# Les maladies infiltrantes diffuses du poumon
## Cours à option RDGN 2331

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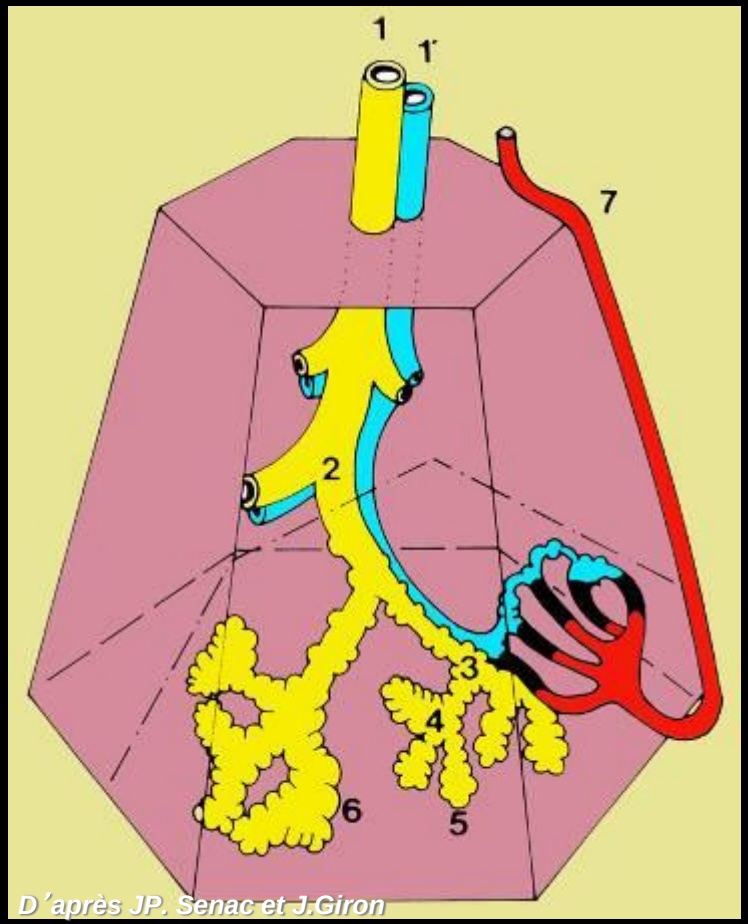
Jeudi 19 mars 2020, 16h30



D'après JP. Senac et J.Giron

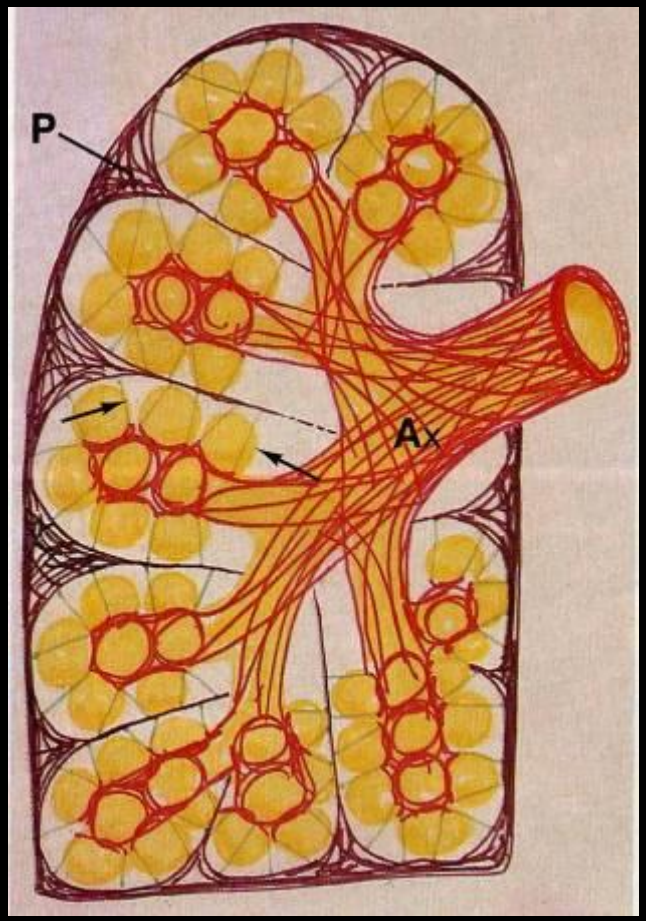


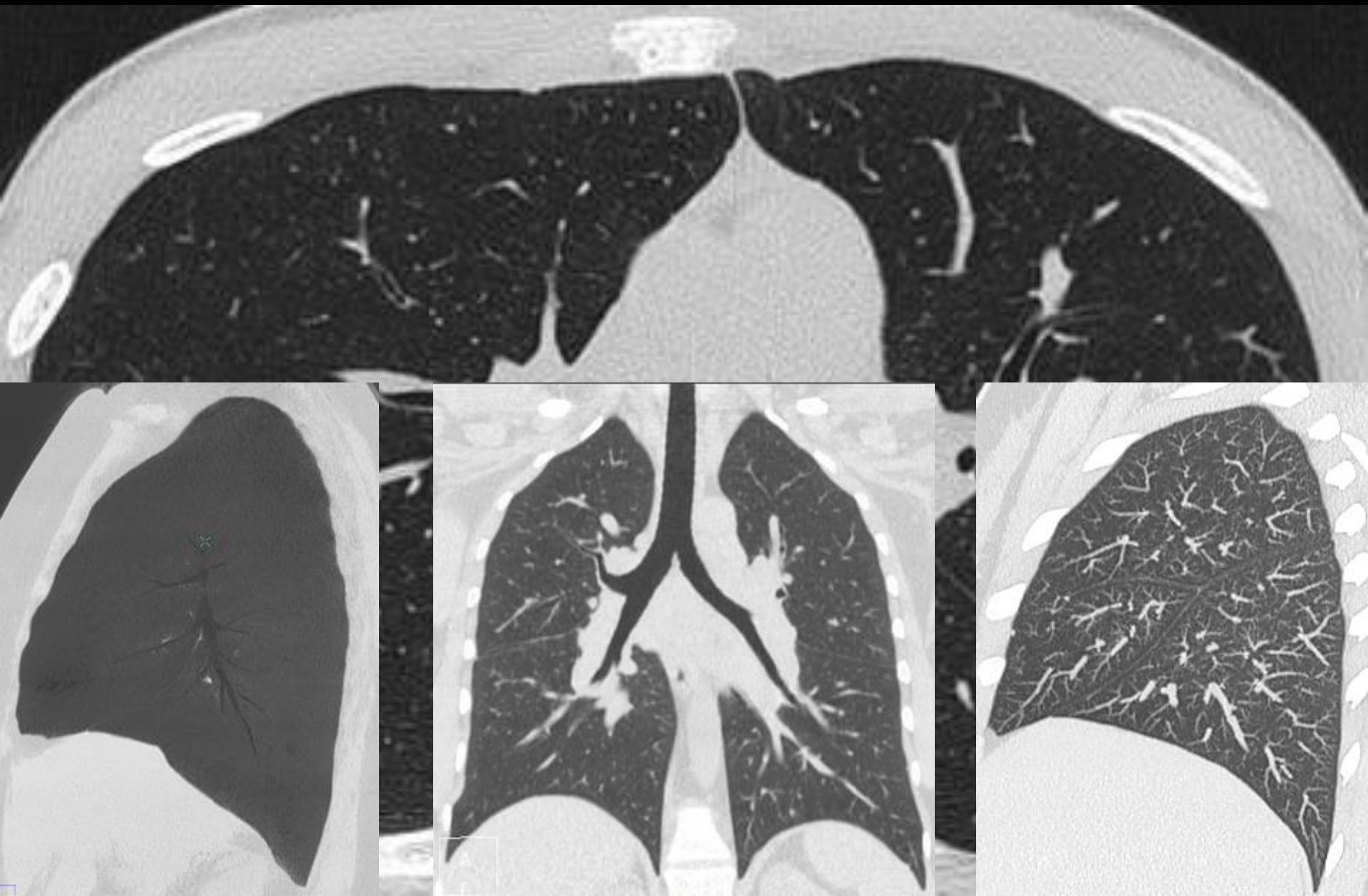
Schéma de Webbel

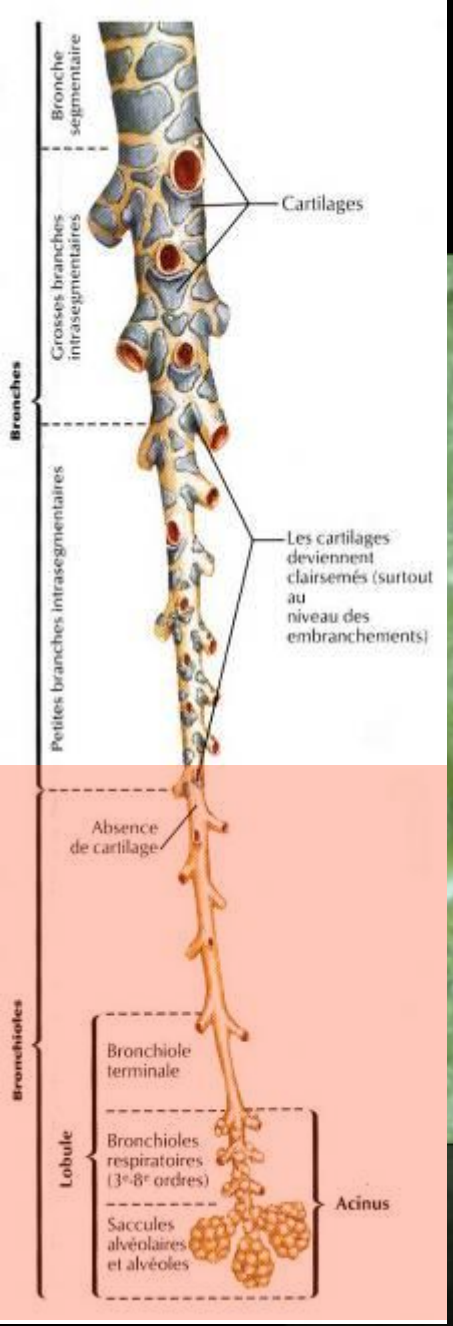
## Dimensions des structures lobulaires *(en mm)*

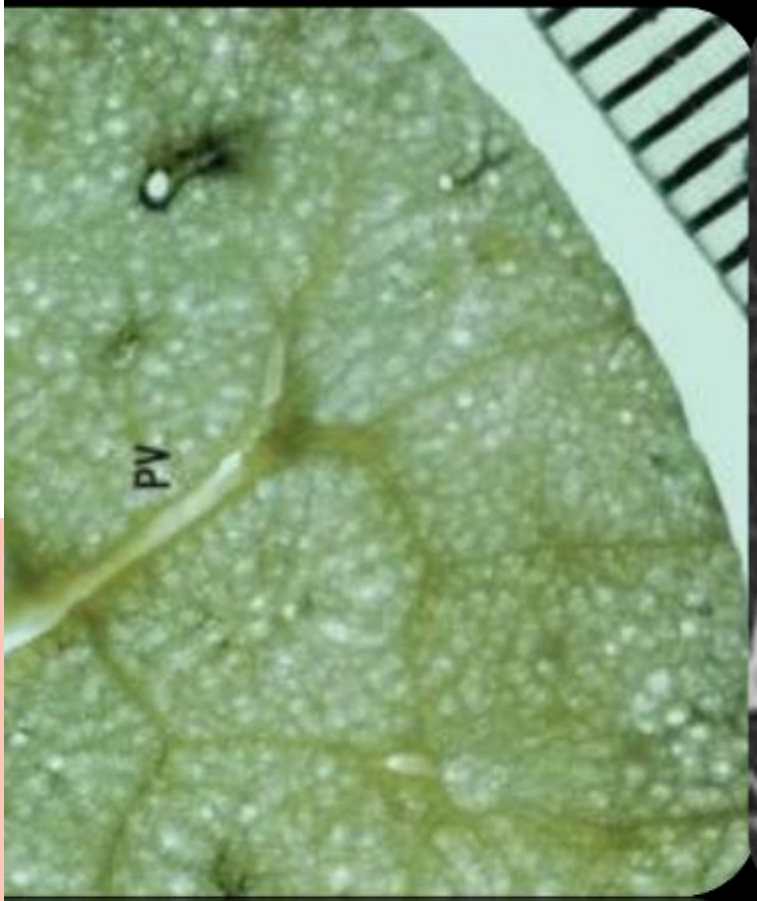
| | |
|---|---|
| **Largeur du lobule** | **10 à 25** |
| Largeur de l'acinus | 7 à 8 |
| **Artériole terminale *(diamètre)*** | **1** |
| Bronchiole terminale *(diamètre)* | 0,6 |
| Septum interlobulaire *(épaisseur)* | 0,1 |
| Largeur d'un alvéole | 0,25 |
| Paroi alvéolaire *(épaisseur)* | 0,030 |

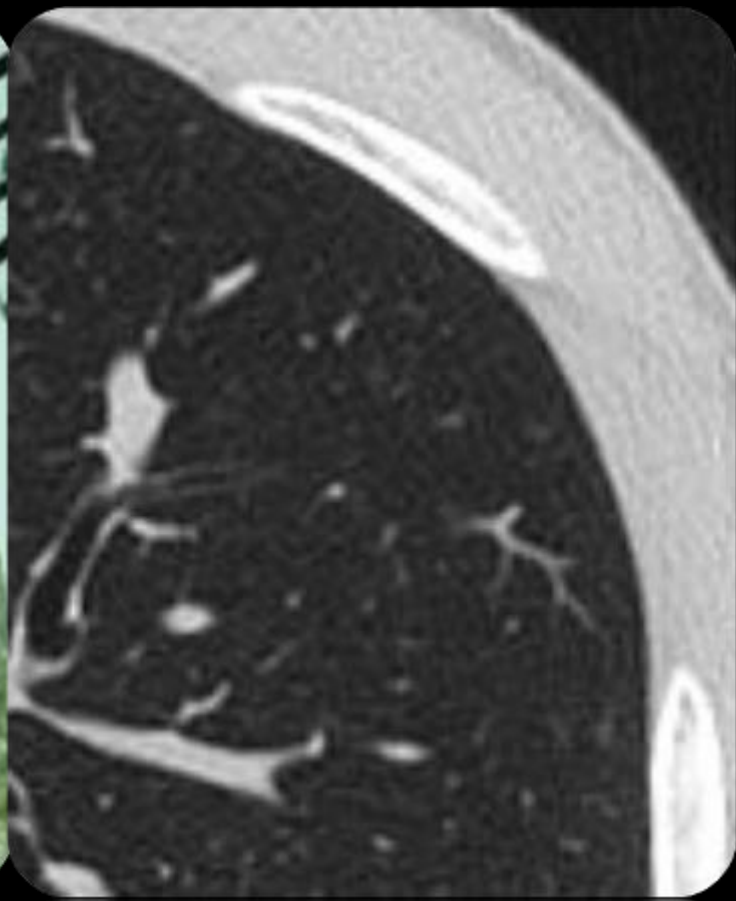
**Le tissu interstitiel**
**On décrit trois compartiments :**
- **Compartiment axial *(Ax)*,**
- **Compartiment pariéto-alvéolaire**
- **Compartiment périphérique *(P)***

# technique




Bronche segmentaire
Grosses branches intrasegmentaires
Cartilages
Bronches
Petites branches intrasegmentaires
Les cartilages deviennent clairsemés (surtout au niveau des embranchements)
Absence de cartilage
Bronchioles
Bronchiole terminale
Lobule
Bronchioles respiratoires (3e-8e ordres)
Acinus
Saccules alvéolaires et alvéoles


PV



# Avantages de la TDM-HRV

- Exhaustivité de l'exploration

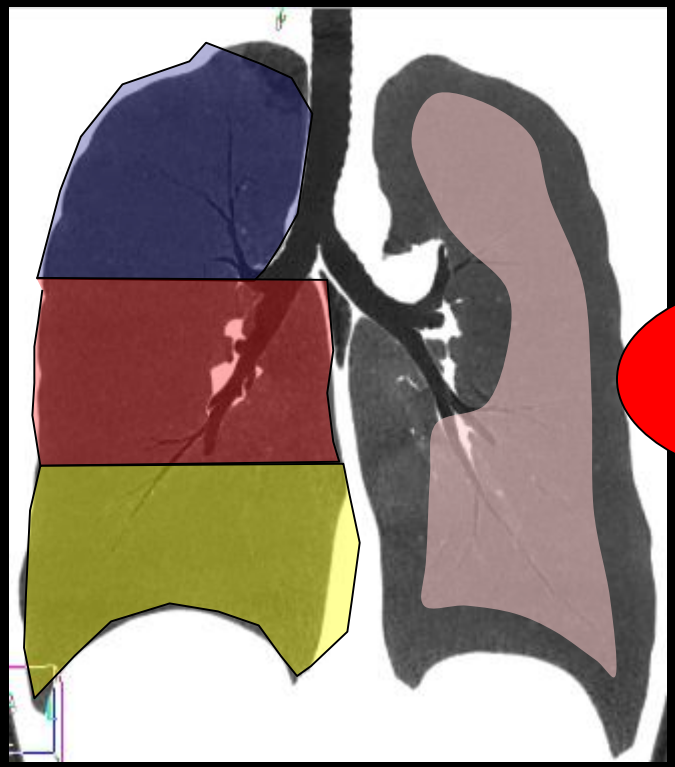
- Accès aux techniques de rendu volumique
  - ✓ reconstructions MPR
  - ✓ reconstruction minIP
  - ✓ reconstruction MIP
  - ✓ VR et 3D surface

**Détection**
**Caractérisation**
**Localisation**
**Quantification**

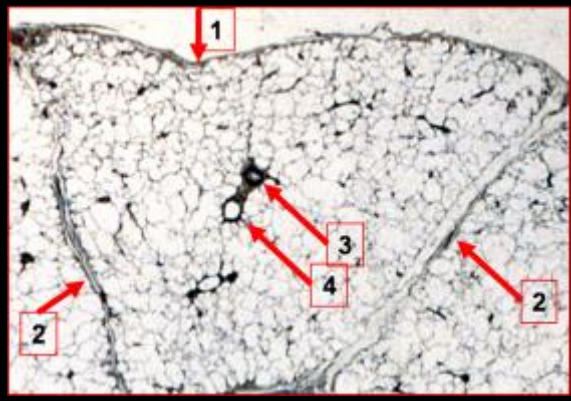
# Diagnostic des PID par TDM-HR

**Signe prédominant**

Signes associés



distribution




temps

# Diagnostic d’une micronodulation

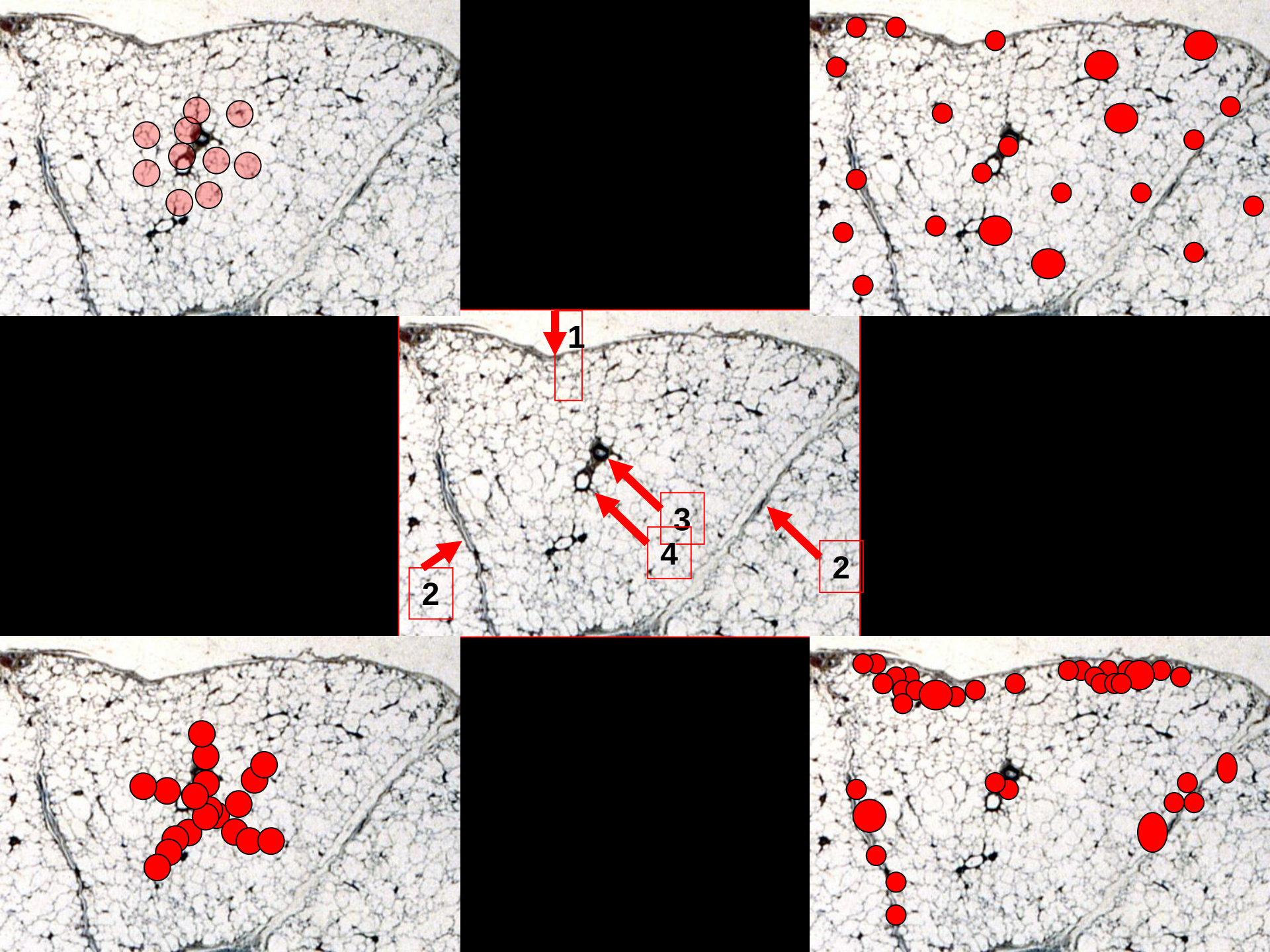
# Image nodulaire

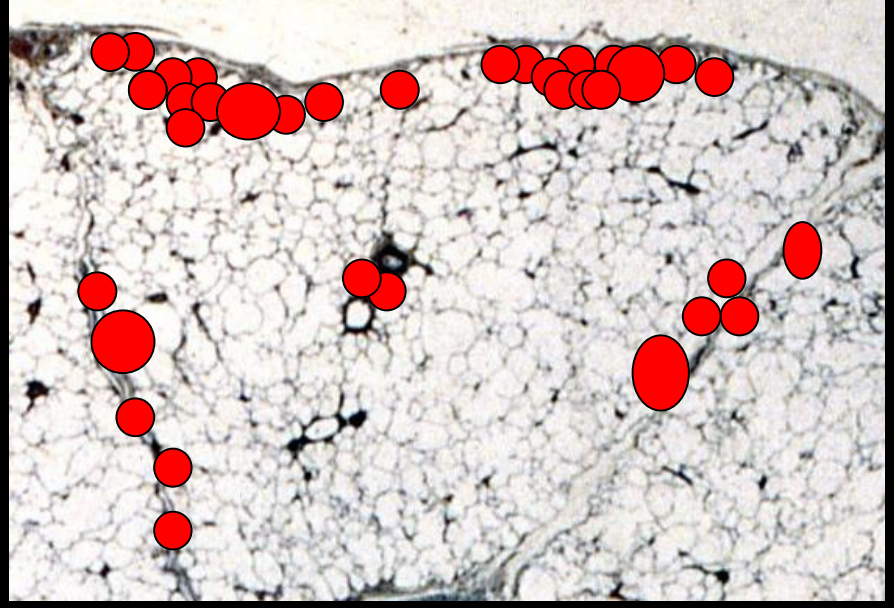
- **Infiltration pulmonaire**
  - **opacités de forme arrondie 1 à 30 mm**
  - **micronodule < 5 mm**
  - **5 mm < nodules < 30 mm**

