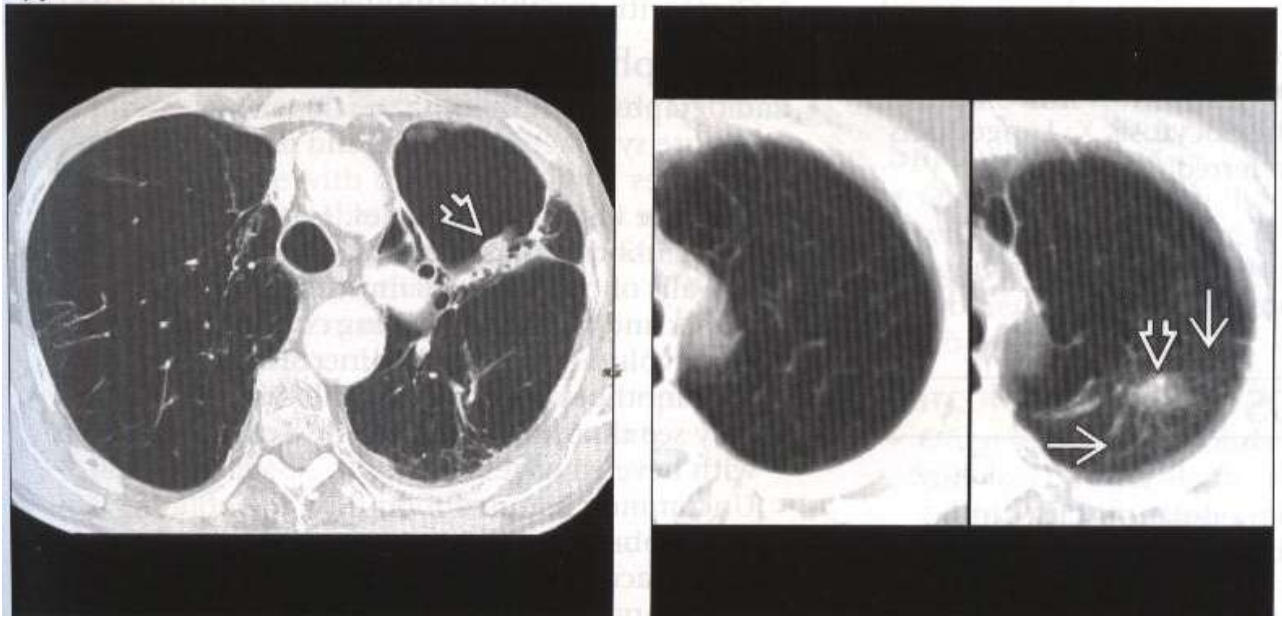


(Left) *Axial HRCT shows panlobular emphysema. Note that disease is equally distributed in upper (white arrows) and lower (black arrows) lobe.* ***(Right)*** *Axial CECT shows patient with extensive PLE and bilateral pneumonia (arrows) as manifested by ground-glass opacities. Due to emphysema, the distribution of pneumonia is atypical.*

Panlobular Emphysema (3)

Image Gallery

Typical



(Left) *Axial CECT shows patient with extensive PLE. One of the left apical emphysematous lesions has been colonialized with aspergillus (arrow).* ***(Right)*** *Axial CECT shows PLE in a cigarette smoker (left). Follow-up 6 months later (right) shows newly occurred adenocarcinoma (open arrow) with ground-glass halo (arrows).*

Respiratory Bronchiolitis

Key Facts

Terminology
- Respiratory bronchiolitis-interstitial lung disease (RB-ILD)
- RB histologic reaction to dusty environments, especially cigarette smoke
- RB-ILD and desquamative interstitial pneumonia (DIP) are regarded as a spectrum of smoking induced interstitial lung diseases

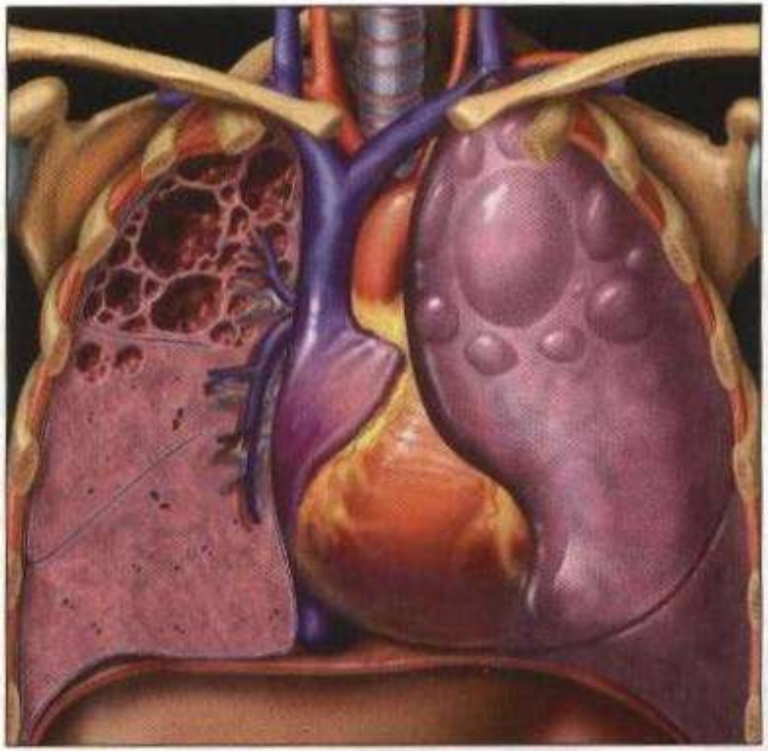
Imaging Findings
- Best diagnostic clue: Centrilobular ground-glass opacities in the upper lobes
- Location: Gradient: More predominant in upper lung zone diminishing to the lung bases
- Size: Centrilobular nodules 3-5 mm in diameter
- Respiratory bronchiolitis: Chest radiograph normal

Top Differential Diagnoses
- Desquamative Interstitial Pneumonia (DIP)
- Hypersensitivity Pneumonitis
- Langerhans Cell Granulomatosis

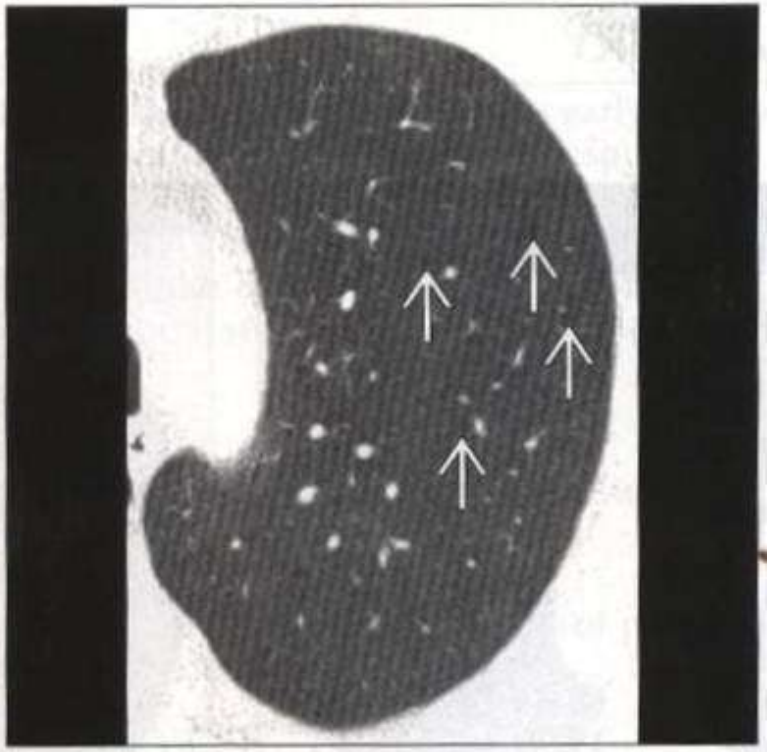
Pathology
- Respiratory bronchioles are filled with pigmented macrophages

Clinical Issues
- RB: Universal histologic response in smokers
- Virtually all patients with RB-ILD are heavy smokers, typically unfiltered cigarettes
- Respiratory bronchiolitis may be precursor to centrilobular emphysema
- Smoking cessation

Centrilobular Emphysema (1)



Graphic shows bilateral upper lobe bullous emphysema. Apical blebs may rupture and cause spontaneous pneumothorax.



Axial HRCT shows subtle CLE lesions (arrows). Lesions are surrounded by normal lung parenchyma and are located near the center of the secondary pulmonary lobule.

Centrilobular Emphysema (2)

Key Facts

Terminology
- CLE: Enlargement and destruction of respiratory bronchioles, classically located near (but not exactly at) the center of the secondary pulmonary lobule

Imaging Findings
- Well-defined holes in the centrilobular portion of the secondary pulmonary lobule on HRCT
- Anatomical borders of the secondary pulmonary lobule are preserved
- Location: Predominantly involves upper lung zones (lung apex, apical segments of lower lobes)
- Well-defined margins between normal and emphysematous lungs create inhomogeneous appearance of CLE
- Can detect clinically and functionally "silent" CLE

Top Differential Diagnoses
- Technical Considerations
- Athletic Hyperinflation
- Panlobular Emphysema
- Langerhans Cell Histiocytosis
- Asthma

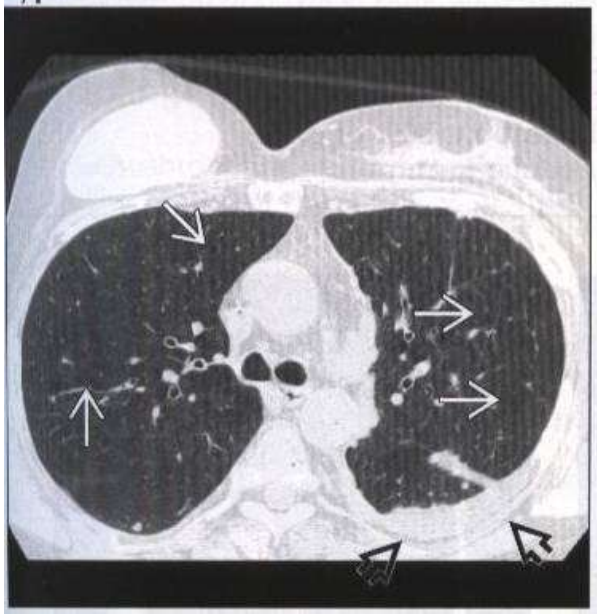
Pathology
- CLE strongly associated with cigarette smoking
- Approximately 30% of the normal lung must be destroyed before pulmonary function deteriorates

