

# 肺結節與腫瘤判讀

臺北榮民總醫院胸腔部

羅永鴻醫師

2022/5/1

# Introduction

- 處理單一肺結節患者最重要的是在於察覺異常之存在。
- 肺內腫瘤依大小可分為nodule ( $\leq 3\text{cm}$ )及mass ( $> 3\text{cm}$ )
- 在胸部X光像看到nodule時，首先須排除一些肺外的異物，例如胸壁上的構造、皮膚/皮下病灶、肋膜病灶、bone island、nipple、鈕扣等外物。
- 肺內結節可分為單一性(solitary)或多發性(multiple)

Miliary nodule: <2 mm

Pulmonary micronodule: 2-7 mm

Pulmonary nodule:  $\leq 30$  mm

Pulmonary mass: > 30 mm



Miliary nodule



micronodule



nodule



Mass

# Nodule/ Mass 鑑別診斷的依據

- Patient factor
  - 臨床症狀(Clinical information)
  - 年齡(Age)
  - 抽菸史
  - 職業
- Lesion factor(2S, 3C, DOA)
  - 大小(Size)
  - 形狀、邊緣(Shape/Margin)
  - 有無開洞(Cavitation)
  - 鈣化的有無與型態(Calcification)
  - CT下注射顯影劑的變化(Contrast enhancement)
  - Doubling time(比較舊片)、Density (CT scan, HU)
  - Other associated findings, ex: satellite lesions
  - 位置(area)、air-bronchogram
- Tissue is the Issue

# S1: 大小(Size)

- 大size要R/I malignancy，但是小size卻不能R/O malignancy
  - Benign lesion: relatively fewer > 3 cm
  - Malignancy: any size
- Literature:
  - $10^9$  cells = 1 cm
  - Benign tumor: 80% < 1cm; only 6% > 3cm
  - Malignant tumor: 57% > 3cm

## **S2: 形狀(Shape)/邊緣(Margin)**

- **Favor Benign**

- Well-defined margin
  - Benign (80%)

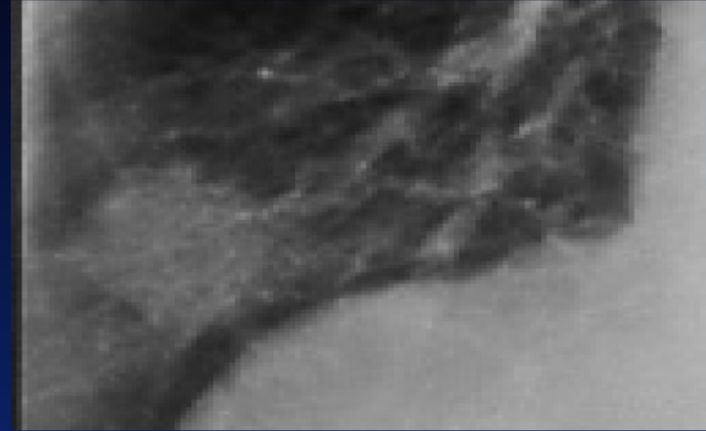
- **Favor malignant**

- Lobulated
  - Malignant 60~80%
- Focal spiculation
  - Malignant 80%
- Diffuse spiculation (corona radiata)
  - Malignant 95%
- Tail sign (pleural tag)
  - Malignant 60~80%

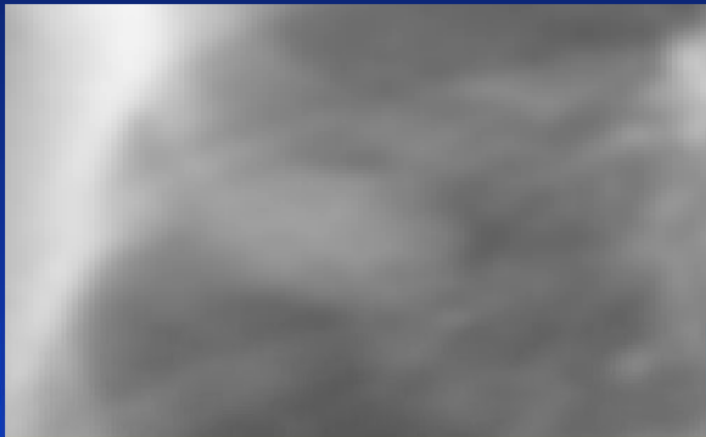
## S2: 形狀(Shape)/邊緣(Margin)



Lobulated(分葉的)



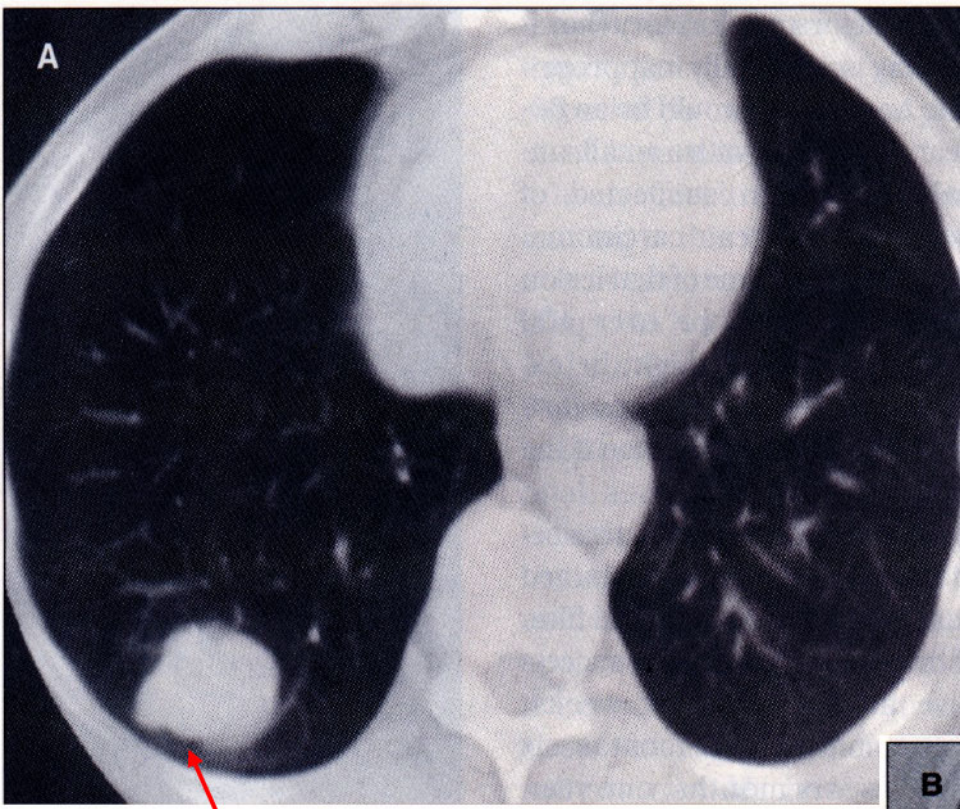
Spiculated (針狀的/長角)



Smooth(外緣平滑)

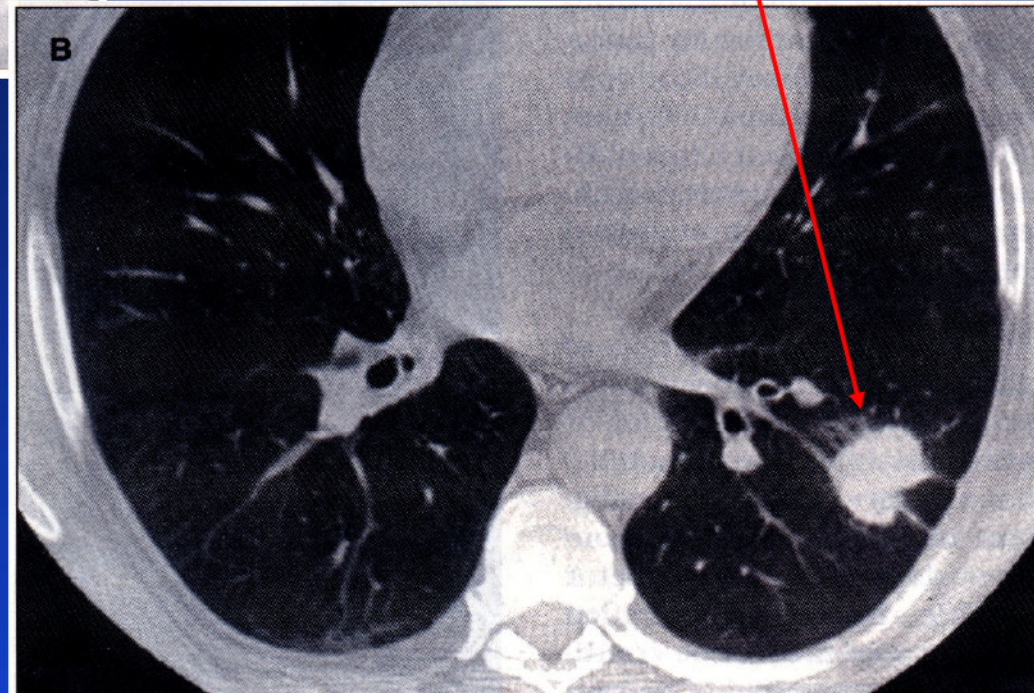


Ill-defined (不清楚/不規則的)

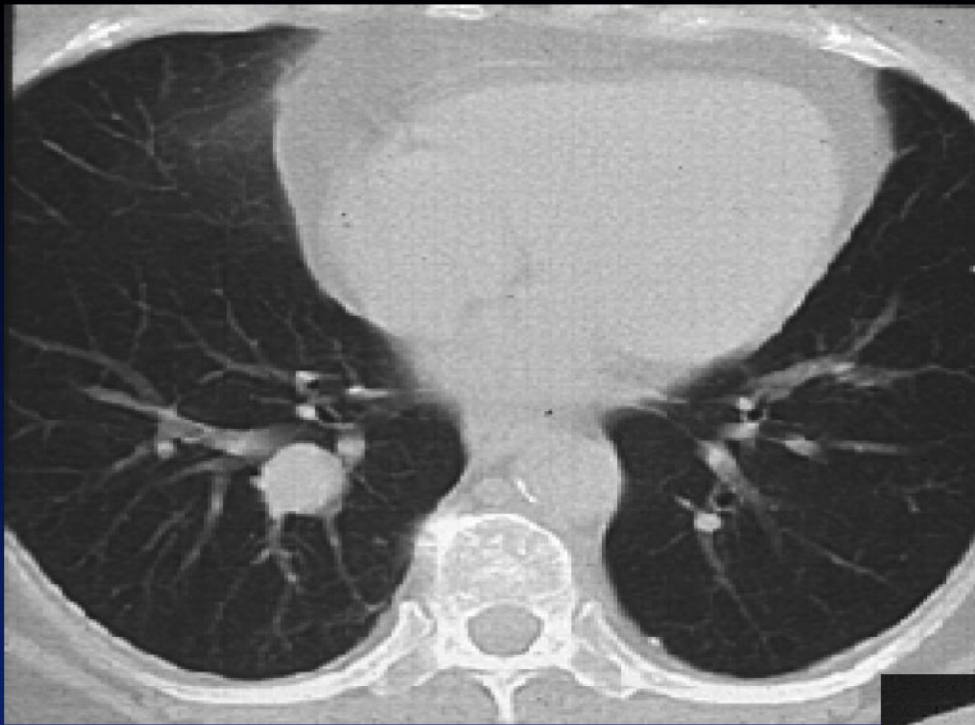


*Lobulated*

*Focal spiculation*

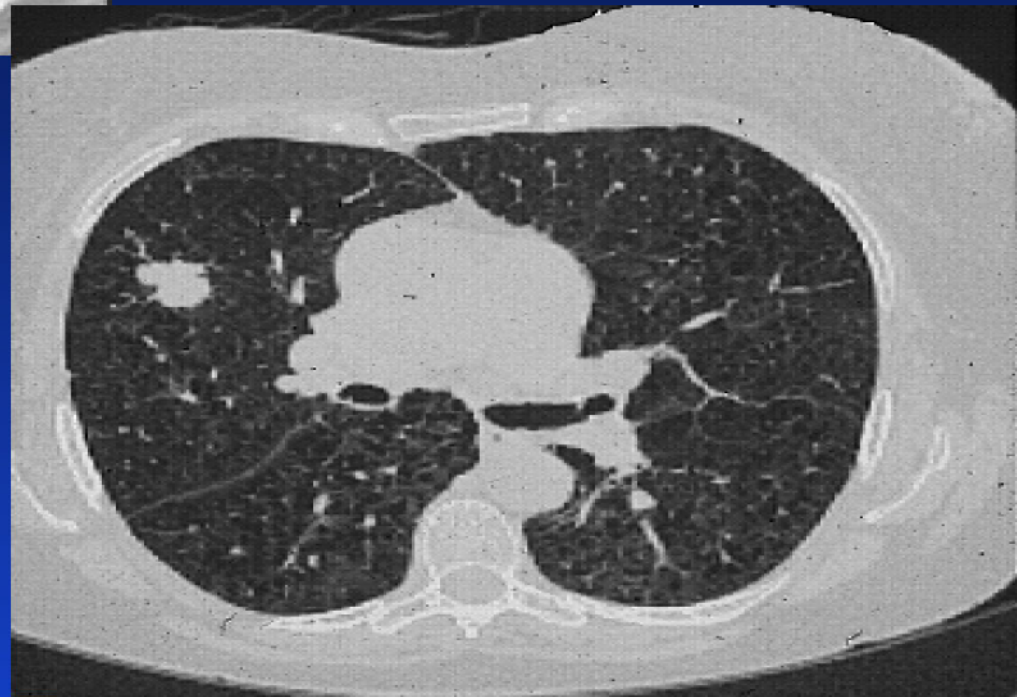




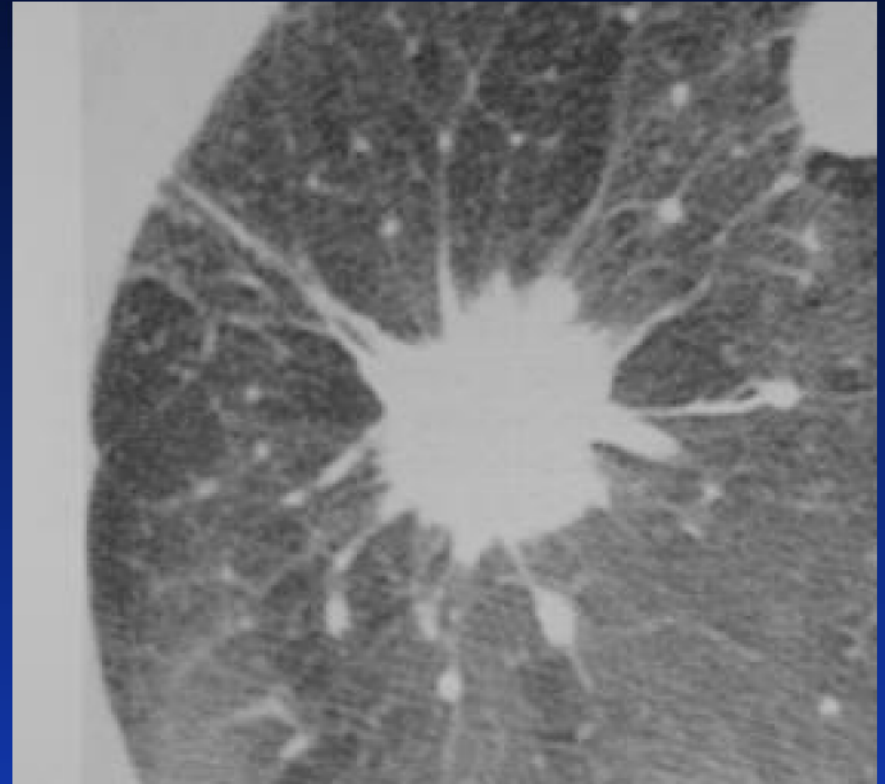
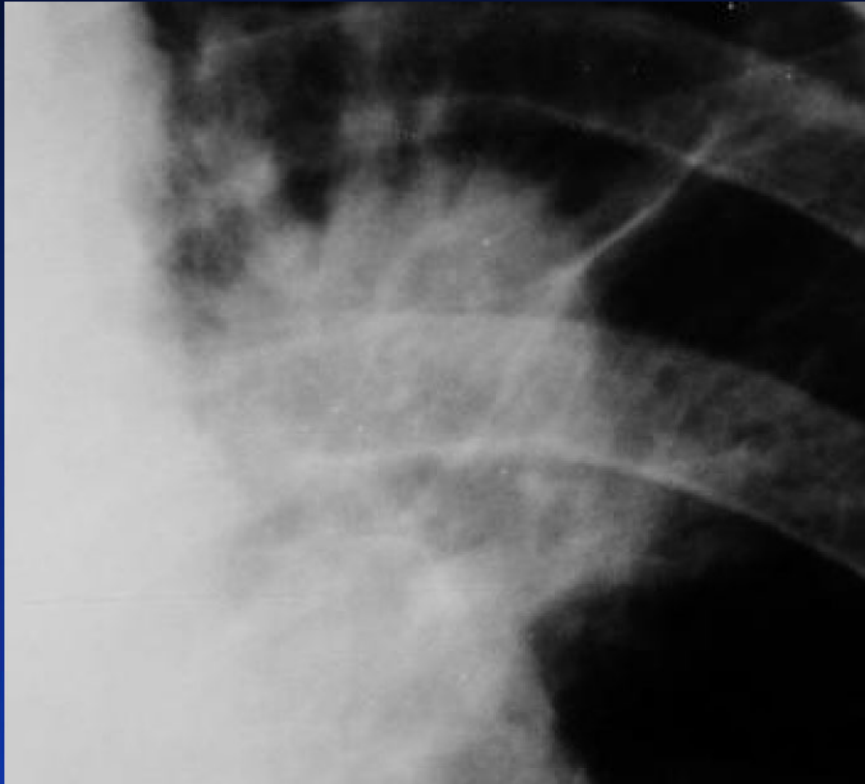


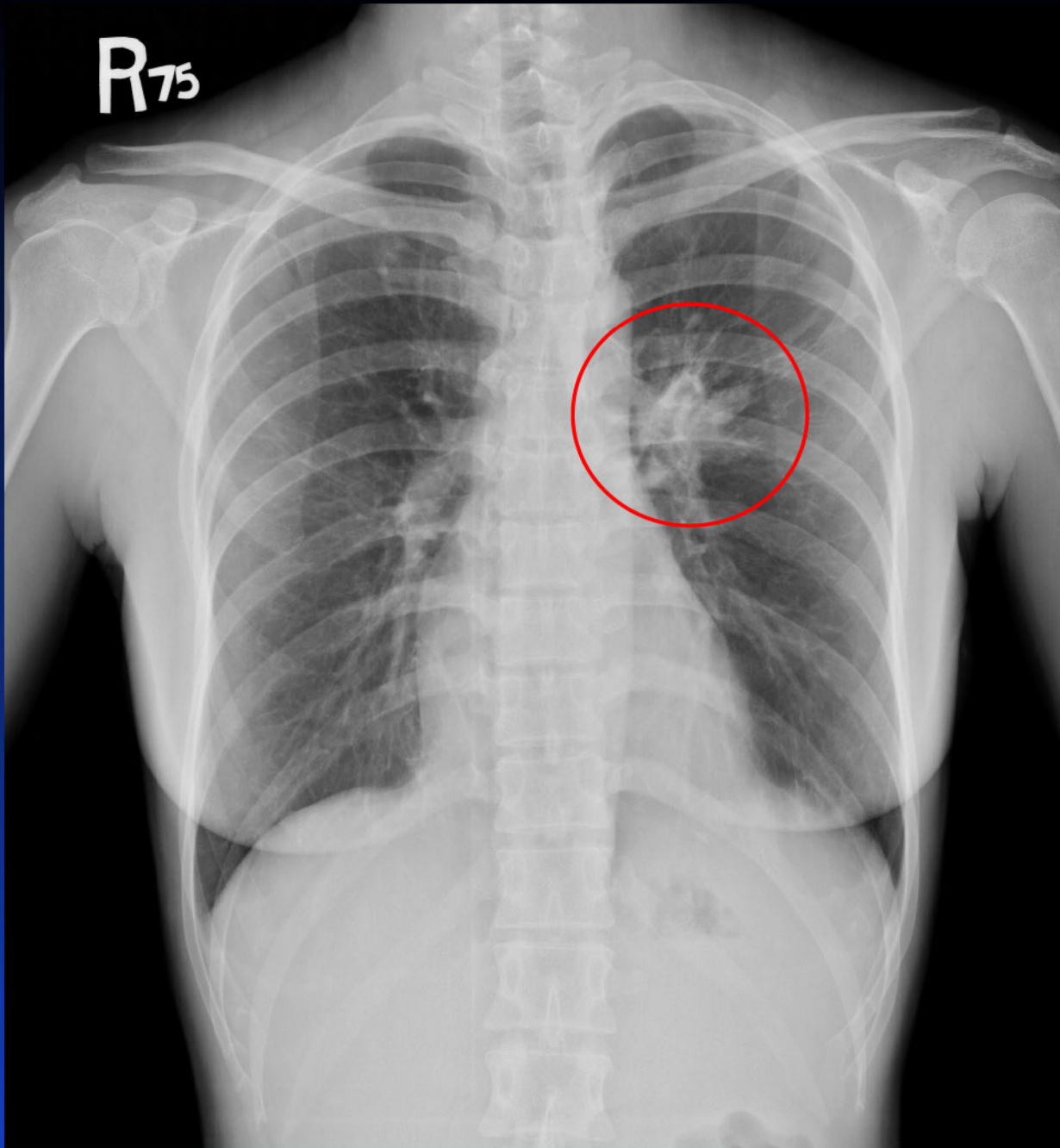
**Smooth border of nodule  
- 20% malignant**

**Scalloped border of nodule  
- 60% malignant**



# Corona Radiata

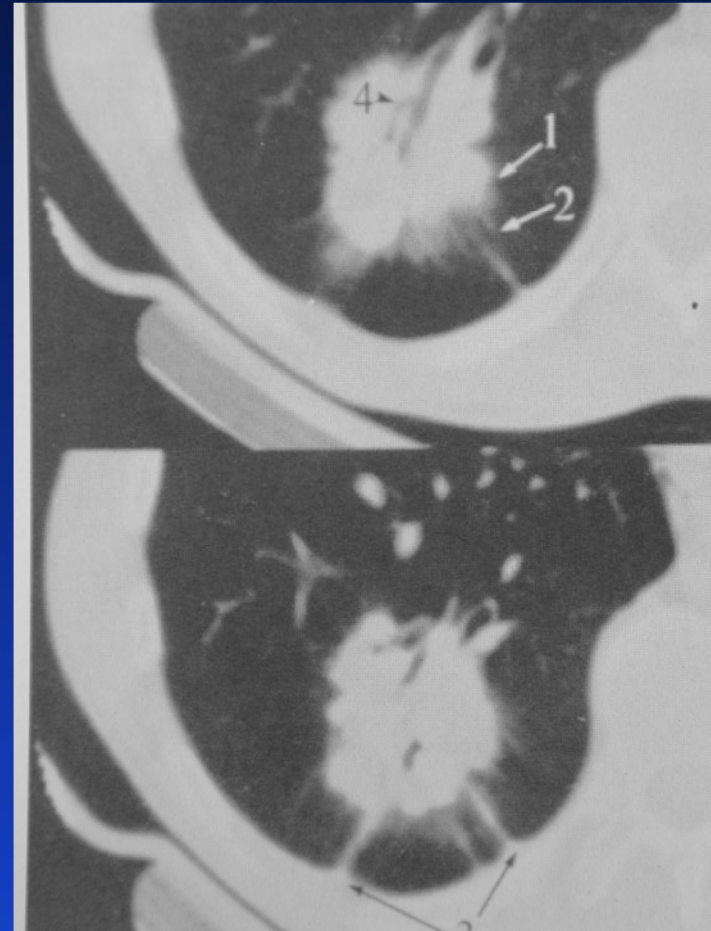
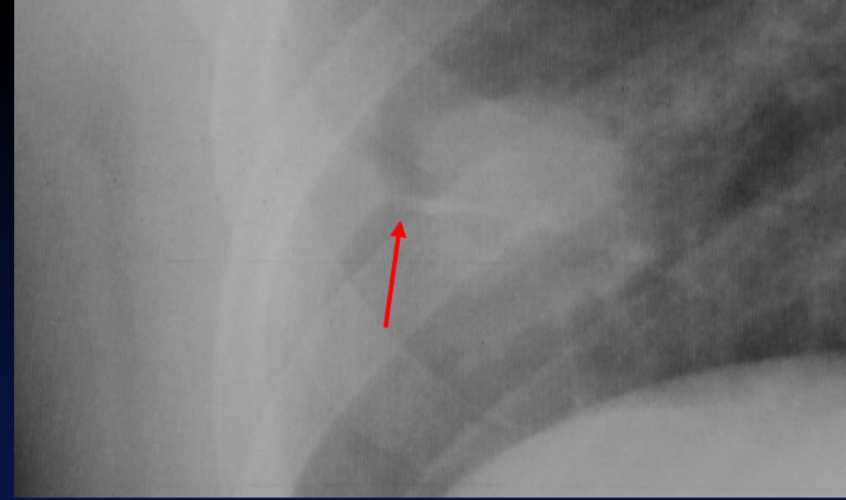




**Pulmonary  
TB**

## Tail sign (Rat tail sign)

- Line extends to visceral pleura
- Favor **malignancy** but of limited value
- Most common **adenocarcinoma**, but also present in other cell type of malignancy, metastasis, granuloma.