- **La composition histologique du nodule : cellulaire, fibreuse ou mixte**
  - **Infiltration bronchiolaire et péribronchiolaire**
  - **Confluence de granulomes *(sarcoïdose)***
  - **Prolifération cellulaire *(métastases)***
  - **Fibrose mutilante nodulaire *(silicose)***

- **Confluence possible avec rétraction : masses pseudo-tumorales**

- **Le nodule est homogène ou présente une clarté centrale *(nodule excavé)***


1
3
4
2
2



# NODULES PÉRILYMPHATIQUES

# Modèle micronodulaire péri-lymphatique

## Caractéristiques :

- contours nets
- forte densité
- distribution
  - Le long des scissures et de la plèvre périphérique
  - Le long des septa interlobulaires
  - Le long des trajets vasculaires et bronchiques
  - au cœur du lobule : axes artériolo-bronchiolaires

## D'autres images peuvent se trouver associées en fonction de l'étiologie :

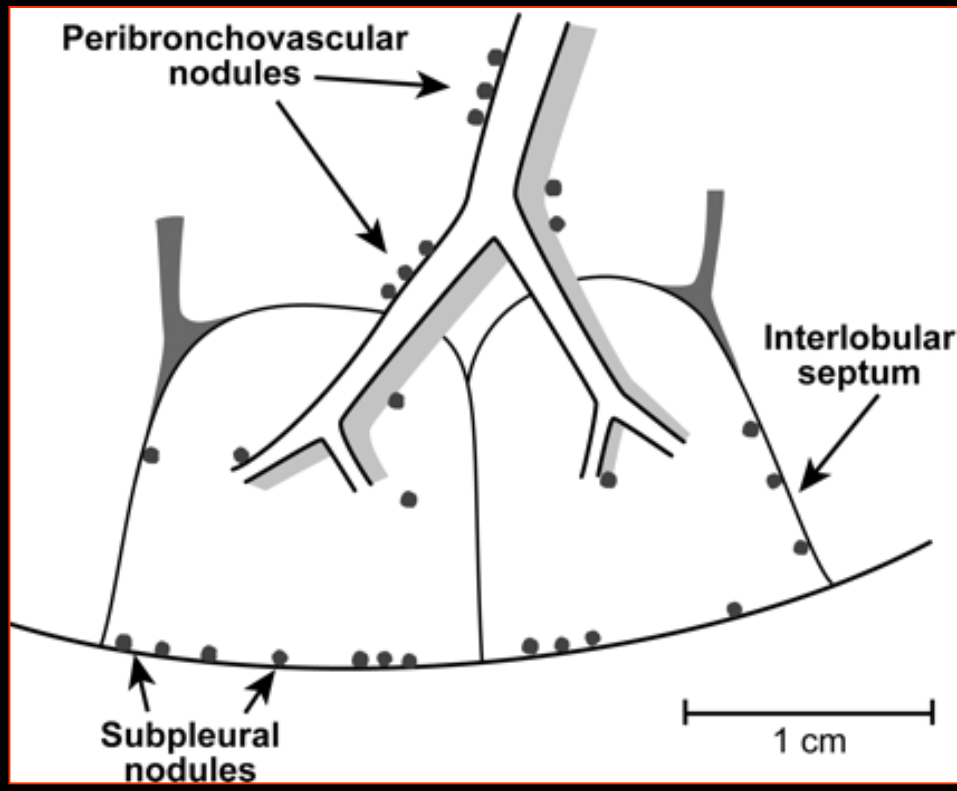
-lignes septales avec aspect perlé