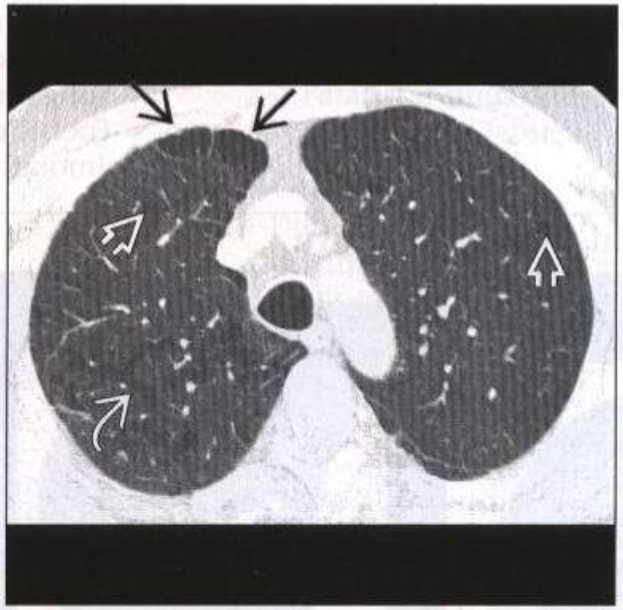
Diagnostic Checklist
- CLE very common "incidental" finding in cigarette smokers

Centrilobular Emphysema (3)

Image Gallery

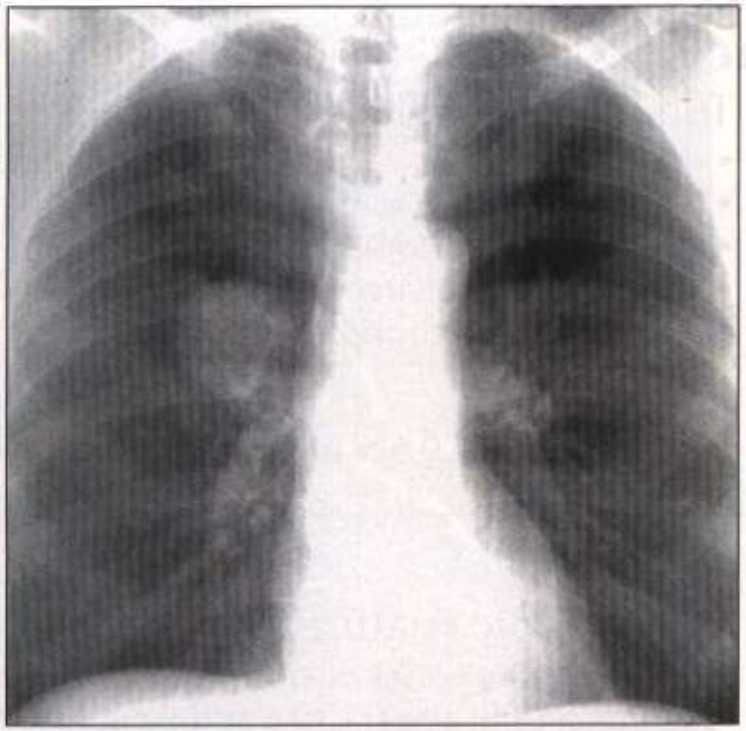
Typical



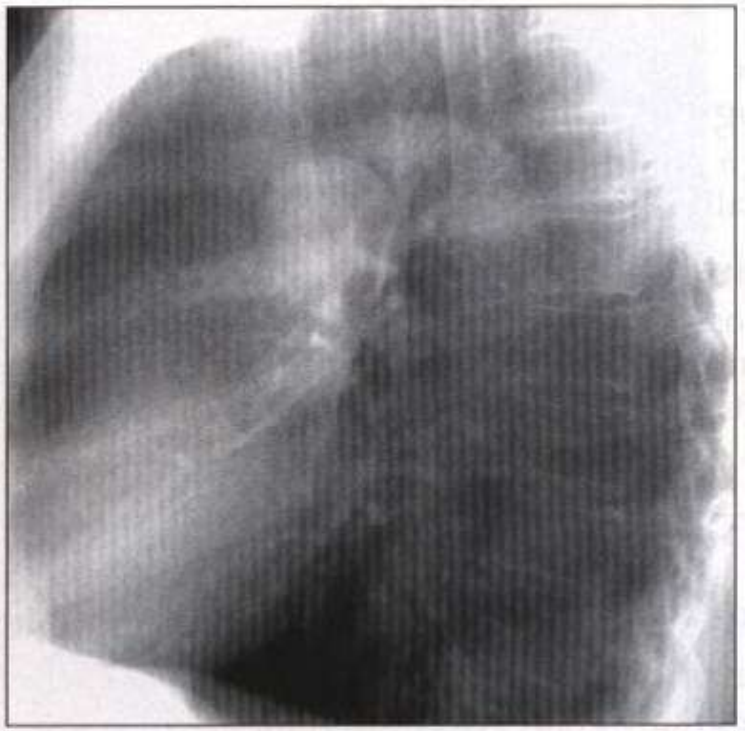


(Left) *Axial HRCT shows widespread asymptomatic emphysema (arrows) in a patient with breast cancer (breast implant) and pleural metastases (open arrows). Because smoking is common, incidental emphysema is common.* ***(Right)*** *Axial HRCT shows subpleural blebs anteriorly (arrows) and centriacinar emphysema (open arrows) some of which has become confluent (curved arrow).*

Carcinoid, Pulmonary (1)



Frontal radiograph demonstrates a 5 cm well-defined perihilar mass in this 51 year old man with a chronic cough. No post obstructive lung changes are present.



Lateral radiograph confirms the perihilar location. No calcification, enlarged lymph nodes or cavitation. A typical carcinoid neoplasm with negative lymph nodes was found at surgery.

Carcinoid, Pulmonary (2)

Key Facts

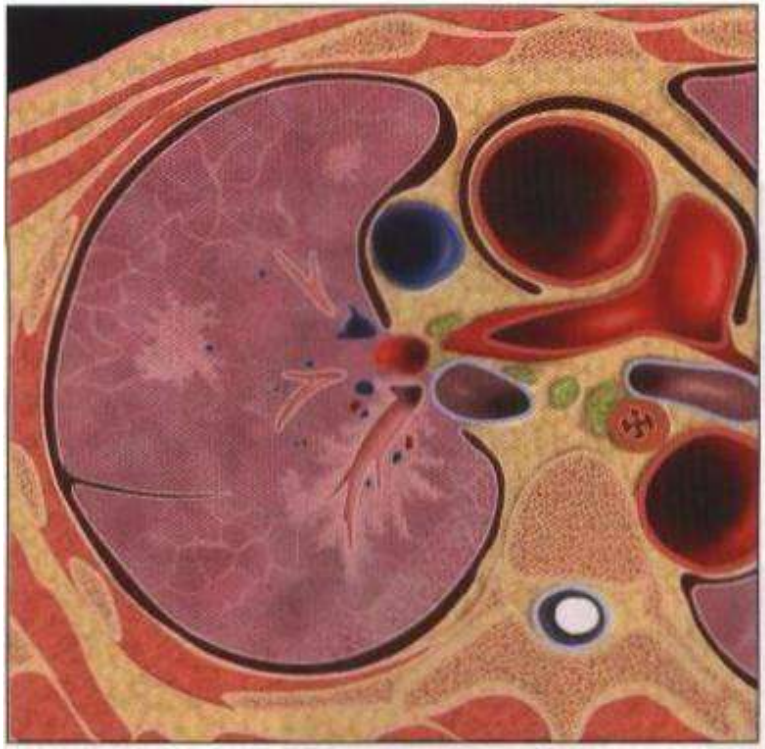
Terminology
- Uncommon pulmonary neuroendocrine neoplasm
- Low grade malignancy with metastatic potential

Imaging Findings
- Typical carcinoid: 85% develop in main, lobar or segmental bronchi
- Atypical carcinoid: Most develop in lung periphery
- Typical carcinoid: Smooth borders without necrosis or cavitation
- Avid contrast enhancement a common feature

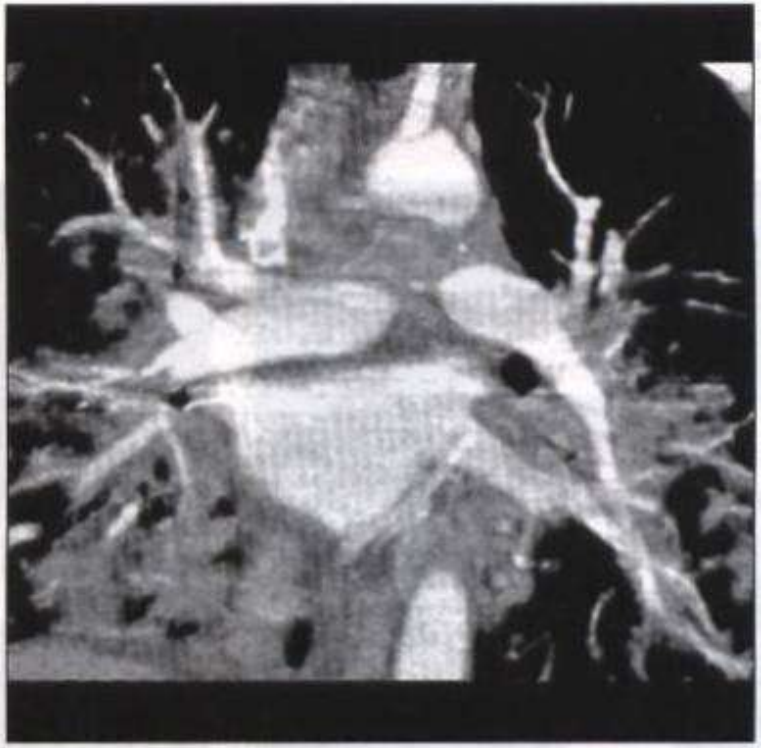
Pathology
- Two distinct pathologic types
- Low-grade "typical" carcinoid (80-90%)
- Intermediate-grade "atypical" carcinoid (10-20%)
- Carcinoid tumors likely have a histologic and clinical spectrum with the more aggressive large cell neuroendocrine and small cell carcinomas

Clinical Issues
- Cough the most common symptom with hemoptysis present at some point in 50%
- Recurrent pneumonia, post obstructive atelectasis/pneumonitis also very common, especially with central tumors (30% presentation)
- Typical carcinoid: 5% have lymph node metastasis at presentation
- Atypical carcinoid: 50-60% have lymph node metastasis at presentation
- Complete surgical excision remains most effective therapy

Kaposi Sarcoma, Pulmonary (1)



Axial graphic shows typical features of Kaposi sarcoma. Tumor infiltrates along bronchovascular bundles, extending from the hilum to the lung periphery. Tumor clusters may be noncontiguous.