# C1: Cavitation/開洞

- 觀察重點：壁厚、內緣、內容物、位置、數目、周圍肺實質的變化
- 壁厚：越厚越懷疑惡性
  - 壁薄 <4mm: favor benign
  - 壁厚 >16mm: favor malignancy
- 內緣(Inner wall)
  - 規則、一致、平滑(Smooth/uniform) : favor benign
  - 不規則、結節狀(Irregular/nodular): favor malignancy

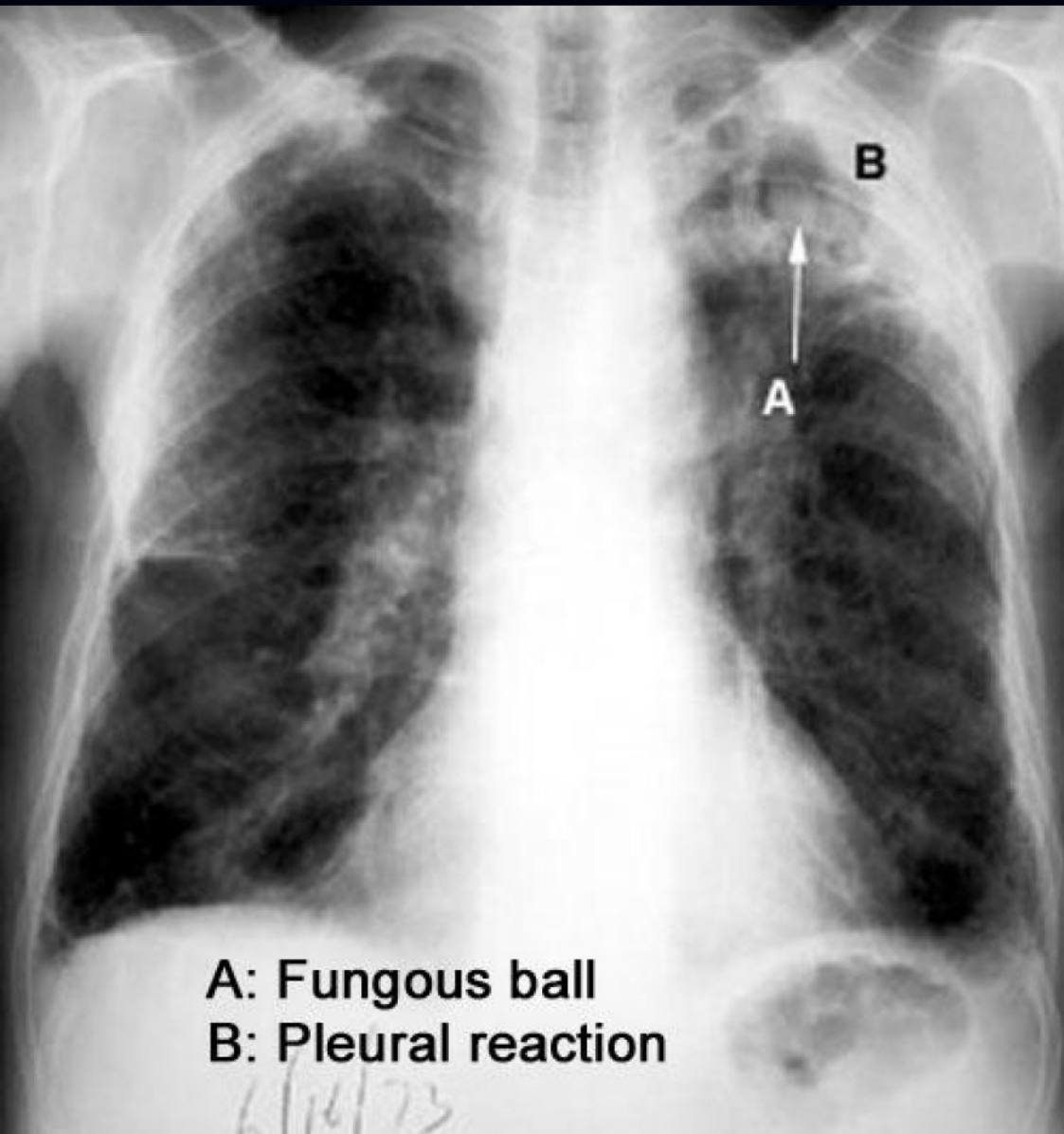
# C1: Cavitation/開洞

- 內容物：
  - Fluid: malignancy is less likely, except bleeding or 2<sup>nd</sup> infection
  - Fungus ball: aspergillosis
- 位置：
  - Central: more common fibrotic or neoplastic lesions
  - Peripheral(eccentric): more metastatic or embolic lesions
  - Apical: TB, fungus ball
- 數目：
  - Solitary多: primary lung cancer, lung abscess
  - Multiple多: metastasis, Granulomatosis with polyangiitis, septic emboli
- 周圍肺實質的變化：
  - Air-space consolidation: acute process
  - Irregular reticular strands: chronic fibrotic change



- LUL mass
- Thick walled cavity
- Eccentric location of cavity

**Squamous Cell  
Carcinoma**



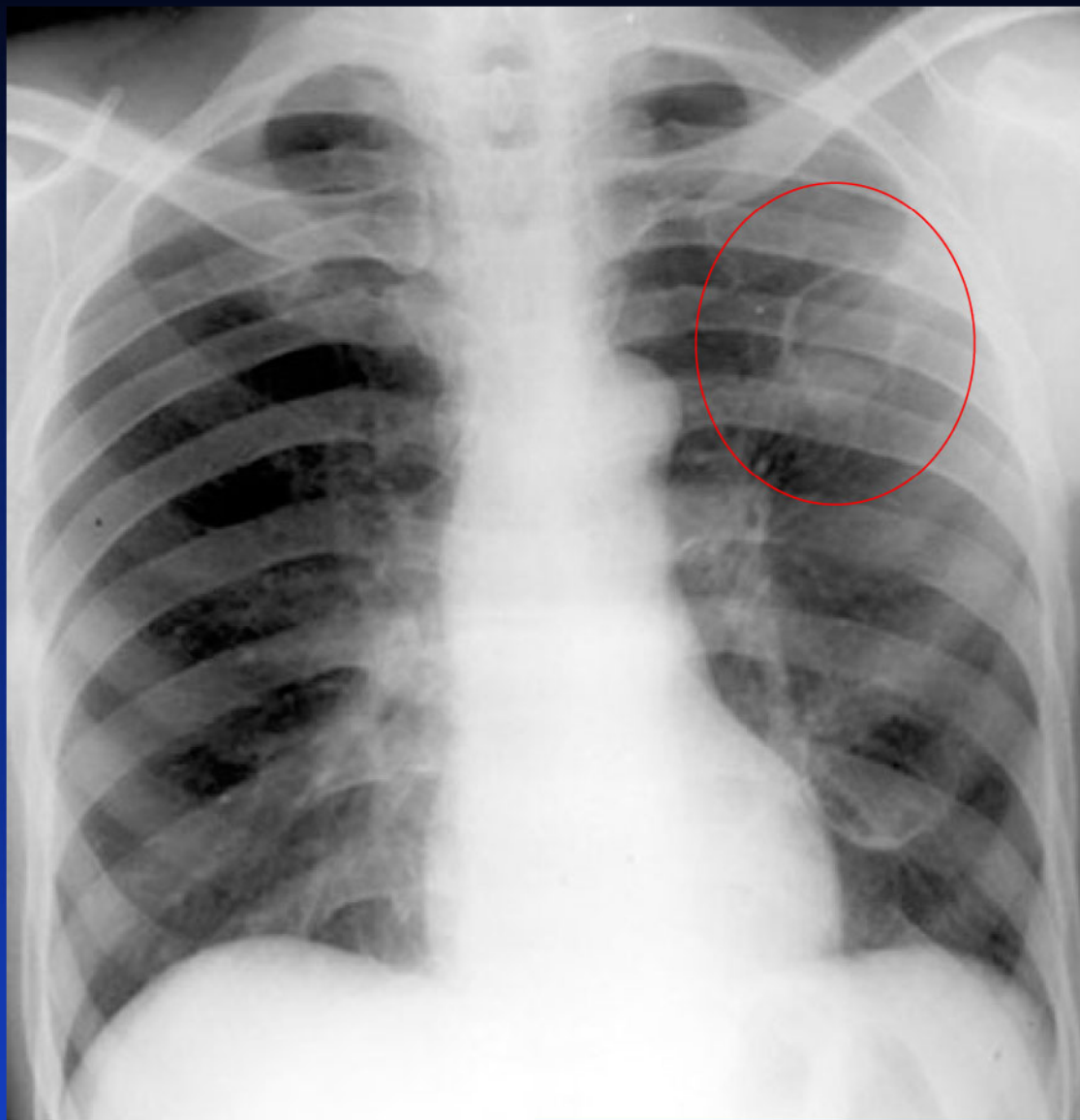
A: Fungous ball  
B: Pleural reaction

# Aspergilloma

Ball in hole



# Coccidioidomycosis



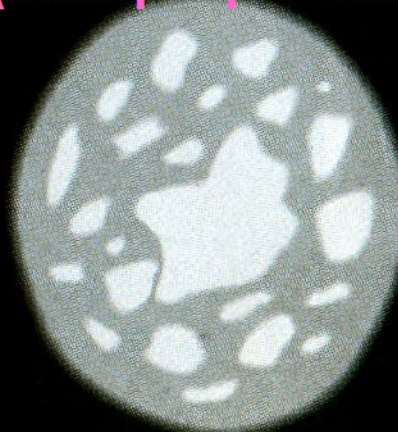
**C2:**  
**Calcific**  
**ation/**  
**鈣化**

**Eccentric**

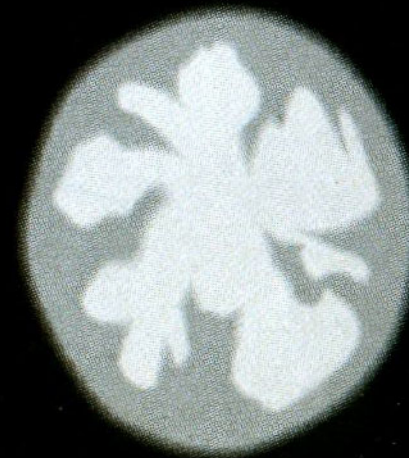


**Stippled**

**(multiple punctate)**



**Popcorn**



**Malignancy**

**Harmatoma**

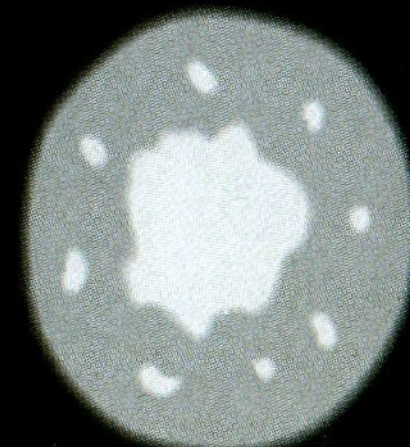
**Diffuse**



**Laminated**

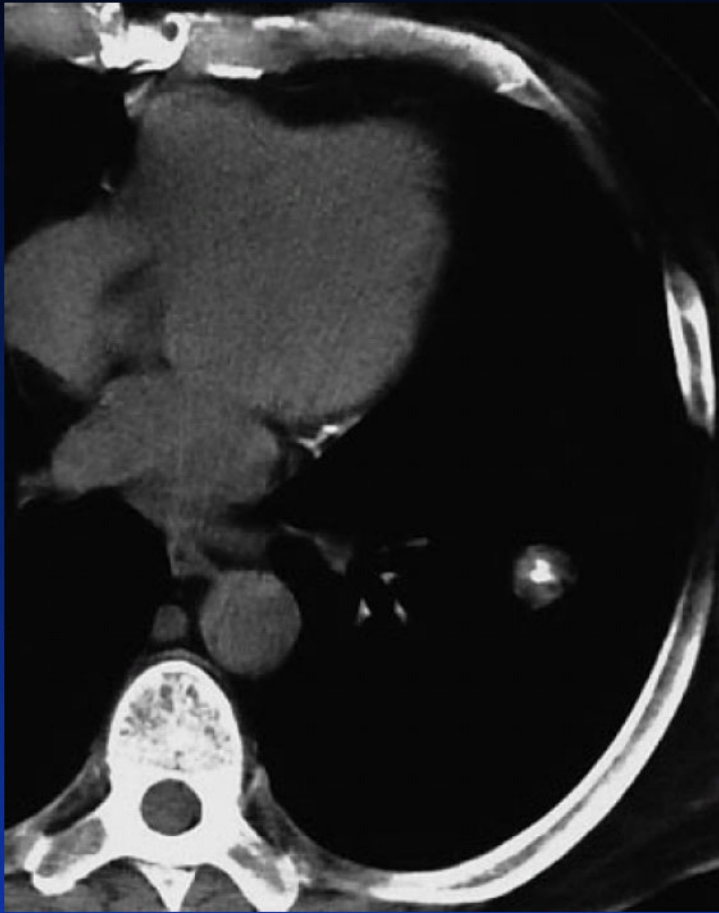


**Central nidus**

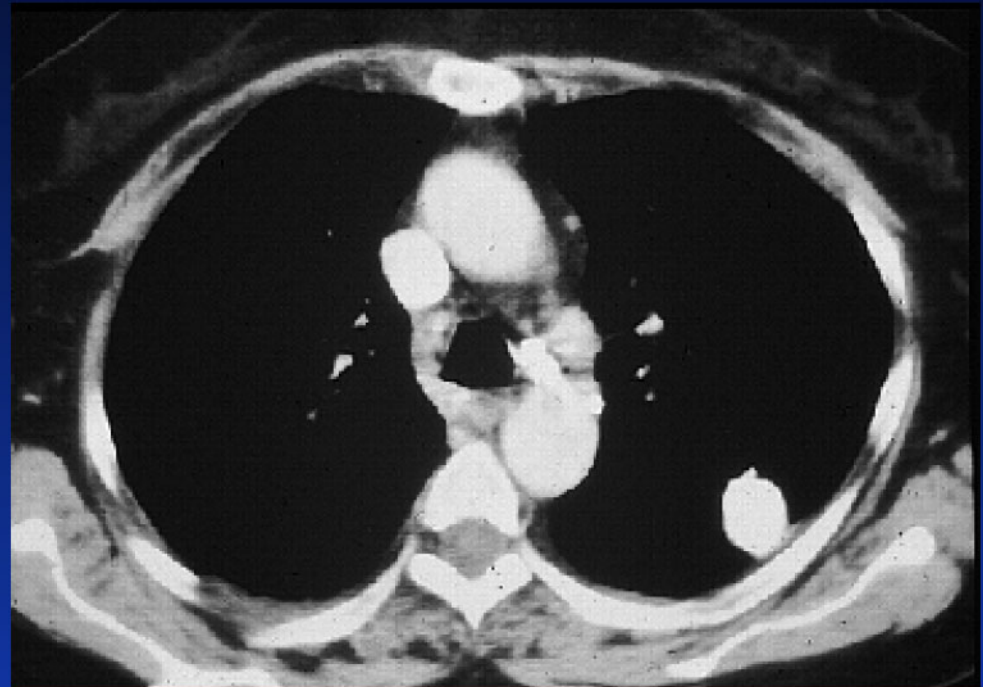


**Benign, esp. granuloma**

# Benign calcification

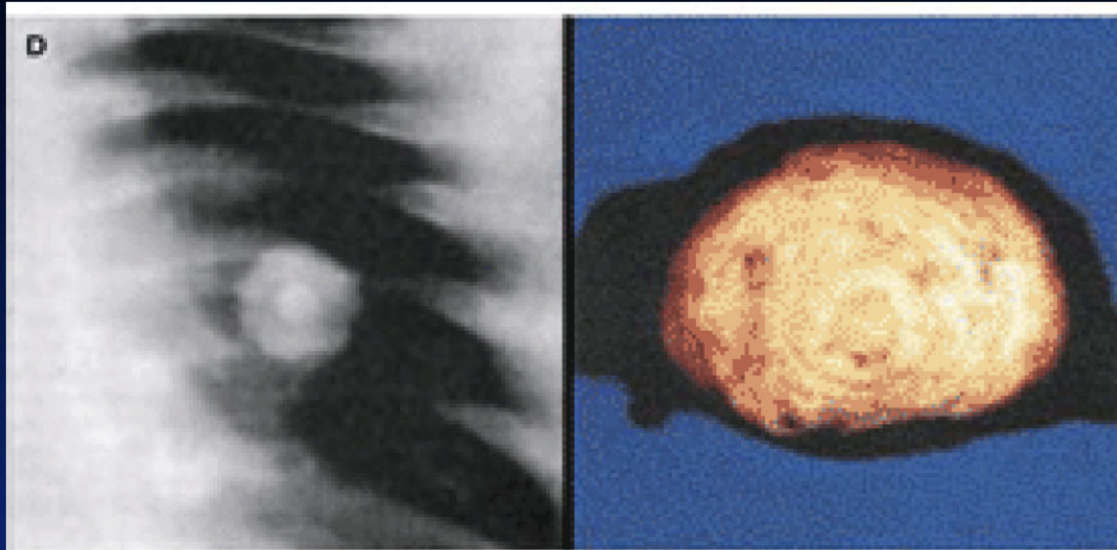


**Central nidus calcification**



**Diffuse calcification**

# Benign calcification



**Histoplasmosis**

**Laminated calcification**



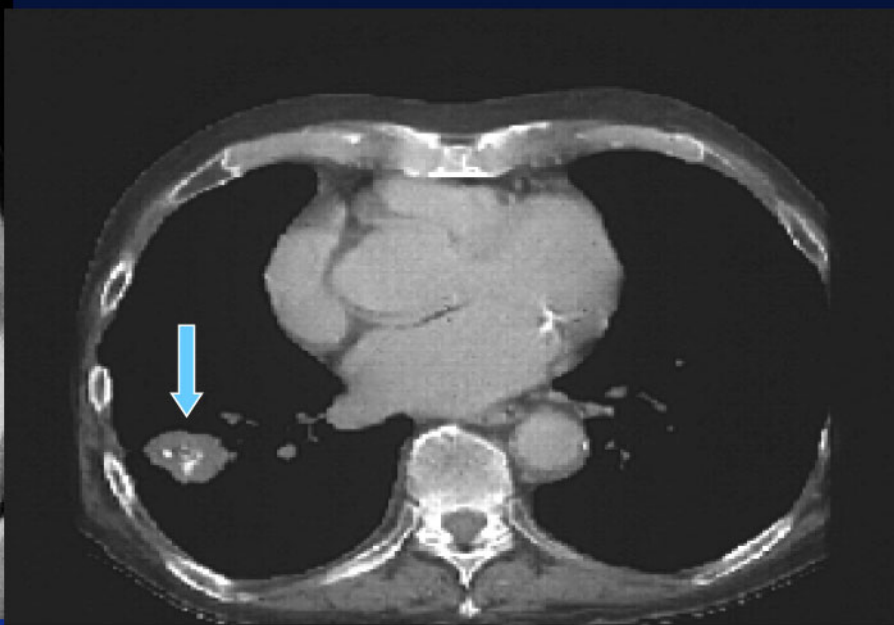
**Hemangioma**

**Popcorn-like calcification**

# Malignant calcification



**Amorphous calcification**



**Punctate calcification**

# Malignant calcification



**Figure 10:** CT scan in an 80-year-old man shows a 2.2-cm-diameter nodule in the left upper lobe with eccentric calcification. FNAB of the nodule revealed adenocarcinoma.