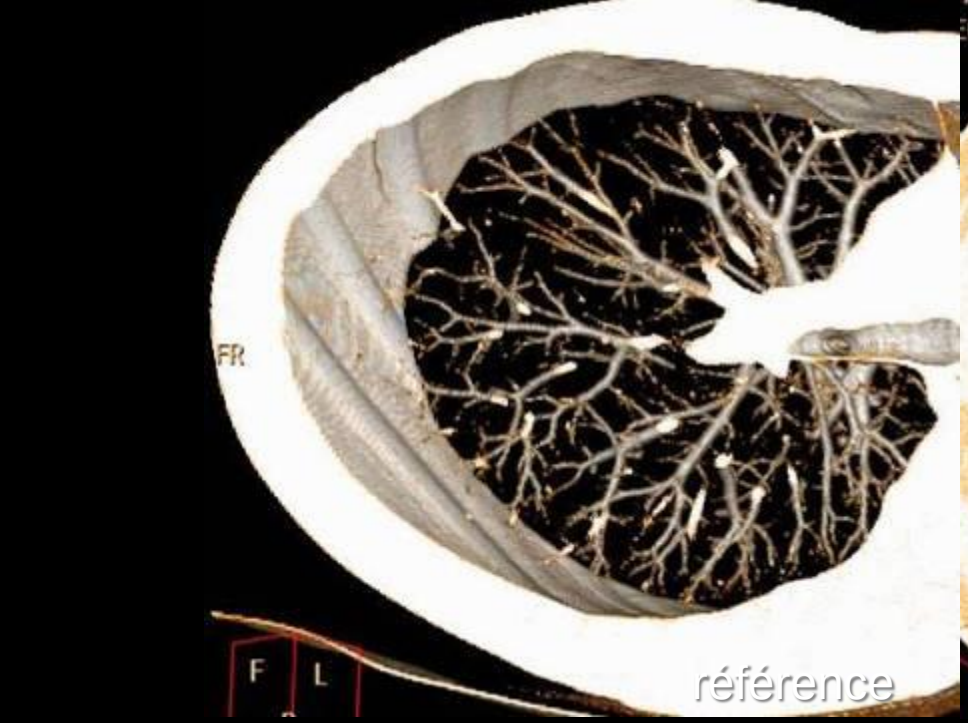
-épaississement péri-broncho-vasculaire

-îlots de dépoli d'étendue variable

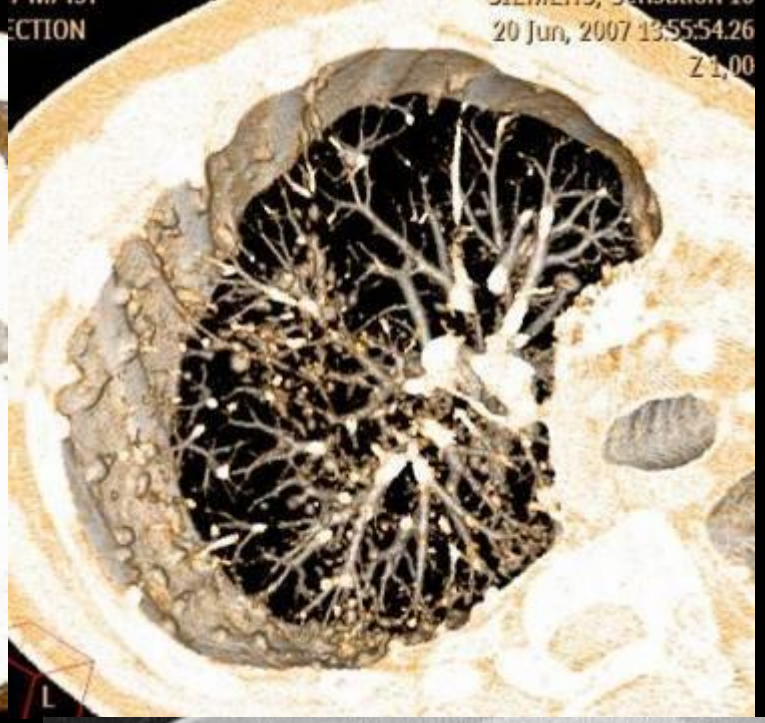
-hypertrophie ganglionnaire

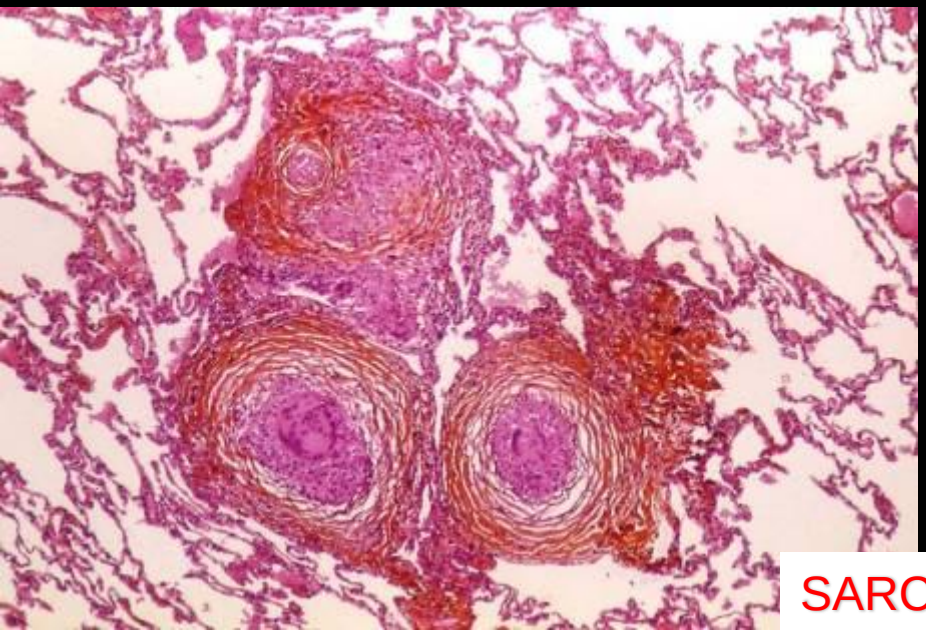
-épanchement pleural

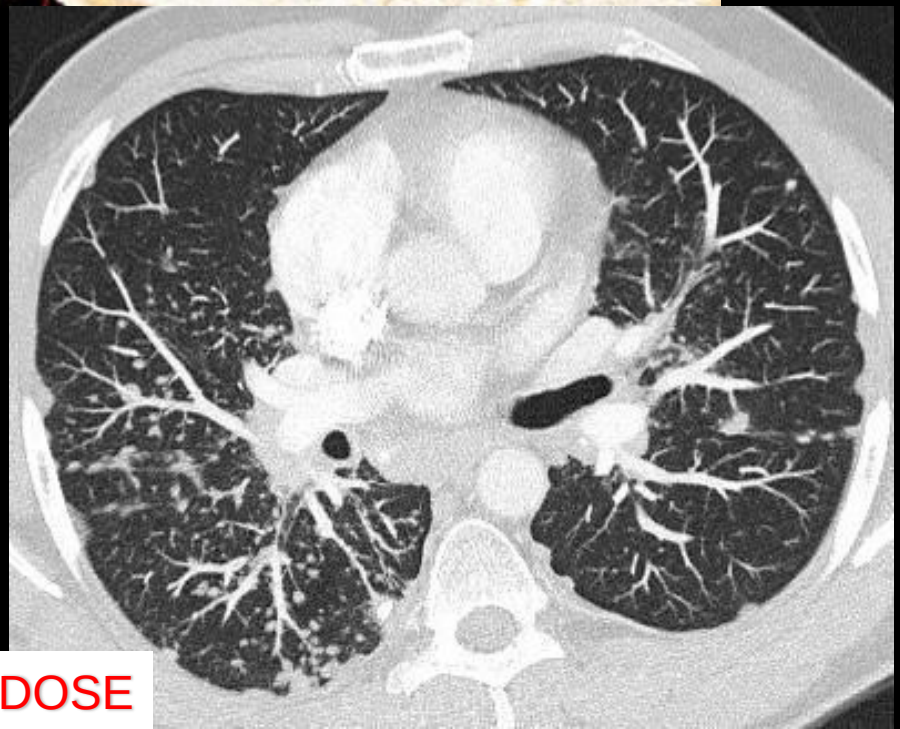




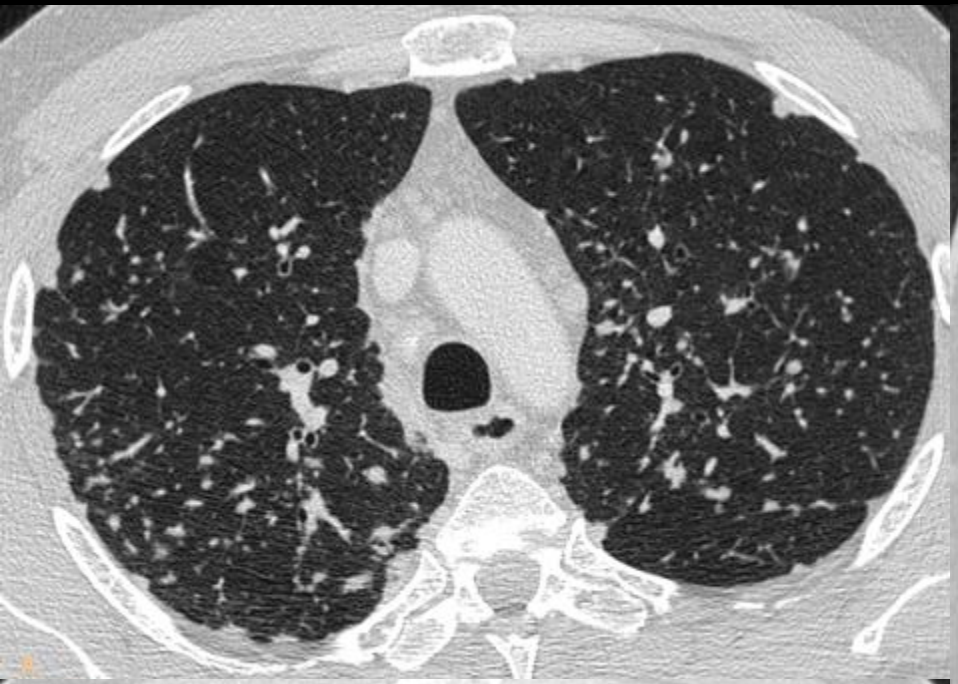

référence

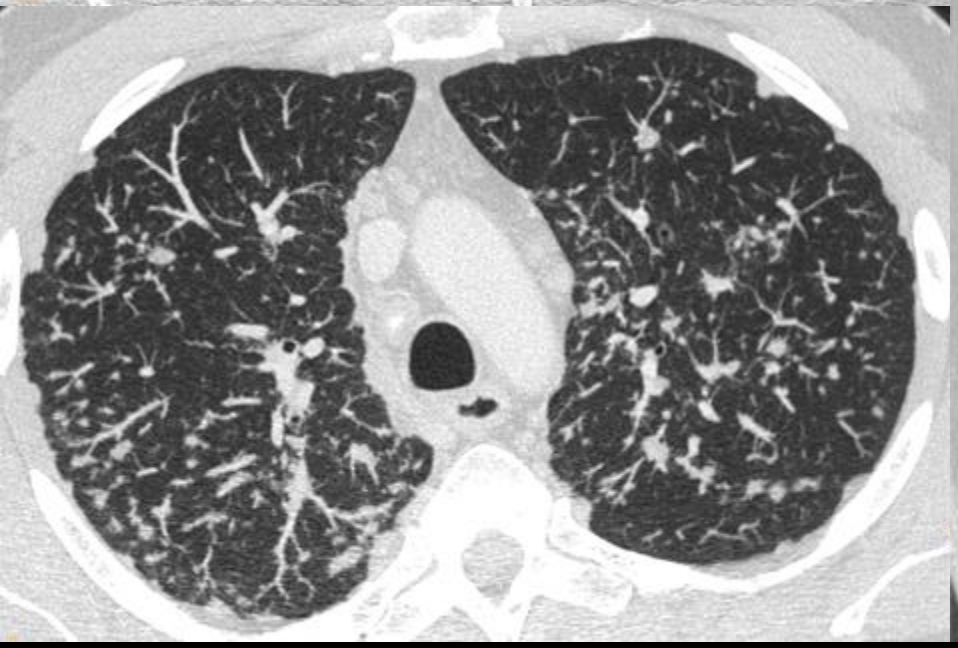


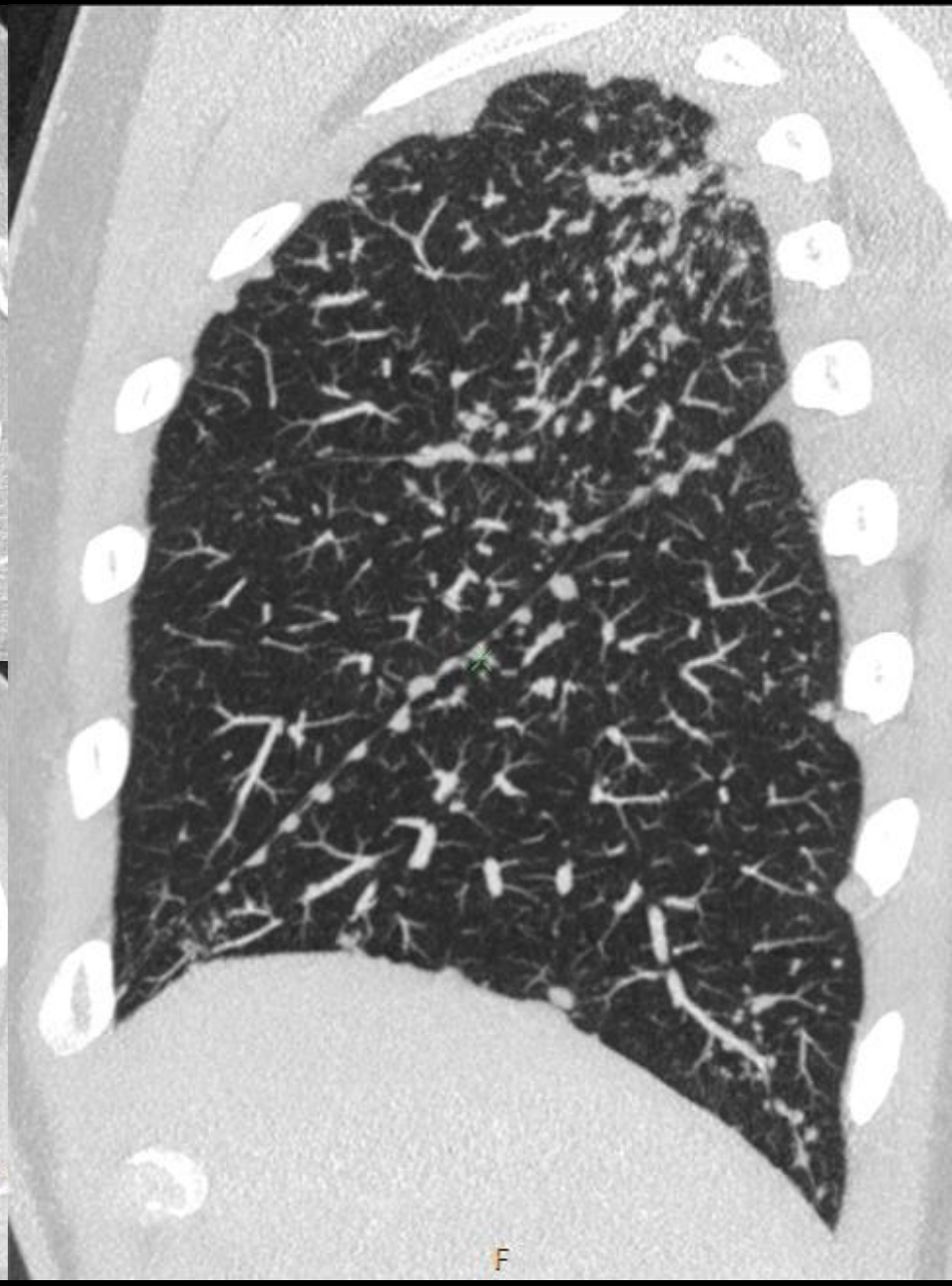





SARCOIDOSE



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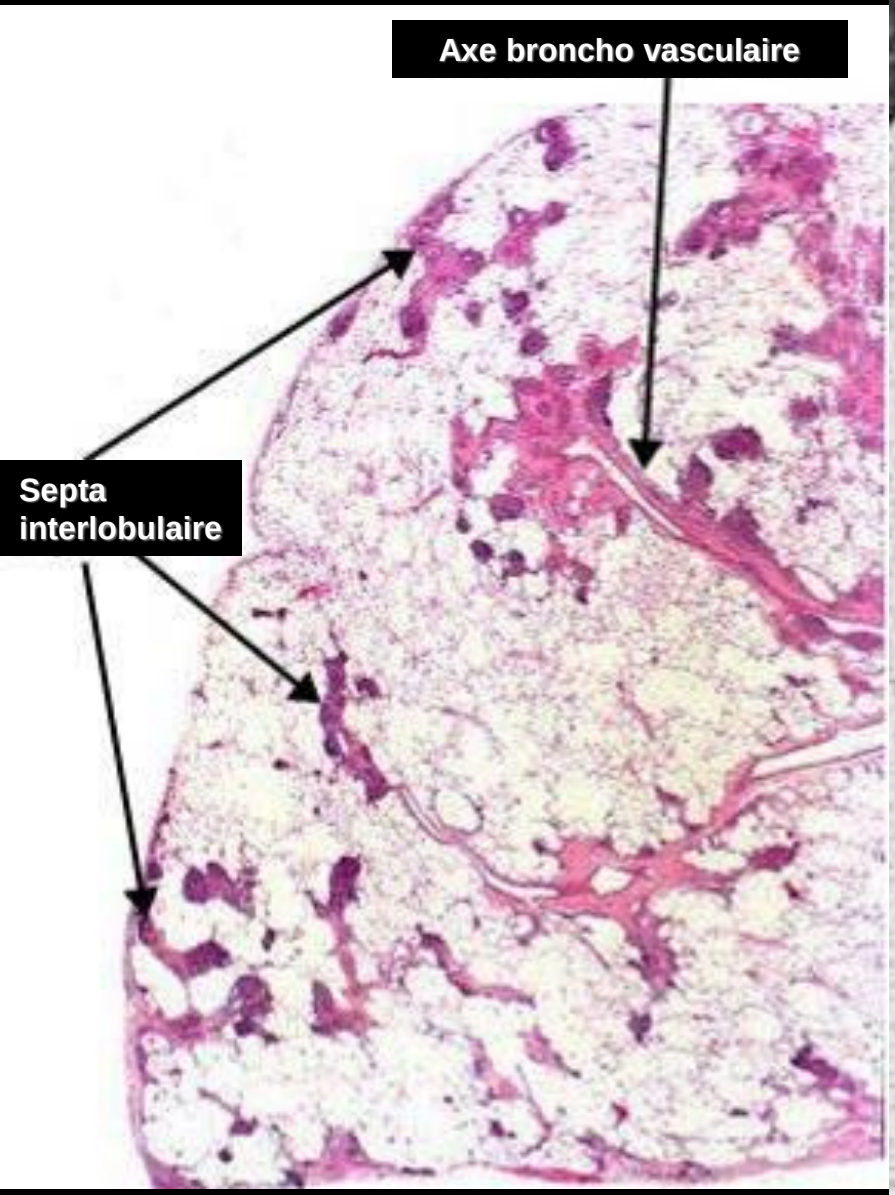
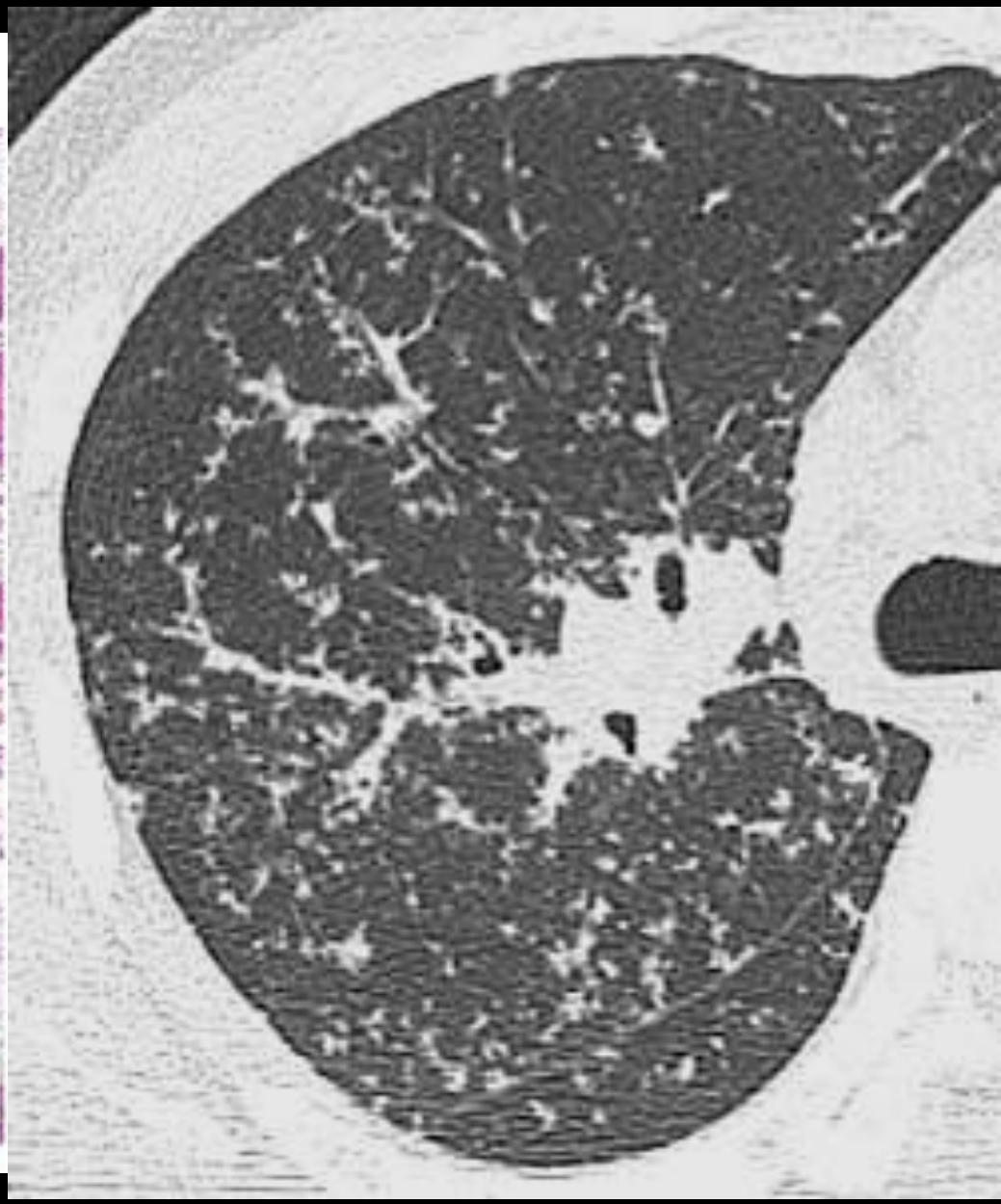
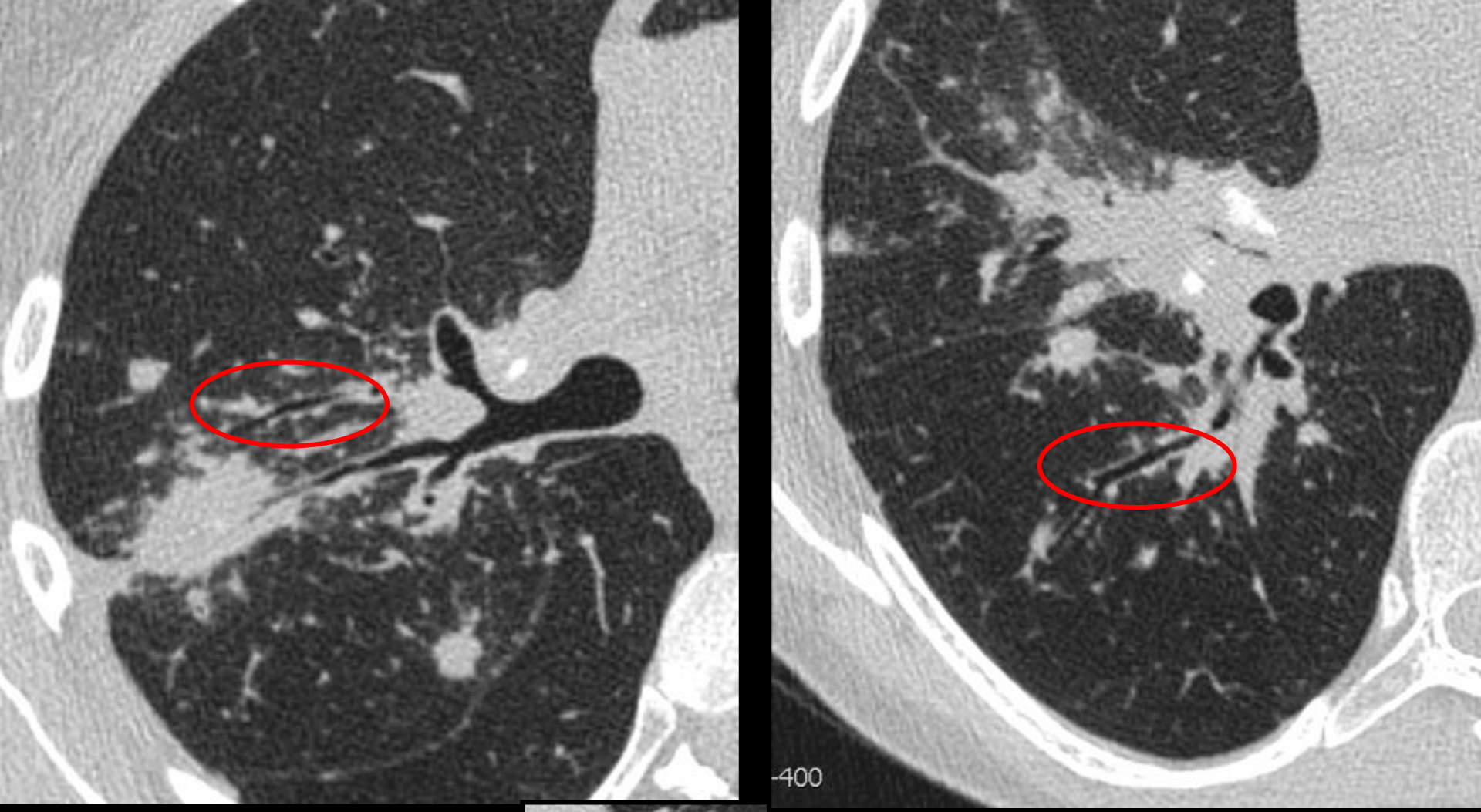

Axe broncho vasculaire
Septa interlobulaire

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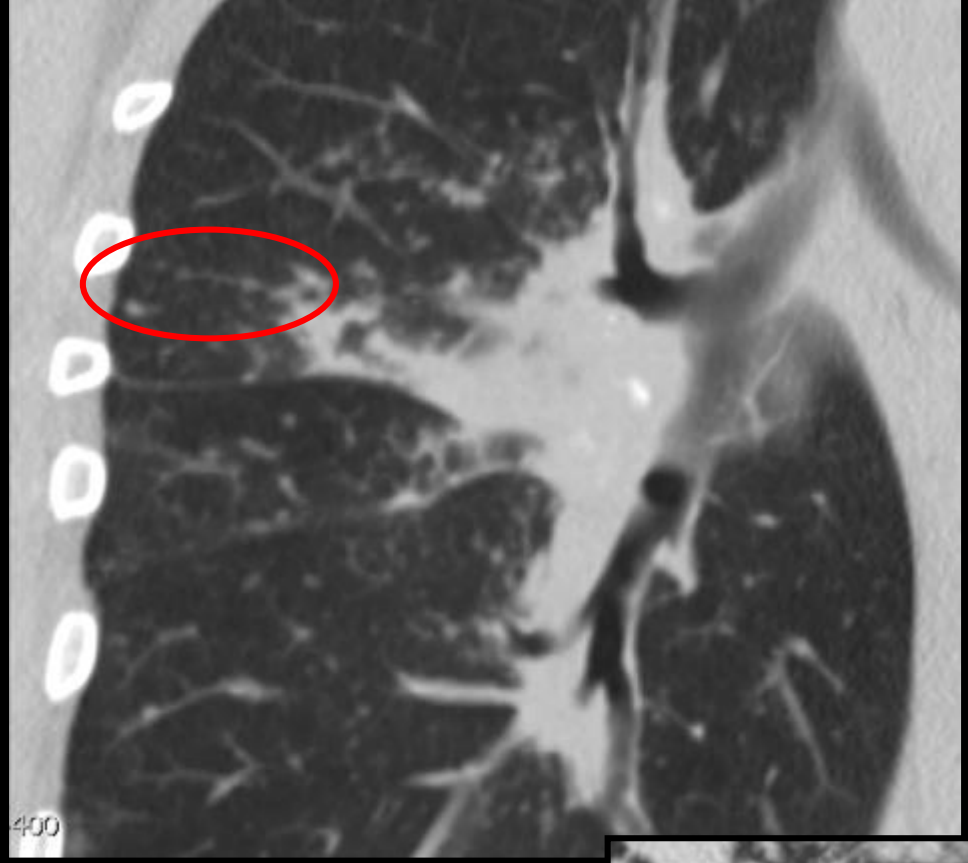
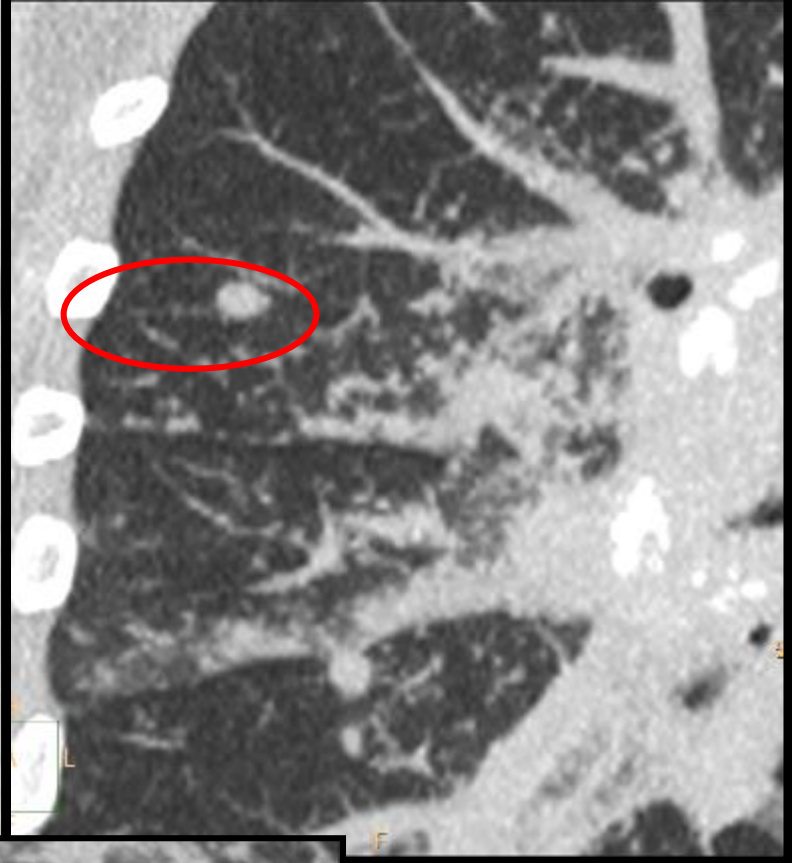
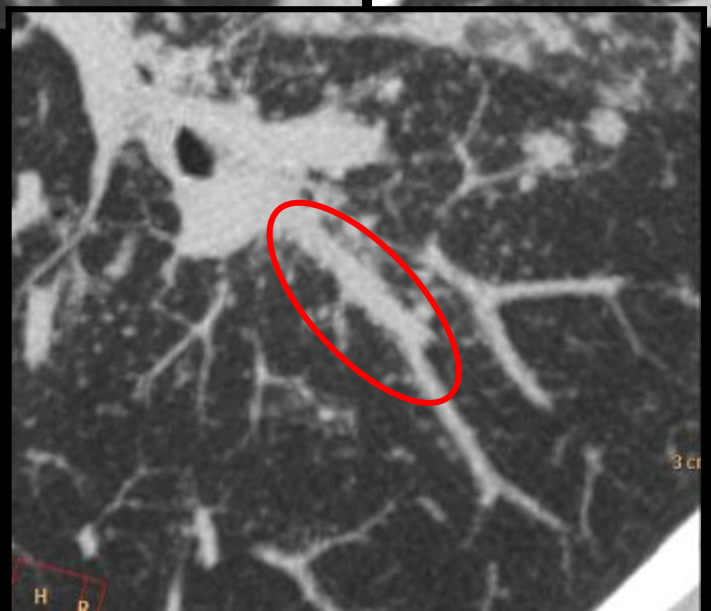
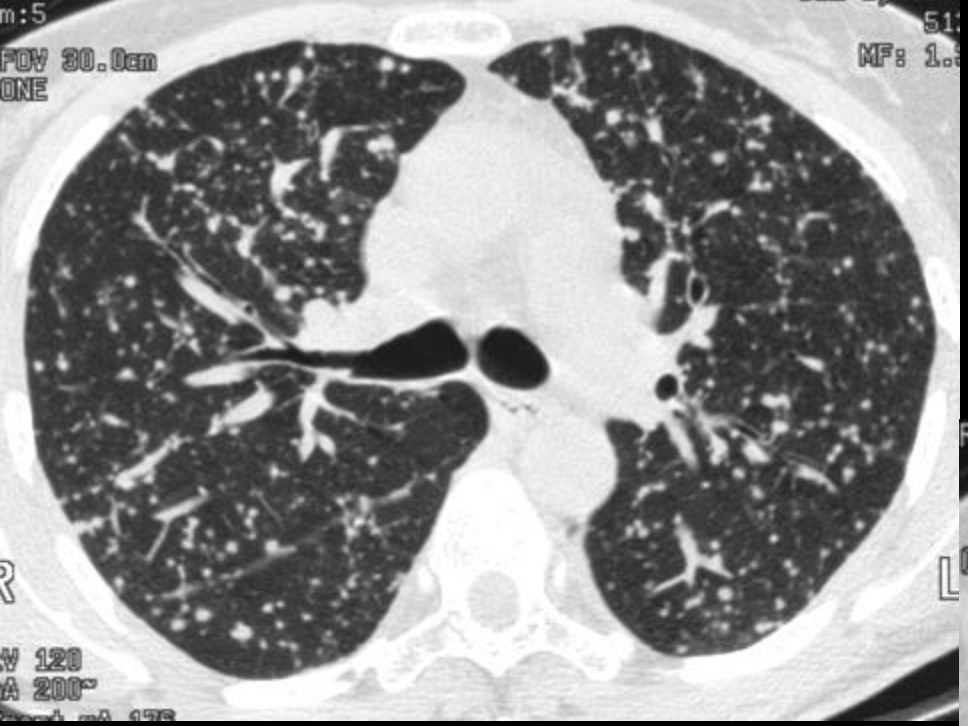
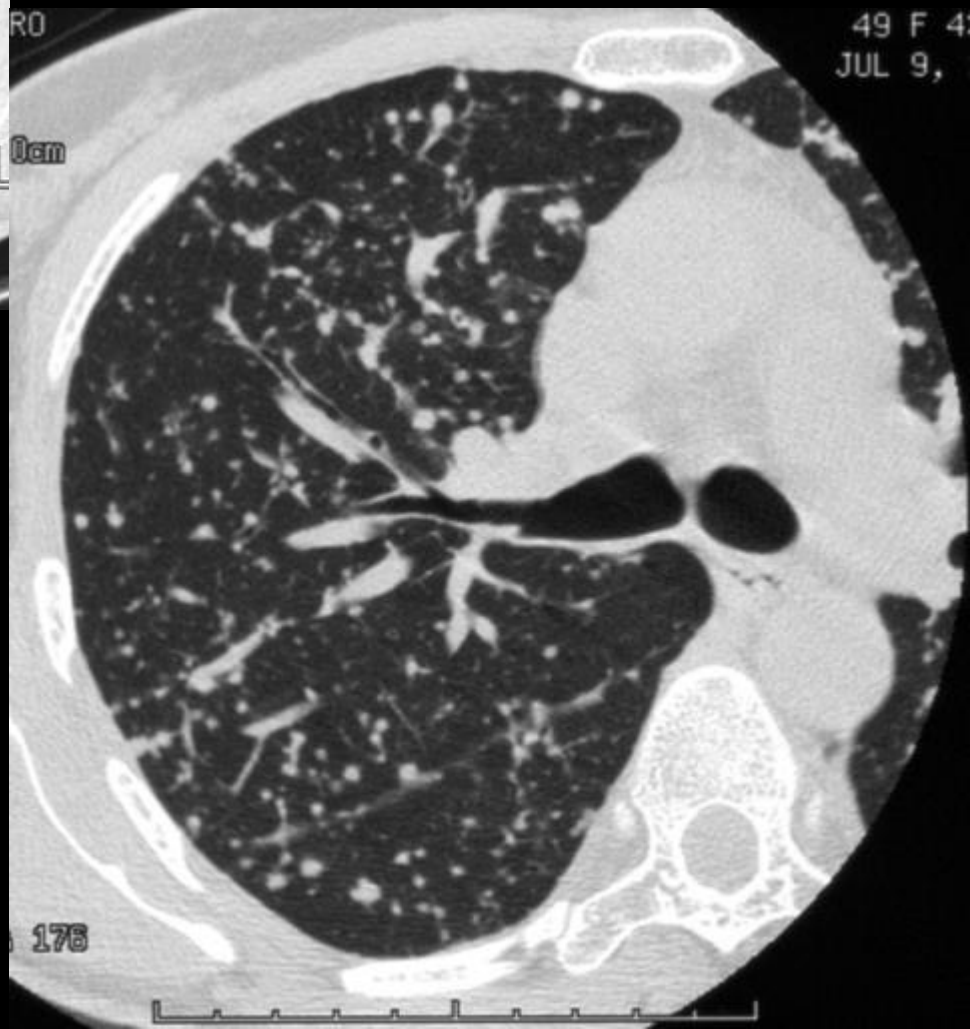