Coronal CECT shows extensive thickening along the bronchovascular bundles, consistent with KS.

Kaposi Sarcoma, Pulmonary (2)

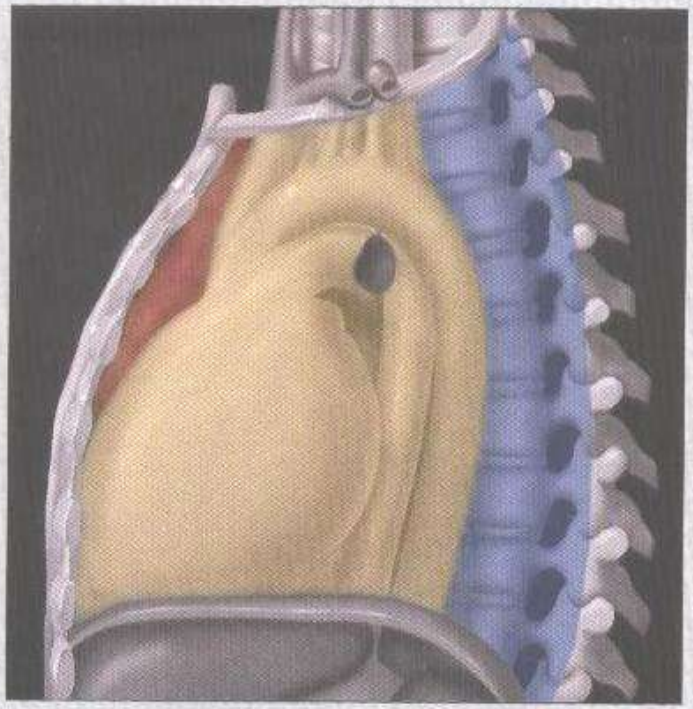
Key Facts

Terminology
- Kaposi sarcoma (KS)
- AIDS-related multicentric neoplasm with propensity to involve skin, lymph nodes, GI tract, and lungs

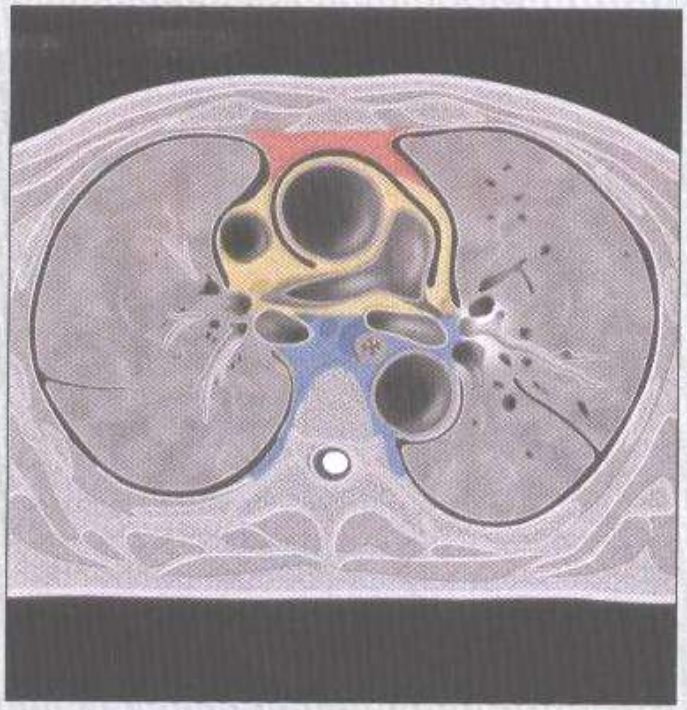
Imaging Findings
- Best diagnostic clue: Thickening of bronchovascular bundles
- CT findings usually highly suggestive

Pathology
- Most common AIDS related neoplasm, but decreased prevalence in current era of highly active antiretroviral therapy
- CD4 count usually < 100
- Associated abnormalities: Skin lesions present in 85% of patients with pulmonary involvement

Mediastinal Compartments (1)



Sagittal graphic shows a common scheme for subdividing the mediastinum. Anterior mediastinum (red), posterior mediastinum (blue), and middle mediastinum (gold).



Axial graphic shows the mediastinal compartments in cross-section. Anterior mediastinum (red), middle mediastinum (gold), posterior mediastinum (blue).

Mediastinal Compartments (2)

Differential Diagnosis

Anterior Mediastinal Mass (T's)

- Thyroid
- Thymoma
- Teratoma
- Terrible lymphoma

Middle Mediastinal Mass

- Lymphadenopathy
- Congenital cysts
- Pathology of visceral organs: Airways, esophagus, aorta

Posterior Mediastinal Mass

- Neurogenic origin (90%)

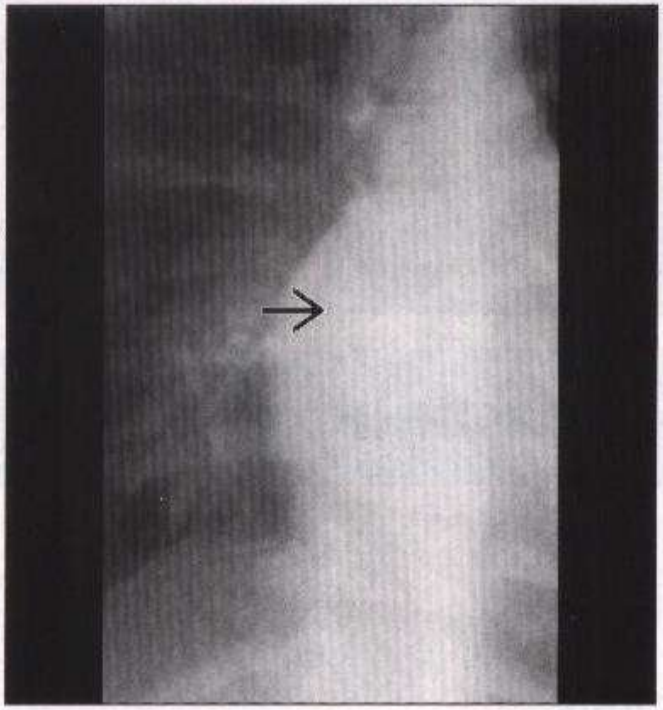
Long Lesions Traversing the Entire Length of the Mediastinum

- Aorta (dissecting aneurysm)
- Esophageal dilatation (achalasia)
- Fat (mediastinal lipomatosis)
- Lymph nodes (lymphoma)

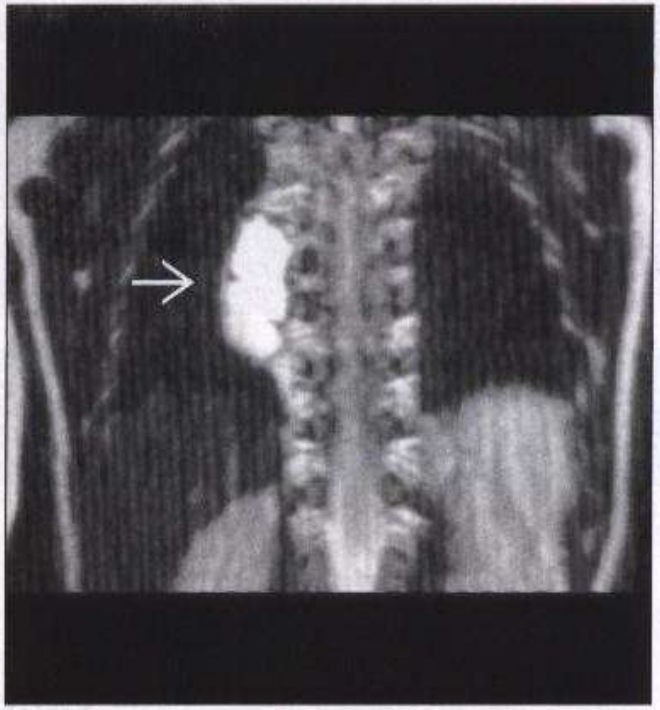
Extrathoracic Tumors that Tend to Metastasize to Mediastinum

- Genitourinary tumors: Renal cell carcinoma, transitional cell carcinoma, testicular tumors, prostatic carcinoma, uterine and ovarian tumors
- Head & neck tumors
- Breast cancer
- Melanoma

Thoracic Cysts (1)



Anteroposterior radiograph shows butterfly vertebra (arrow). (Courtesy B. Karmazyn, MD).



Coronal oblique T2WI MR in same patient shows a vertically oriented tubular-shaped fluid-filled structure that represents a neurenteric cyst (arrow). (Courtesy B. Karmazyn, MD).