**Figure 11:** CT scan shows eccentric dense calcification in a right lower lobe carcinoid tumor.

## Eccentric Calcification

# Malignant calcification



**Pitfall: Take the history carefully**

**Dense, diffuse calcification resembles benign granuloma**

**Hx of osteosarcoma**

**-- metastasis from OGS**

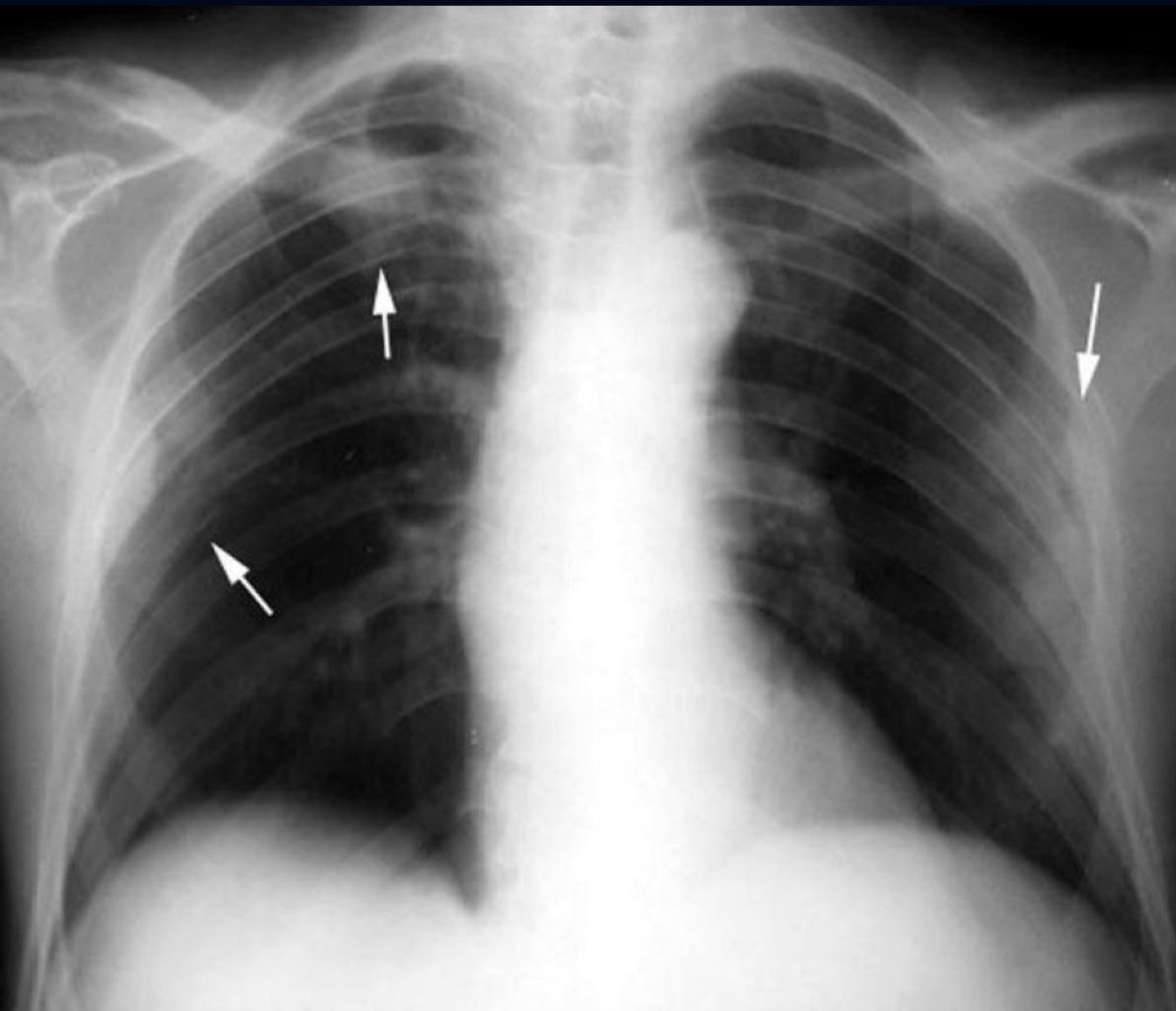
# D1: Doubling Time

- 在CXR上，tumor由single cell要長到 1 cm nodule 才容易看的到，期間需要經過 約30 doubling time。
- Malignancy的doubling time, range from **30-300 days or 1.8-18 months**
- 一般而言，lung cancer的doubling time：
  - Small cell carcinoma = **30 days**
  - Squamous cell, Large cell carcinoma = **90 days**
  - Adenocarcinoma = **120 days(30~180 days)**
- Rule of “2”
  - **Doubling time < 2wk or > 2 yrs: favor benign lesion**



# O: Other Associated Findings

- Rib destruction
- Satellite lesion
- Hilar/mediastinal LN enlargement
- Parenchymal scar
- Pleural effusion

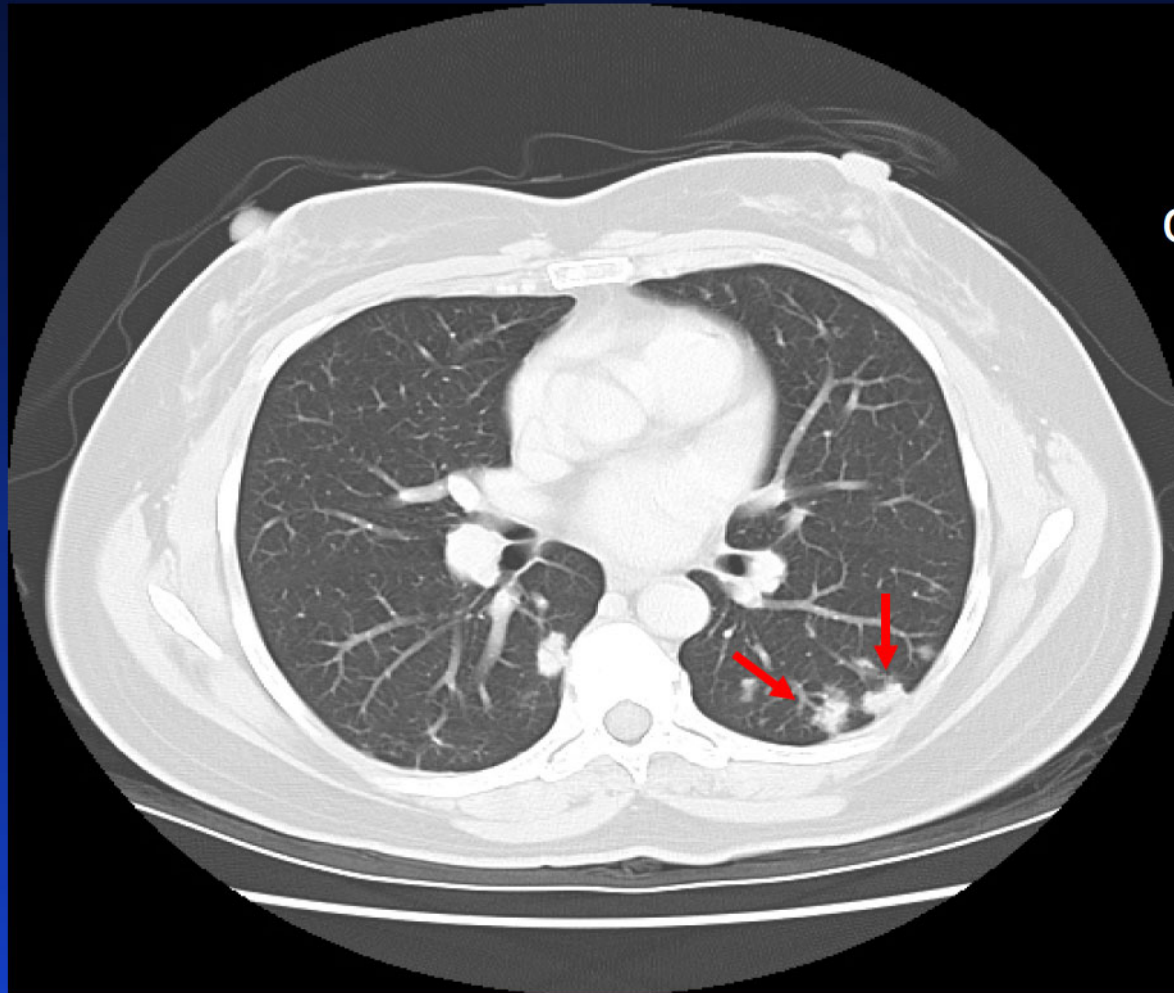


*Lung cancer with rib metastasis*

Solitary pulmonary nodule  
behind right clavicle

# Others: Satellite lesions

Benign: TB, fungus



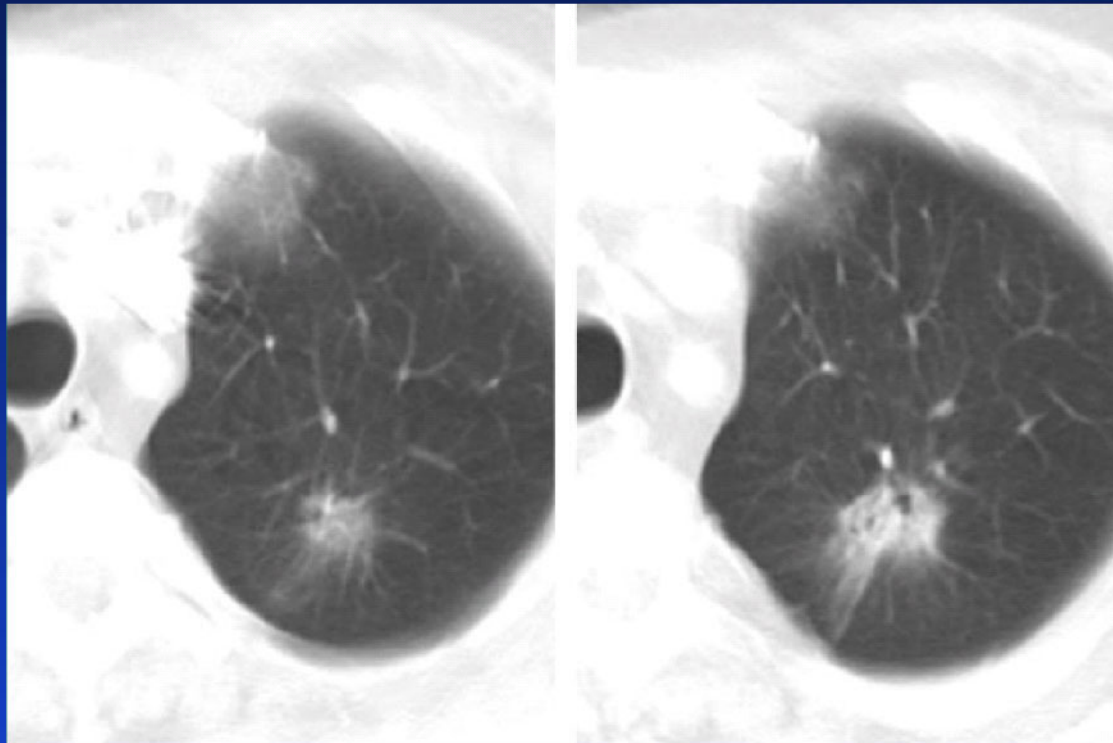
cryptococcus

# A1: Area/位置

- Malignant:
  - One study showed most missed lung cancers are located in the **right upper lobe**
  - In **IPF**, lung cancer is more common located over **periphery of lower lobe**, where fibrosis is most likely to occur.
  - Primary lung cancer
    - SCLC, SqCC: more **central**; high-tar, unfiltered cigarettes
    - Adenocarcinoma: more **peripheral**; low-tar, filtered cigarettes(可以吸得比較深)
- Benign:
  - Equally distributed over upper and lower lobes
  - TB: upper lobe or superior segment of lower lobe

## A2: Air-bronchogram

- 大多為**良性**，如pneumonia等感染性疾病
- 例外：但有時pneumonic-type lung cancer 或 lymphoma亦可見air-bronchogram (因為parenchymal lesion為consolidative type)。



# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

- **H**emodynamic- vascular
- **I**nfection
- **I**nflammation
- **N**eoplasm
- **C**ongenital (先天)
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

# **Hemodynamic- Vascular**

- **Cardiovascular**
  - Arteriovenous malformation (AVM)
  - Pulmonary artery aneurysm
  - Pulmonary vein varix
- **Thromboembolic**
  - Infarct(organizing)

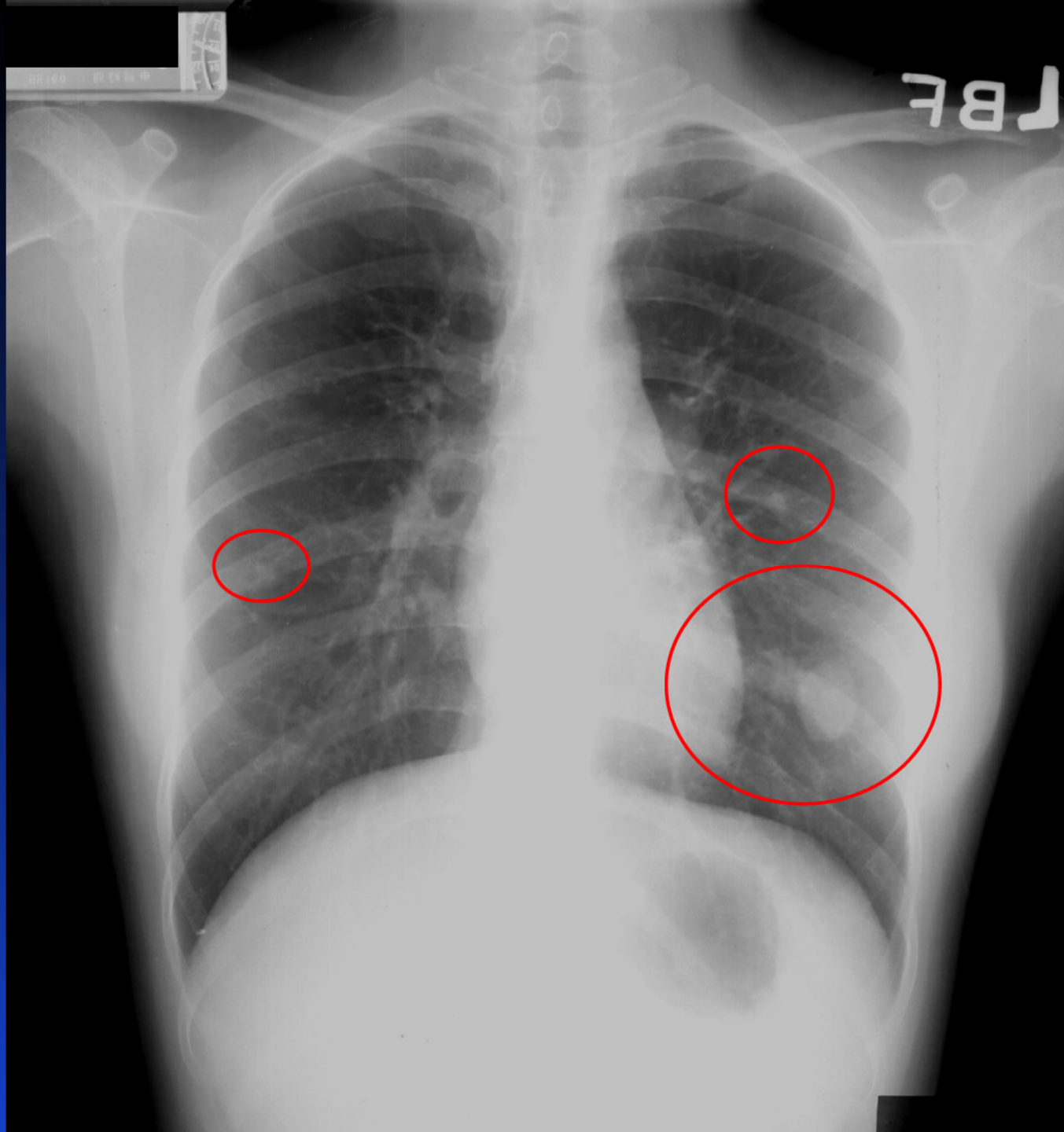
# Pulmonary AVM



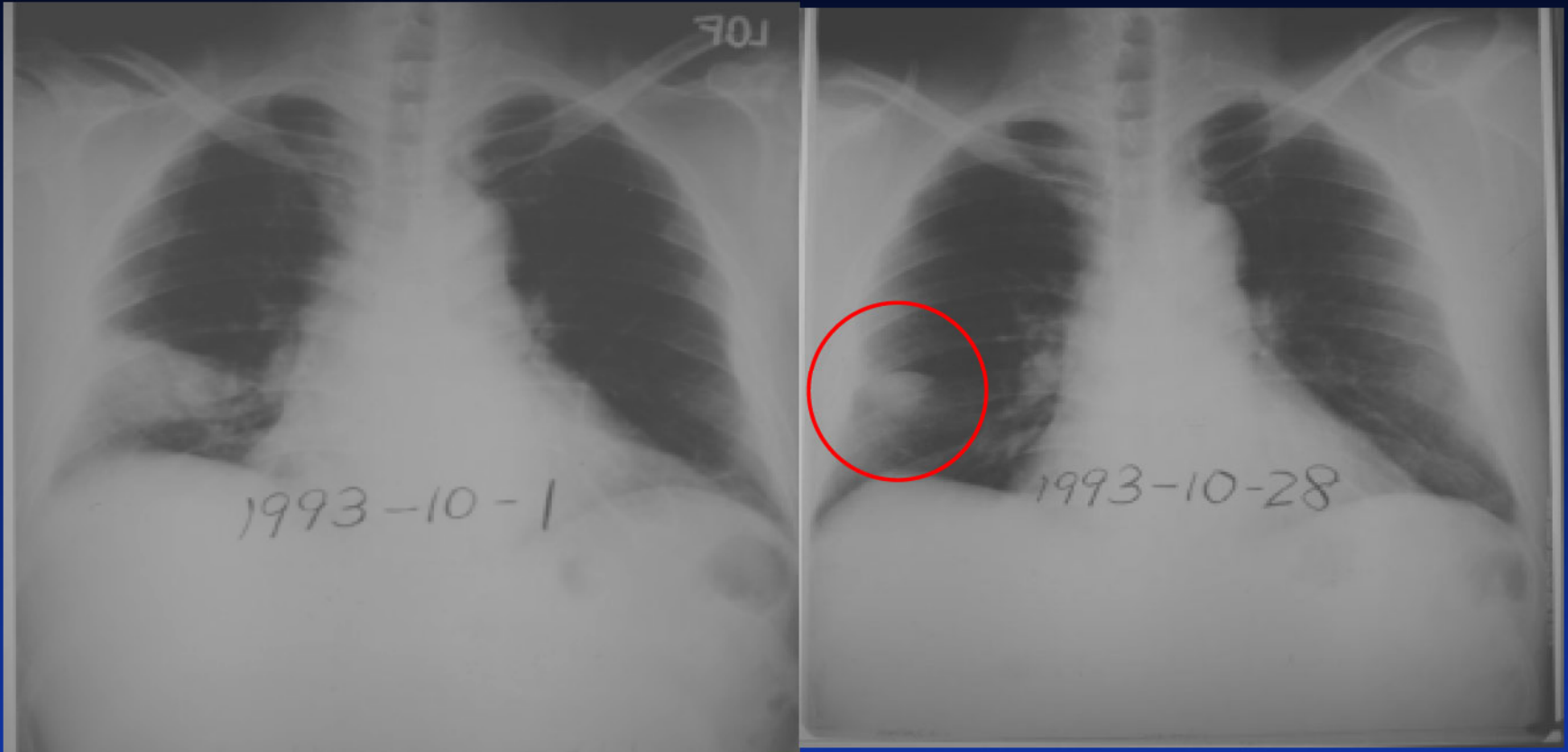
- Round or oval shape; somewhat **lobulated**, but sharply defined margin.
- Connected with **feeding a.** and **drainage v.**
- **1/3** have **multiple** lesions
- More common in **lower lobes**



# Pulmonary AVM



# Pulmonary Infarction (Hampton's hump/Melting sign)



**Melting sign:** shadow gradually diminishes while **maintaining its homogeneity and its original shape** (pneumonia resolution: shape change).

# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

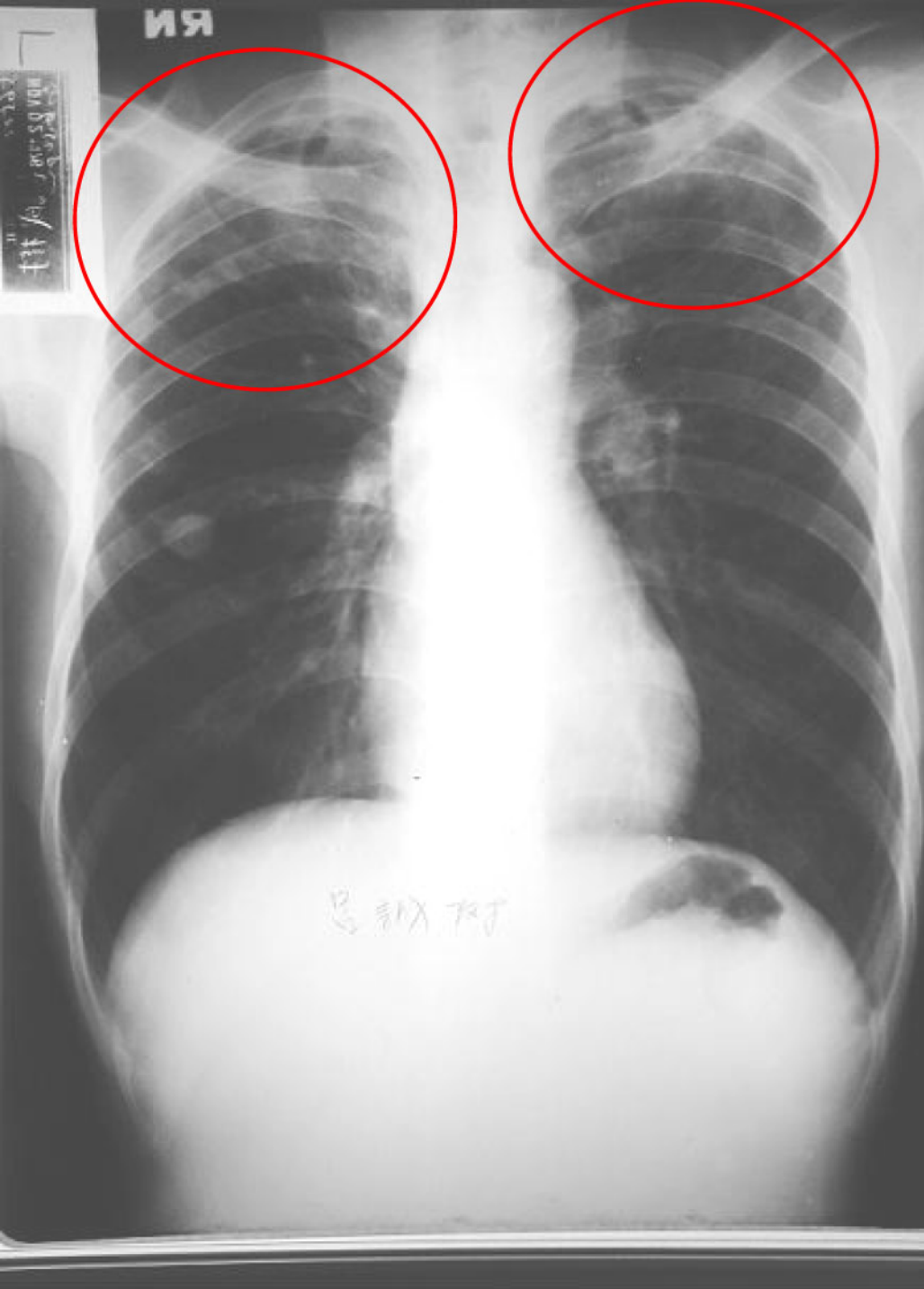
- **Hemodynamic- vascular**
- **Infection**
- **Inflammation**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

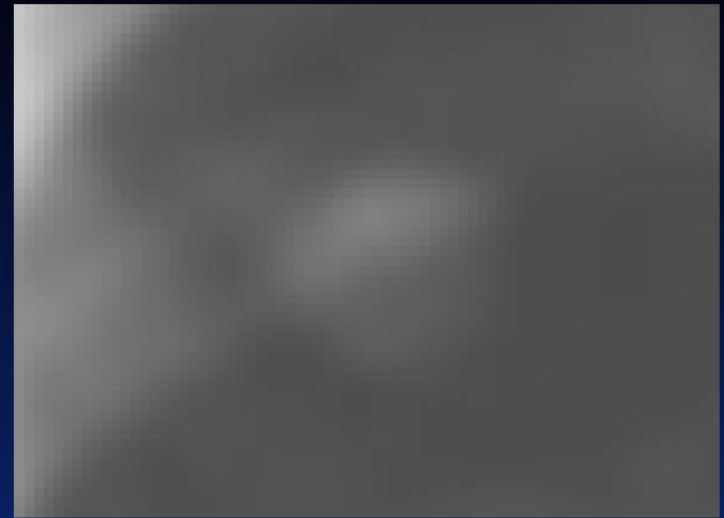
Figure 5: Chart shows differential diagnosis of SPN.