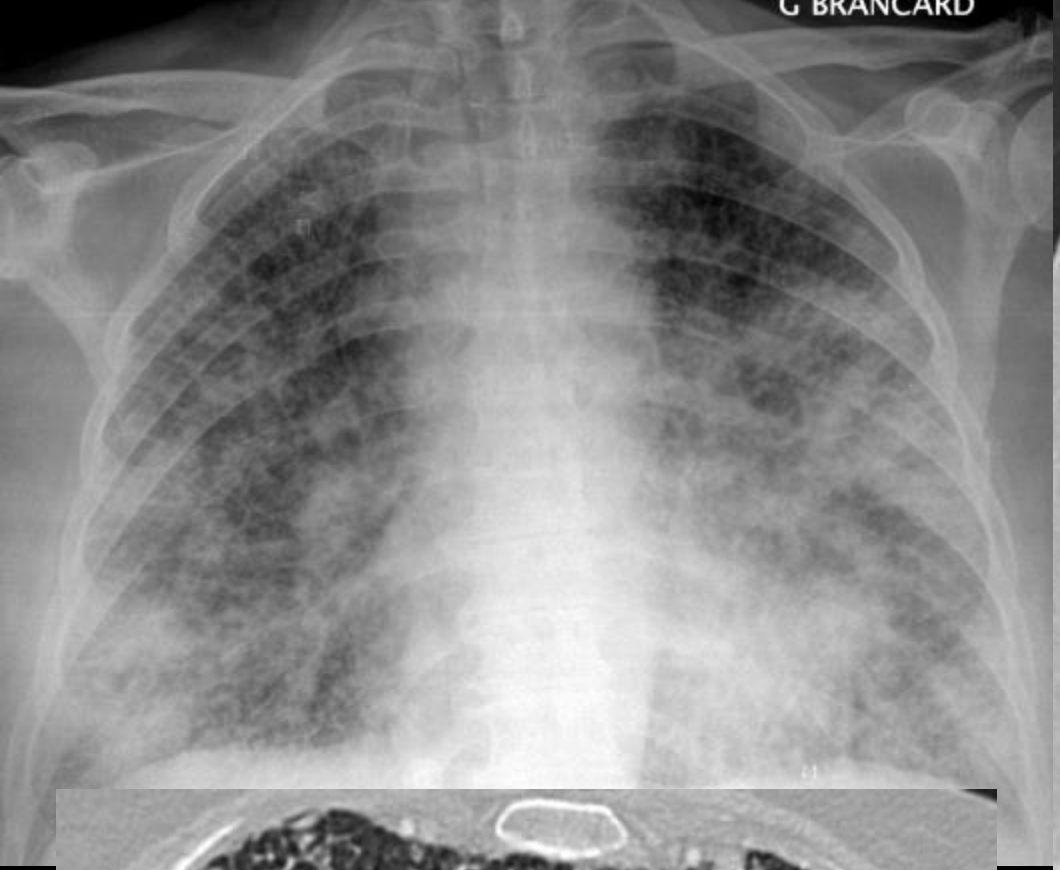


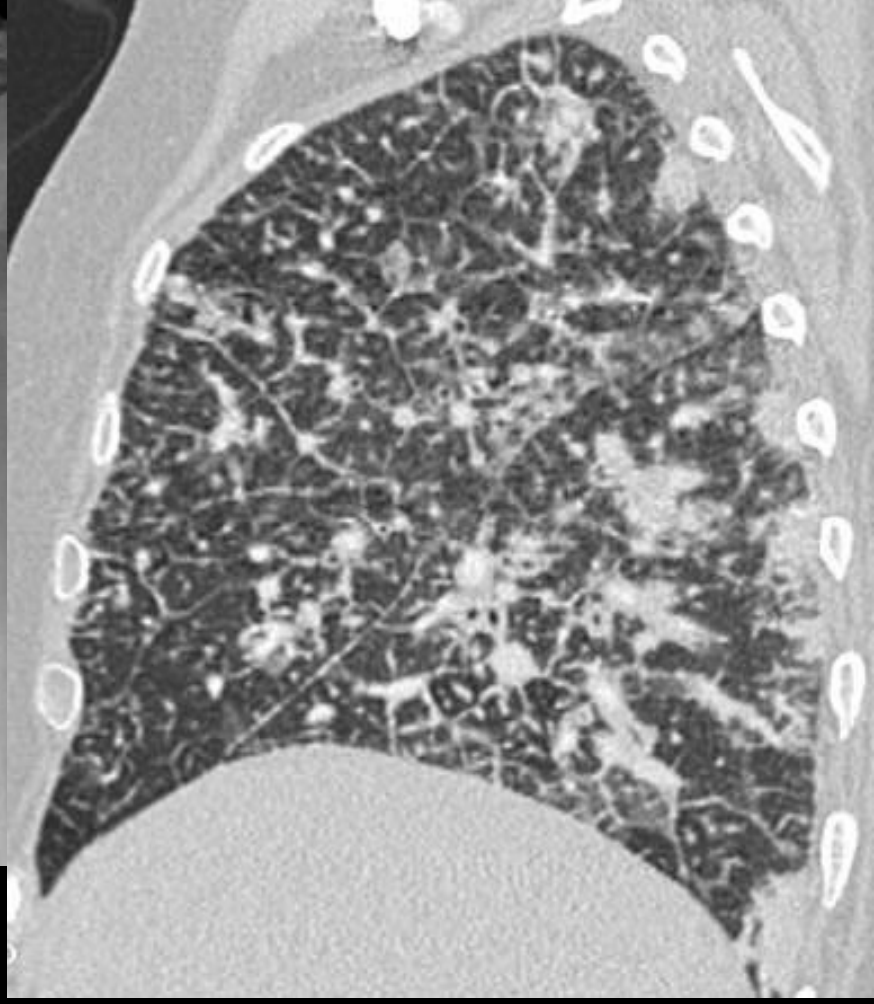


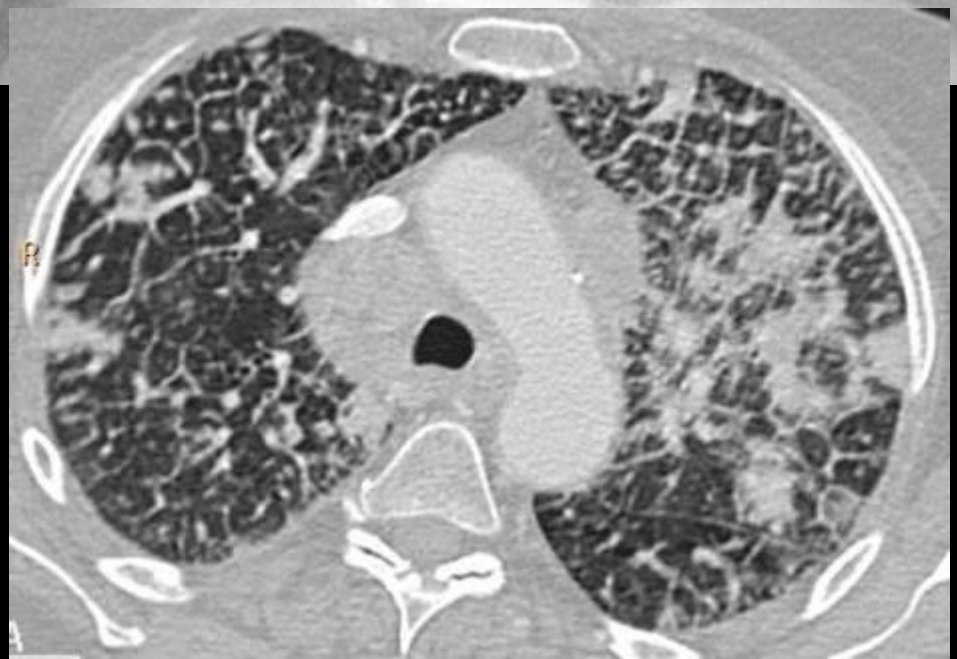


**Lymphangite carcinomateuse.**

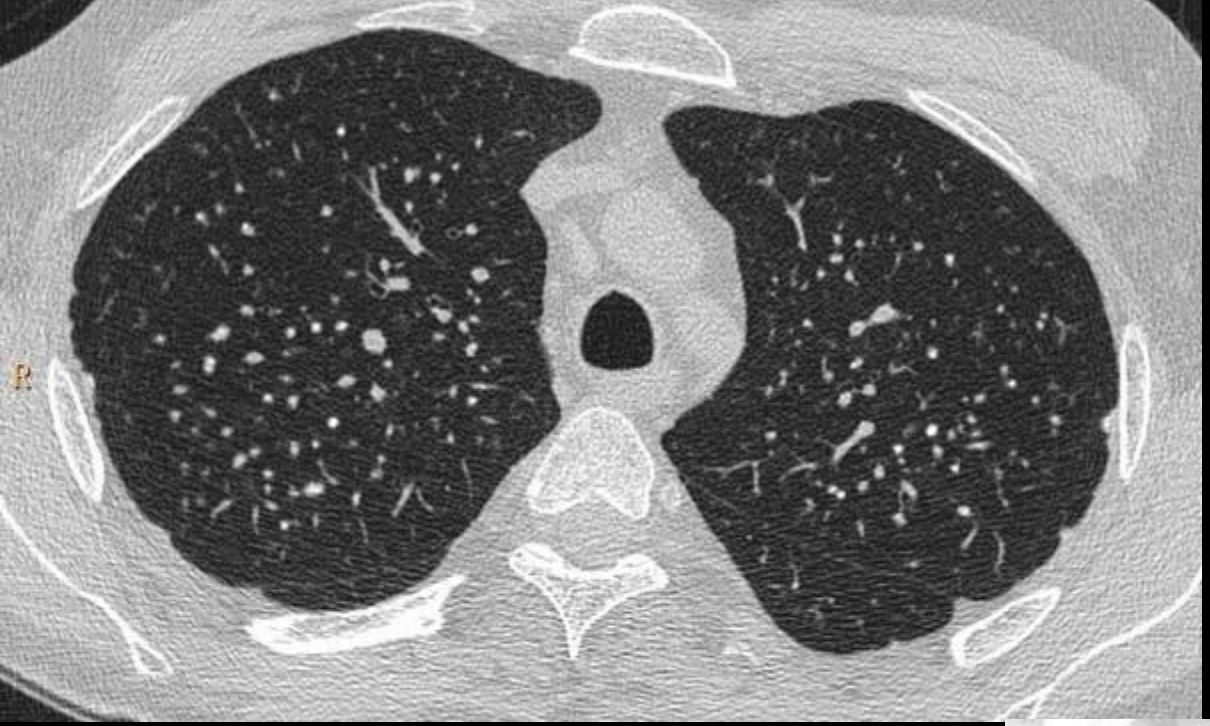
**L’ infiltration micronodulaire est constituée par des amas de cellules tumorales situées autour ou  dans les canaux lymphatiques dilatés.**

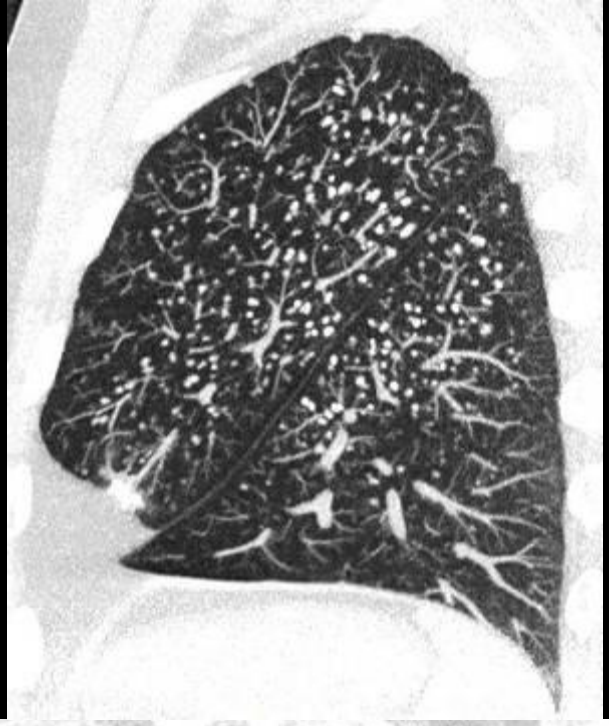


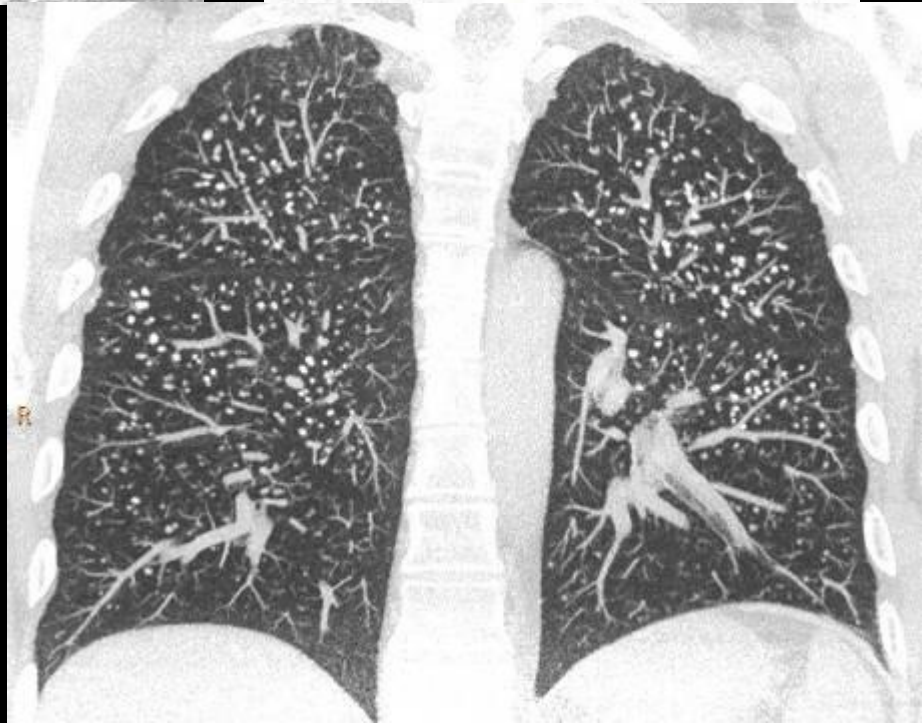


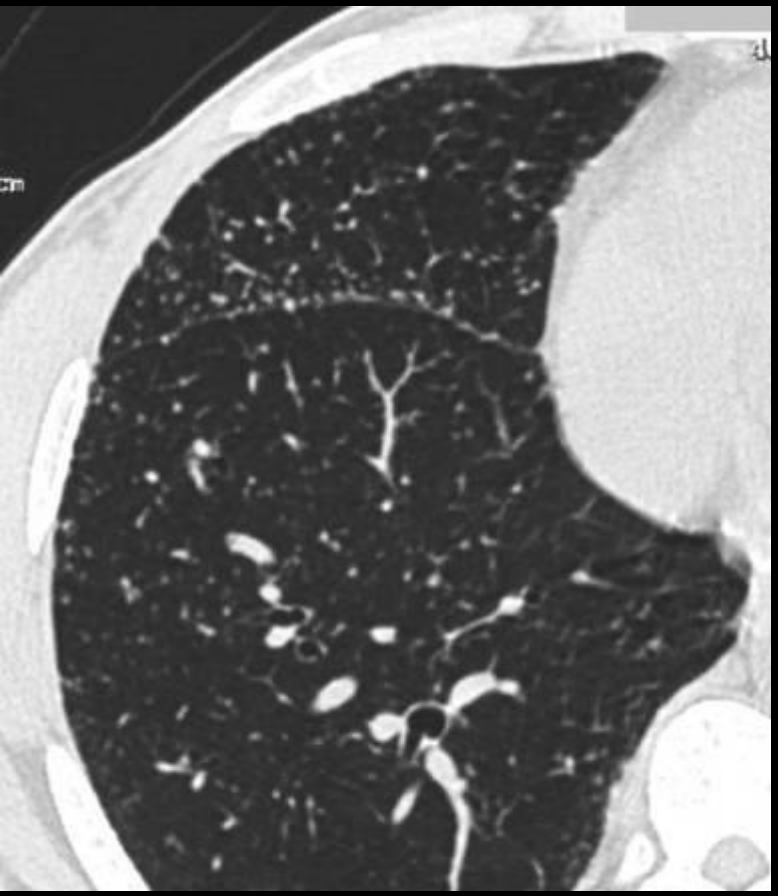
Cancer du rein droit avec métastases pulmonaires et hépatiques





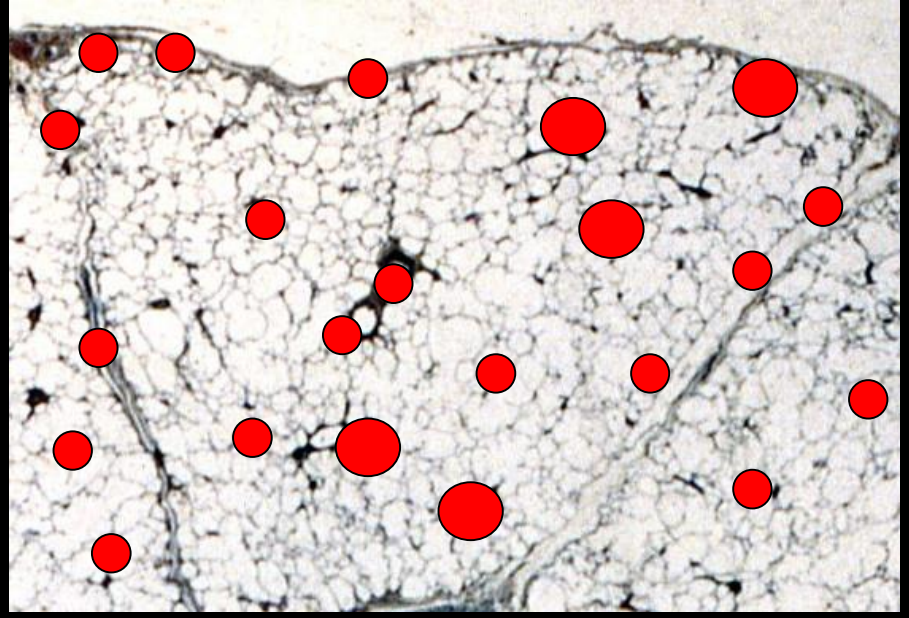
silicose





## Principales étiologies

**Sarcoïdose**
**Lymphangite carcinomateuse**
**Lymphome pulmonaire**
**Bérylliose ; Silicose**
**Amylose**
**LIP *(syndrome sec ; maladie auto-immune ; VIH)***



# MICRONODULATION UBIQUISTE

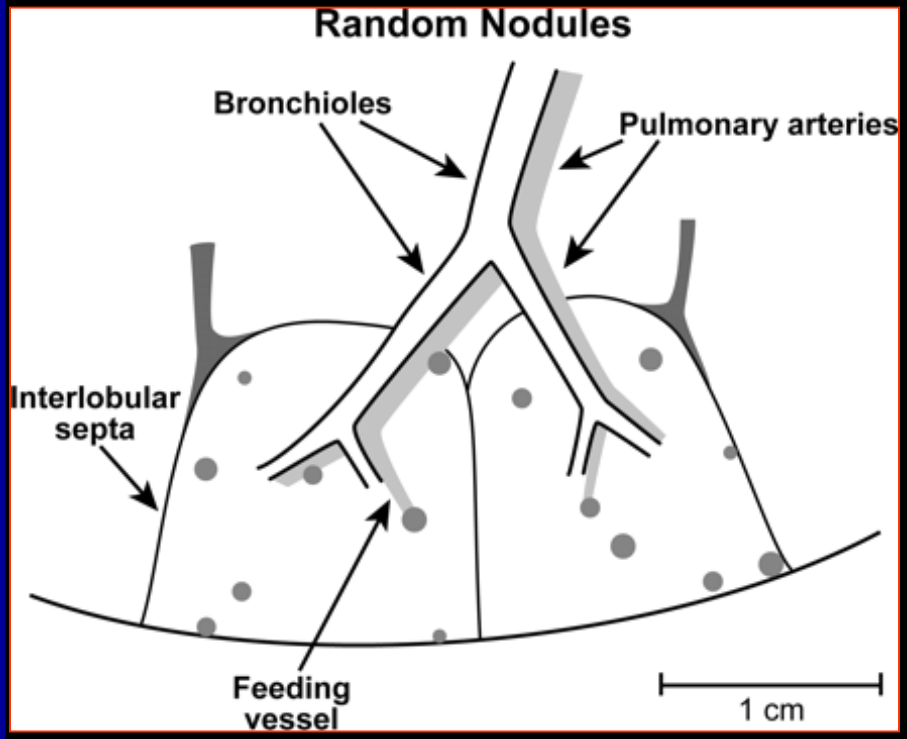
# Modèle micronodulaire ubiquiste

**micronodules** régulièrement répartis au niveau des deux plages pulmonaires, **sans prédominance éléments topographique par rapport à la surface pleurale, aux scissures, aux éléments bronchovasculaires, et aux limites du lobule.**