Thoracic Cysts (2)

Key Facts

Terminology
- Foregut malformations: Lung "bud" anomalies
- Bronchogenic, esophageal duplication, neurenteric, CAM and others

Imaging Findings
- Best diagnostic clue: Most cysts near tracheal carina are bronchogenic
- Size: Variable, 2-10 cm in size
- Morphology: Round, elliptical or tubular
- Sharply marginated homogeneous mass-like opacity
- Vertebral anomaly with neurenteric cysts
- Homogeneous attenuation; usually in the range of water, serous fluid, 0–20 HU
- Increased attenuation, viscous, mucoid, blood, calcium oxalate contents
- Pericardial cyst: Usually anterior cardiophrenic angle, on right side
- High signal intensity T2, parallel to cerebrospinal fluid

Top Differential Diagnoses
- Mediastinal Cystic Tumors
- Pancreatic Pseudocyst

Pathology
- Bronchogenic cysts: 1/5 of mediastinal masses, up to 90% are mediastinal
- CAM: 1/4 of all congenital lung abnormalities

Clinical Issues
- Most common signs/symptoms: Usually asymptomatic
- Observation, for most cases

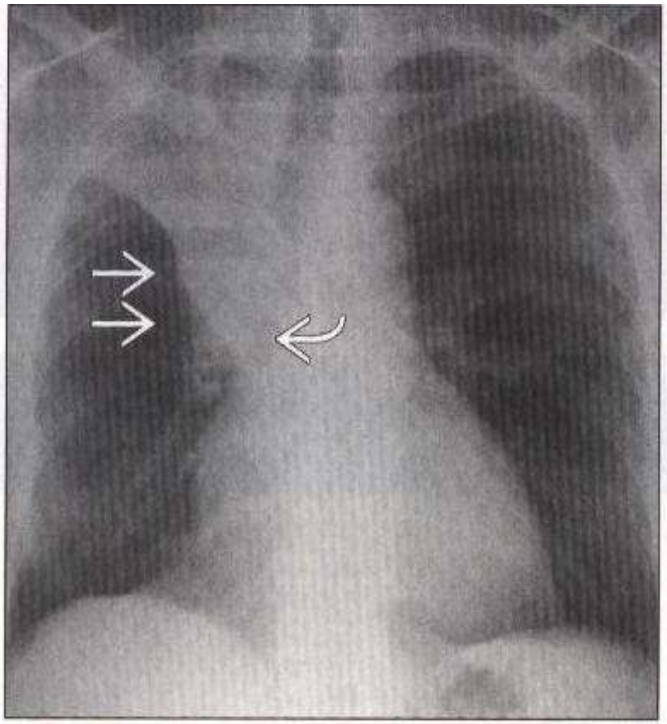
TABLE 15-2

CLINICAL AND RADIOLOGIC FEATURES OF THE FOUR HISTOLOGIC TYPES OF BRONCHOGENIC CARCINOMA

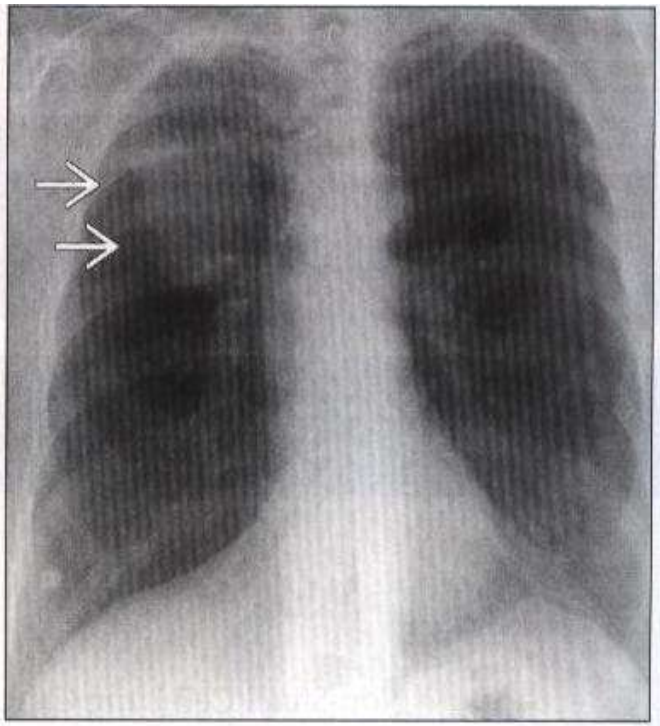
Non–small cell carcinoma
- Adenocarcinoma
  - Most common type
  - Weak association with cigarette smoking
  - Usually peripheral in location
  - Most common type to have air bronchograms
  - Bronchioloalveolar carcinoma is a subtype
- Squamous cell carcinoma
  - Second most common type
  - Strong association with cigarette smoking
  - Usually central in location
  - Most common type to cavitate
- Large cell carcinoma
  - Least common type
  - Usually >3 cm in size
  - Usually in lung periphery

Small cell carcinoma
- Strong association with cigarette smoking
- Usually central in location
- Often presents with bulky mediastinal adenopathy
- Worst prognosis of all types

Non-Small Cell Lung Cancer (1)



Frontal radiograph shows right upper lobe collapse with minor fissure outlining central mass (arrows), S-sign of Golden. Cut off of right upper lobe bronchus (curved arrow). Diagnosis: Squamous cell carcinoma.

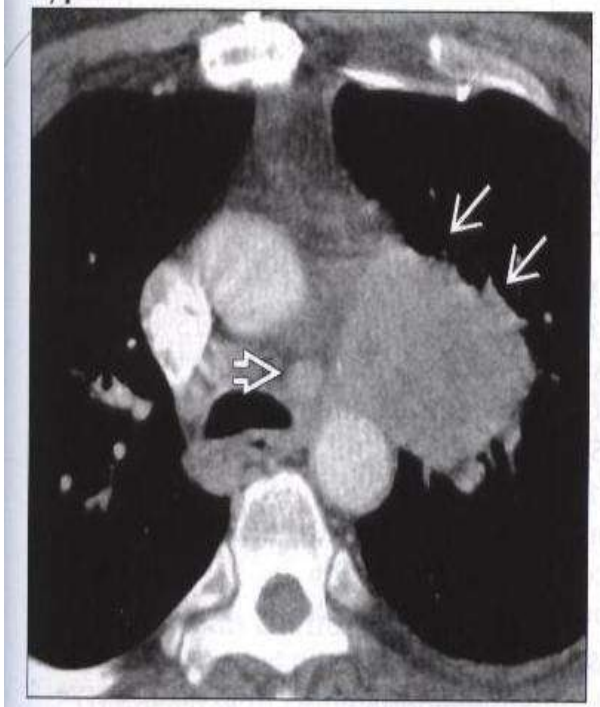


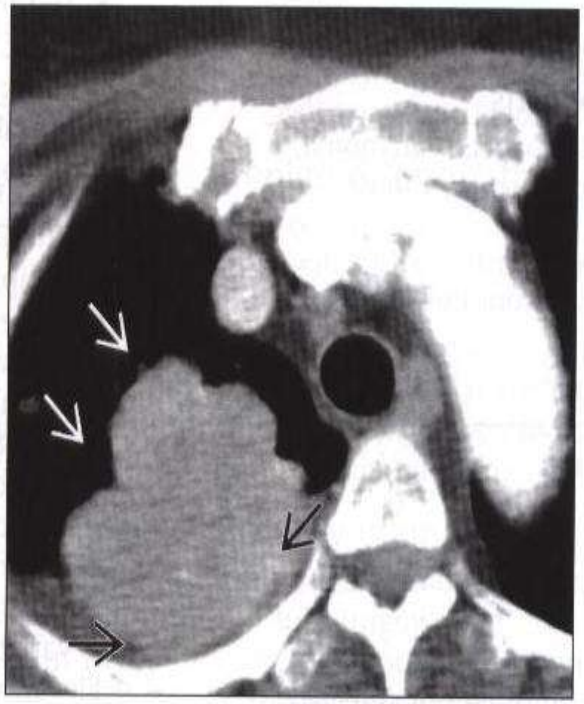
Frontal radiograph shows large mass in right upper lobe (arrows) without rib destruction extending to the right hilum; diagnosed as adenocarcinoma at biopsy.

Non-Small Cell Lung Cancer (2)