# Infection

- Bacteria:
  - Lung abscess
- TB: granuloma
- Fungus:
  - Cryptococcus
  - Aspergillosis: aspergilloma(fungus ball)
  - Coccidioidosis
  - Histoplasmosis
- Parasite
  - paragonimiasis



# Tuberculoma



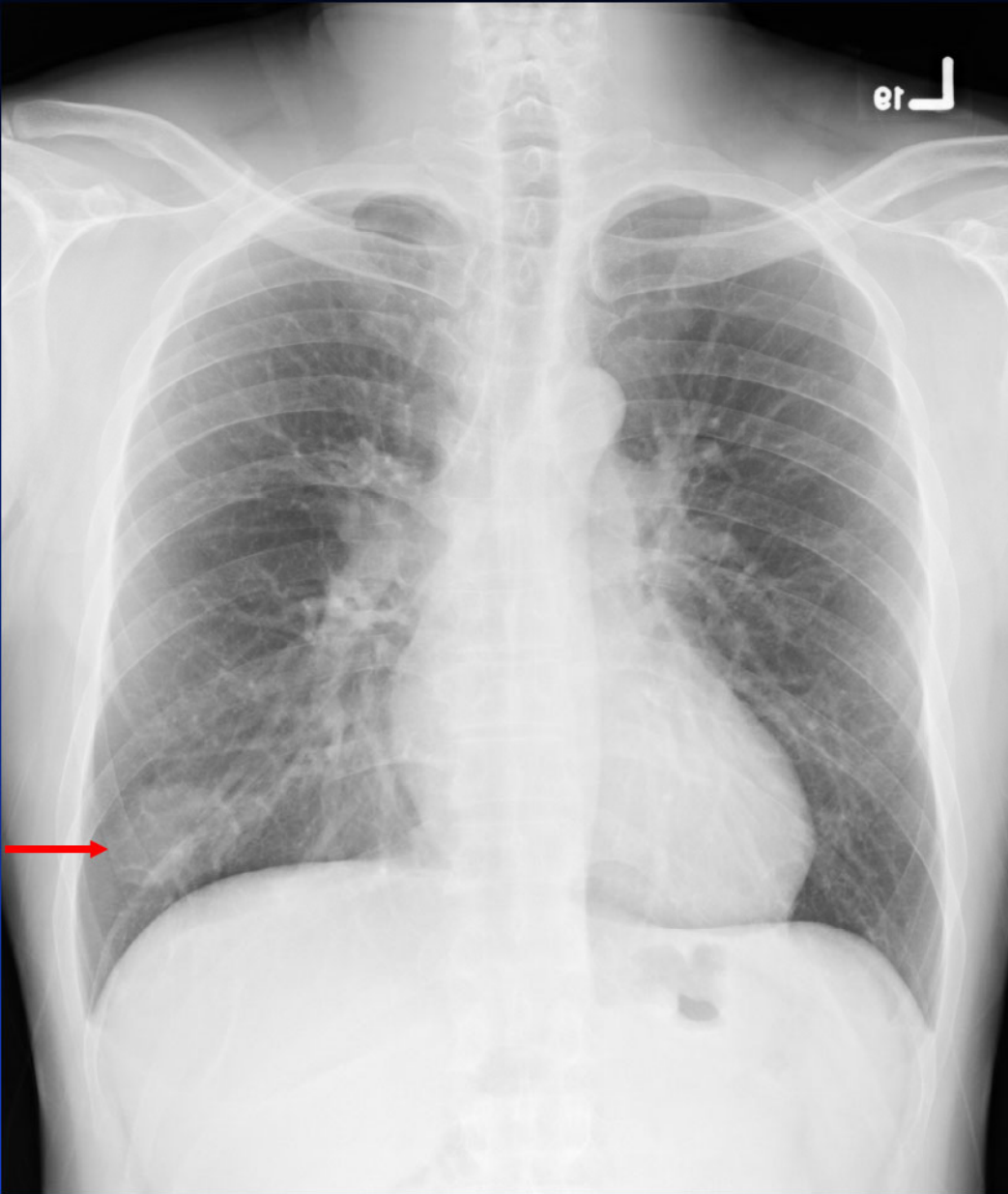
- Usually 1-4 cm, typically **smooth** and **sharply defined**; occasionally, lobulated or spiculated
- 多發生在**upper** lung field
- **Satellite lesions**: in 80% of cases
- **Calcification**: diffuse, central or punctate
- Cavitation: uncommon

# Tuberculoma

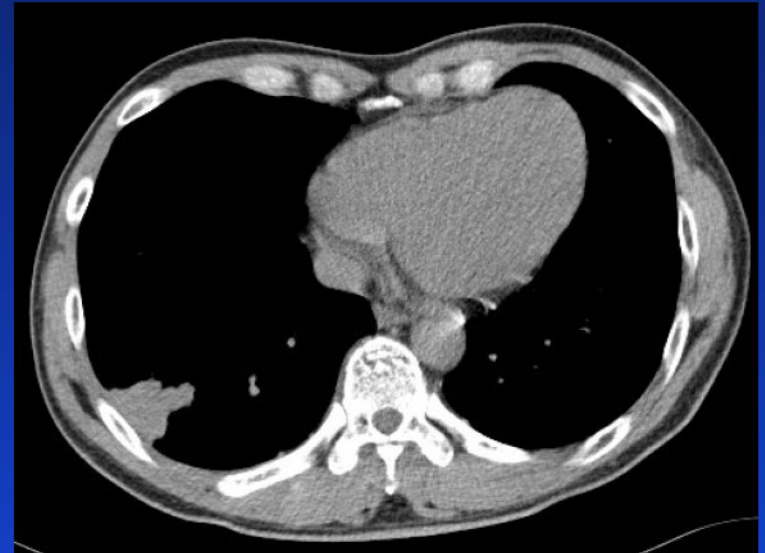


Densely calcified  
nodule

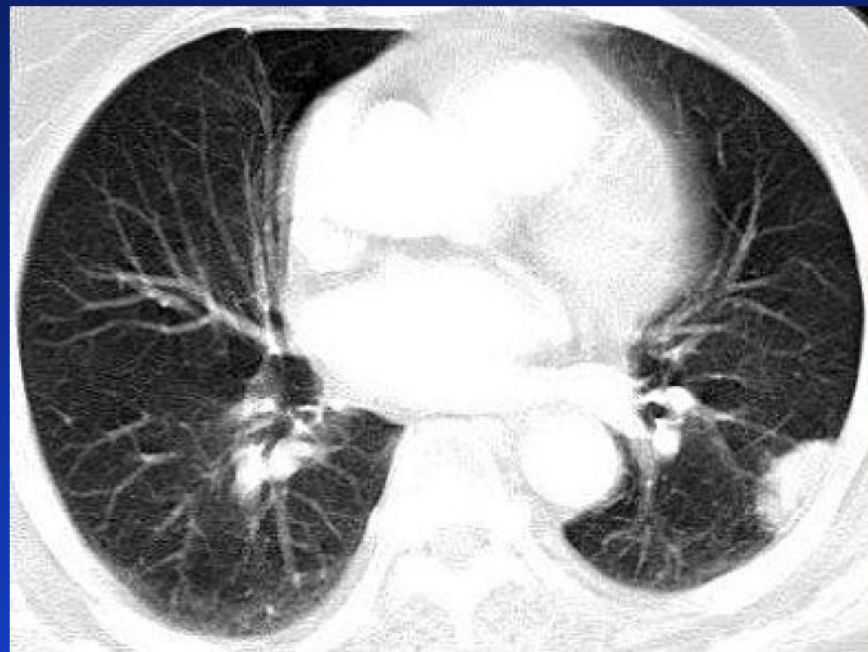
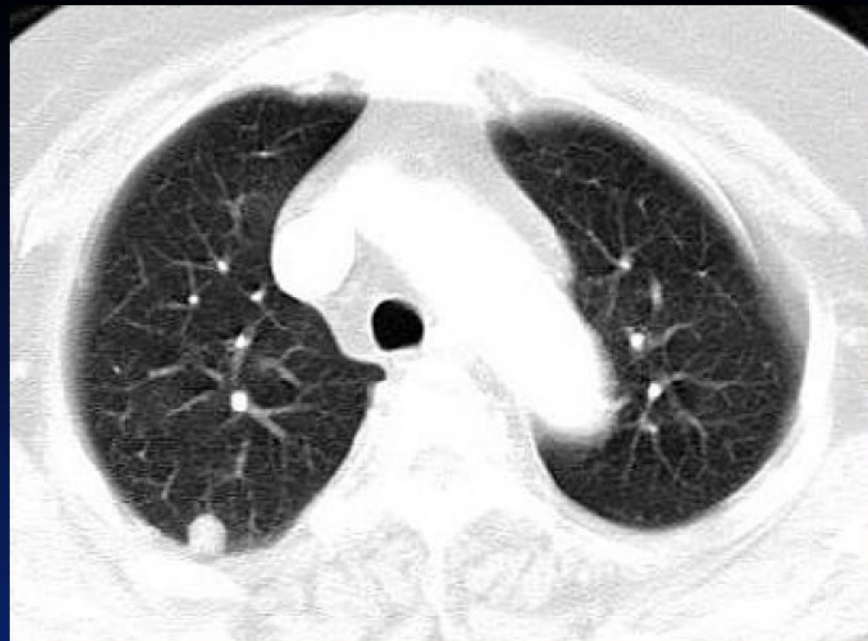
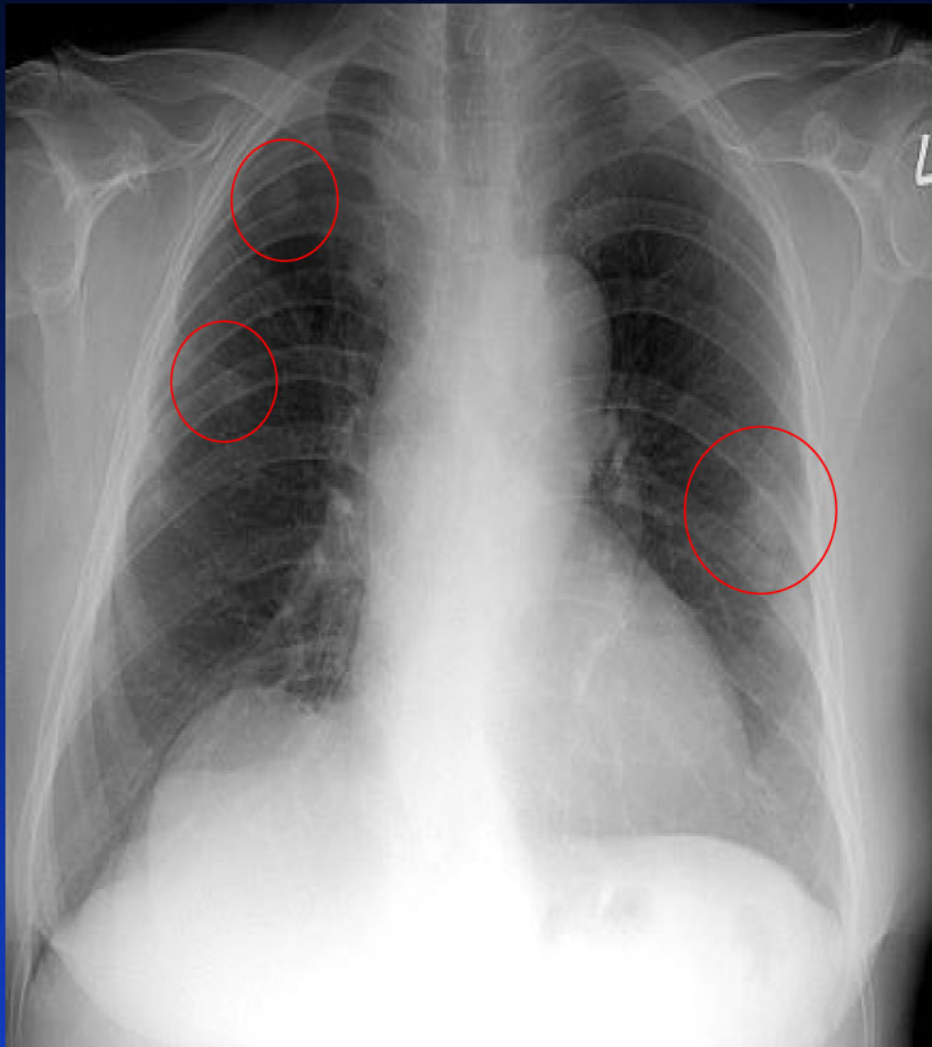
# Cryptococcus infection



- Solitary or multiple pulmonary nodules or masses
- 0.5~5cm in size; more common in lower and peripheral lung
- Focal areas of consolidation: air-bronchogram (+)

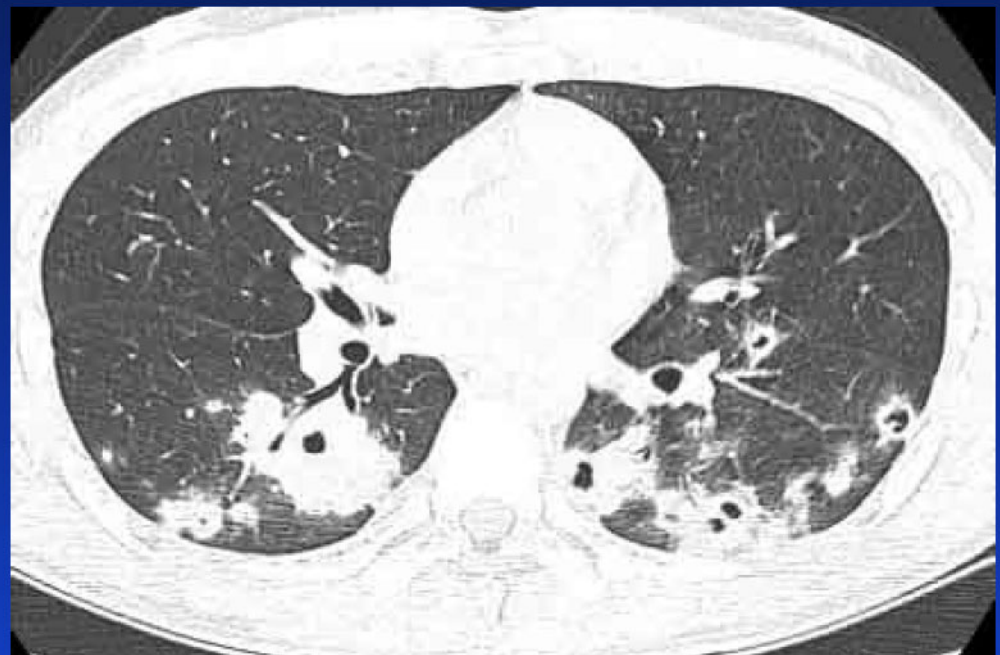


# Cryptococcus pneumonia





# Cryptococcal pneumonia



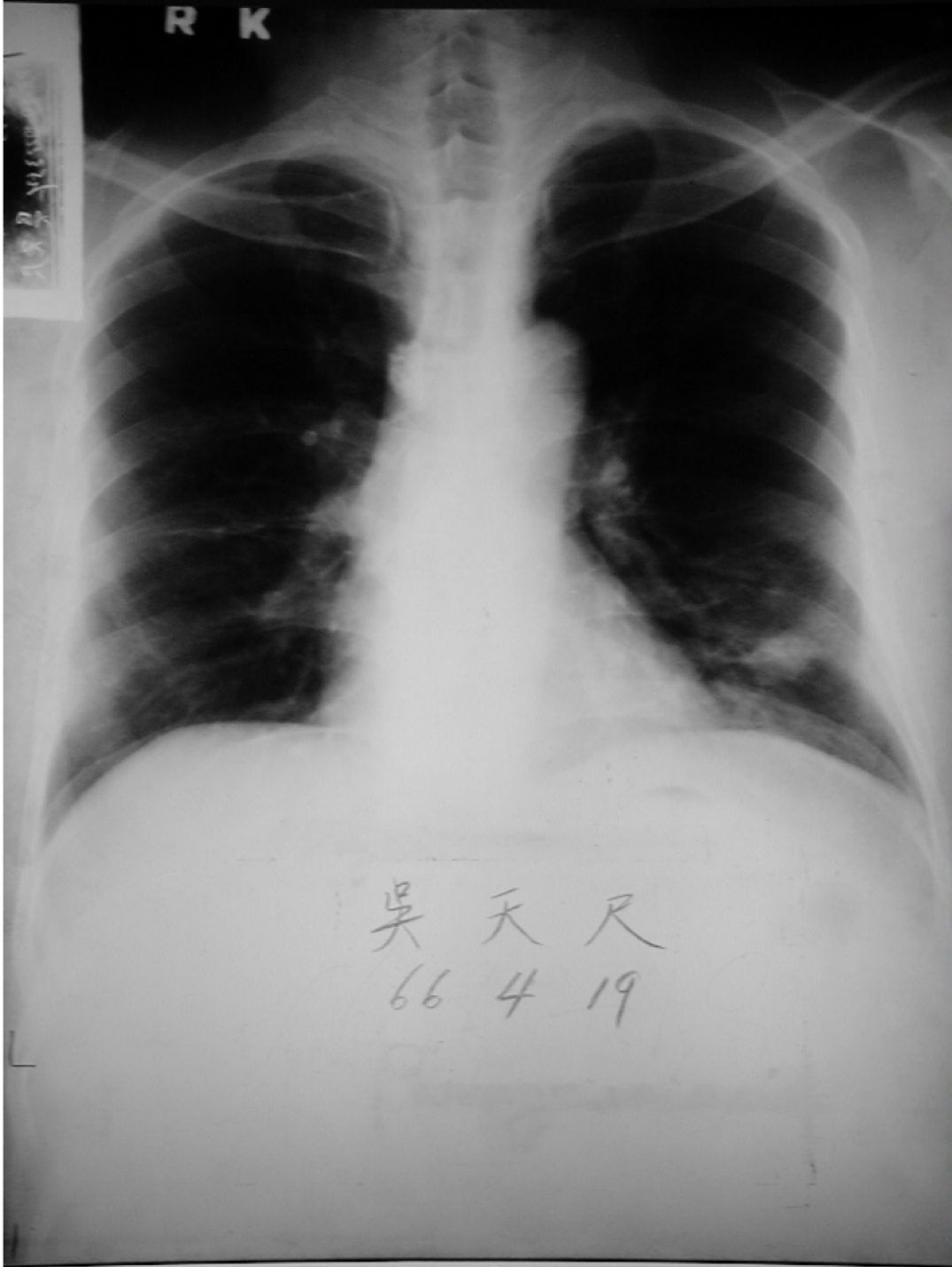
# Aspergilloma



**Multiple fungus ball within a cavity  
over RUL**



**Multiple irregular fungus balls virtually  
filling the pulmonary cavity**



# Paragonimiasis

## 肺吸蟲病



# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

- **Hemodynamic- vascular**
- **Infection**
- **Inflammation: GPA, RA**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

# **Granulomatosis with polyangiitis (GPA) (Wegener Granulomatosis): mostly multiple**



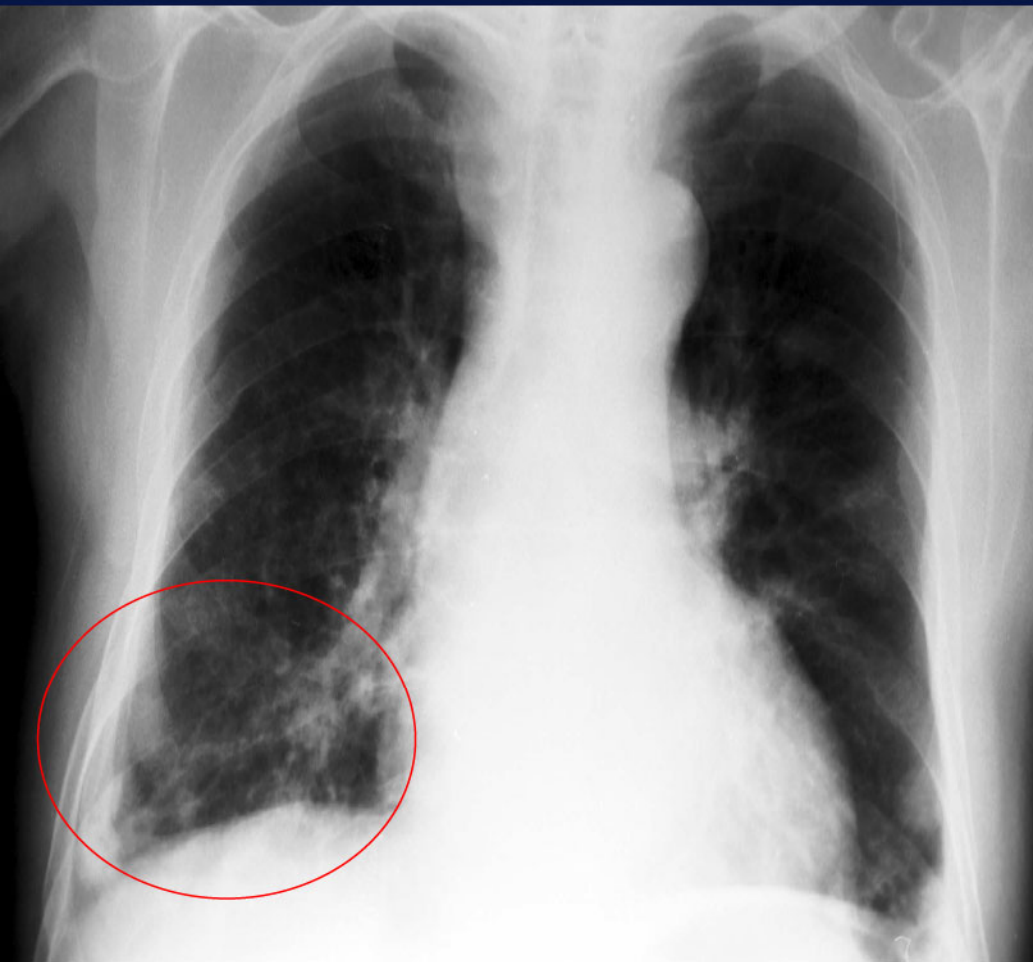
**bilateral irregular nodules and a mass in the right lower lobe**



**multiple irregular nodules in a peribronchovascular distribution**

# Rheumatoid Arthritis

- Pulmonary nodules
  - Uncommon; usually associated with **advanced** disease
  - Usually **multiple** and **well circumscribed**, they often result in **thick-walled cavities**.



# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

- **Hemodynamic- vascular**
- **Infection**
- **Inflammation**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

# Lung Cancer

- Could be any size
- Often **irregular, spiculated margin**
- **Tail sign**: mostly in **adenocarcinoma**
- **Cavitation**: most in **squamous cell carcinoma > 3 cm**
- Contrast-enhancement in CT
- Associated findings:
  - Hilar / mediastinal LN enlargement
  - Rib destruction / PE
  - Rarely with satellite lesions



Squamous cell  
Carcinoma of lung:  
lobulated border

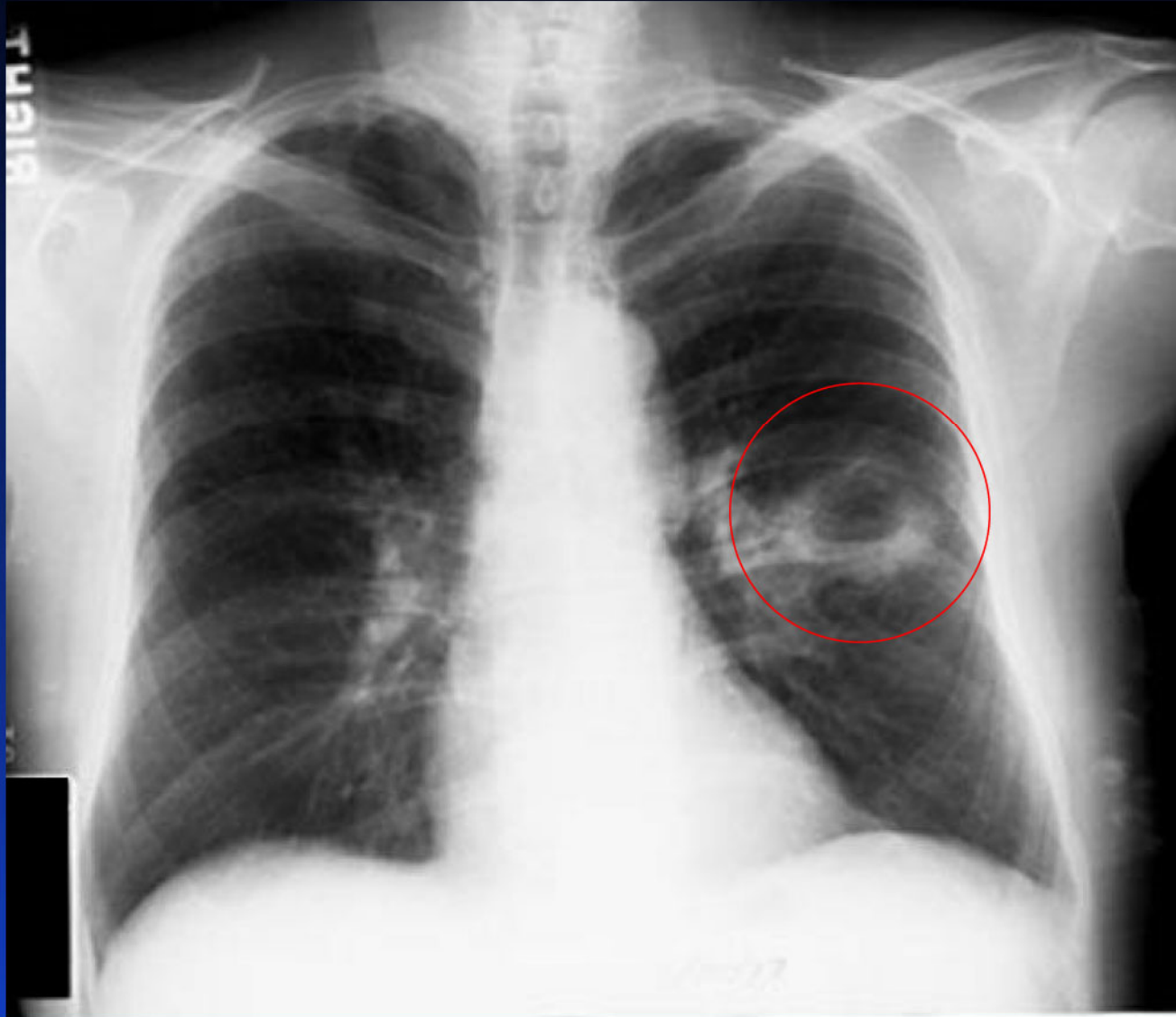




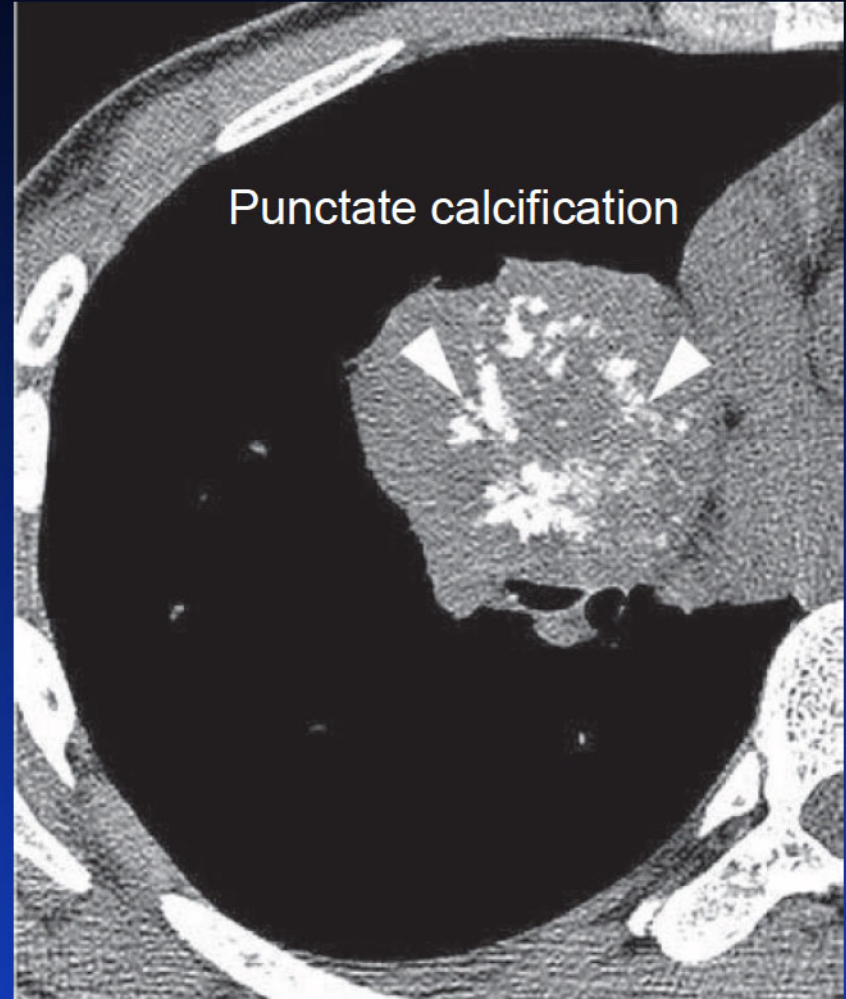
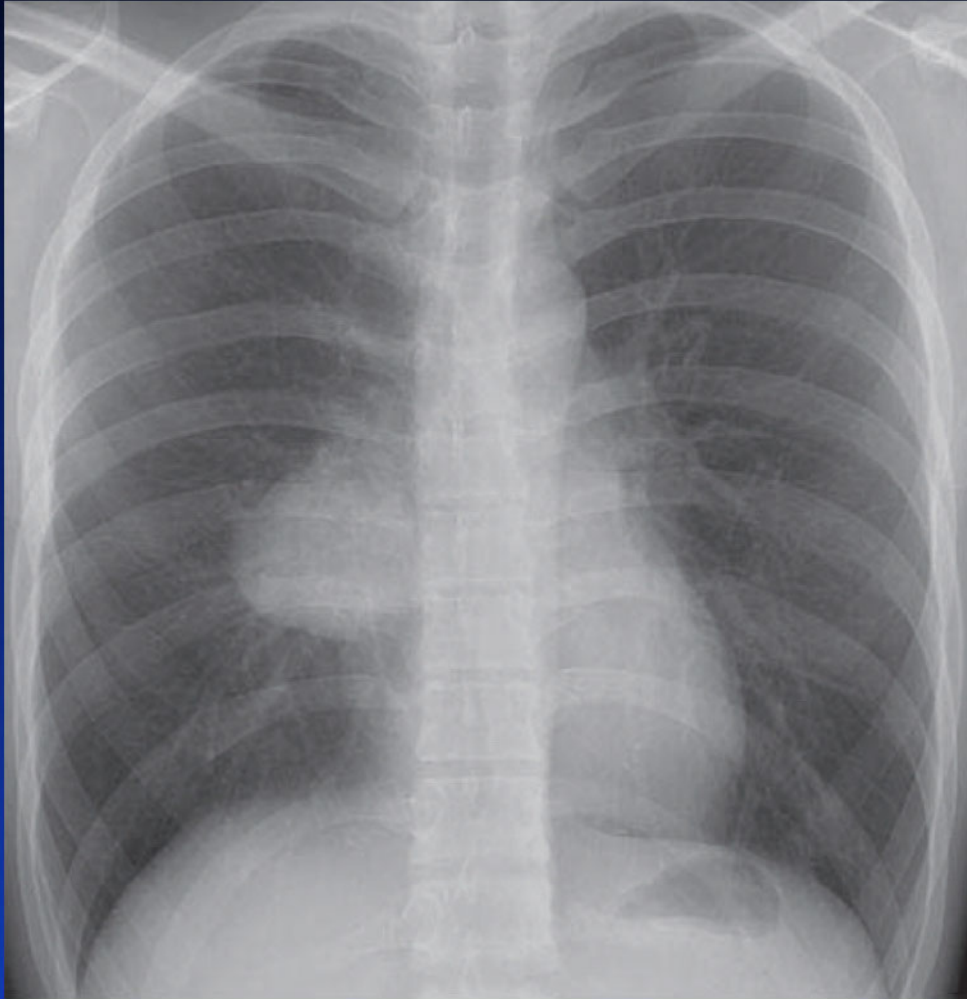
*Tail sign*

**Adenocarcinoma**

# Squamous Cell Carcinoma of Lung

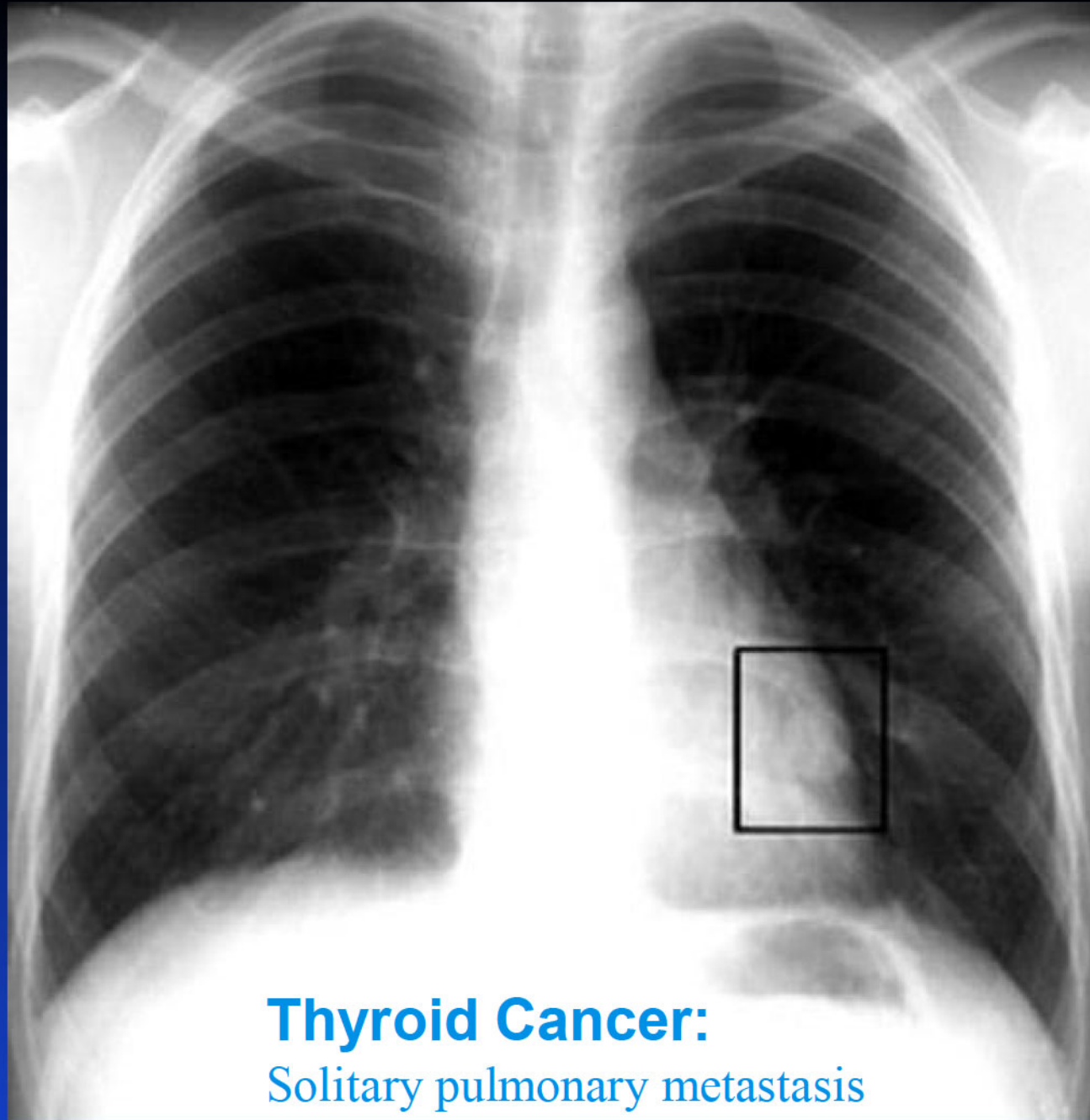


# Typical Carcinoid

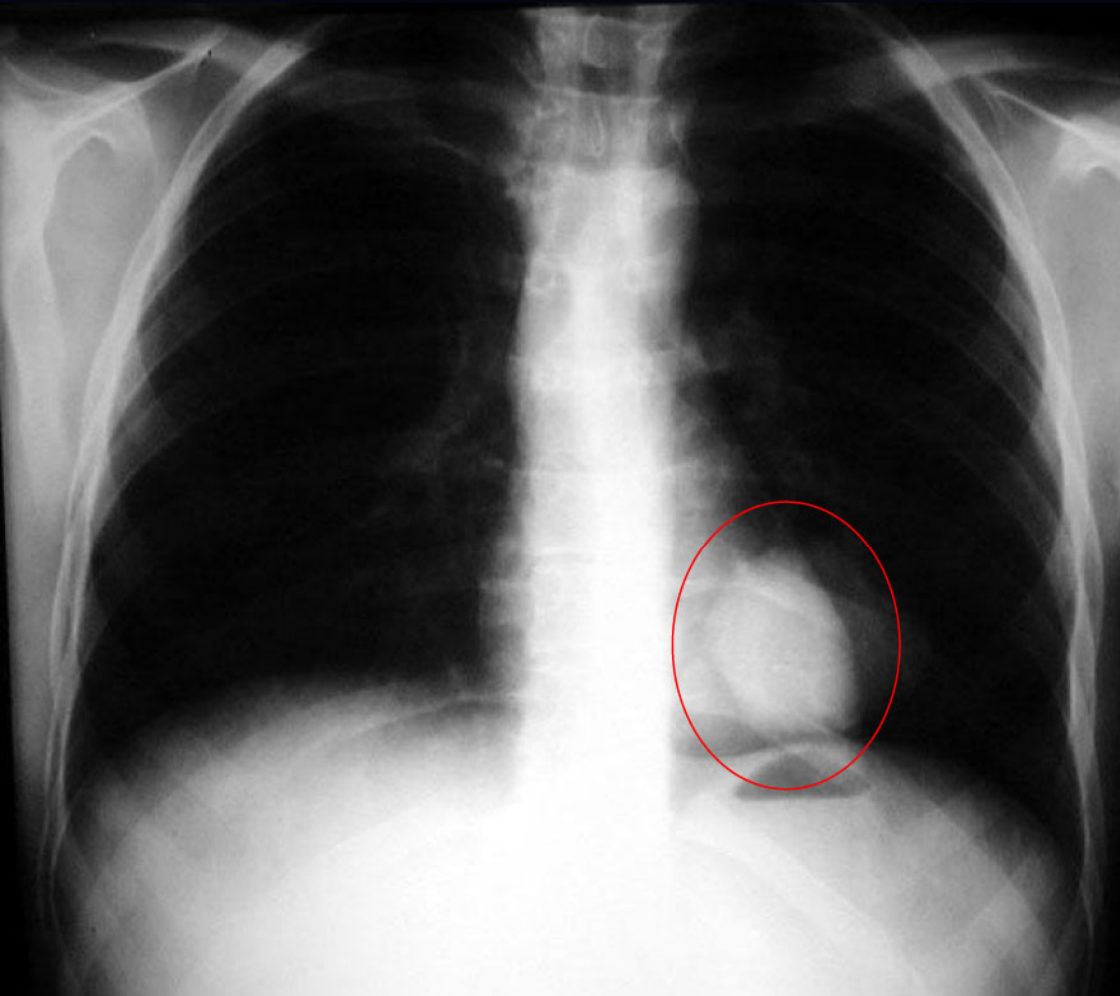


# Metastasis

- Solitary metastasis is relatively uncommon.
- Certain metastasis are more likely to produce solitary metastases: **colon** (esp. rectosigmoid ca), **kidney, testes, ovary** cancer; **sarcoma** (esp. bone); **malignant melanoma**.
- **50% have smooth margins; round, oval or lobulated contour.**

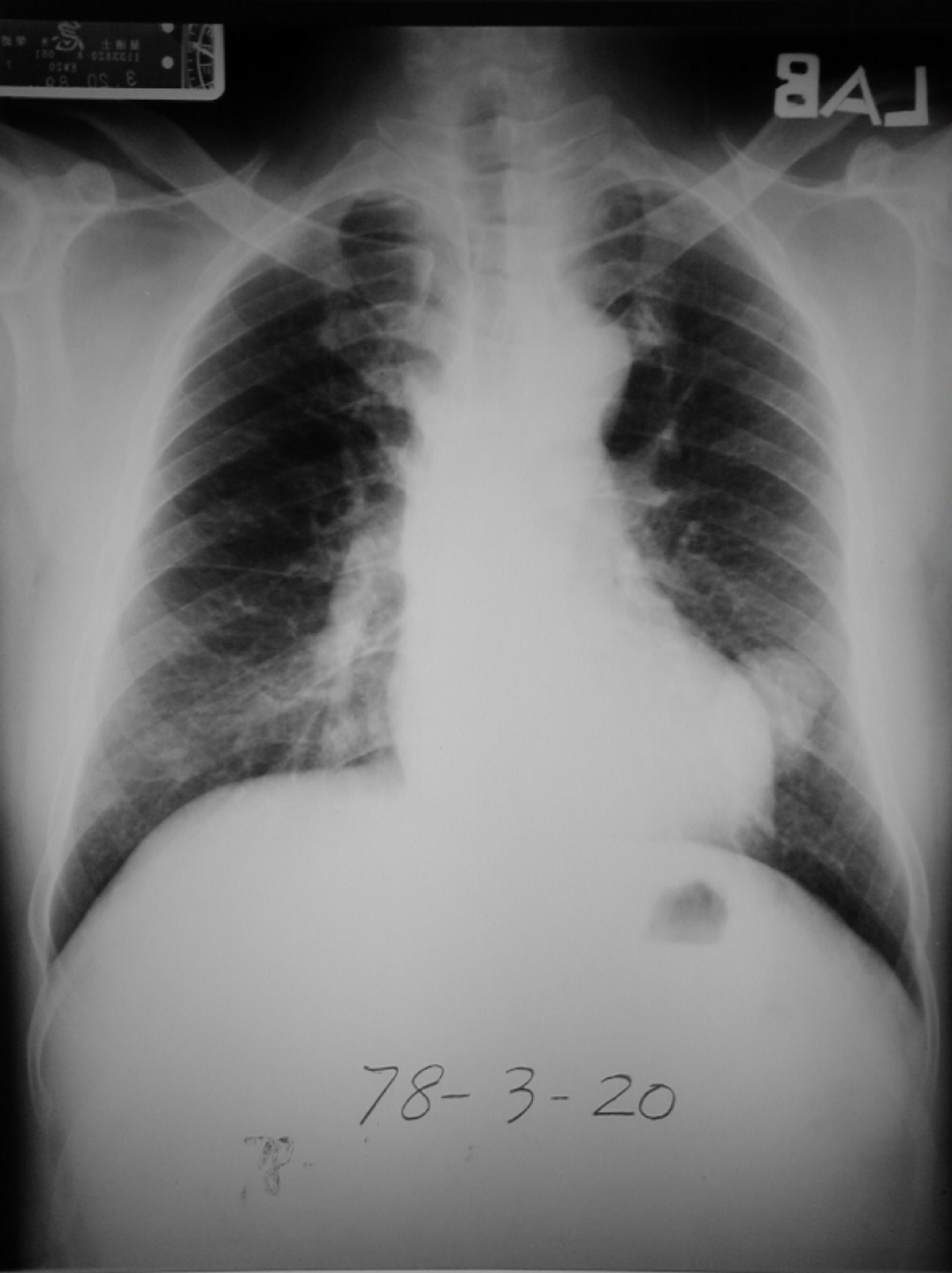


**Thyroid Cancer:**  
Solitary pulmonary metastasis



## **Malignant melanoma metastatic to lung**

- Mass density LLL
- Retrocardiac soft tissue density



## Hamartoma

- Benign neoplasm
- Spherical, lobulated, notched
- Rarely > 4cm in size



**Harmatoma**

**Popcorn  
Calcification**

# Sclerosing hemangioma

Solitary well-defined, round pulmonary nodule, usually enhances inhomogeneously after contrast.





# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

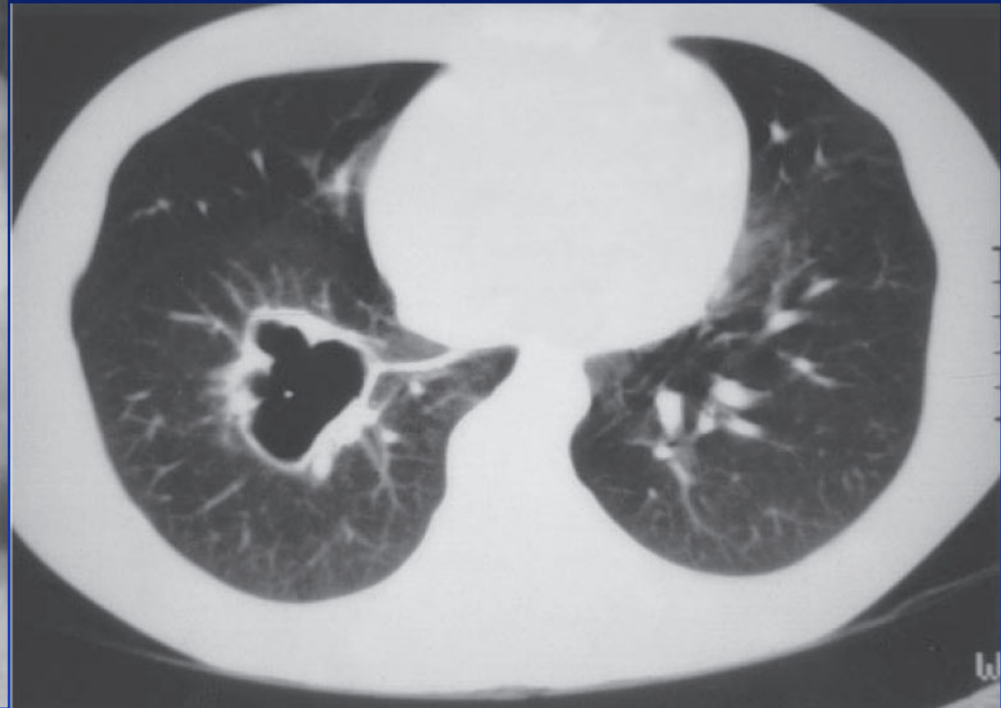
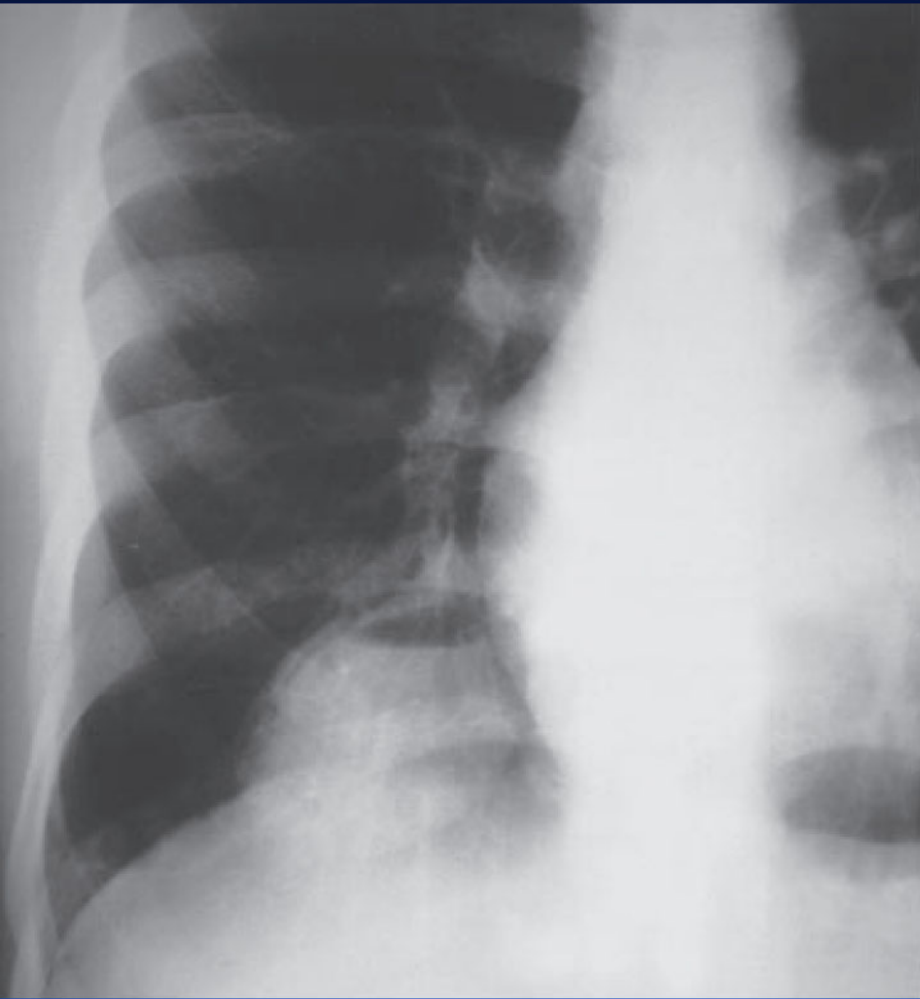
- **Hemodynamic- vascular**
- **Infection**
- **Inflammation**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

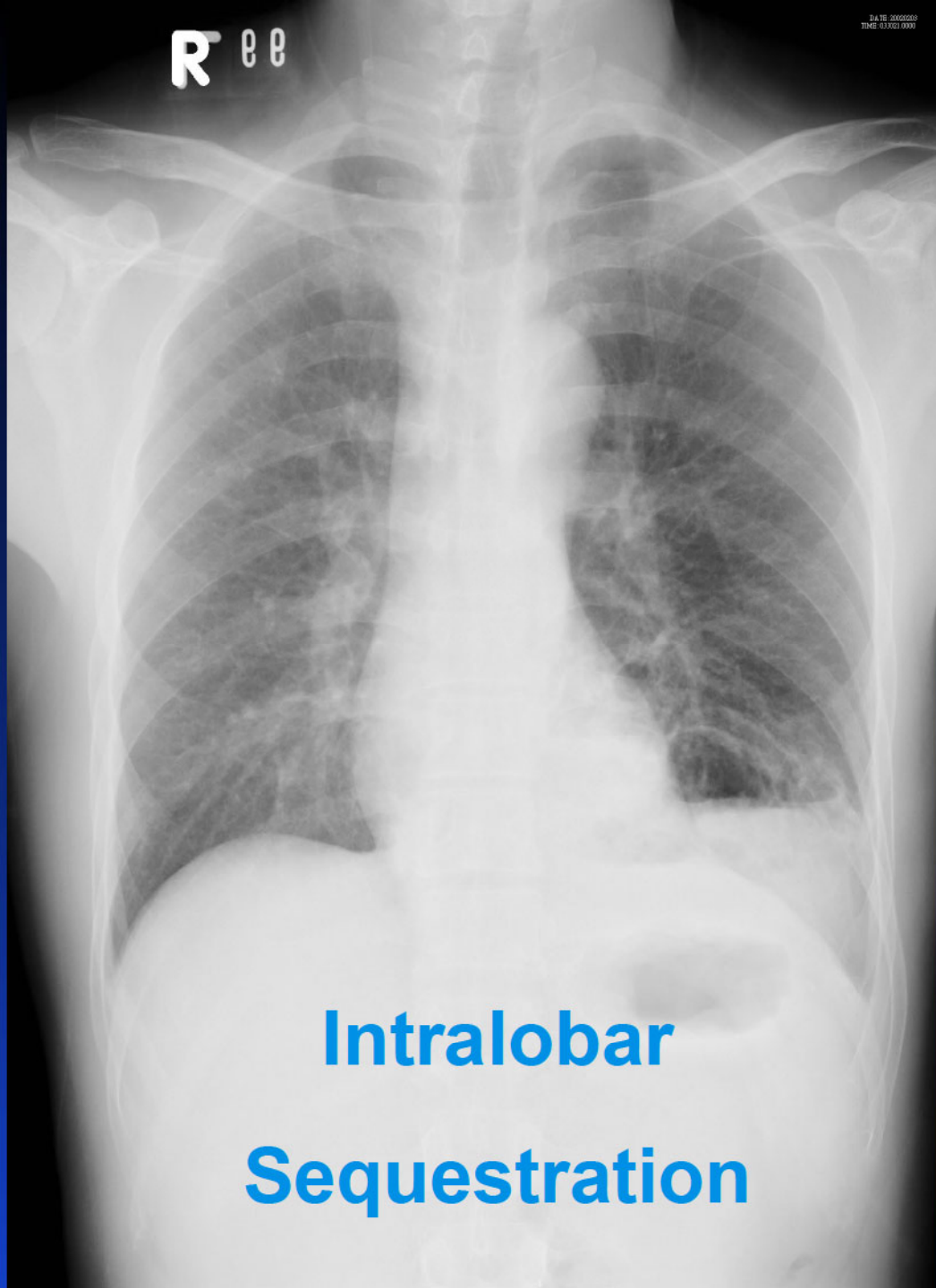
# Bronchogenic Cyst

- Usually **solitary, well-defined, thin-walled, and unilocular.**
- The common location is the **lower lobes.**



R ee

RA 18 2000000  
TIME 01:01:00

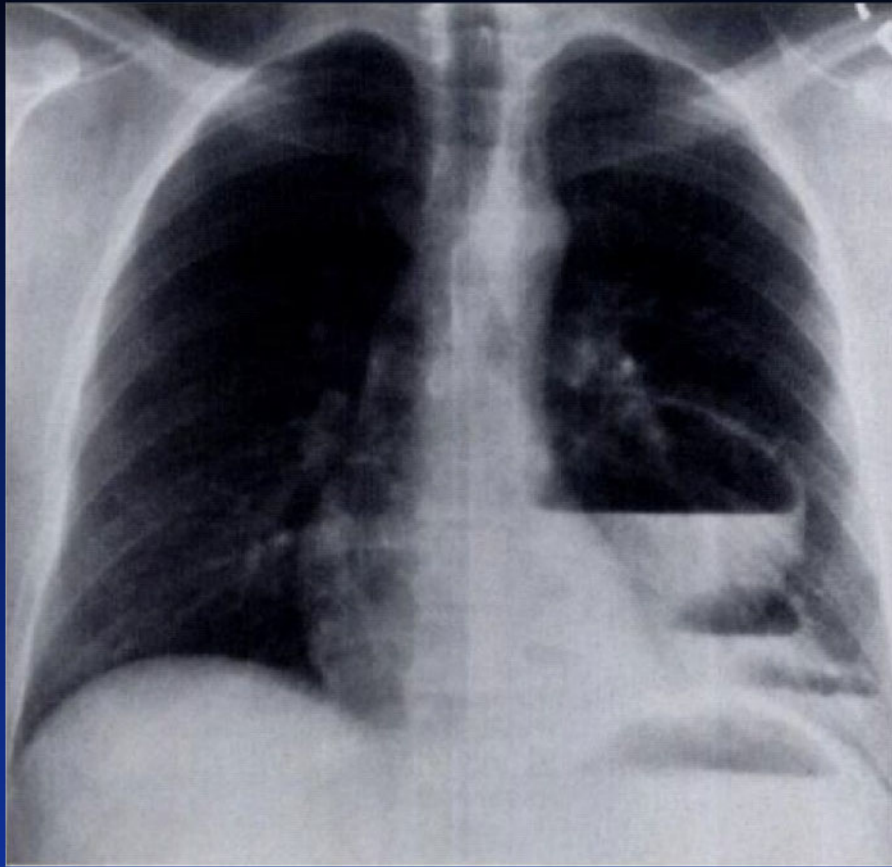


Intralobar  
Sequestration

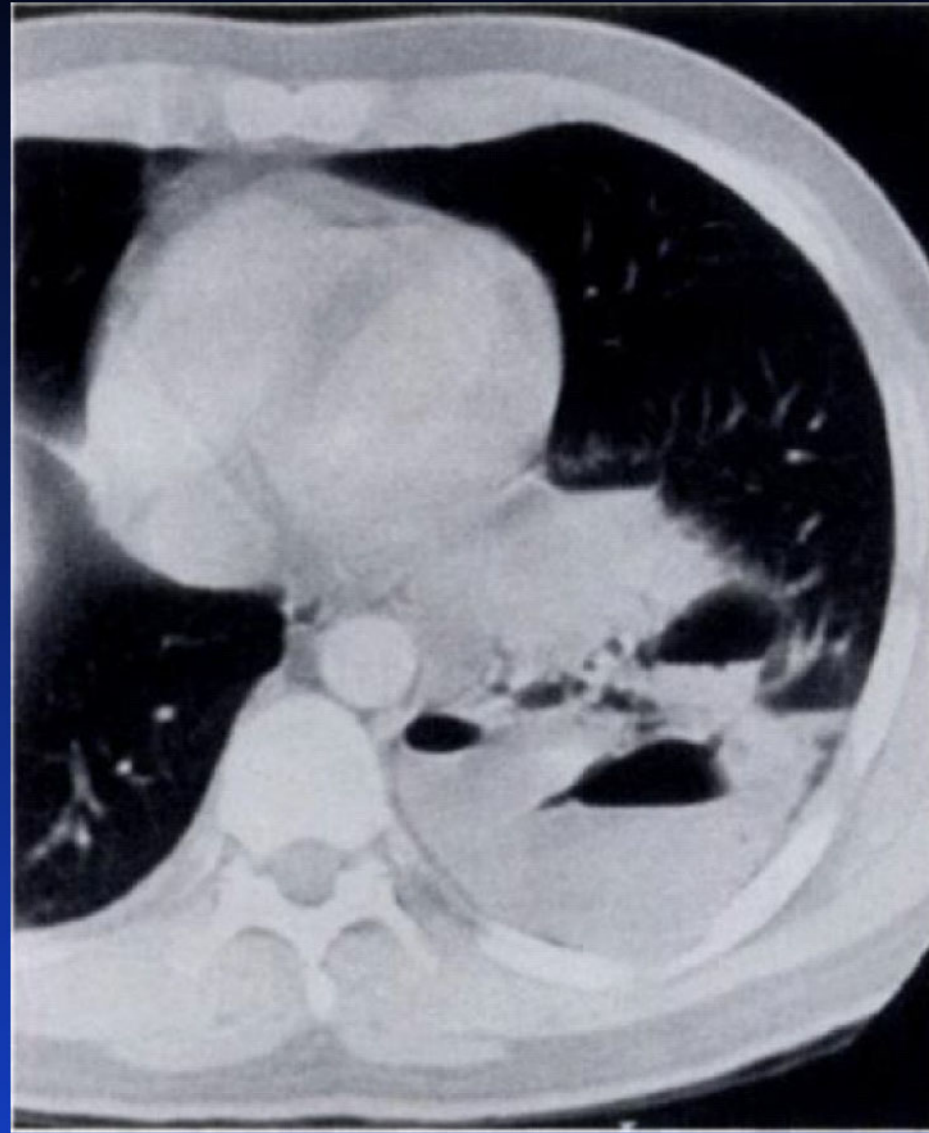
## Pulmonary Sequestration

- CXR:
  - Uncomplicated:
    - Usually a homogeneous consolidation with irregular margins or as a uniformly dense mass with smooth or lobulated contours, in the lower lobe
  - Complicated with advanced chronic infection
    - Predominantly cystic/cavitary lesion, single large cyst or multiple cysts of variable size.

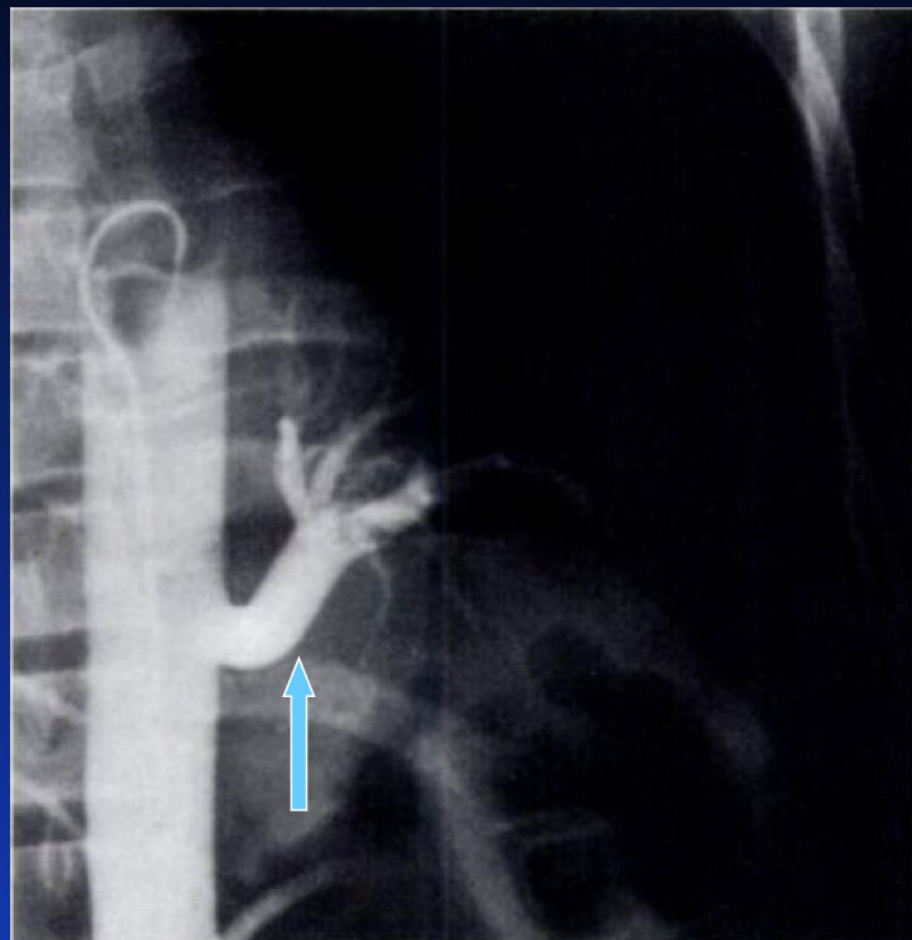
# Intralobar Sequestration



**Multiple cystic mass containing several air-fluid level in LLL**



# Intralobar Sequestration



A large artery from D-aorta  
supplying sequestration

# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

- **Hemodynamic- vascular**
- **Infection**
- **Inflammation**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

# Etiology of Multiple Pulmonary Nodules/masses – HIIN

- **H (hemodynamic)**
    - Cardiovascular
      - AVM
      - Organizing hematoma
    - Thromboembolic
      - Organizing infarct
  - **I (infection)**
    - Bacteria:
      - Septic emboli
      - Leptospirosis
    - TB:
      - Miliary TB
      - TB granuloma
    - Fungus:
      - Cryptococcus
      - Histoplasmosis: USA
    - Virus: atypical measles
    - Nocardiosis
  - **I (inflammation/inhalation)**
    - Collagen-vascular
      - Wegener's granulomatosis
      - Rheumatoid nodules
    - Sarcoidosis
    - Pneumoconiosis
  - **N (neoplasm)**
    - Metastasis
    - Lymphoma
- 多發性肺結節和腫塊之etiology與單一性肺結節之etiology大同小異。但以metastatic disease最為常見。

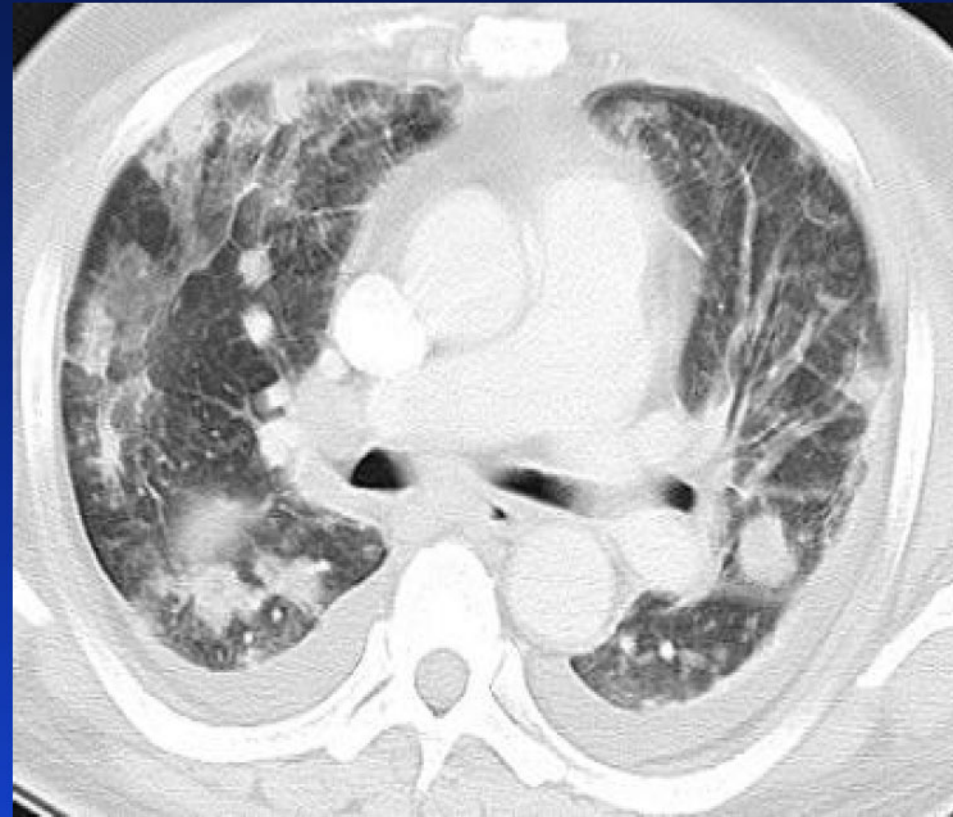
# Etiology of Multiple Pulmonary Nodules/masses – HIIN

- **H (hemodynamic)**
    - Cardiovascular
      - AVM
      - Organizing hematoma
    - Thromboembolic
      - Organizing infarct
  - **I (infection)**
    - Bacteria:
      - Septic emboli
      - Leptospirosis
    - TB:
      - Miliary TB
      - TB granuloma
    - Fungus:
      - Cryptococcus
      - Histoplasmosis: USA
    - Virus: atypical measles
    - Nocardiosis
  - **I (inflammation/inhalation)**
    - Collagen-vascular
      - Wegener's granulomatosis
      - Rheumatoid nodules
    - Sarcoidosis
    - Pneumoconiosis
  - **N (neoplasm)**
    - Metastasis
    - Lymphoma
- 多發性肺結節和腫塊之etiology與單一性肺結節之etiology大同小異。但以metastatic disease最為常見。