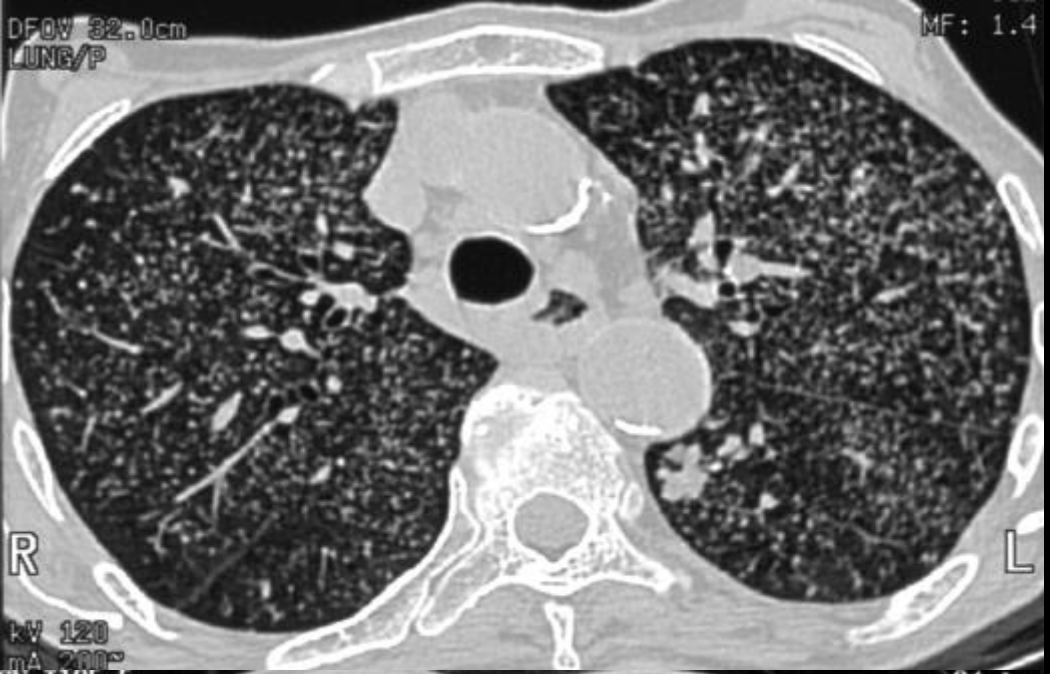
**diamètre identique**

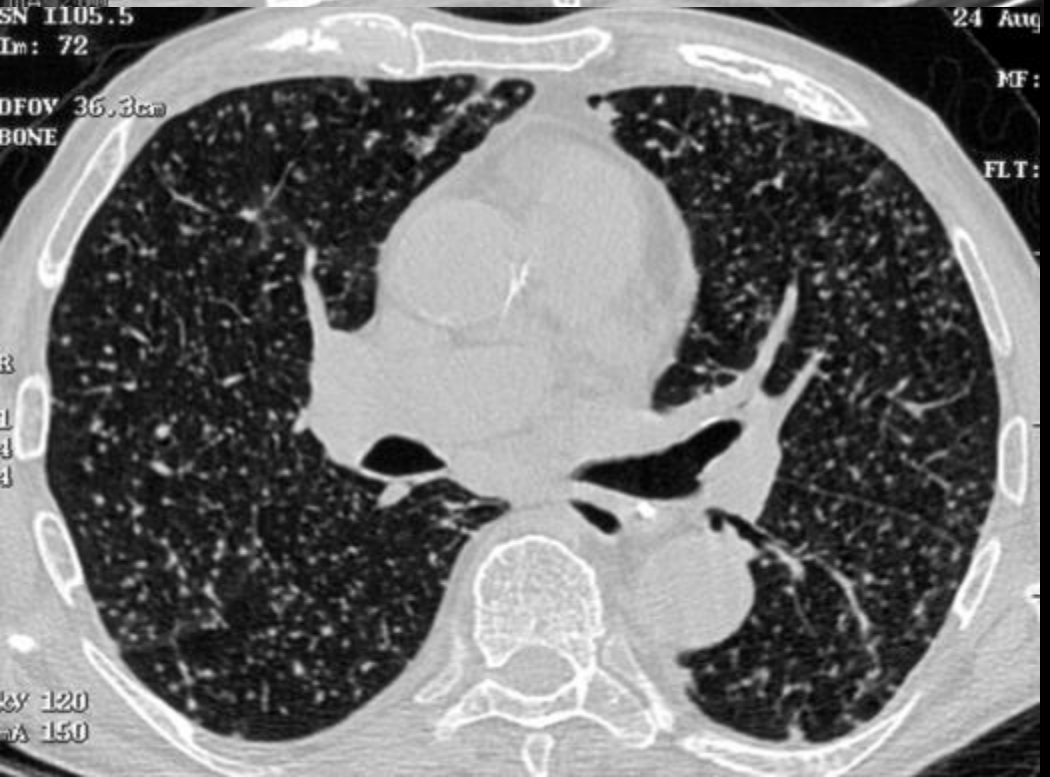
## étiologies

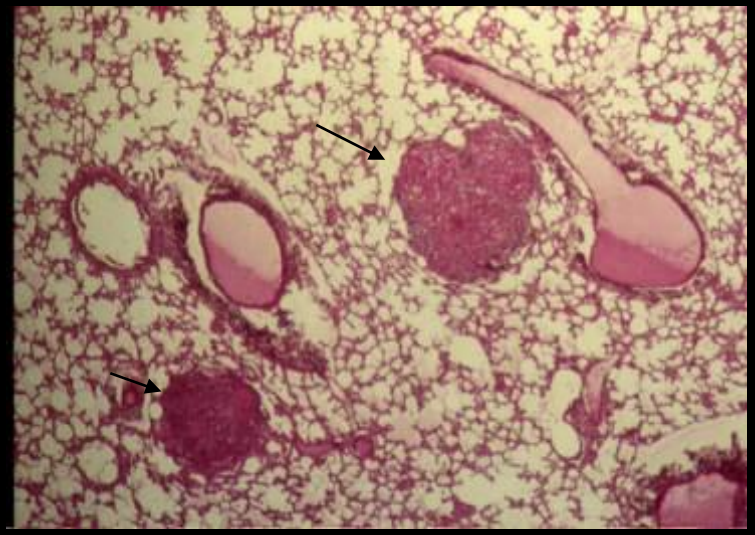
- **tuberculeuse**
- **métastatique**
  - **mycoses *(aspergillose, candidose)*,**
  - **viroses *(herpès, CMV)*.**



# Miliaire tuberculeuse hématogène



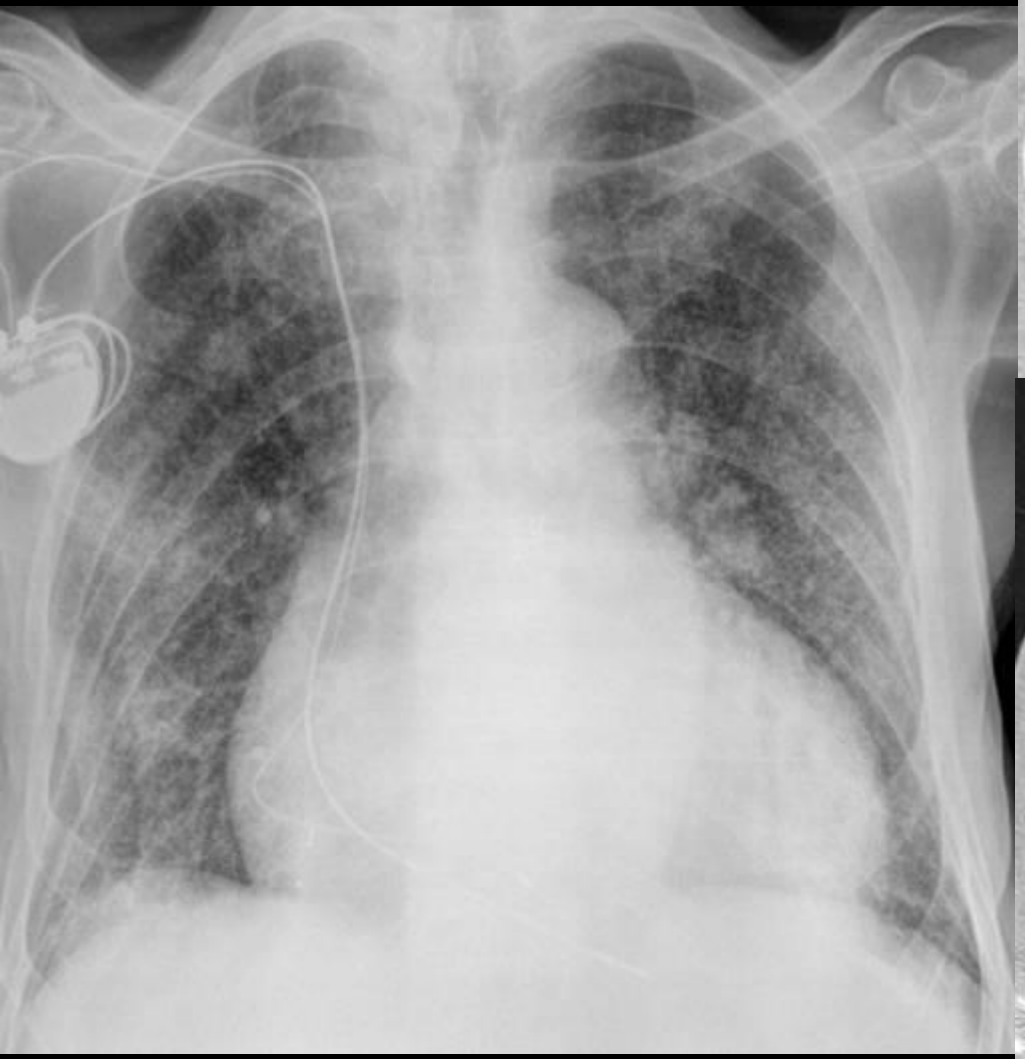



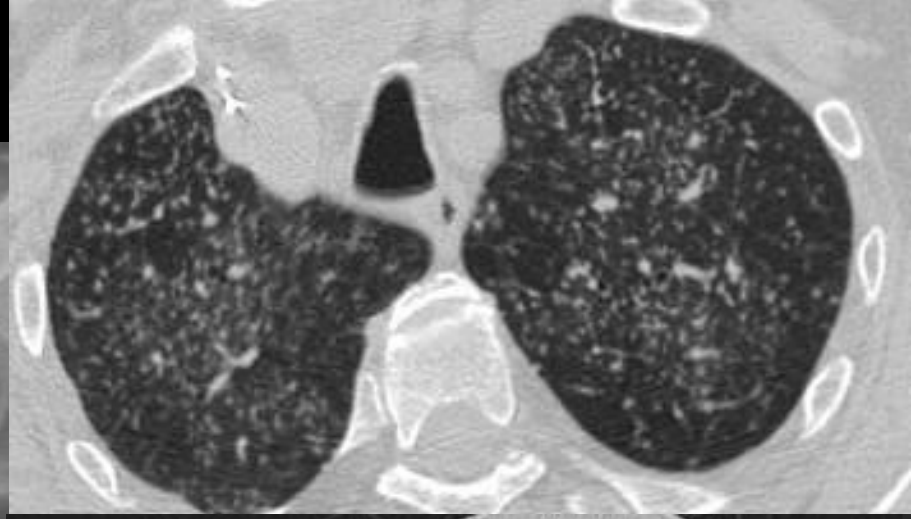



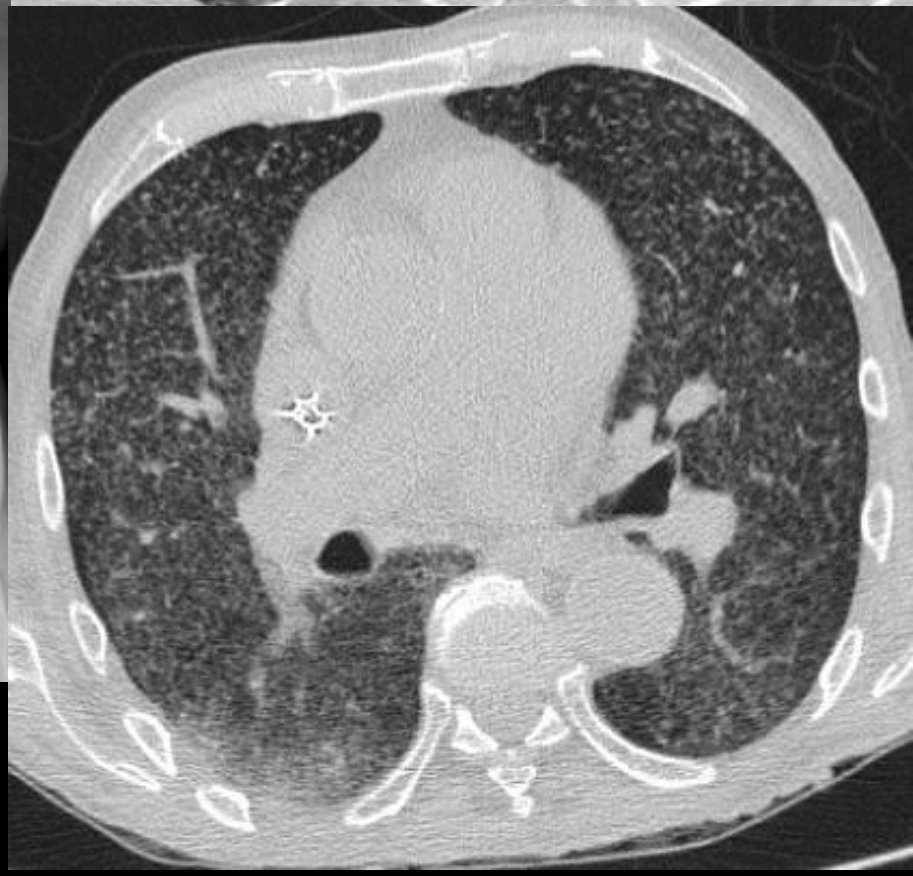
**Histologie**

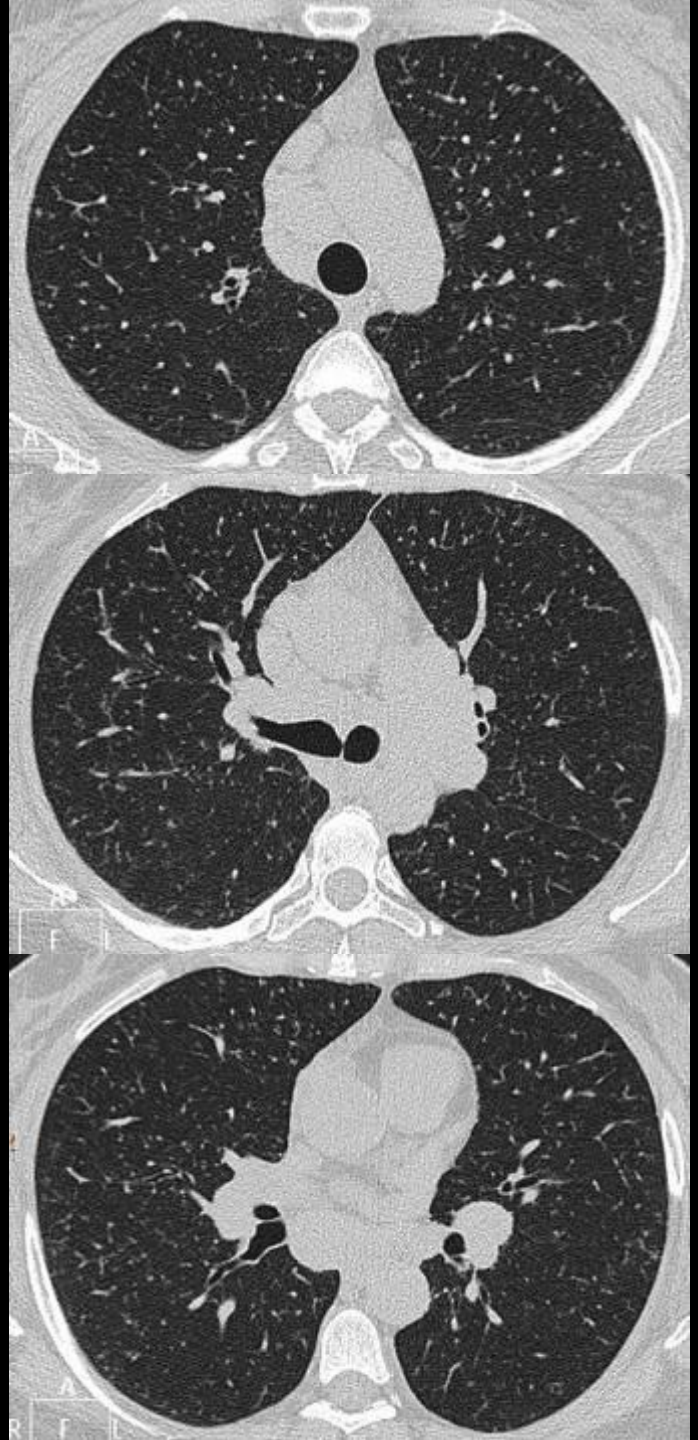
**Agglomérats de follicules à distance des éléments broncho-artériels et veineux**

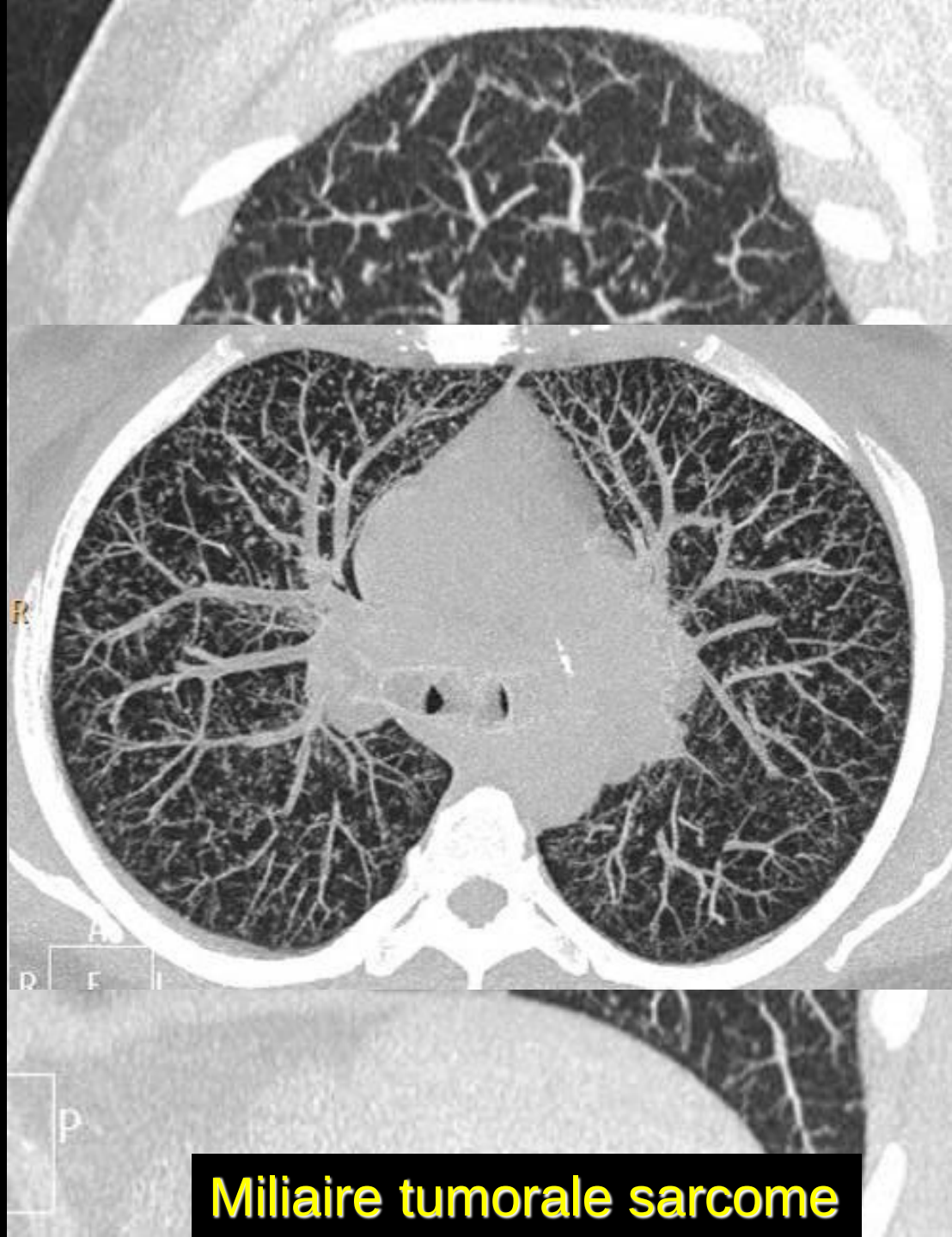
# Miliaire tuberculeuse hématogène



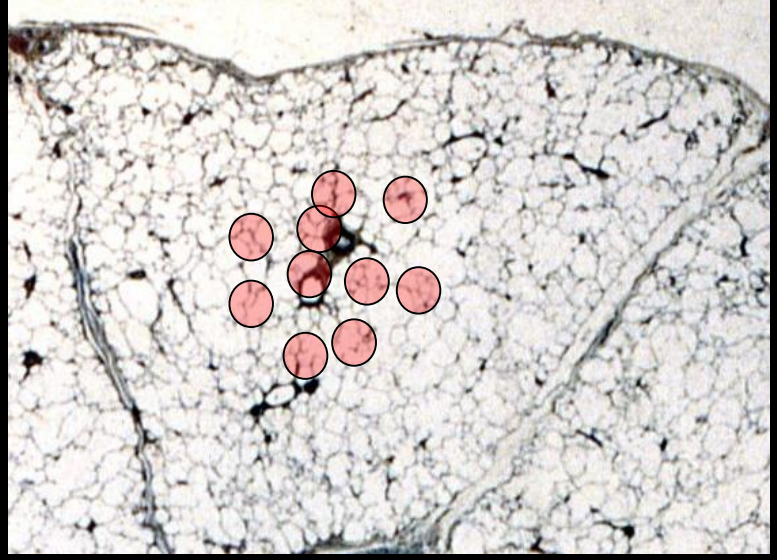


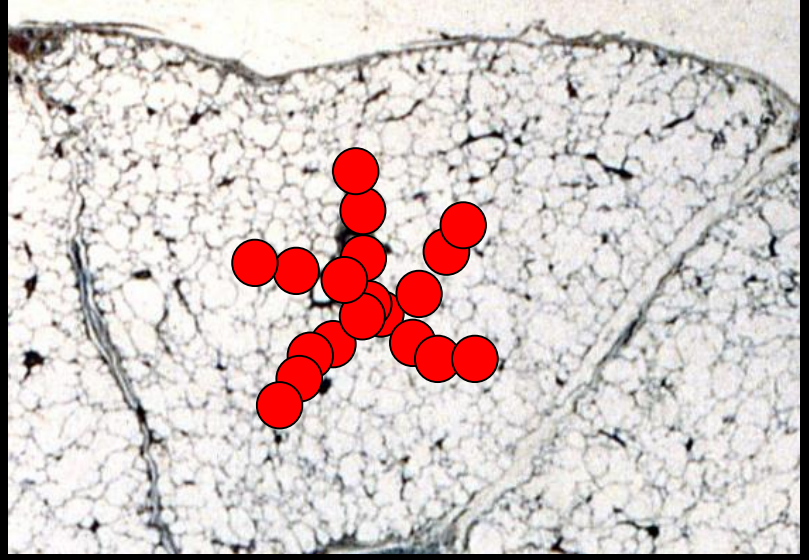






Miliaire tumorale sarcome





# NODULES CENTROLOBULAIRES

# Topographie centrolobulaire ?

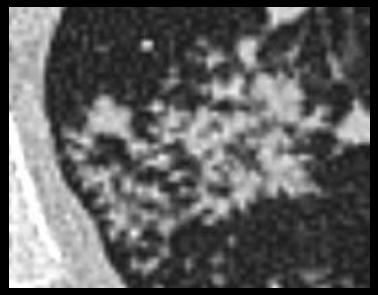
**région du pédicule broncho vasculaire du LPS : B – A - L**

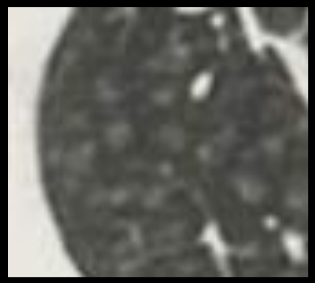

**typiquement à 3 mm de la plèvre et des septas**

From Takahashi M. Imaging of pulmonary emphysema: a pictorial review. Int J Chron Obstruct Pulmon Dis. 2008;3(2):193-204.