Image Gallery

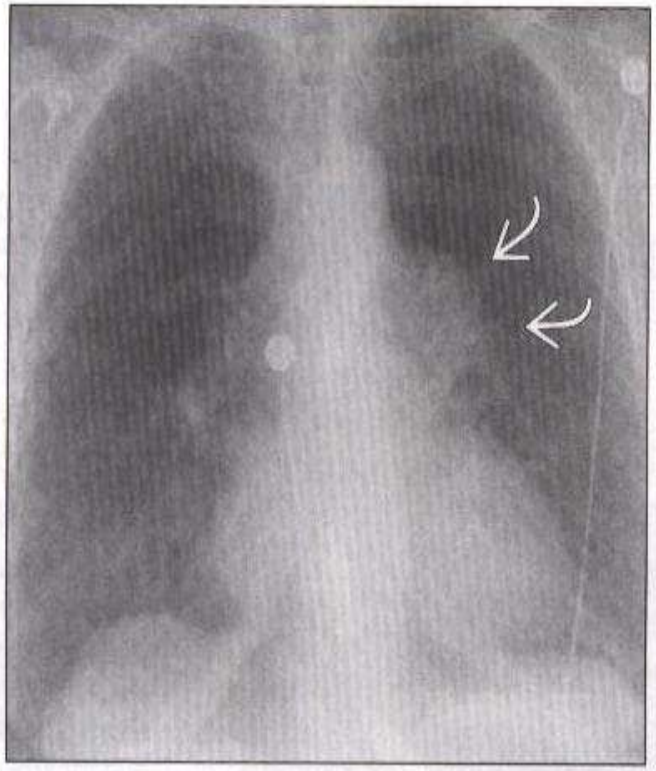
Typical



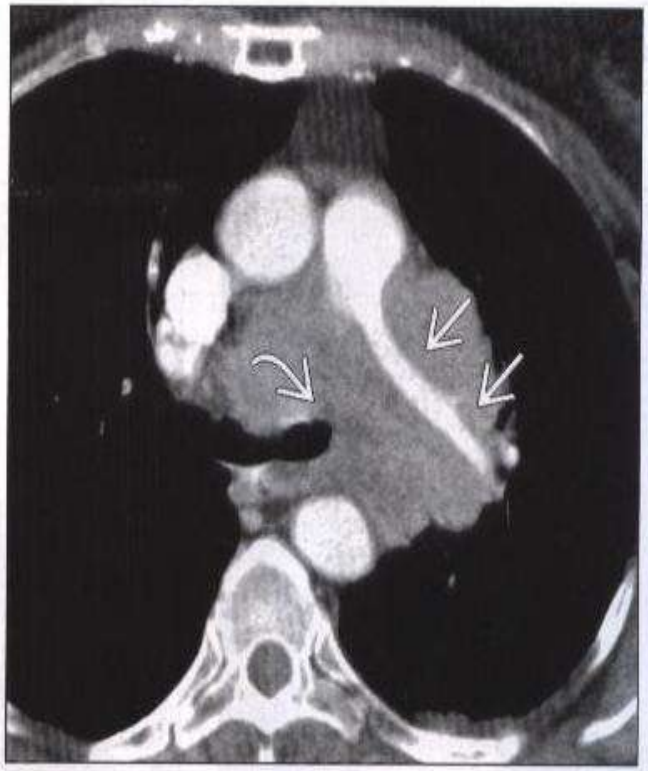


(Left) *Axial CECT shows large mass invading the mediastinum (arrows) with metastatic left tracheobronchial lymph node (open arrow) diagnosed as large cell carcinoma at histology.* ***(Right)*** *Axial CECT shows large lobulated right upper lobe mass (white arrows) with extensive contact with parietal pleura (black arrows). Small pleural effusion seen.*

Small Cell Lung Cancer (1)



Frontal radiograph shows large mediastinal and hilar mass in aorto-pulmonary window (arrows) as a result of lymph node metastasis from small cell lung cancer.



Axial CECT shows large mediastinal mass encasing the left main bronchus (curved arrow). The mass envelopes and attenuates main and left pulmonary artery (arrows).

Small Cell Lung Cancer (2)

Key Facts

Imaging Findings

- Best diagnostic clue: Large mediastinal mass
- Arises within proximal airway
- Discrete pulmonary nodule or mass (5-15%) may not be visible (cavitation distinctly rare)
- Large mediastinal mass extending to at least one hilum (85%)
- Endobronchial obstruction
- Solitary pulmonary nodule, 5%
- Mass enveloping pulmonary arteries, aorta, great vessels
- Compression/invasion of superior vena cava, 10-15%

Top Differential Diagnoses

- Lymphoma
- Non-small cell lung carcinoma (NSCLC)
- Metastases from extra-thoracic primary
- Benign Adenopathy

Pathology

- General path comments: Aggressive behavior: Rapid growth and early metastatic spread
- Strong relationship to tobacco use
- Epidemiology: 15-20% of lung cancers
- Hilar mediastinal mass usually bulky

Clinical Issues

- Most common signs/symptoms: Cough, chest pain, hemoptysis, dyspnea
- Age: 5th-7th decade most common
- Gender: M > F
- Most rapidly growing of the lung carcinomas
- Overall poor prognosis, 5 year survival 4%

Staging Of Lung Cancer (1)

- Location
  - Staging non-small cell carcinoma
  - T1: Solitary pulmonary nodule < 3 cm diameter
  - T2
    - Mass > 3 cm
    - Invasion of visceral pleura
    - Involves major bronchus > 2 cm from carina
    - Lobar atelectasis
  - T3
    - Any tumor extending into chest wall, diaphragm, mediastinal fat, or pericardium
    - Whole lung atelectasis
    - < 2 cm from carina
  - T4
    - Any tumor invading heart, great vessels, trachea, esophagus, vertebral body, carina
    - Malignant pleural effusion
    - Satellite nodule in ipsilateral tumor lobe

Staging Of Lung Cancer (2)

CT Findings

- NECT
  - Suitable for staging lung cancer
    - Equivalent to CECT for staging mediastinum
    - Provide definitive evaluation of indeterminate adrenal lesions
    - Less sensitive than CECT for detecting liver lesions
  - Adrenal evaluation
    - Up to 10% normal population have incidental adrenal lesion
    - Adrenal adenomas < 10 HU due to lipid content
    - Nonenhanced CT 98% specific, 70% sensitive to rule-in adrenal adenoma
- Abnormal nodes > 1 cm short axis diameter
  - Subcarinal nodes may be up to 12 mm in short axis diameter
- Accuracy of CT nodal staging
  - Sensitivity (57%), specificity (82%), NPV (56%), PPV (83%)
    - Causes of false positive lymph nodes: Reactive adenopathy, congestive heart failure, sarcoidosis, granulomatous infection, collagen vascular disease
  - Frequency of nodal metastases (20-50%)
  - Frequency of metastases nodes over 3 cm (66%)
  - Frequency of metastases nodes over 4 cm (100%)
- Predictors of chest wall invasion
  - Greater than 3 cm contact with pleural surface, absent fat plane, obtuse angle
    - Two of three present: Sensitivity 87%; specificity 59%
    - Chest wall pain: Sensitivity 67%; specificity 94%
- Predictors of aortic invasion
  - Greater than 90 degrees contact with aortic wall
- Adrenal evaluation
  - Enhanced CT
  - % Enhancement washout = (enhanced CT attenuation - delayed CT attenuation)/(enhanced CT attenuation - unenhanced CT attenuation) x 100
    - Adenomas > 60% washout
    - Sensitivity 86%, specificity 92%
  - % Relative washout = (enhanced CT attenuation - delayed CT attenuation)/enhanced CT attenuation x 100
    - Adenomas > 40% washout
    - Sensitivity 82%, specificity 92%

Staging Of Lung Cancer (3)

MR Findings

- Overall accuracy similar to CT
  - Slightly more sensitive than CT for chest wall invasion
  - Coronal plane advantageous for superior sulcus tumors
- Adrenal Imaging
  - Perform in phase and out of phase imaging
    - Adenoma: Signal drop out on out of phase image
    - Sensitivity 81-100%; specificity 94-100%
- CNS imaging
  - Not routinely necessary for T1 tumors
  - Perform in otherwise asymptomatic potentially resectable lesions > 3 cm
  - Asymptomatic metastases 3-10%
    - Adenocarcinoma and large cell most common subtypes to metastasize to brain

Nuclear Medicine Findings

- PET
  - Use of PET prevents unnecessary thoracotomy in up to 20% of patients
  - Primary tumor
    - Sensitivity of PET for malignancy > 95% for tumors > 1 cm; specificity < 80%
    - False positive: Focal pneumonia, active granuloma
    - False negative: Bronchioloalveolar carcinoma, low grade adenocarcinoma, carcinoid tumor
    - Standard uptake value (SUV) correlates with prognosis
  - Mediastinum
    - Sensitivity and specificity linked to CT result
    - CT positive mediastinum: Sensitivity approaches 100%; specificity 78%
    - CT negative mediastinum: Sensitivity 82%; specificity 93%
  - Distant metastases
    - Adrenal: Sensitivity 94-100%; specificity 80-91%
    - Bone: Sensitivity and accuracy similar to bone scintigraphy; better specificity

Staging Of Lung Cancer (4)

PATHOLOGY

General Features

- General path comments
  - Non-small cell carcinoma, in order of frequency
    - Adenocarcinoma > squamous cell carcinoma > large cell carcinoma
  - Prevalence of metastases in normal-sized nodes: 15%

Staging, Grading or Classification Criteria

- Stage 1
  - A: T1N0M0
  - B: T2N0M0
- Stage 2
  - A: T1N1M0
  - B: T2N1M0; T3N0M0
- Stage 3
  - A: T3N1M0; T1-3N2M0
  - B: T1-3N3M0; T4N1-3M0
- Stage 4
  - Any T; any N; M1

CLINICAL ISSUES

Natural History & Prognosis

- Stage 1A (T1N0) 65% 5-year survival
- Stage 1B (T2N0) 40% 5-year survival
- Stage 2A (T1N1) 35% 5-year survival
- Stage 2B (T2N1, T3N0) 25% 5-year survival
- Stage 3A (T1-3N2, T3N1) 10% 5-year survival
- Stage 3B (T1-4N3, T4N0-3) 5% 5-year survival
- Stage 4 (M1) 1% 5-year survival

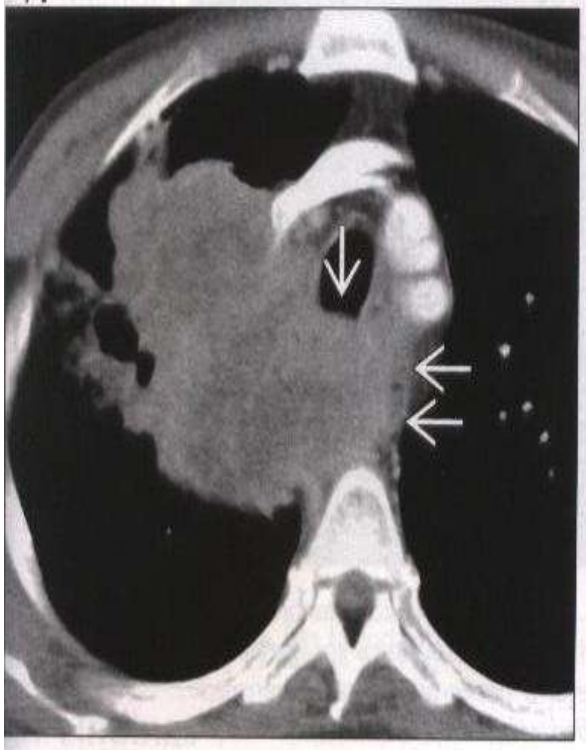
Treatment

- Patient should be given the benefit of proof, stage should be confirmed pathologically
- Stage 1 and 2: Surgical resection
  - Adjuvant chemotherapy appropriate when recurrence risk is high
  - Radiation therapy and radiofrequency ablation can be considered for medically inoperable stage 1 disease
- Stage 3A: Neoadjuvant chemotherapy and radiation therapy
  - May be performed as definitive treatment or followed by surgery
  - Primary resection of 3A disease when malignant lymph nodes are detected at thoracotomy; should receive adjuvant chemotherapy
- Stage 3B and 4 considered unresectable disease
  - Stage 3B disease may be treated with chemotherapy and radiation therapy with curative intent
  - Occasionally T4N0 tumors with limited invasion of vertebral body, mediastinum or left atrium may be resectable
  - Stage 4 disease treated primarily with chemotherapy; radiation therapy reserved for palliation of symptoms