# Septic embolism

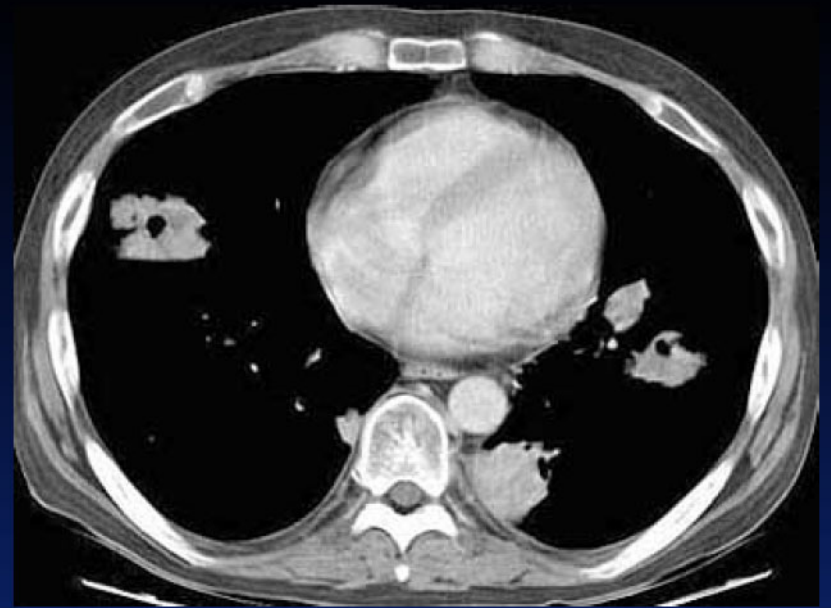
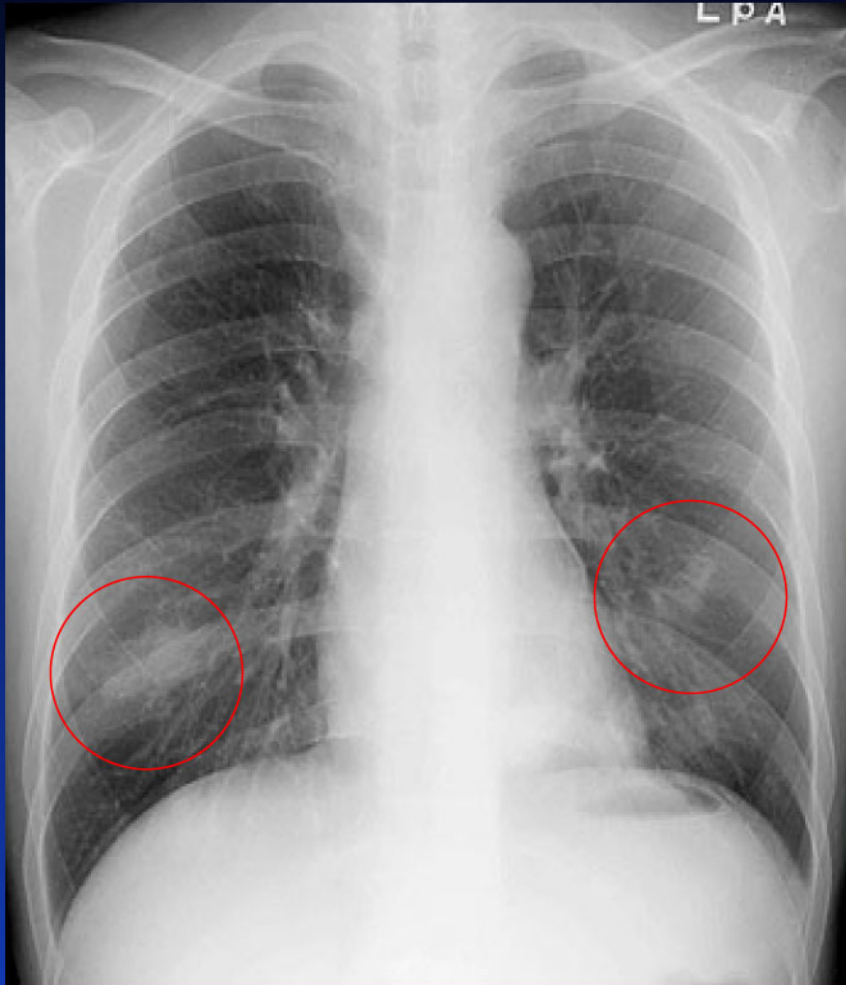
- Multiple, bilateral **patchy areas of consolidation** rapid evolving into **ill-defined cavitory nodules**





Septic emboli, cavity  
*Staphylococcus aureus*

# Pulmonary TB



# Nocardiosis

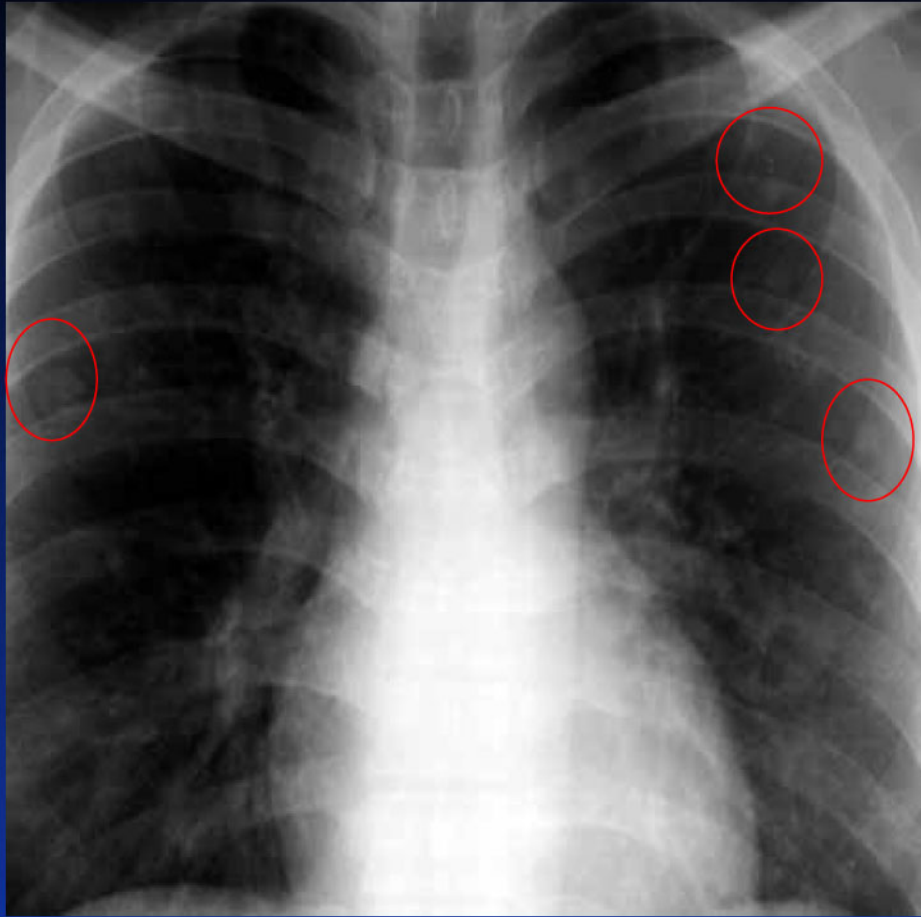
- The typical radiologic manifestations:
  - **Nodules and areas of consolidation**, with or without cavitation, that frequently involve the **pleural space**



# Pneumonia due to measles virus



poorly defined nodules and patchy consolidation in the left middle and lower lung zones.



**Varicella-Zoster pneumonia**

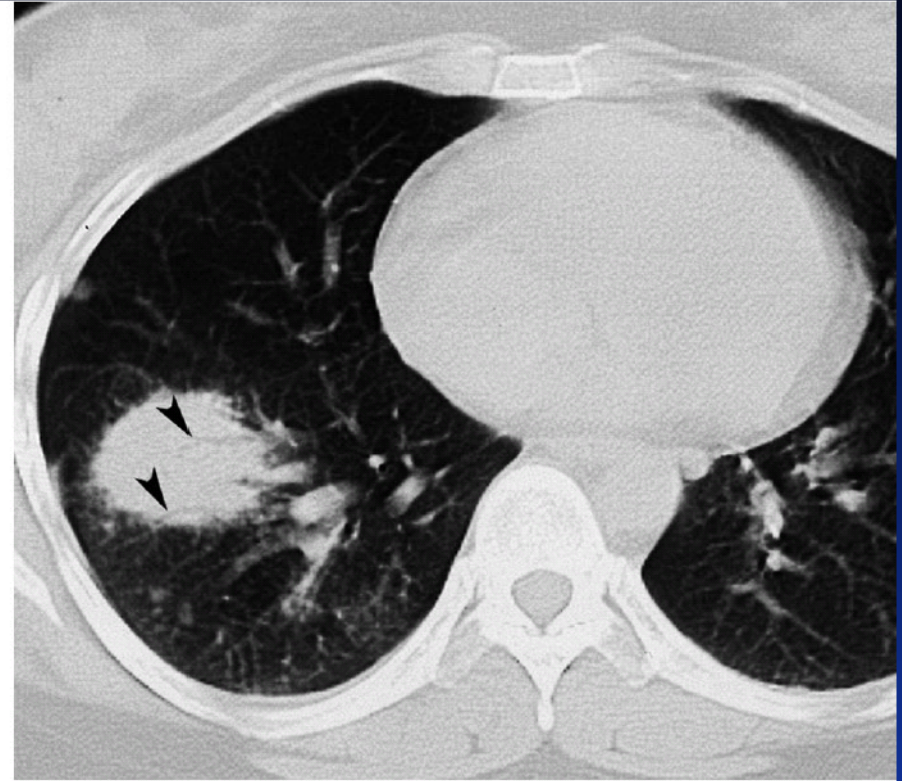
# Etiology of Multiple Pulmonary Nodules/masses – HIIN

- **H (hemodynamic)**
  - Cardiovascular
    - AVM
    - Organizing hematoma
  - Thromboembolic
    - Organizing infarct
- **I (infection)**
  - Bacteria:
    - Septic emboli
    - Leptospirosis
  - TB:
    - Miliary TB
    - TB granuloma
  - Fungus:
    - Cryptococcus
    - Histoplasmosis: USA
  - Virus: atypical measles
  - Nocardiosis
- **I (inflammation/inhalation)**
  - Collagen-vascular
    - Granulomatosis with polyangiitis
    - Rheumatoid nodules
  - Sarcoidosis
  - Pneumoconiosis
- **N (neoplasm)**
  - Metastasis
  - Lymphoma

# Alveolar Sarcoidosis



**a.**



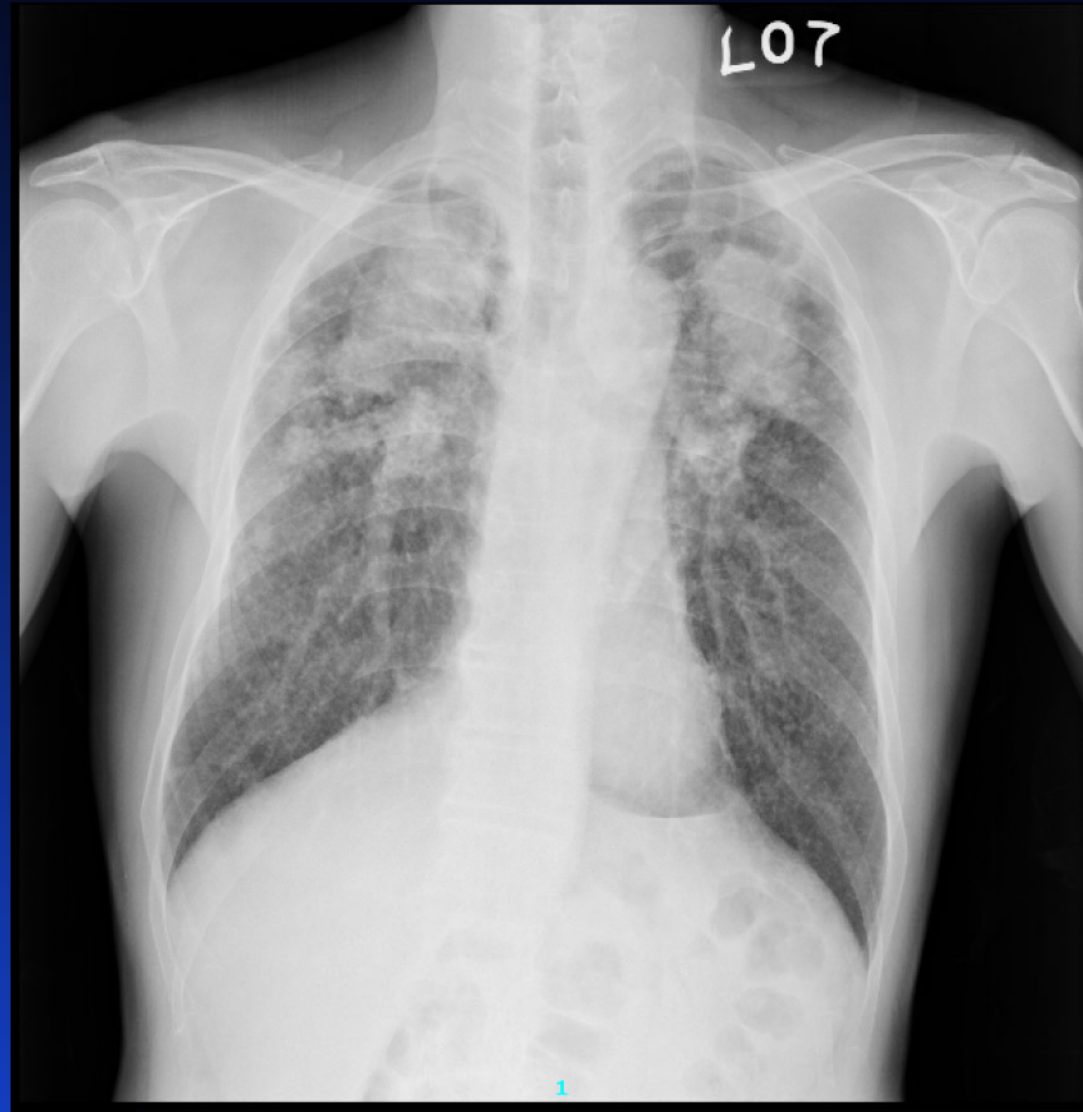
**b.**

**Figure 7.** Pulmonary sarcoidosis in a 26-year-old woman. **(a)** Chest radiograph demonstrates multiple lung nodules bilaterally and minimal hilar adenopathy, findings that may simulate metastatic disease. **(b)** CT scan obtained at the lower lung level demonstrates a nodular consolidation with ill-defined borders. Note the presence of an air bronchogram (arrowheads) within the nodules, a finding that is unusual for metastatic tumors.



# Pneumoconiosis with PMF

- CXR findings:
  - Nodule in upper lobes 融合
  - 當PMF逐漸形成，nodule會逐漸減少
  - 病灶外緣平行chest wall且清楚，內緣較為模糊

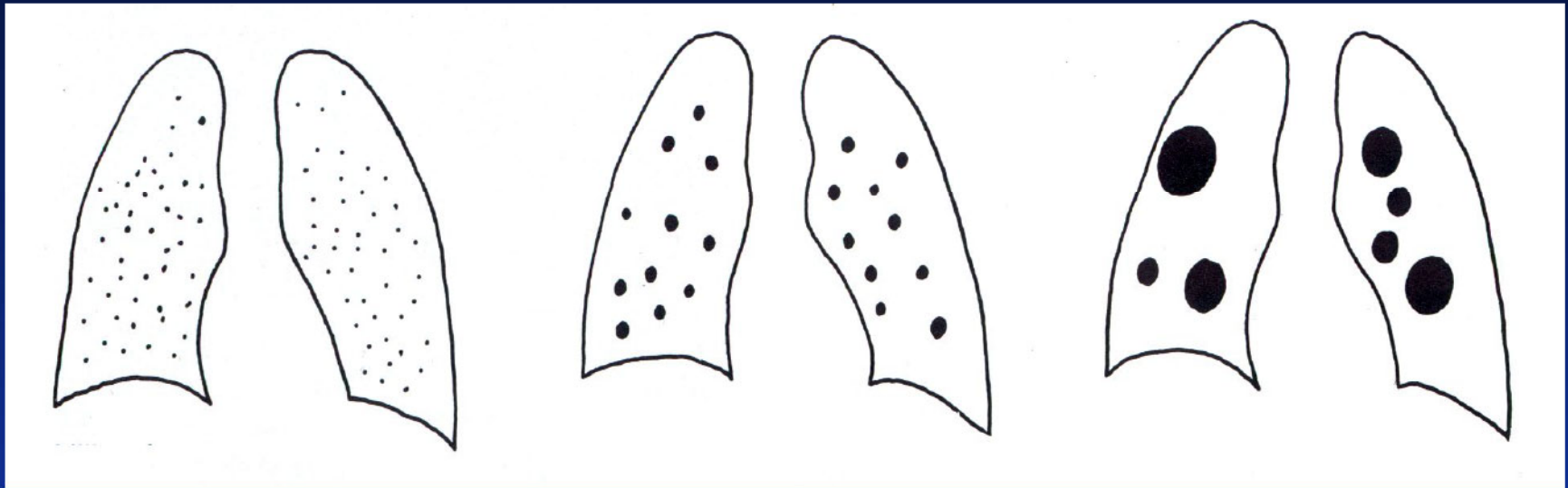


# Etiology of Multiple Pulmonary Nodules/masses – HIIN

- **H (hemodynamic)**
  - Cardiovascular
    - AVM
    - Organizing hematoma
  - Thromboembolic
    - Organizing infarct
- **I (infection)**
  - Bacteria:
    - Septic emboli
    - Leptospirosis
  - TB:
    - Miliary TB
    - TB granuloma
  - Fungus:
    - Cryptococcus
    - Histoplasmosis: USA
  - Virus: atypical measles
  - Nocardiosis
- **I (inflammation/inhalation)**
  - Collagen-vascular
    - Granulomatosis with polyangiitis
    - Rheumatoid nodules
  - Sarcoidosis
  - Pneumoconiosis
- **N (neoplasm)**
  - Metastasis
  - Lymphoma

# Type of Pulmonary Metastases

Round metastases (1-10 cm) – *hamatogenous spreading*



**Miliary form:**

*Thyroid, lung, breast, bone*

**Coarse nodular form:**

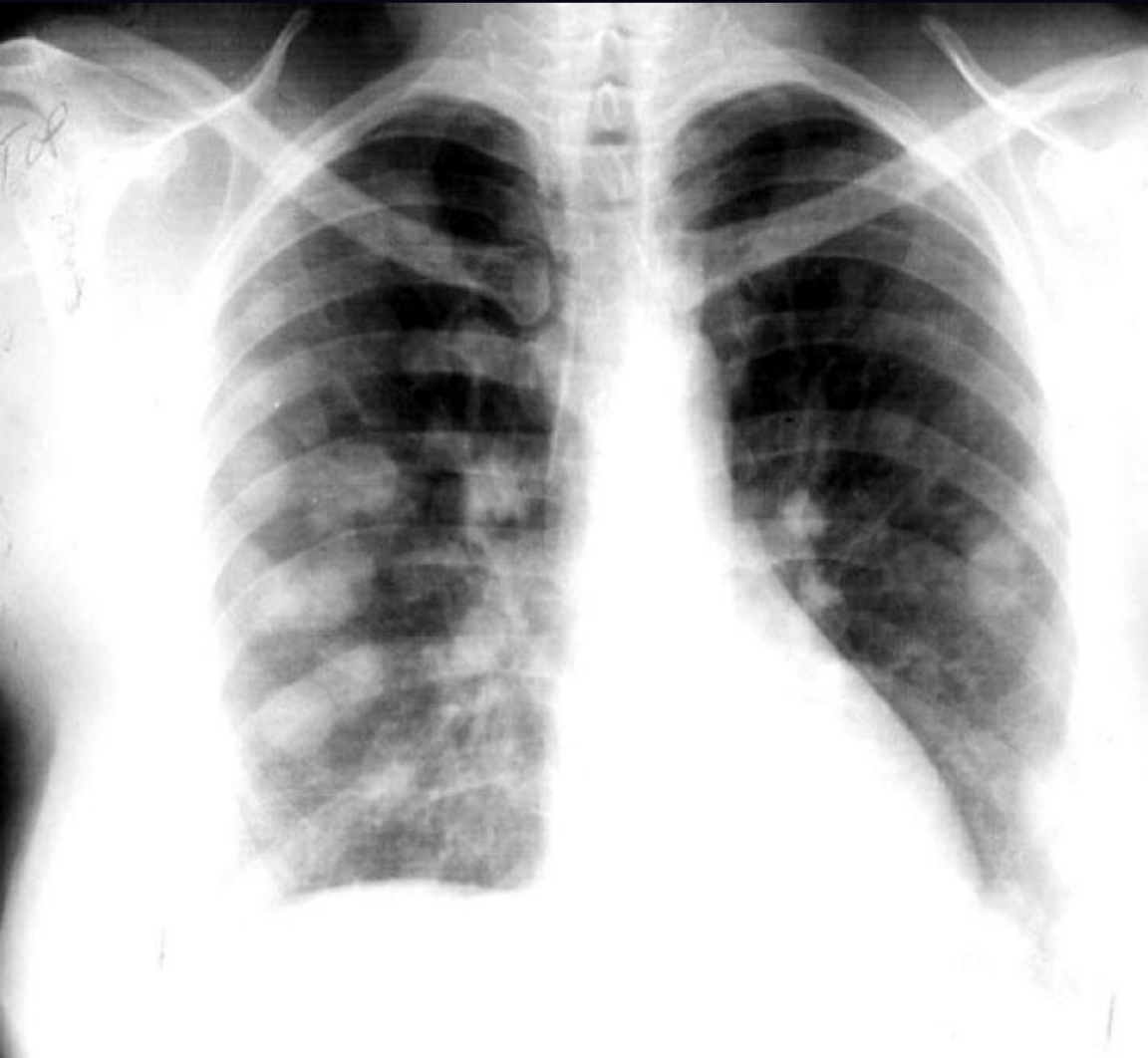
*Oropharynx, stomach, thyroid,  
female genitals, lymphoma,  
chorion carcinoma*