# Nodules centrolobulaires

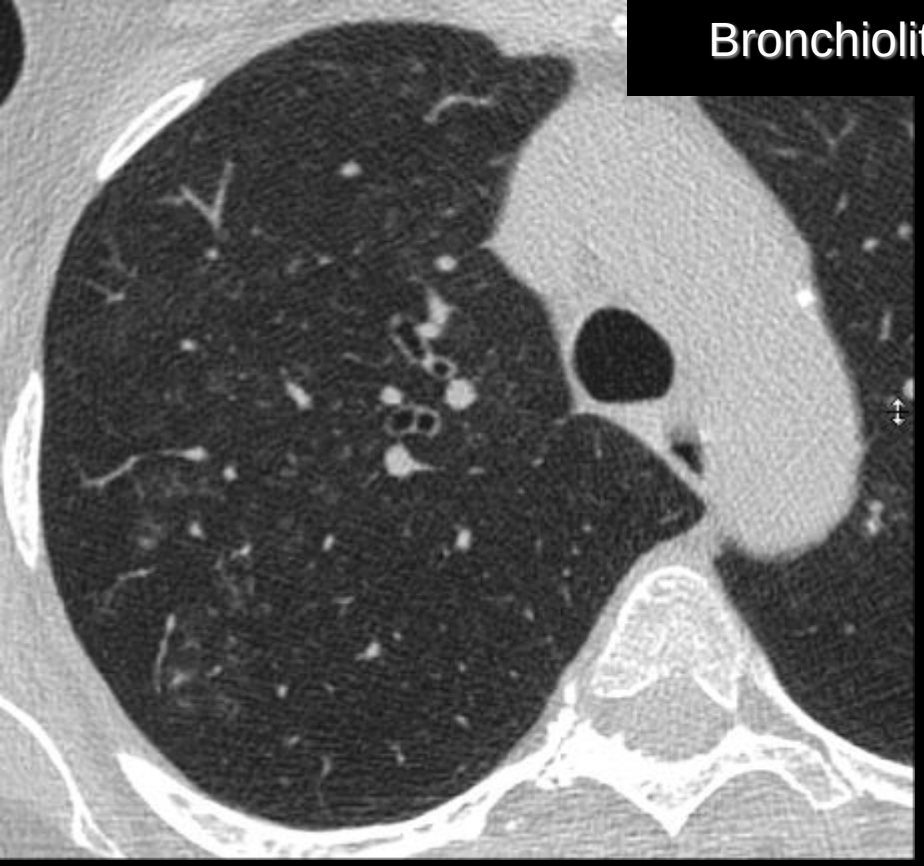
- Limites : nettes régulières / floues

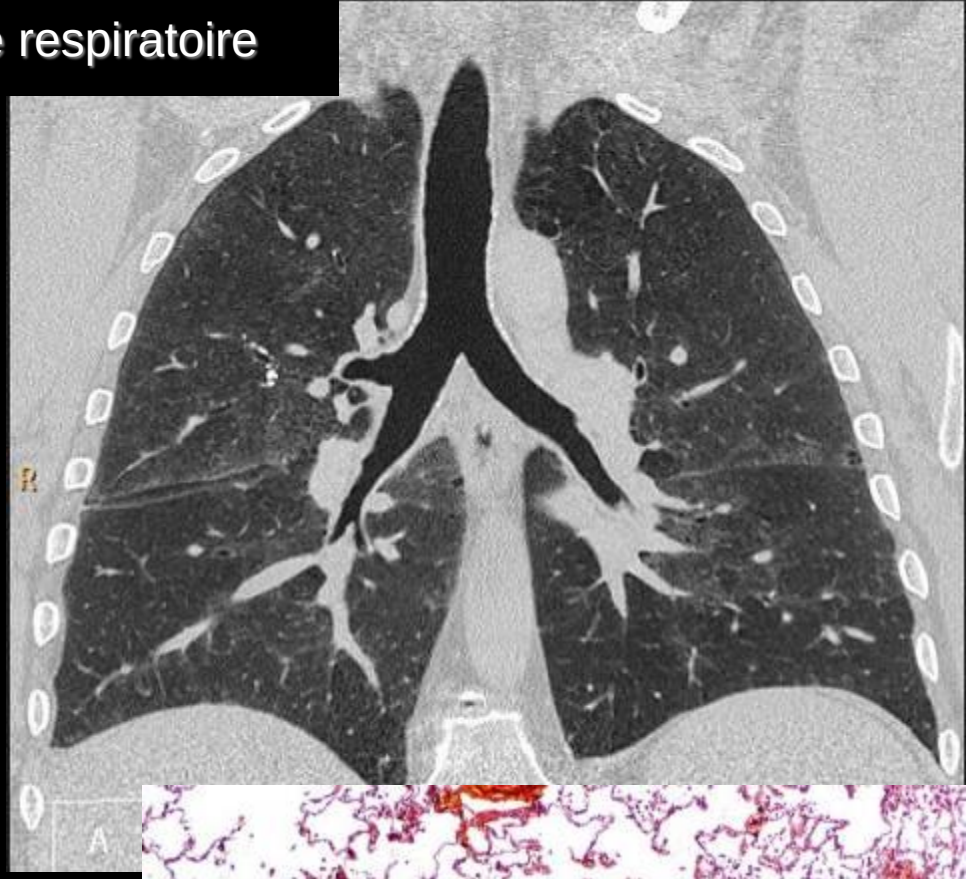


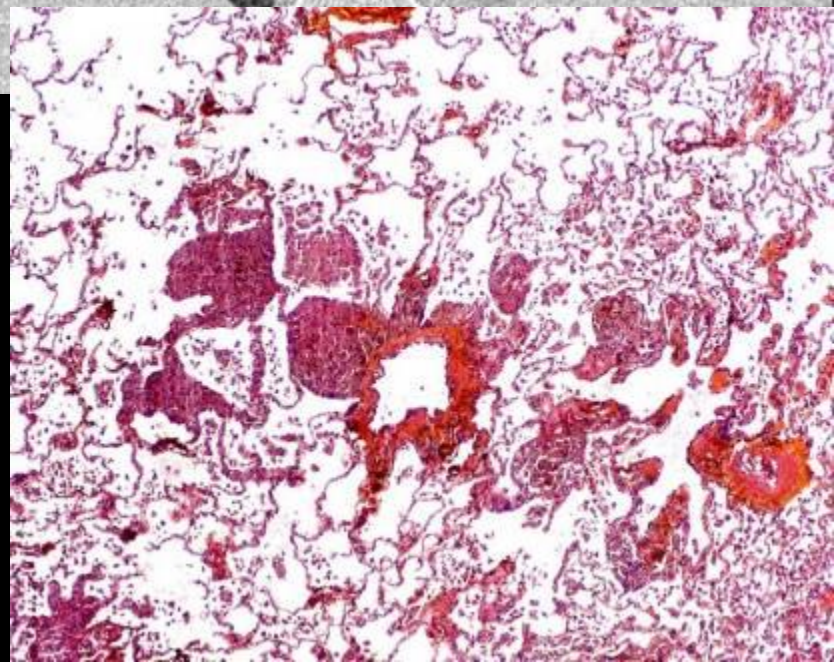


- Densité : tissulaire / verre dépoli

# Bronchiolite respiratoire







**Pathologie tabagique : EXCES DE MACROPHAGES**

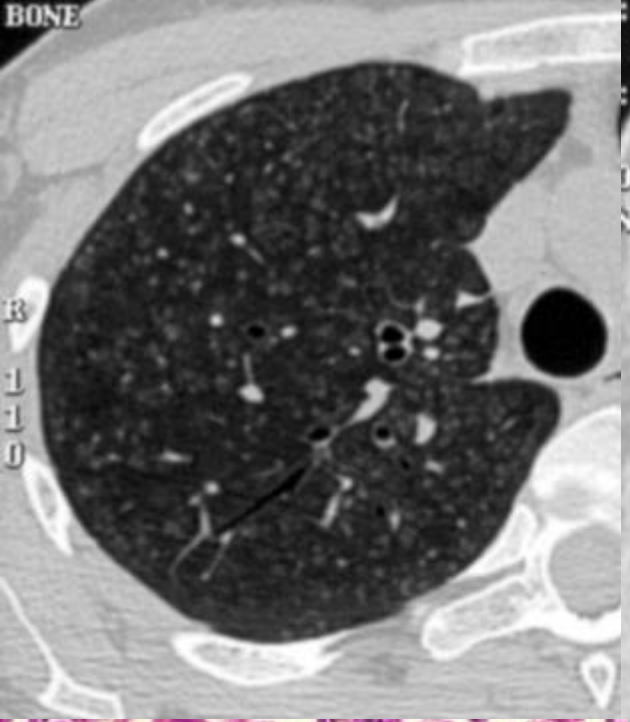
***Bronchiolite respiratoire***

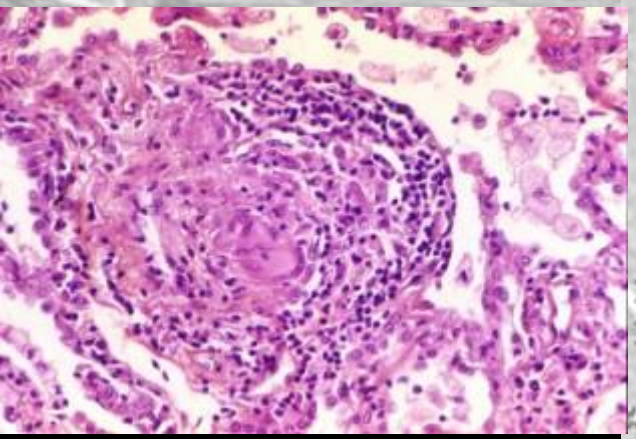
- **inflammation chronique bronchiolaire, macrophages tatoué**

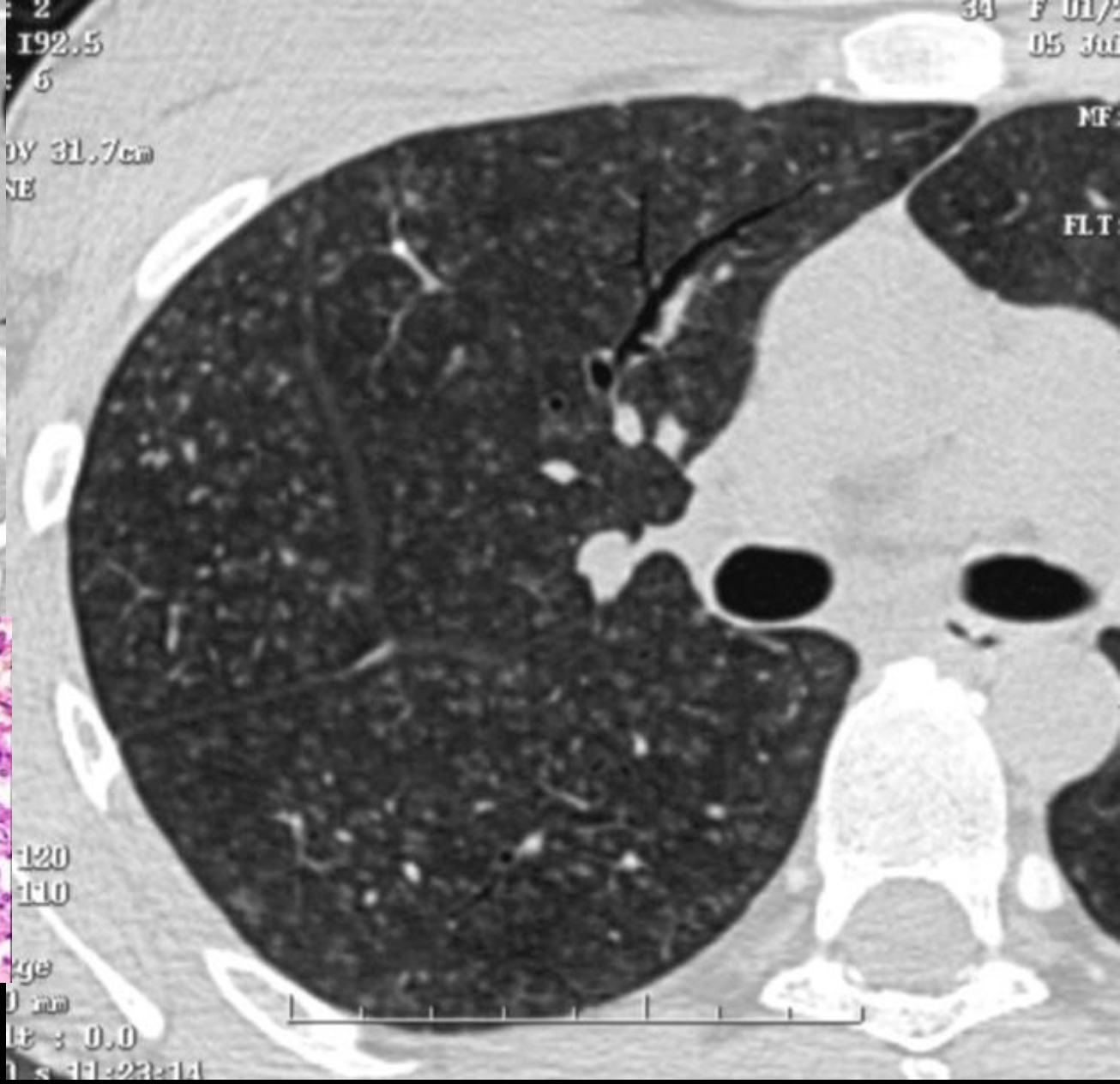
***Bronchiolite respiratoire avec infiltration pulmonaire diffuse* (RB-ILD)**

- **Extension dans l'espace des anomalies TDM.**

***Pneumopathie interstitielle desquamative* (DIP))**

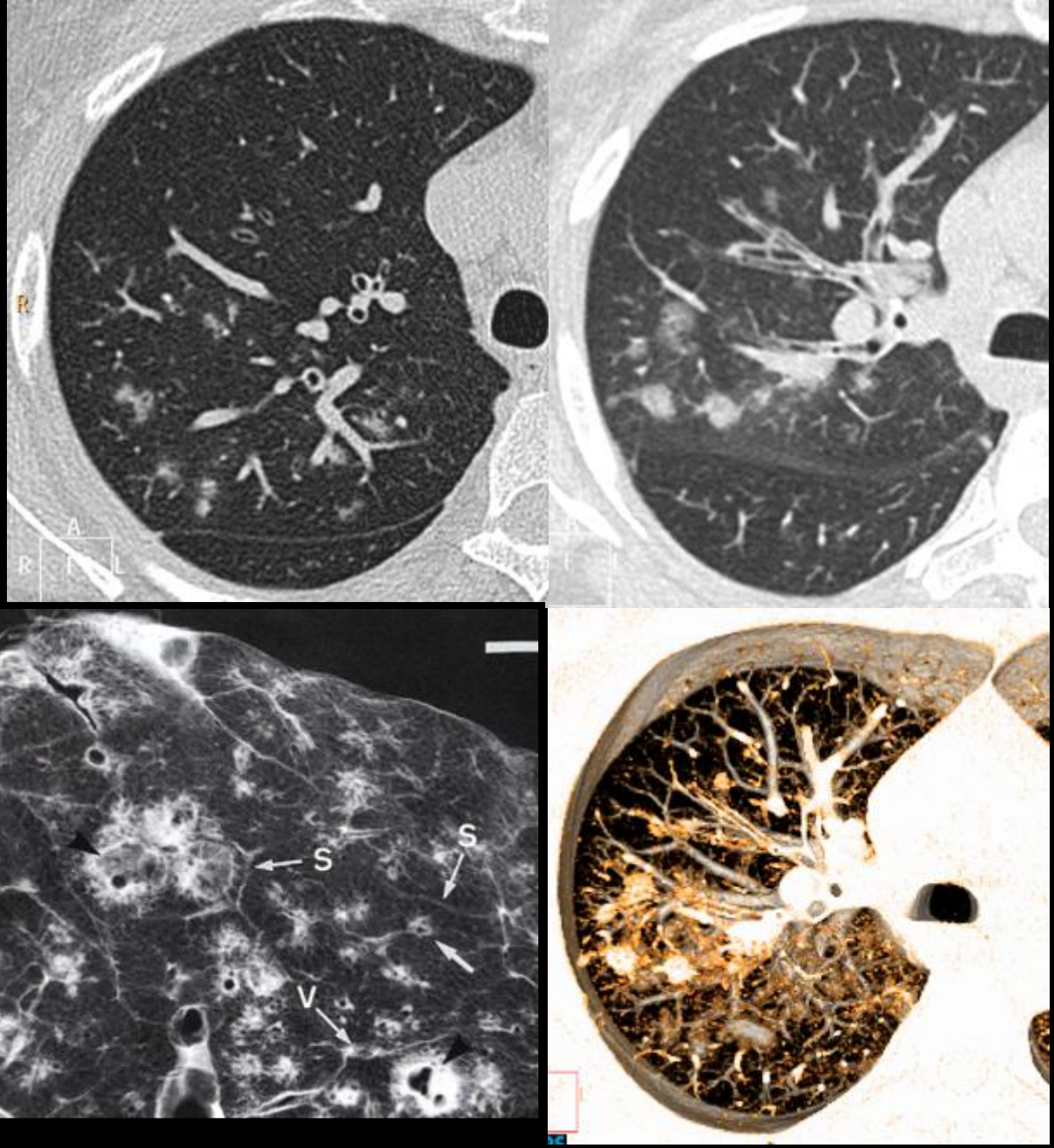


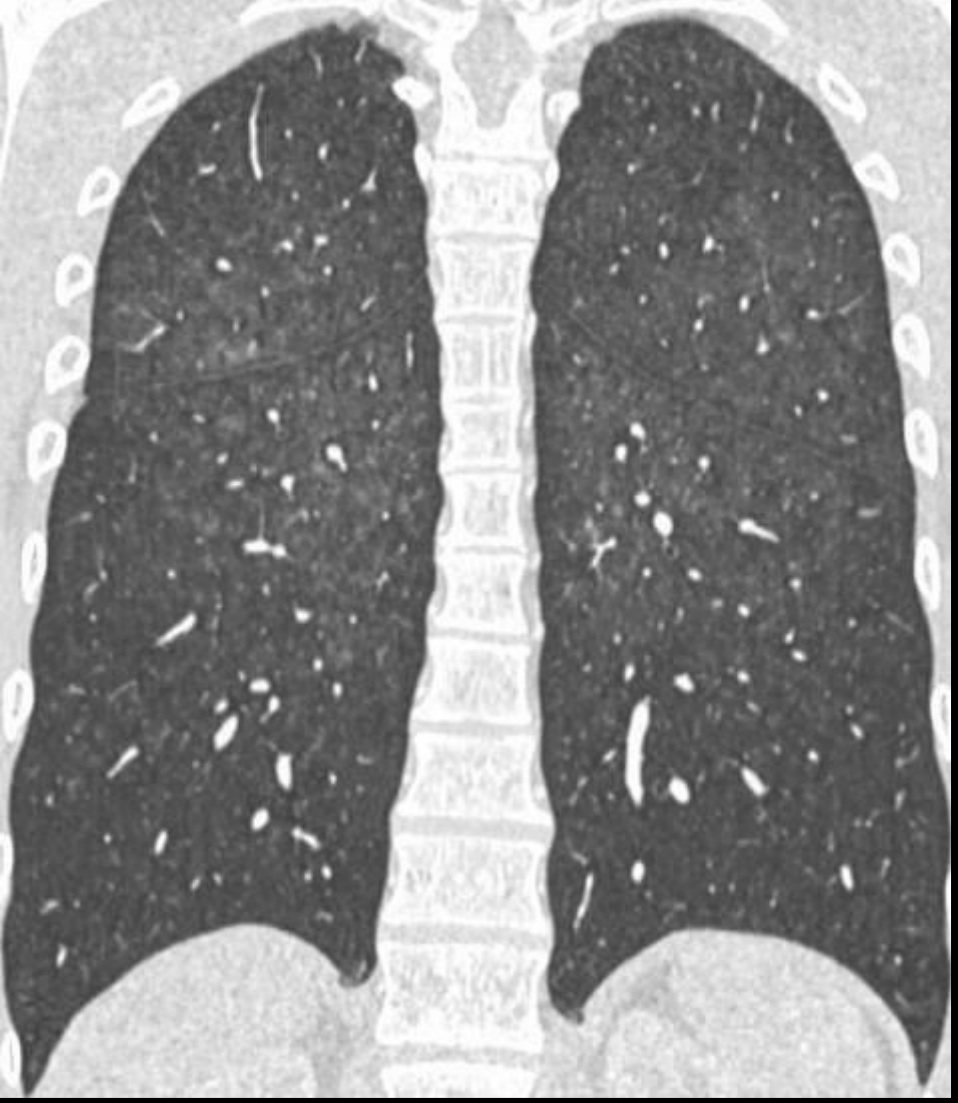



**Alvéolite allergique extrinsèque *(forme aigue)***

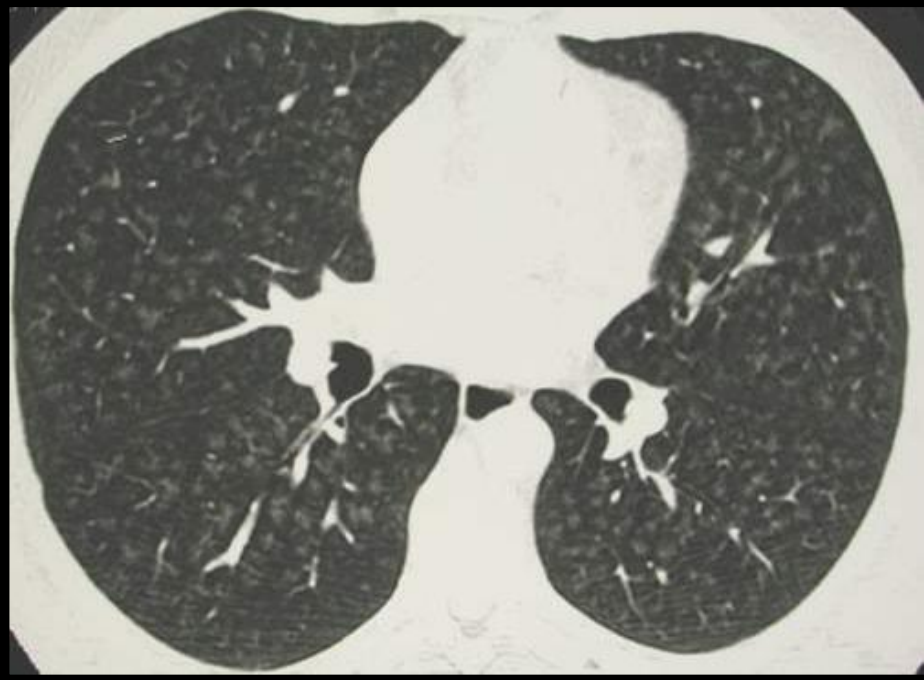
**Opacités à contours flous de siège centro-lobulaire.**