Staging Of Lung Cancer (5)

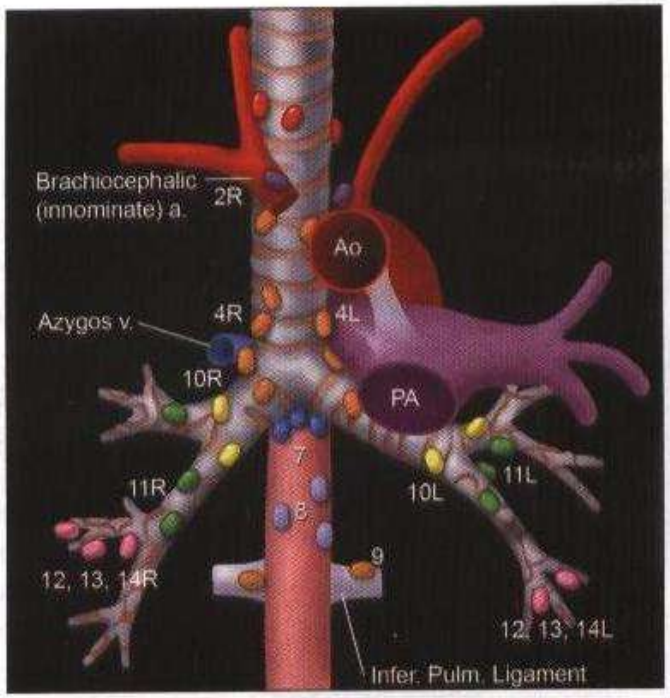
Image Gallery

Typical

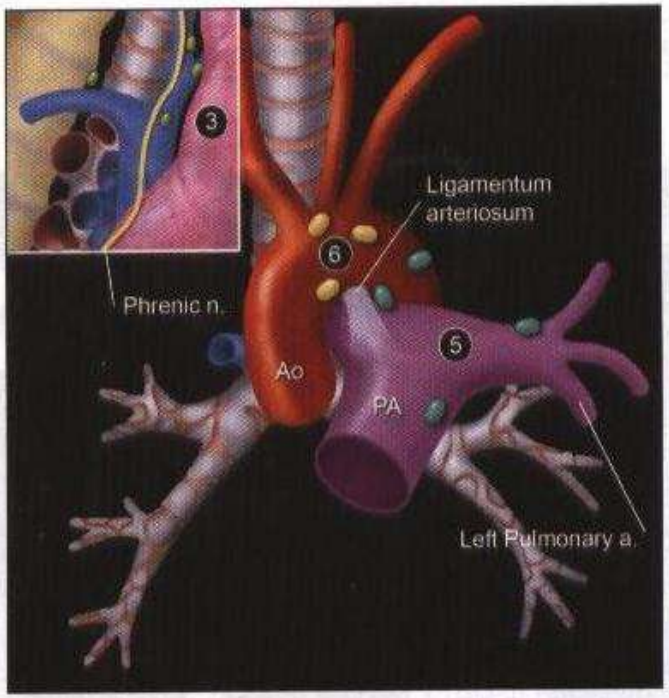


(Left) *Axial CECT shows heterogeneous right upper lobe mass with invasion of mediastinum posterior to trachea and mass effect on the esophagus (arrows). T4 tumor.* ***(Right)*** *Coronal CECT shows left upper lobe mass extending through chest wall (arrow) and contacting left subclavian artery (curved arrow); Pancoast tumor. T3 tumor by TNM classification system.*

Regional Lymph Node Classification (1)



Anatomic distribution and labeling of mediastinal and hilar lymph nodes (with exception of levels 5 and 6) as specified by American Thoracic Society (ATS). Modified with permission ATS.



Aorta-pulmonary window from left anterior oblique perspective. Level 5 nodes are lateral to ligamentum arteriosum and level 6 nodes are lateral to transverse aortic arch. Modified with permission ATS.

Regional Lymph Node Classification (2)

IMAGING FINDINGS

CT Findings

- CT is primary modality for anatomic detection of lymph nodes
- Allows for selection of appropriate route to attain tissue
- Right lung tumor
  - N1 lymph nodes: 10R, 11R, 12R, 13R, 14R
  - N2 lymph nodes: 1R, 2R, 3, 4R, 7, 8R, 9R
  - N3 lymph nodes: 1L, 2L, 4L, 5, 6, 8L, 9L
- Left lung tumor
  - N1 lymph nodes: 10L, 11L, 12L, 13L, 14L
  - N2 lymph nodes: 1L, 2L, 3, 4L, 5, 6, 7, 8L, 9L
  - N3 lymph nodes: 1R, 2R, 4R, 8R, 9R

Regional Lymph Node Classification (3)

CLINICAL ISSUES

Treatment

- Methods for pathologic confirmation
  - Bronchoscopy and biopsy
    - Operator dependent; sensitivity for mediastinal nodes approximately 75%
  - Trans-esophageal ultrasound (EUS) with fine needle aspiration (FNA)

Regional Lymph Node Classification (4)

Treatment

- FNA performed under direct ultrasound guidance
- EUS-FNA best for levels 4L, 5, 7, 8
- Sensitivity 85-90%

Trans-bronchial ultrasound (EBUS) with FNA

- EBUS allows access to sites not evaluable by EUS
- Can perform FNA on hilar nodes

Mediastinoscopy

- Cervical mediastinoscopy can reach levels 1, 2, 3, 4, anterior 7
- Extended cervical mediastinoscopy reaches levels 5 and 6 as well

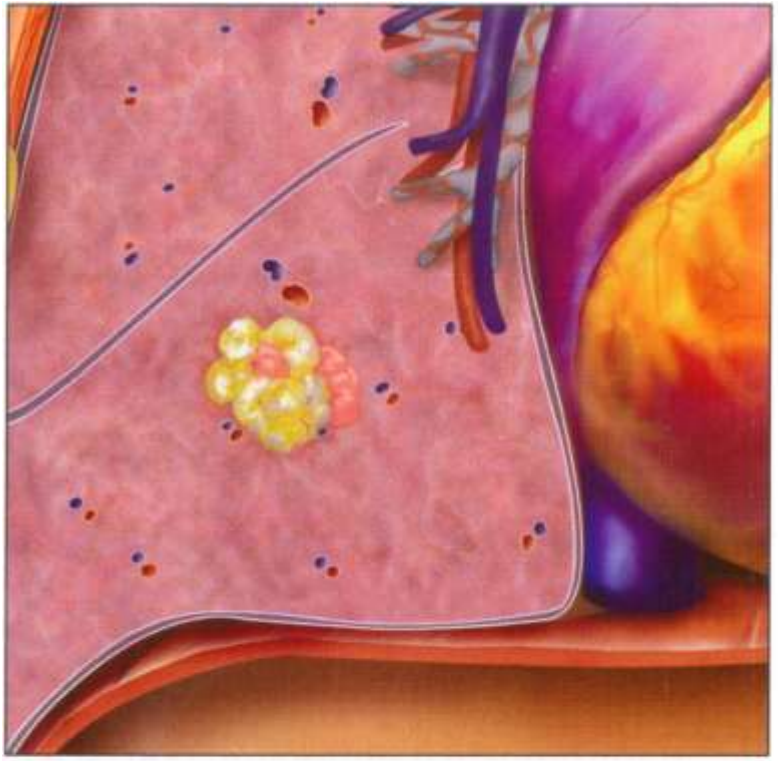
Anterior mediastinotomy (Chamberlain procedure)

- Via right thorax reaches level 2R, 3, 4R
- Via left thorax reaches level 5 and 6 only

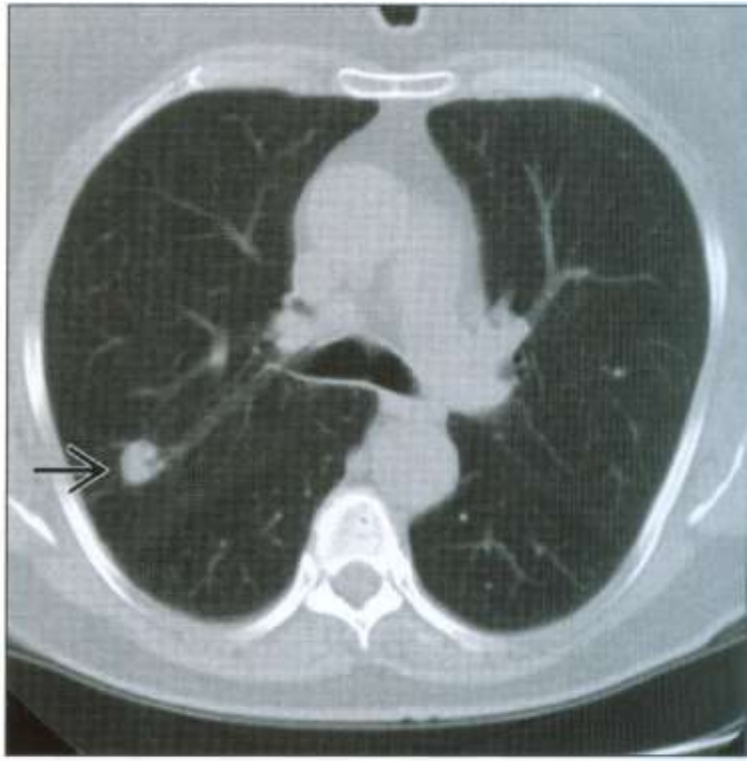
Video assisted thoracoscopic surgery (VATS)

- VATS may be used to reach levels 4, 5, 6 , 7, 8, and 9 in selected cases

Solitary Pulmonary Nodule (1)



Graphic shows hamartoma. CT detection of fat and "popcorn" calcification in a lobulated soft tissue nodule < 2.5 cm in diameter suggests diagnosis. Slow growing and usually detected in 4th or 5th decade of life.