**Cannon ball type:**

*Sarcoma, carcinoma, seminoma,  
hypernephroma*



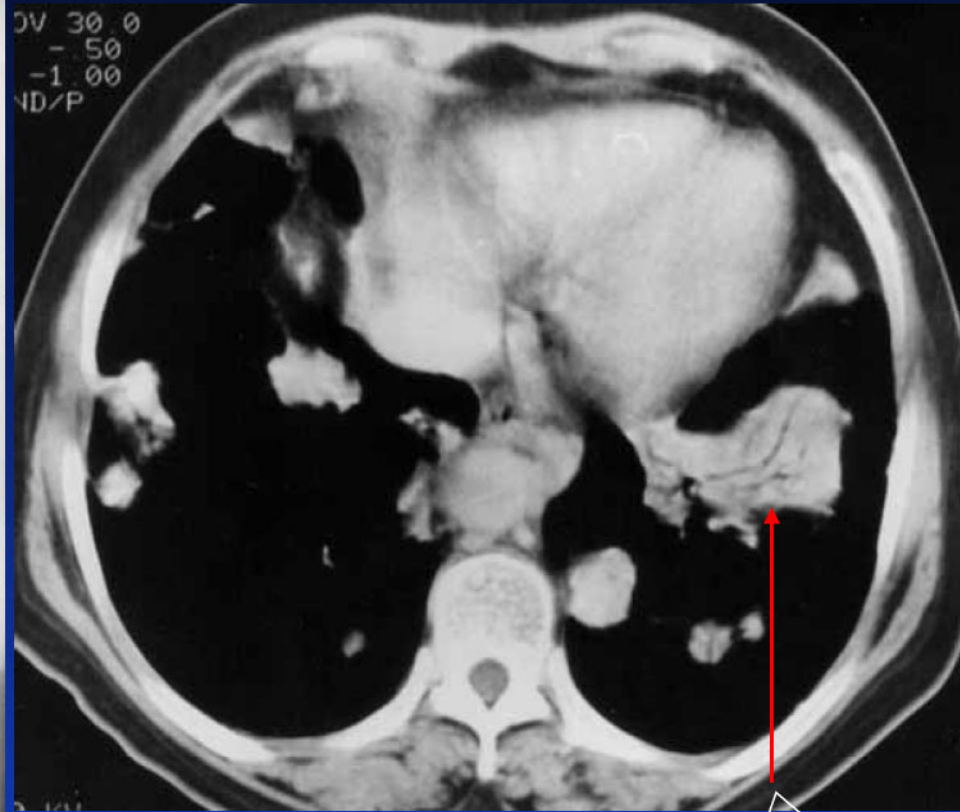
**Pancreatic Ca with Diffuse alveolar metastasis**



*Cannon Ball type–  
Lung Metastasis -  
Rectosigmoid Cancer*

- Bilateral
- Multiple
- Round mass densities
- Sharp margins

# Non-Hodgkin's lymphoma



Air bronchogram

Multiple lung masses to ill defined consolidation

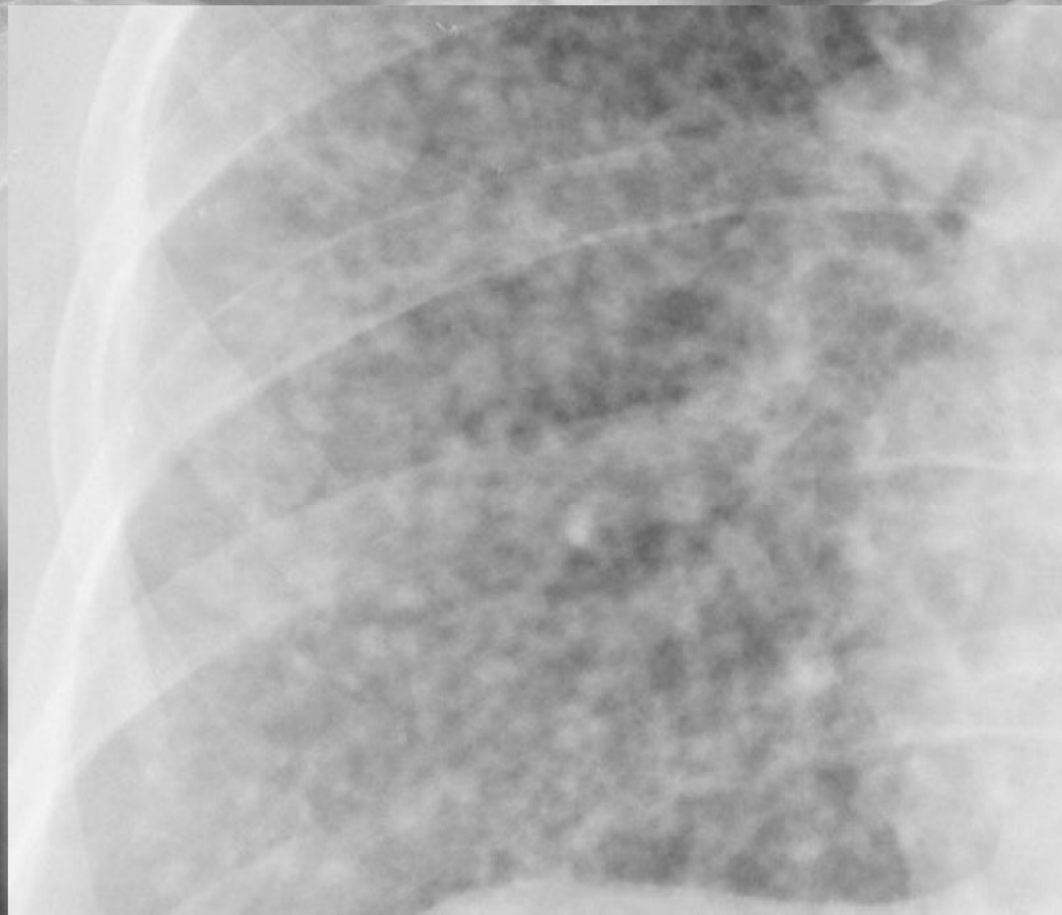
Widening of mediastinum

# Diffuse Micronodular Lesion (<1cm)

## Differential Diagnosis

- Malignancy: diffuse metastasis
  - Lower lung predominant, C-P angle (+)
  - Variable size
- Inhalation Dx:
  - Pneumoconiosis: upper lung predominant
- Infection:
  - Miliary TB : from apex to C-P angle
  - Miliary fungal infection
  - Virus: eg, chickenpox
  - Nocardiosis
- Others:
  - Diffuse panbronchiolitis (DPB): lower lung predominant
  - Alveolar lithiasis
  - Sarcoidosis
  - Hypersensitivity pneumonitis: HP
  - Histiocytosis X(PLCH): upper lung predominant

L21



**Lung cancer with lung to lung metastasis**

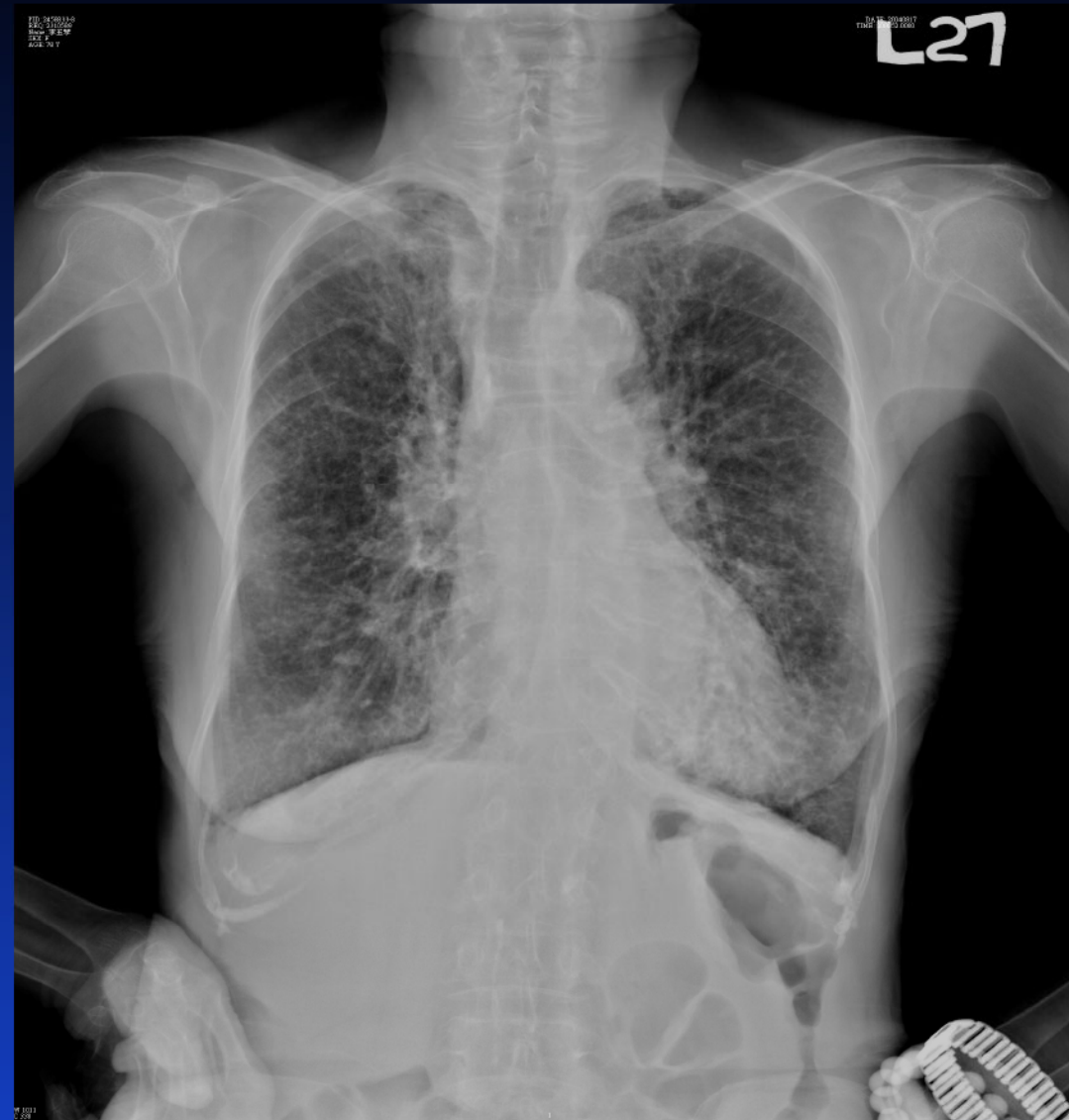


# Miliary TB

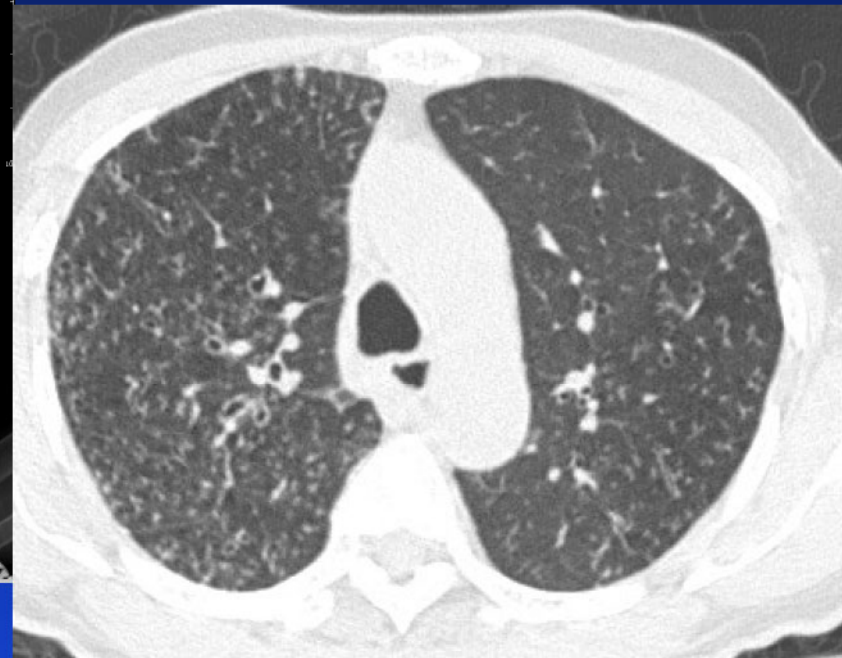


- Evenly distributed miliary nodules (from apex to CP angle), diffuse small 2~3 mm nodules
- 細到不能再細，密到不能再密
- May increase in size to 3-5 mm, when -- in immunocompromised host or without treatment

# Diffuse Panbronchiolitis

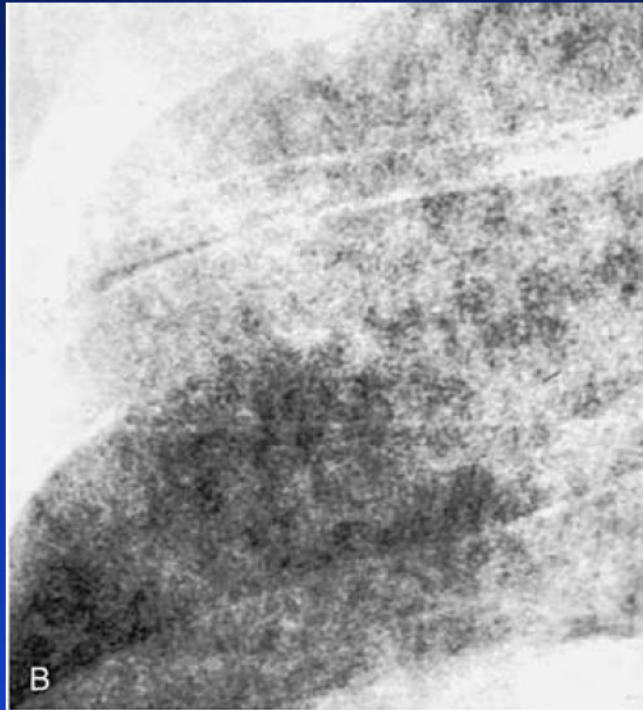


- CXR: triad
  - Diffuse nodules <5 mm, mainly in lower lung fields
  - Hyperinflation, bilateral
  - Bronchiectasis



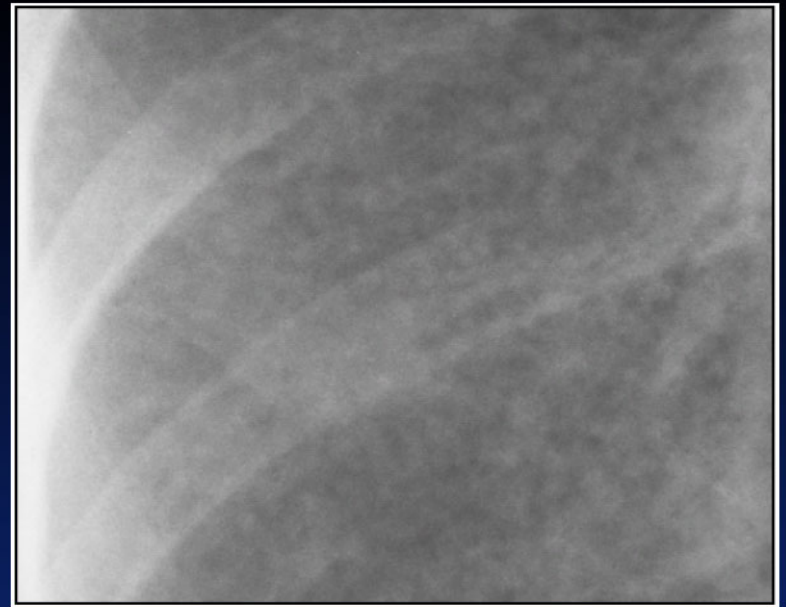
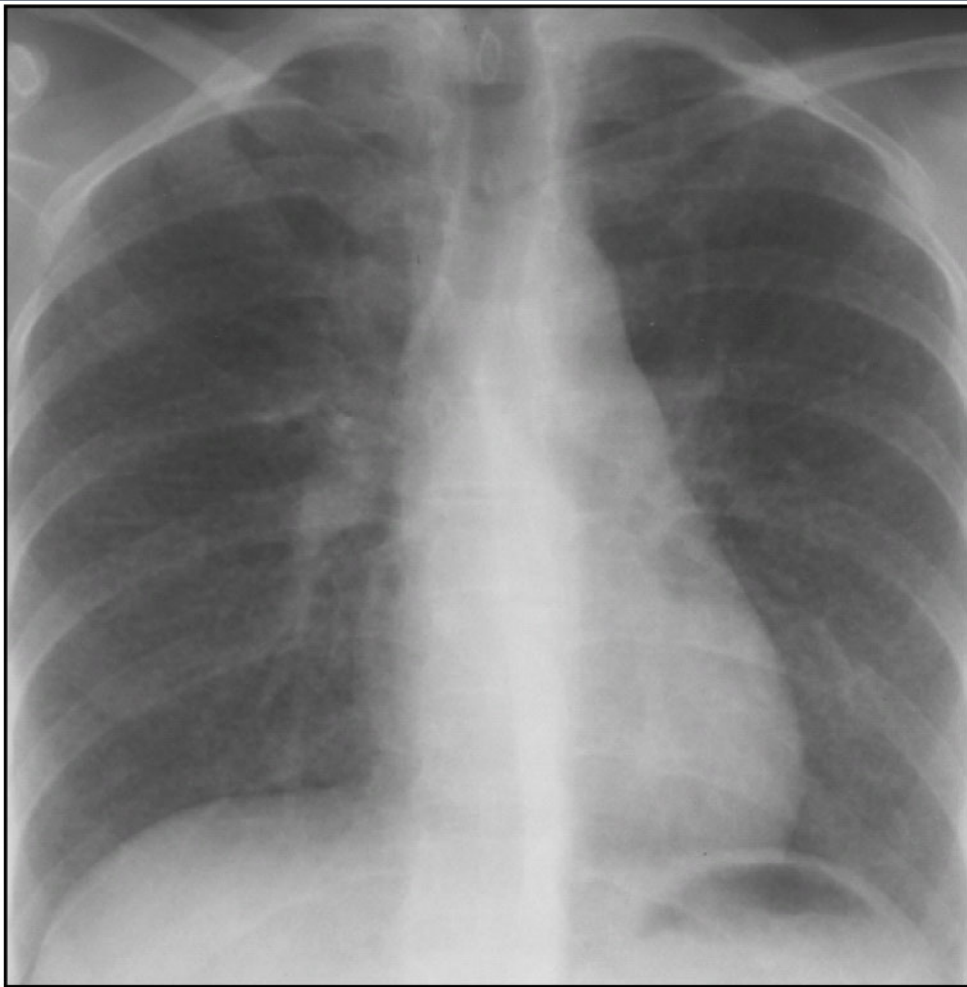
# Alveolar Microlithiasis

- Rare, innumerable tiny calculi within alveolar air spaces
- Sandstorm appearance
  - Sharply defined micronodules,  $< 1$  mm, diffusely in both lungs



# Hypersensitivity Pneumonitis

## – Subacute Stage



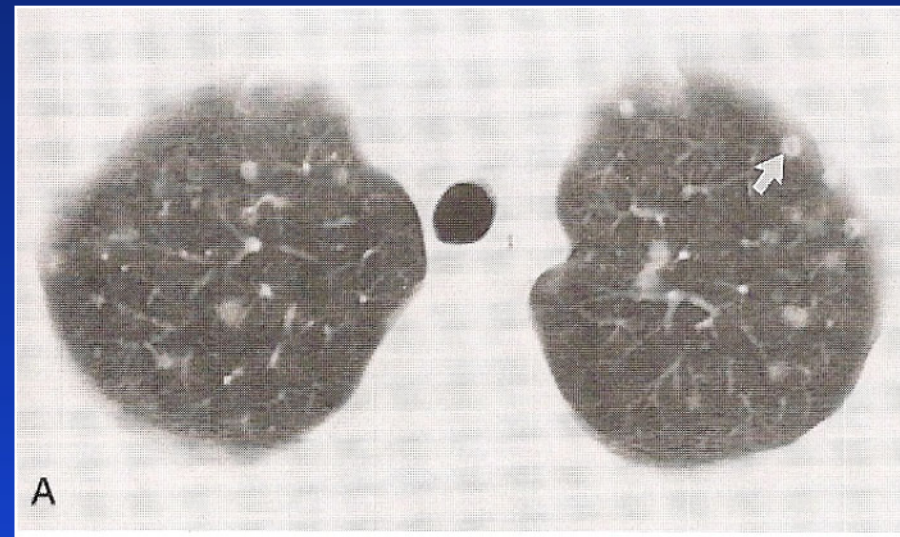
bilateral, diffusely distributed, well-defined  
small lung nodules and GGO.

Scattered ground-glass opacities  
Centrilobular distribution peripherally

# Pulmonary Langerhans Cell Histiocytosis (PLCH)



- Diffuse symmetric **nodular** and **reticulonodular** opacities
  - Multiple ill-defined nodules, 1-10mm, 60%~80%
  - Multiple irregular cysts, 1-3cm, more common than nodules, 80%
  - **Upper and middle** lung zones, **sparing C-P angle**



A

# Etiology of solitary pulmonary nodules/mass

## H-I-I-N

- **Hemodynamic- vascular**
- **Infection**
- **Inflammation**
- **Neoplasm**
- **Congenital (先天)**
- **肺外**

• Tissue is the Issue

Type of Cause	Disease Entity
<b>Neoplastic</b>	
Malignant	Primary pulmonary carcinoma Adenocarcinoma, squamous cell carcinoma, bronchioloalveolar cell carcinoma, small cell carcinoma Primary pulmonary lymphoma Primary pulmonary carcinoid Solitary metastasis Melanoma, osteosarcoma, testicular cancer, breast, prostate, colon, renal cell carcinoma
Benign	Hamartoma, chondroma Arteriovenous malformation Fibroma Neural tumor (schwannoma, neurofibroma) Sclerosing hemangioma
<b>Infectious</b>	Granuloma <i>Mycobacterium tuberculosis</i> Fungal ( <i>Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Aspergillosis</i> ) <i>Dirofilaria immitis</i> Bacterial ( <i>Nocardia, Actinomycosis, round pneumonia</i> ) Measles Abscess Septic embolus
<b>Noninfectious</b>	Sarcoidosis Lipoid pneumonia Amyloid Subpleural lymph nodule Rheumatoid arthritis Wegener granulomatosis Pulmonary scar Infarct
<b>Congenital</b>	Bronchogenic cyst Bronchial atresia with mucoid impaction Sequestration
<b>Other</b>	Skin nodule Rib fracture Pleural thickening, mass or fluid

Figure 5: Chart shows differential diagnosis of SPN.

# Etiology of Multiple Pulmonary Nodules/masses – HIIN

- **H (hemodynamic)**
  - Cardiovascular
    - AVM
    - Organizing hematoma
  - Thromboembolic
    - Organizing infarct
- **I (infection)**
  - Bacteria:
    - Septic emboli
    - Leptospirosis
  - TB:
    - Miliary TB
    - TB granuloma
  - Fungus:
    - Cryptococcus
    - Histoplasmosis: USA
  - Virus: atypical measles
  - Nocardiosis
- **I (inflammation/inhalation)**
  - Collagen-vascular
    - Granulomatosis with polyangiitis
    - Rheumatoid nodules
  - Sarcoidosis
  - Pneumoconiosis
- **N (neoplasm)**
  - Metastasis
  - Lymphoma

Thanks for your attention!