bronchopneumonie grippale

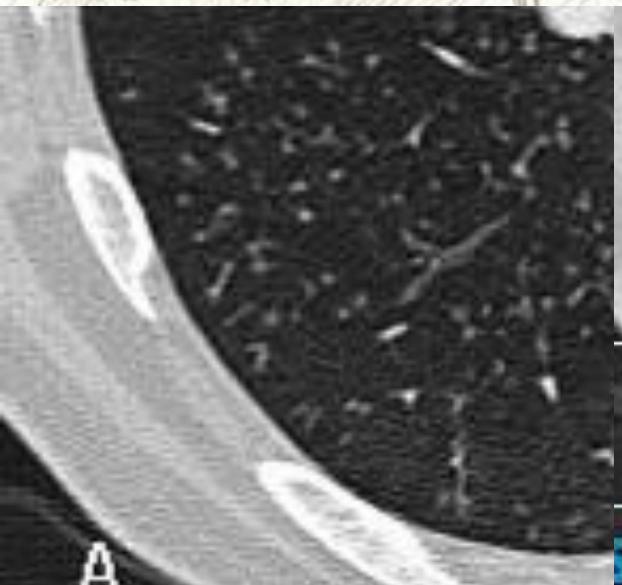


Hémorragie alvéolaire



Hémosidérose

F Laurent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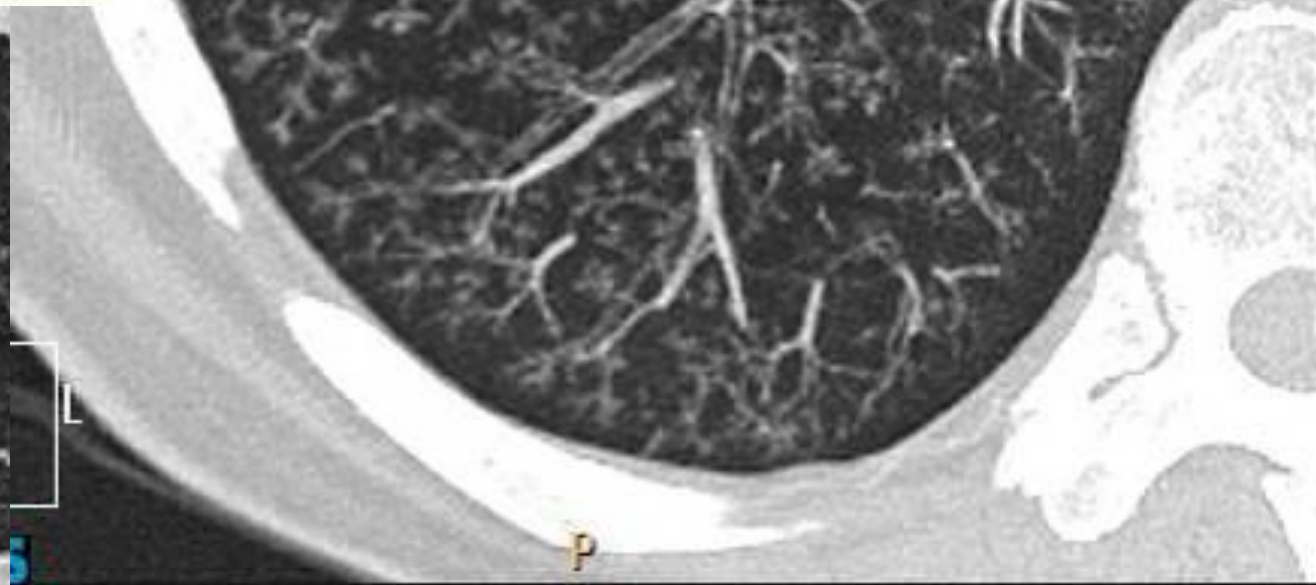
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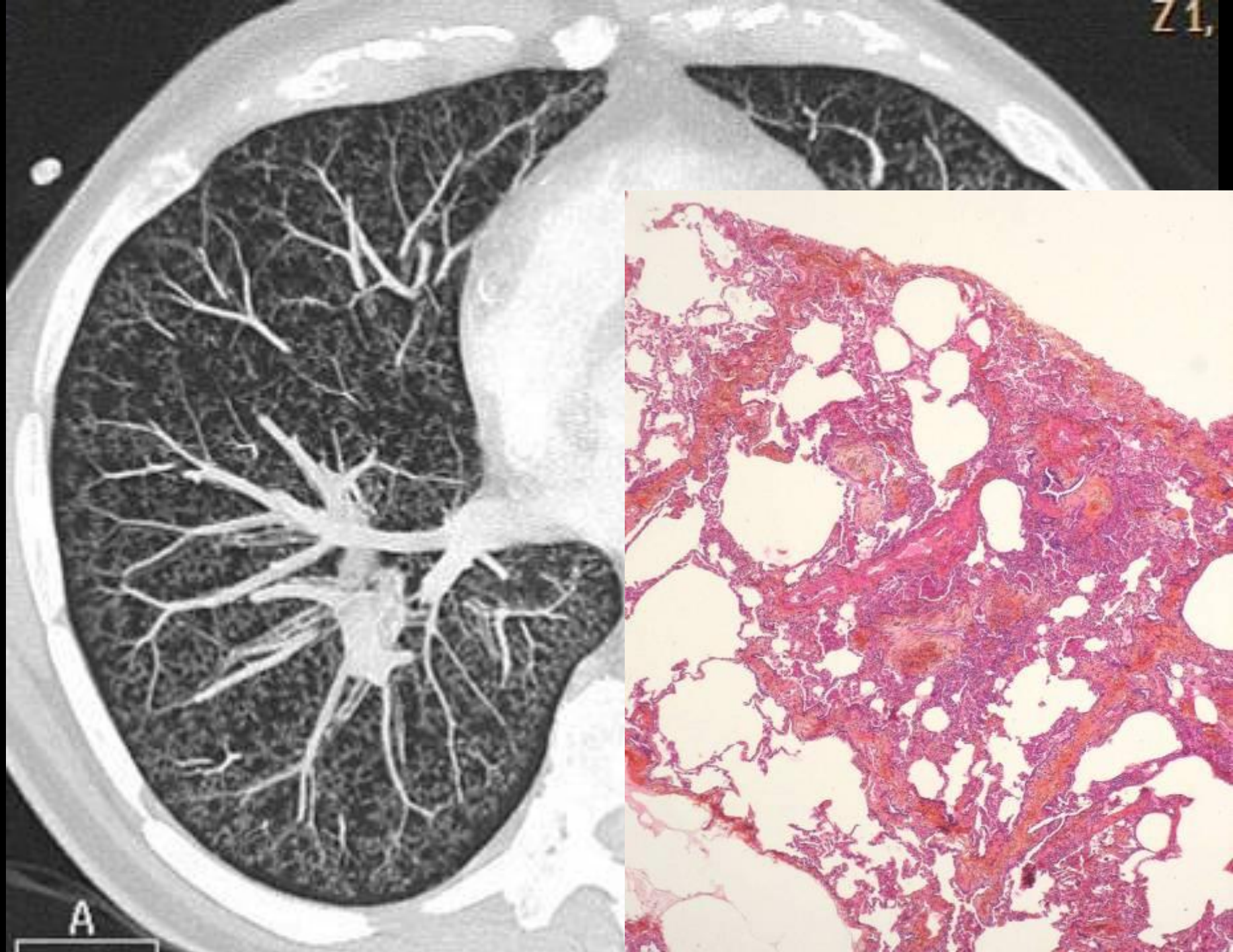
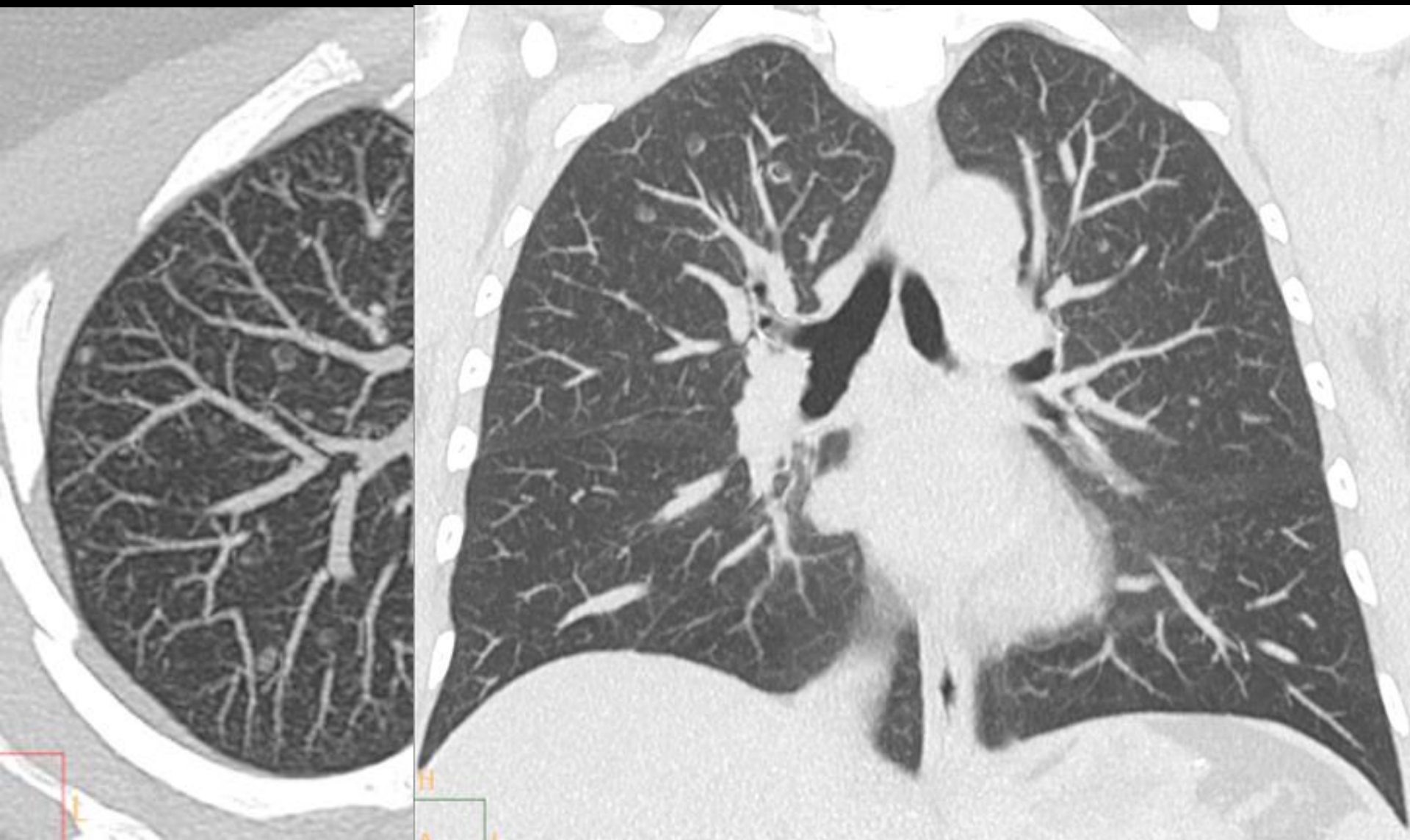

A

- Peripheral airway disease
  - Infection
    - Bacterial
      - *Mycobacterium tuberculosis*
      - *M avium-intracellulare* complex
      - *Staphylococcus aureus*
      - *Haemophilus influenzae*
    - Fungal
      - *Aspergillus*
    - Viral
      - Cytomegalovirus
      - Respiratory syncytial virus
  - Congenital disorders
    - Cystic fibrosis
    - Kartagener syndrome
  - Idiopathic disorders
    - Obliterative bronchiolitis
    - Diffuse panbronchiolitis
  - Aspiration
  - Inhalation
    - Toxic fumes and gases
  - Immunologic disorders
    - Allergic bronchopulmonary aspergillosis
  - Connective tissue disorders
    - Rheumatoid arthritis
    - Sjögren syndrome
- Peripheral pulmonary vascular disease
  - Neoplasms
    - Gastric cancer
    - Breast cancer
    - Ewing sarcoma
    - Renal cancer

**Tree-in-Bud Pattern at Thin-Section CT of the Lungs: Radiologic-Pathologic Overview**
**Santiago Enrique Rossi, MD,** xSantiago Enrique Rossi
Radiographics 2005; 25: 789-801

# HX

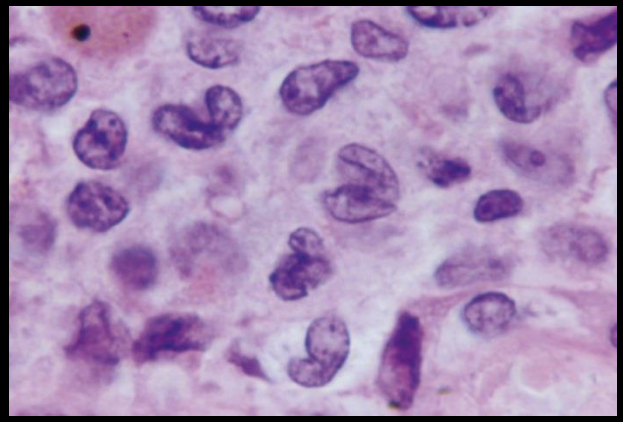


# Histiocytose Langerhansienne

- Prolifération d'histiocytes CD1+ (cellules de Langerhans) formant des granulomes.
- Développement au niveau des parois des bronchioles

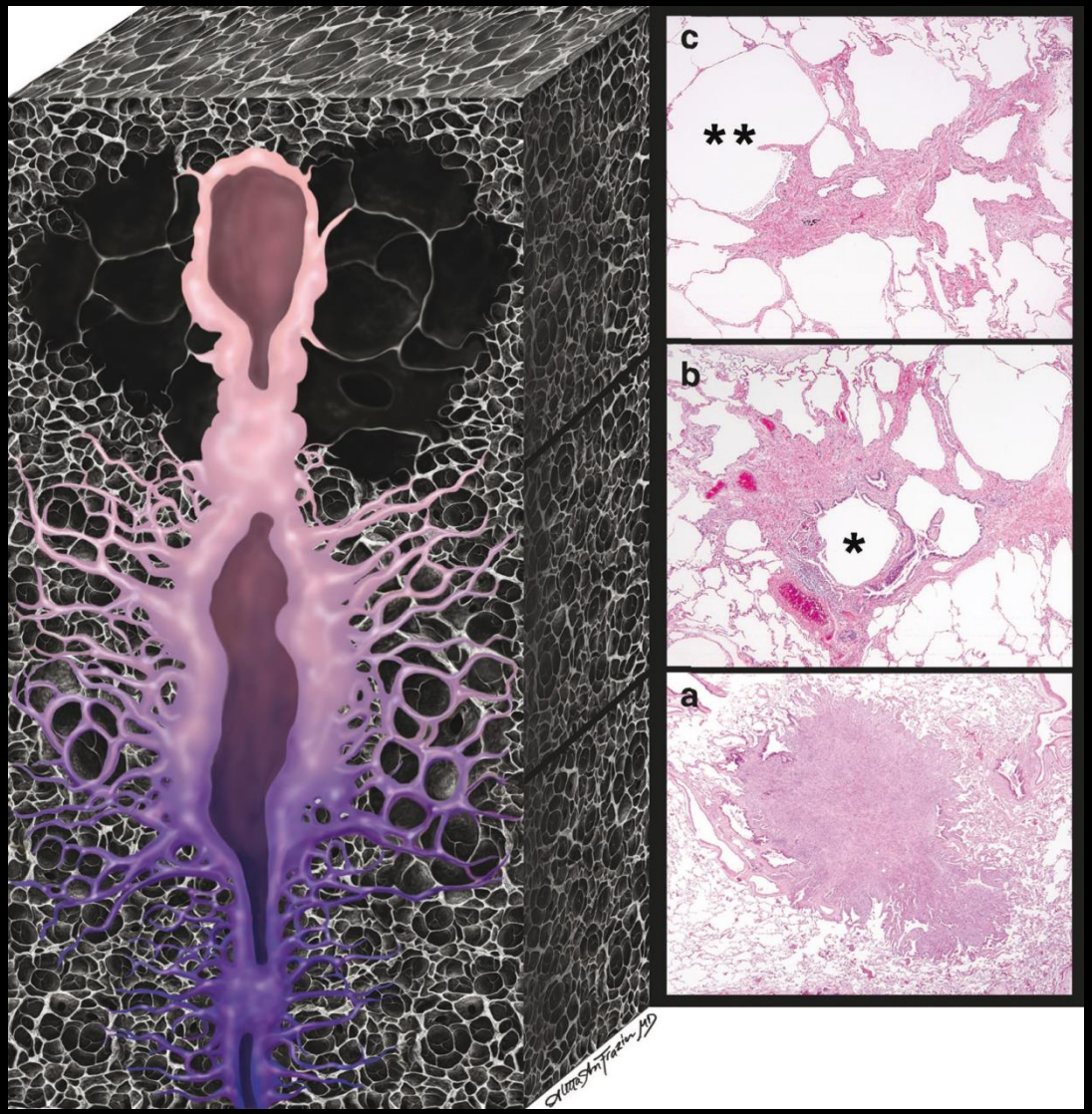
→ Bronchiolectasies/cavitation

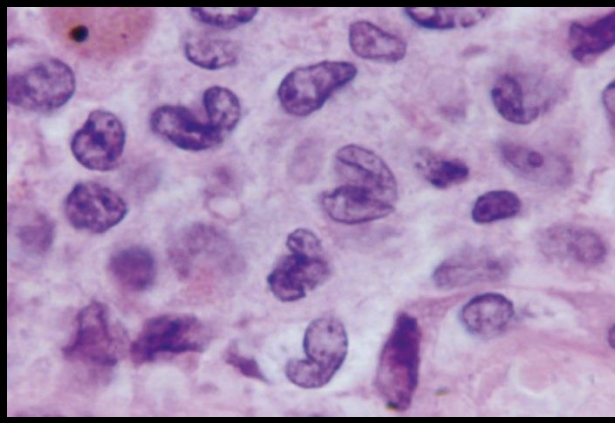
→ Kystes

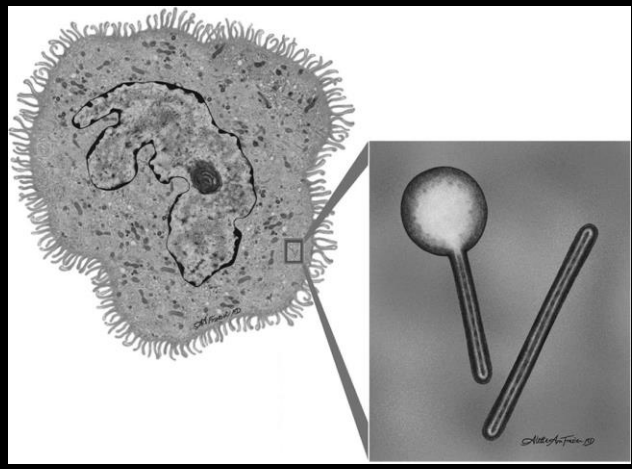


90 % des patients atteints sont fumeurs. Association fréquente avec l'emphysème ou des lésions de fibrose