Axial NECT shows 1.5 cm solid nodule (arrow) in the posterior segment right upper lobe. FNA showed no malignant cells, a nonspecific benign diagnosis. Further CT observation or intervention is indicated.

Solitary Pulmonary Nodule (2)

Key Facts

Terminology
- Round or oval opacity, < 3 cm in diameter

Imaging Findings
- < 3 cm; > 90% of nodules < 2 cm are benign
- Nodules approaching 3 cm, more likely to be malignant
- Radiography: Site of most missed cancers, right upper lobe
- Prior radiographs critical for nodule detection
- Benign calcification: Central nidus, laminated, popcorn, diffuse
- Hamartomas, 1/3 show popcorn calcification
- Diffuse calcification in osteogenic sarcoma, chondrosarcoma metastases
- 1/2 hamartomas contain fat
- Growth: Much overlap between benign and malignant nodules
- Mixed solid/part solid, up to 50% < 1.5 cm in diameter are malignant

Top Differential Diagnoses
- 1st costochondral junction osteophytes
- Nipple shadow

Pathology
- 90% represent (in order) granuloma, bronchogenic carcinoma, hamartoma, solitary metastasis, carcinoid

Diagnostic Checklist
- Some lung cancers grow so slowly that growth may not be detected with 2 year follow-up

Lymphangitic Carcinomatosis(1)

Key Facts

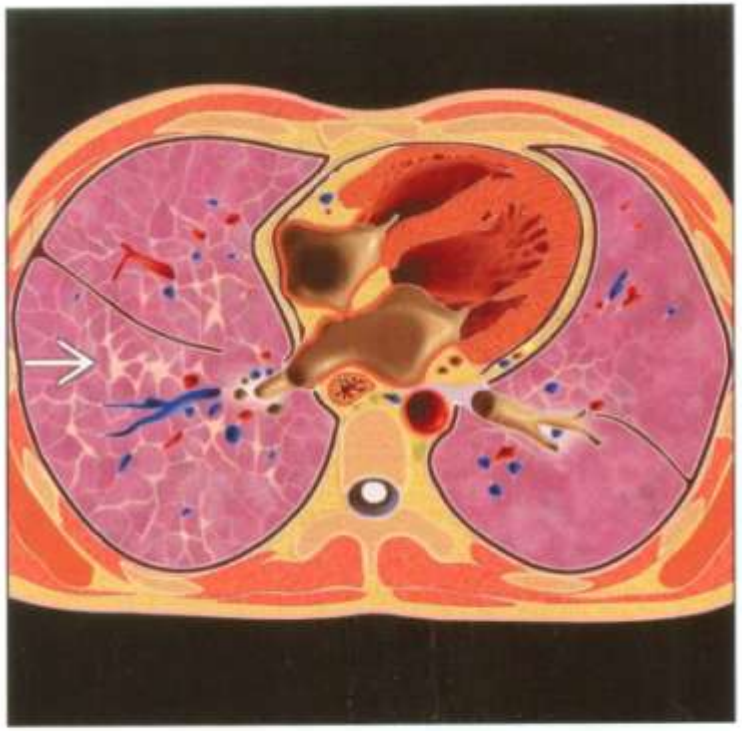
Terminology
- Permeation of lymphatics by neoplastic cells

Imaging Findings
- Best diagnostic clue: Nodular or beaded septal thickening which may spare whole lobes or lung
- Location: Usually diffuse but confined to 1 lung or lobe in 30%
- Chest radiograph may be normal (30-50%)
- Hilar and mediastinal lymphadenopathy may be present (30%)
- Pleural effusion common (50%)
- Frequency of involvement: Axial (75%) > axial + peripheral (20%) > peripheral (5%)

Top Differential Diagnoses
- Pulmonary Edema
- Idiopathic Pulmonary Fibrosis
- Scleroderma
- Lymphoma
- Drug Reaction

Pathology
- Frequent form of tumor spread found in 33% to 50% of those with solid tumors at autopsies
- Common tumors: Breast, stomach, pancreas, prostate, lung
- Hematogenous metastases: Tumor emboli to small pulmonary artery branches with subsequent spread along lymphatics
- Some tumors such as lymphoma spread from hilar nodes retrograde into pulmonary lymphatics

Lymphangitic Carcinomatosis (2)



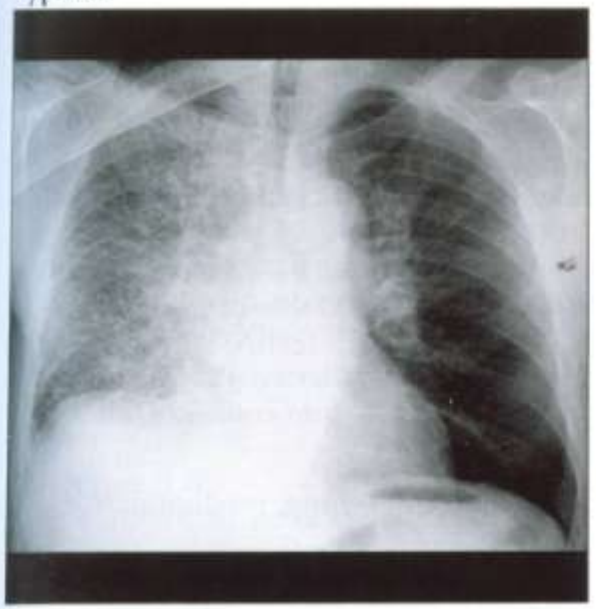
Axial graphic shows typical features of lymphangitic tumor. Irregular septal thickening (arrow). Distribution also markedly asymmetric, right greater than left.

Gross pathology shows lymphangitic tumor. Subpleural and interlobular septa (arrows) irregularly thickened and beaded. Bronchovascular bundles are also thickened (curved arrow).

Lymphangitic Carcinomatosis (3)

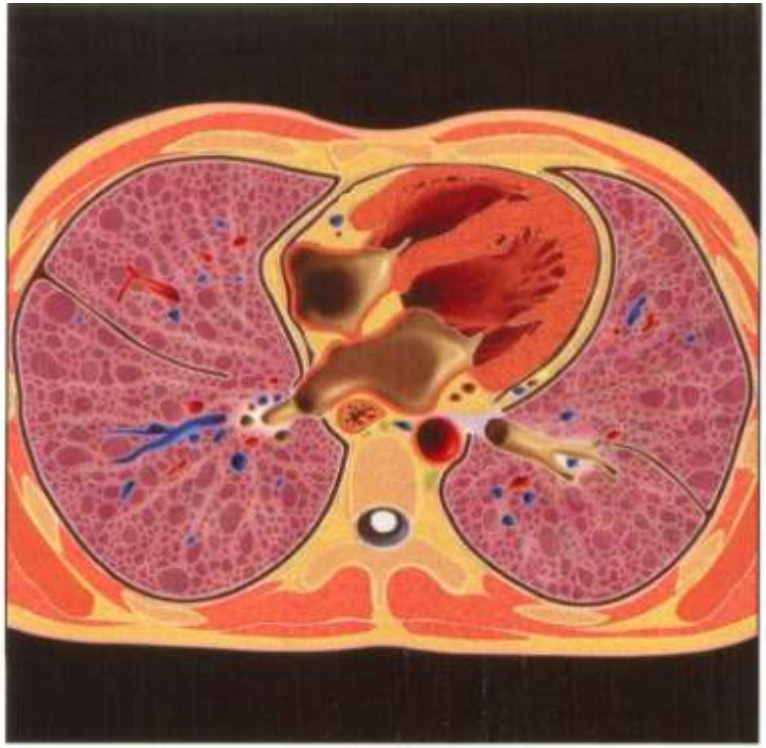
Image Gallery

Typical

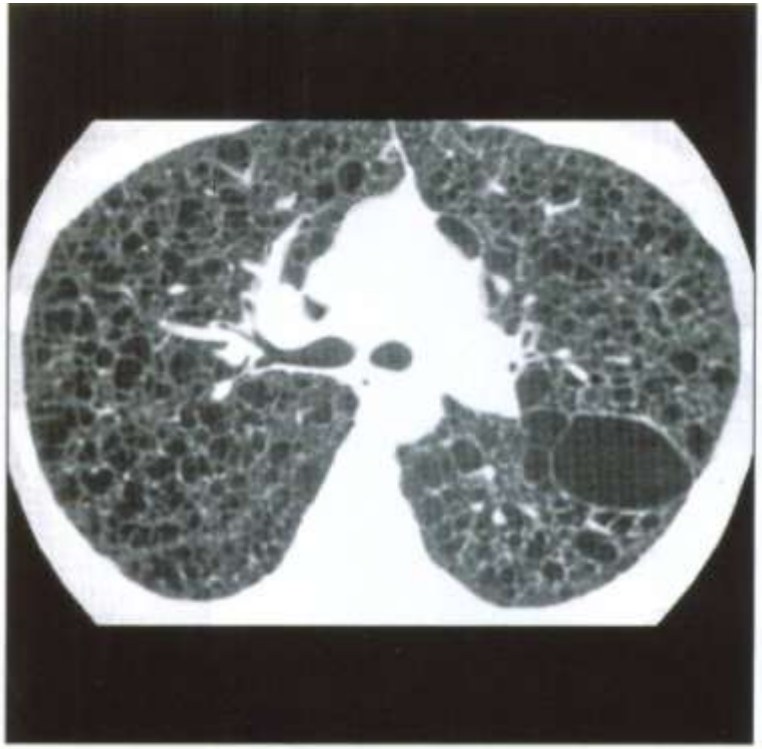


(Left) *Frontal radiograph shows diffuse reticular thickening right lung. Differential includes pneumonia, edema, aspiration, radiation therapy, and lymphangitic tumor.* ***(Right)*** *Axial HRCT shows irregular and beaded (arrow) thickening of the interlobular septa from lymphangitic tumor. Bronchovascular bundles are also thickened (open arrow).*

Lymphangiomyomatosis(1)



Axial graphic shows typical appearance of LAM: Thin-walled cysts of slightly heterogeneous sizes that lead to diffuse destruction of lung parenchyma.



Axial HRCT shows near complete replacement of the lung with variable sized cysts.

Lymphangiomyomatosis (2)

Key Facts

Terminology
- Characterized by non-neoplastic hamartomatous proliferation of atypical muscle cells that leads to progressive cystic destruction of lung parenchyma

Imaging Findings
- Radiograph: Paradoxical coarse interstitial thickening in hyperinflated lungs in young women
- HRCT: Large thin-walled cysts diffusely distributed in the lungs that will eventually replace entire lung parenchyma
- HRCT, more sensitive than chest radiograph

Top Differential Diagnoses
- Panlobular Emphysema
- Langerhans Cell Histiocytosis
- Sjögren Syndrome (Lymphocytic Interstitial Pneumonia)
- Neurofibromatosis
- Laryngotracheal Papillomatosis

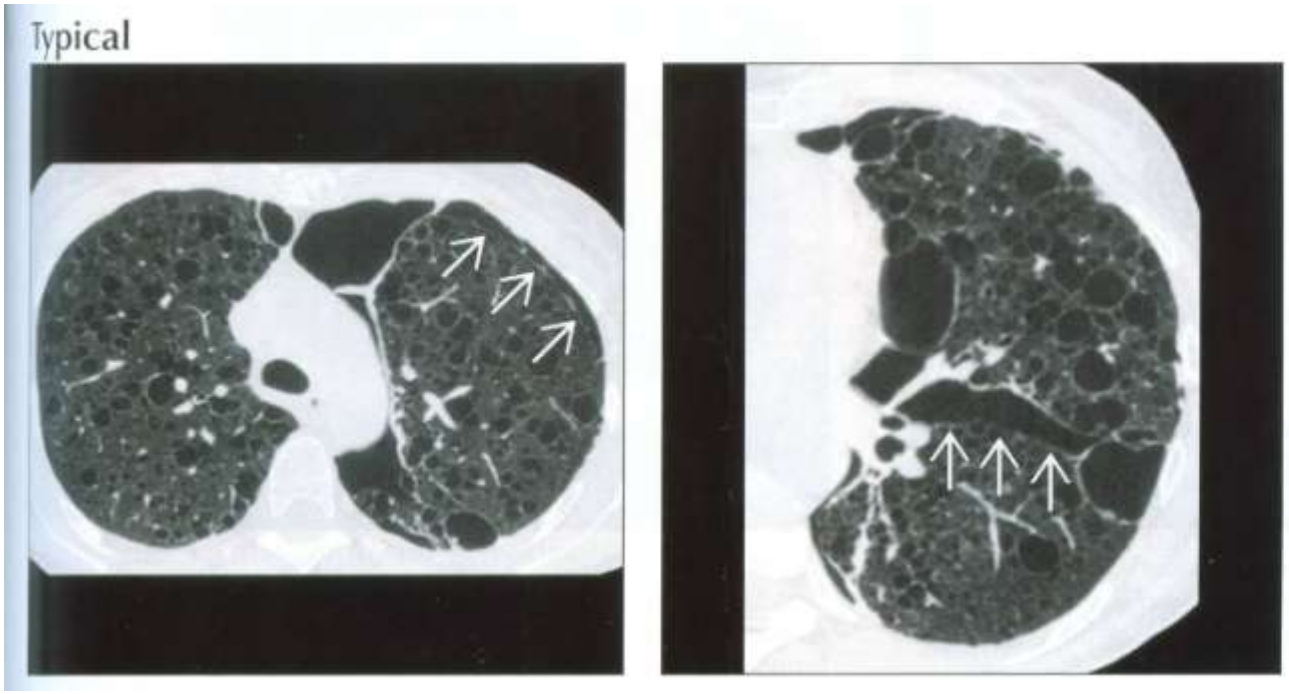
Pathology
- Hamartomatous proliferation of smooth muscle around lymphatics and blood vessels
- Etiology: Predilection for premenopausal women suggests estrogen plays a role in pathogenesis

Clinical Issues
- Five year survival: 50%

Diagnostic Checklist
- HRCT findings in appropriate clinical context are pathognomonic

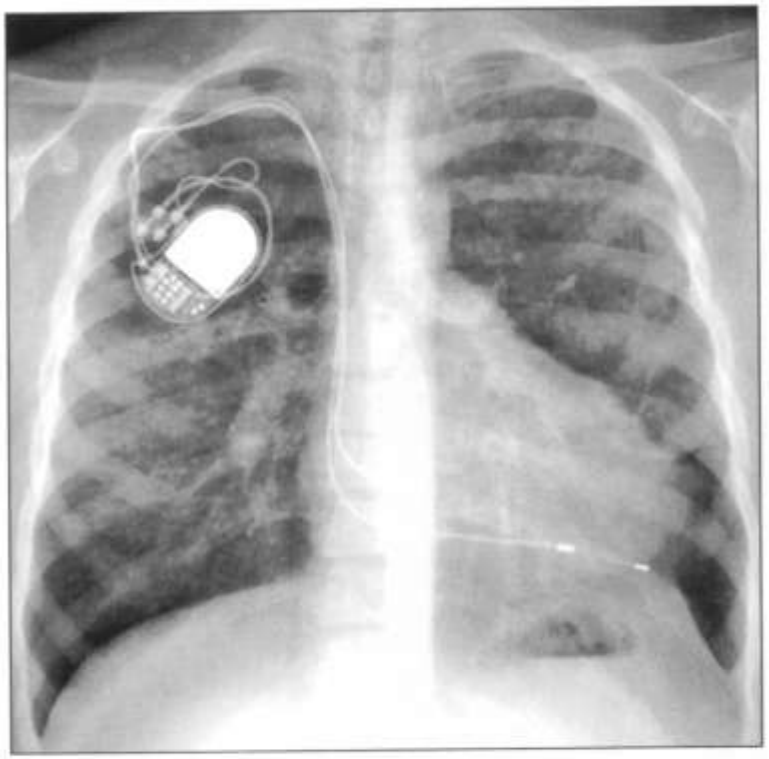
Lymphangiomyomatosis (3)

Image Gallery

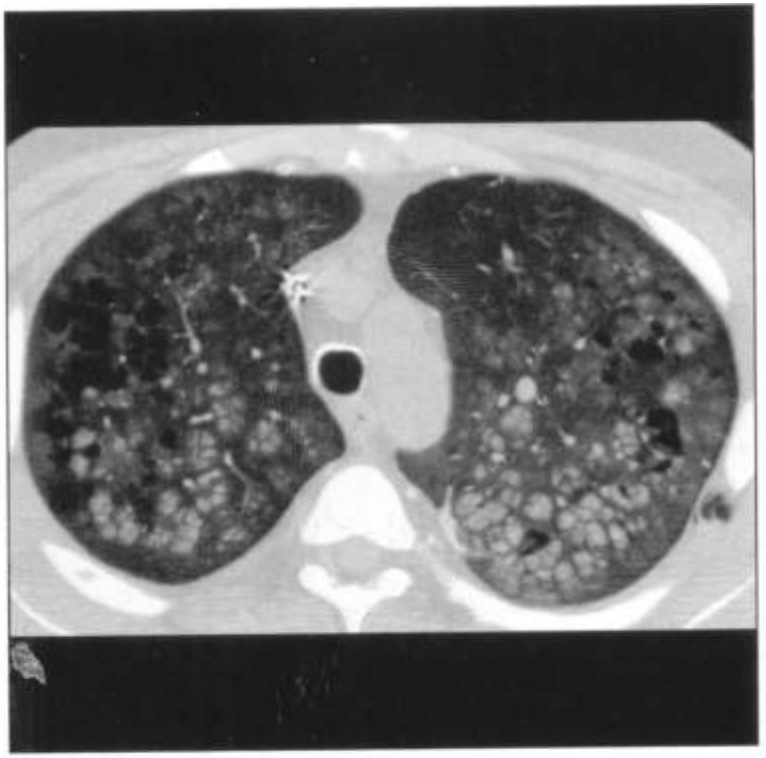


(Left) *Axial HRCT shows extensive parenchymal lesions and a subpleural air collection (arrows).* ***(Right)*** *Axial HRCT shows large subpleural lesions and an air collection along the interlobar fissure (arrows).*

Metastatic Pulmonary Calcification (1)



Frontal radiograph shows diffuse nodularity more profuse in the upper lung zones. Mild cardiomegaly and bipolar pacemaker. Long history of renal dialysis.



Axial HRCT shows clusters of poorly defined centrilobular nodules in the dorsal aspect of the upper lobes. Note the well defined emphysema.

Metastatic Pulmonary Calcification (2)

Key Facts

Terminology
- Calcium deposition in normal tissue, predominantly affects lung, stomach, kidney, and heart

Imaging Findings
- Mulberry-shaped or miniature cotton balls, amorphous calcifications 3-10 mm diameter
- Centrilobular location
- Best imaging tool: CT or bone scanning sensitive for detection of calcium, CT useful to characterize distribution

Top Differential Diagnoses
- Tuberculosis
- Silicosis
- Sarcoidosis
- Mitral Stenosis
- Talcosis
- Amyloidosis
- Alveolar Microlithiasis
- Idiopathic Ossification

Pathology
- Physiology: Normally high V/Q ratio in upper lobes leads to alkaline pH (7.51)
- Calcium is less soluble in alkaline environment

Clinical Issues
- Gradual onset dyspnea, however, some have sudden onset of symptoms and rapid fulminant course

Diagnostic Checklist
- Suspect in chronic hemodialysis patients with chronic ill-defined opacities in the upper lung zones

Summary

認識各種疾病的X光特徵及其臨床issues