# Histiocytose Langerhansienne

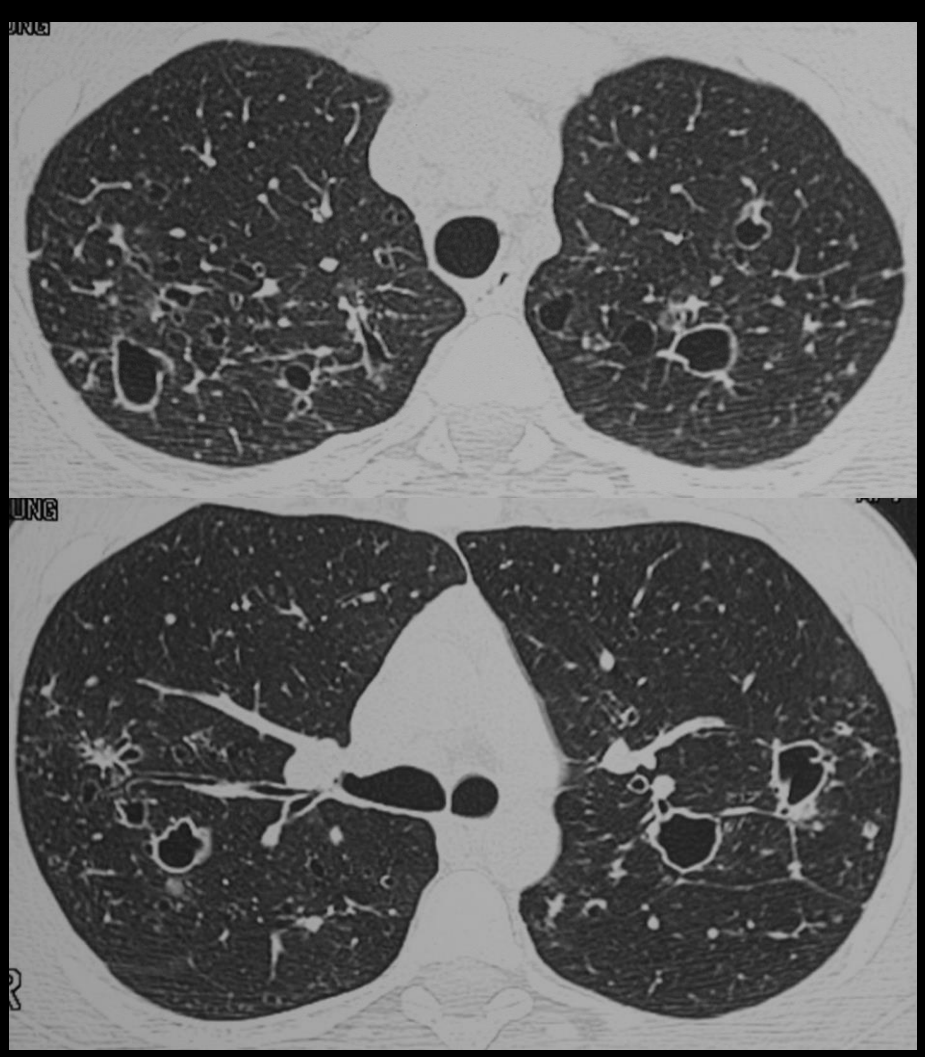


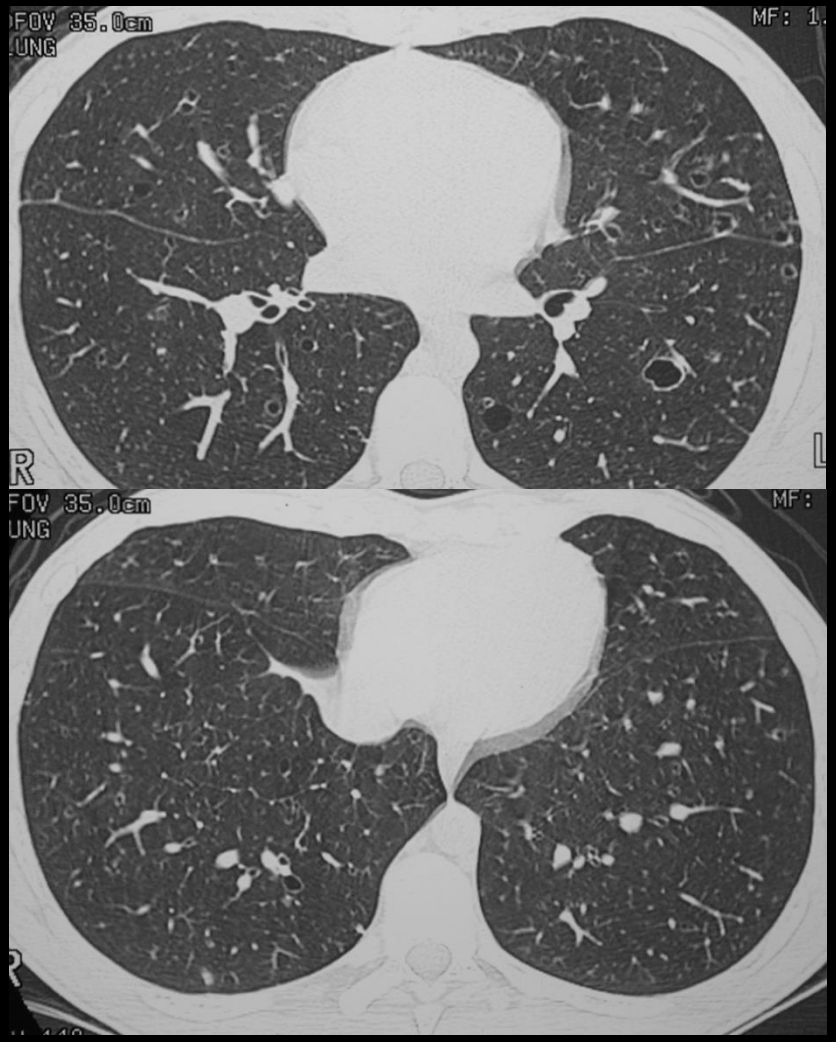





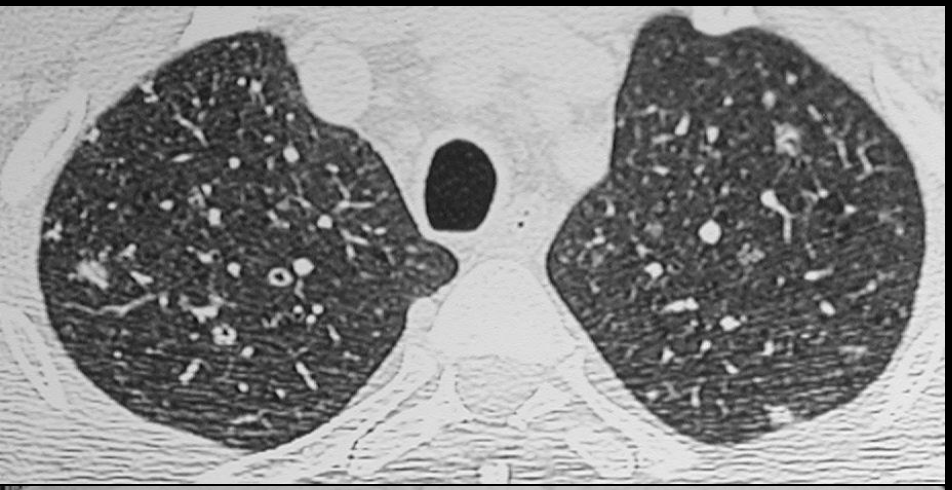
Abbot Radiographics 2005

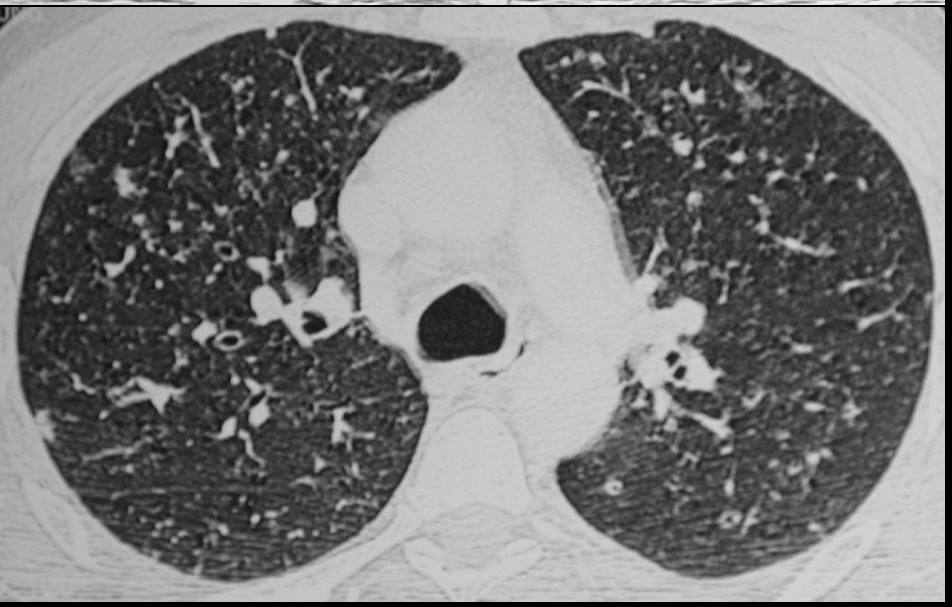
# Histiocytose Langerhansienne

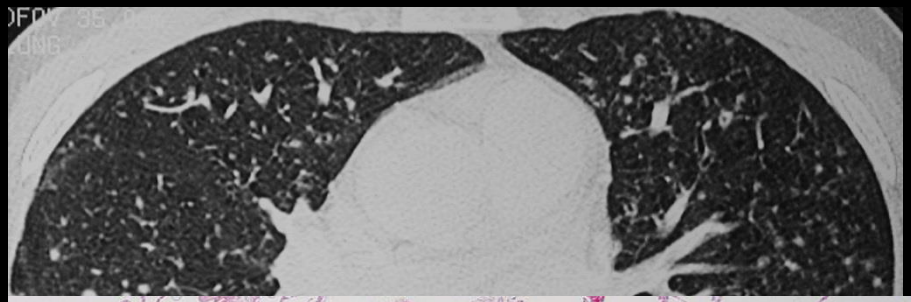


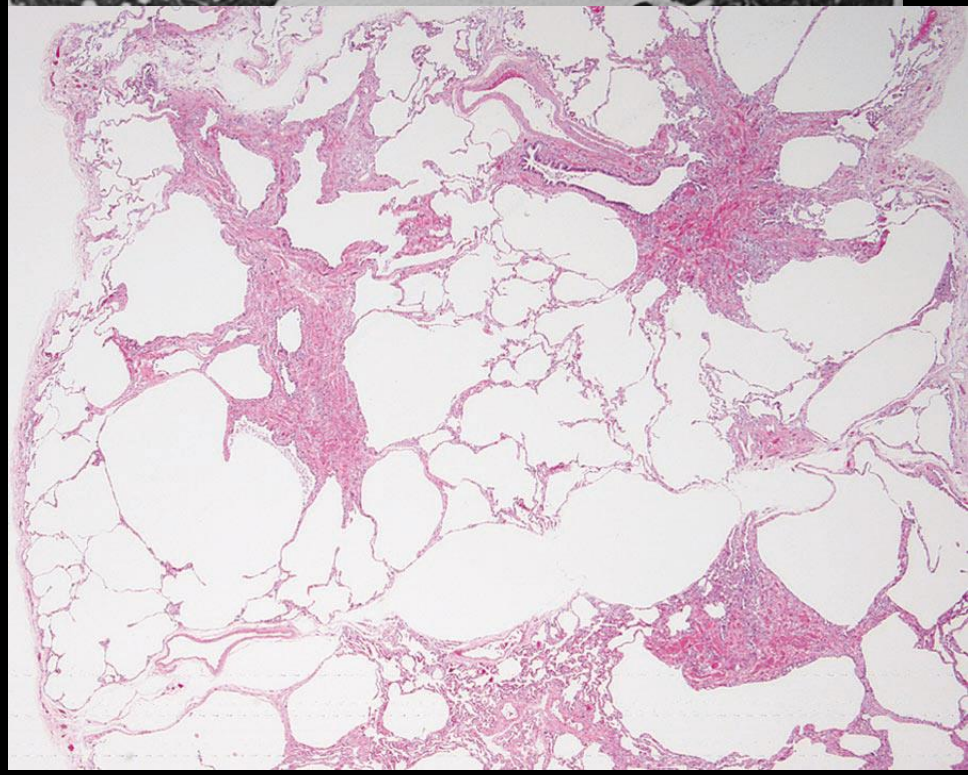


# Histiocytose Langerhansienne

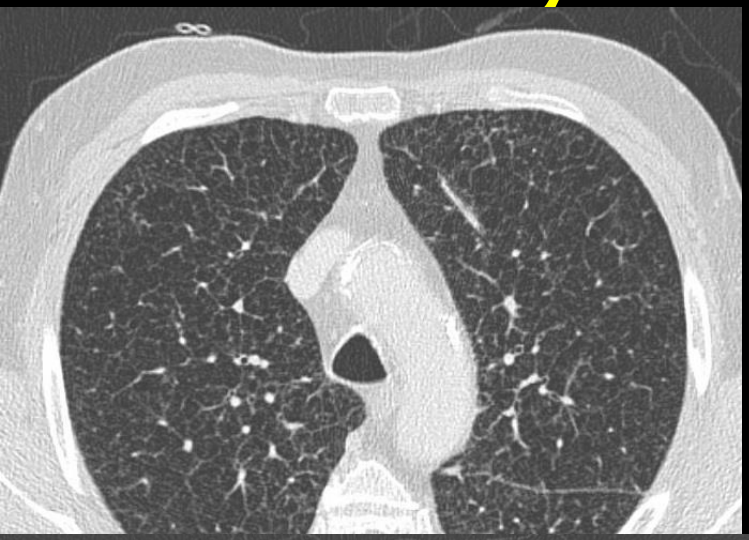


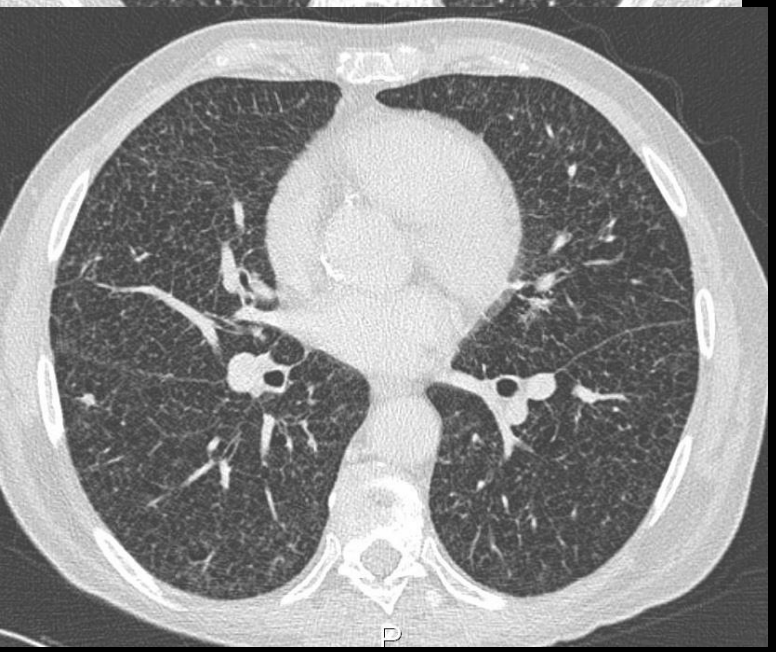


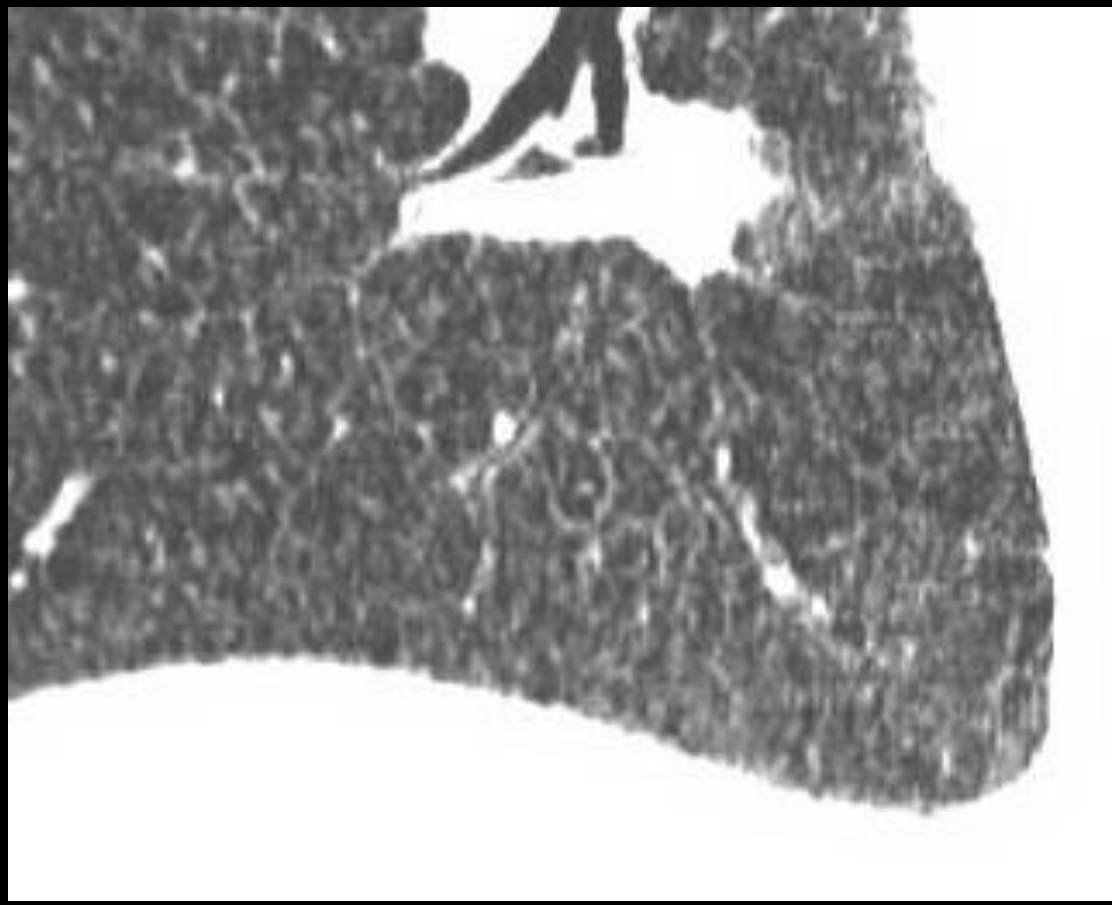




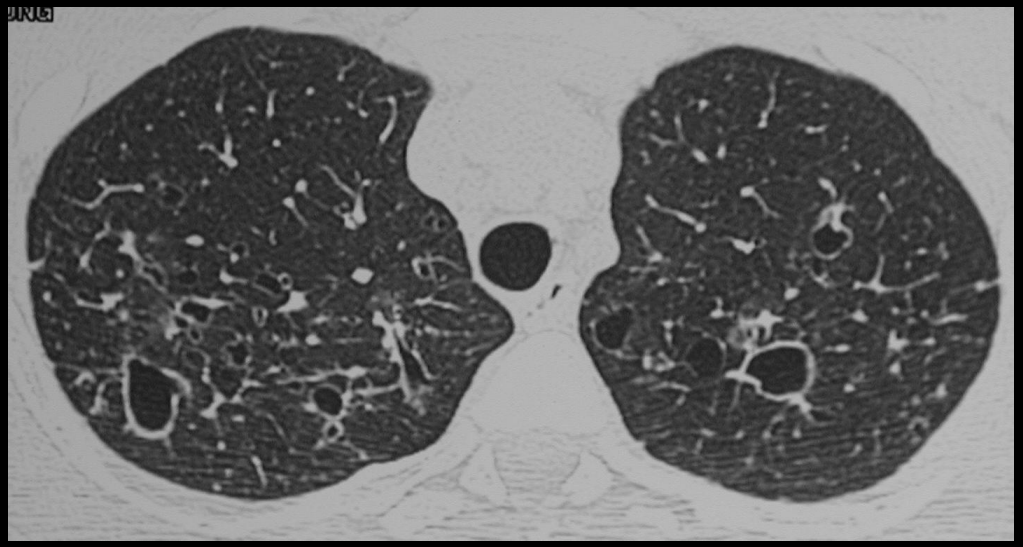
# Histiocytose Langerhansienne







# Histiocytose Langerhansienne



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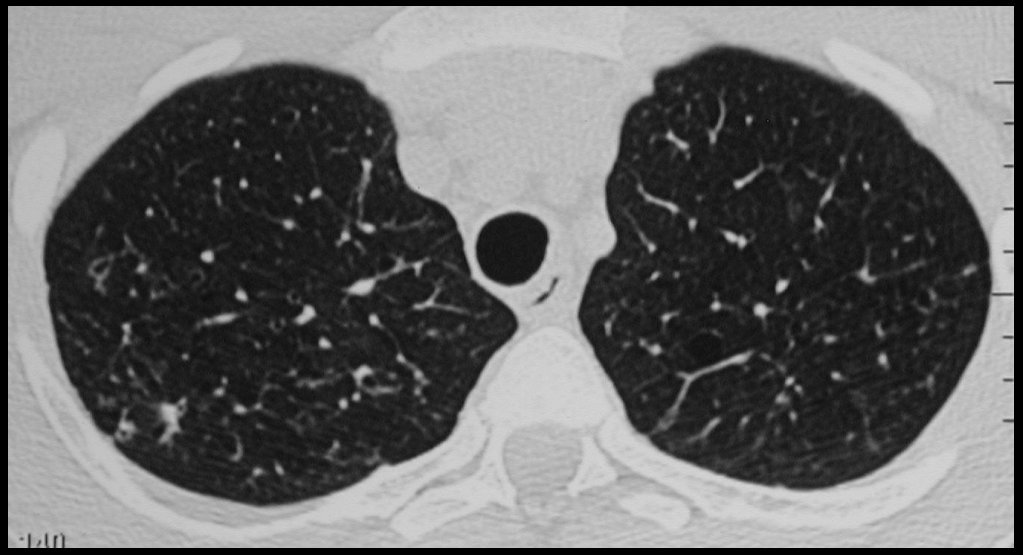

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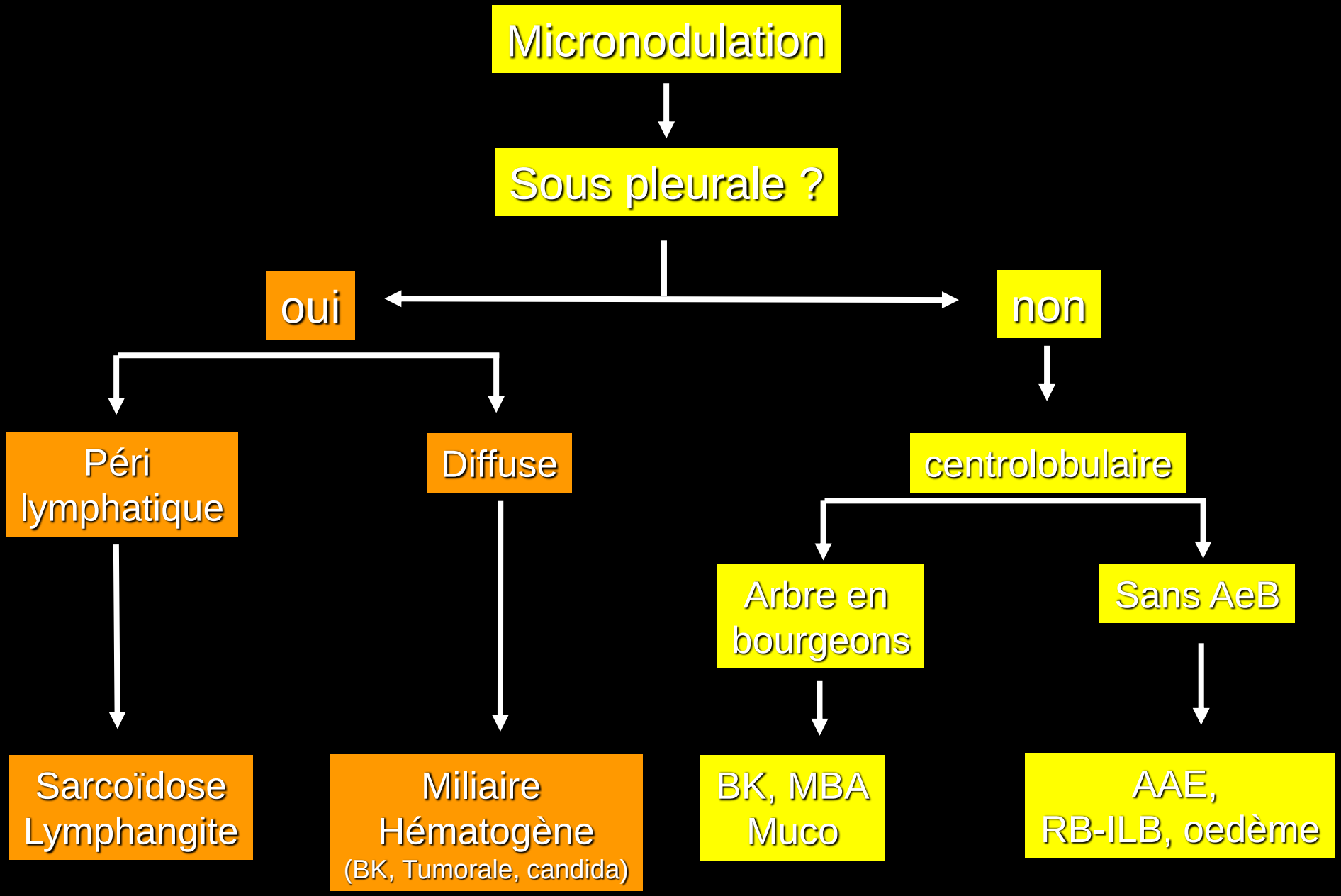
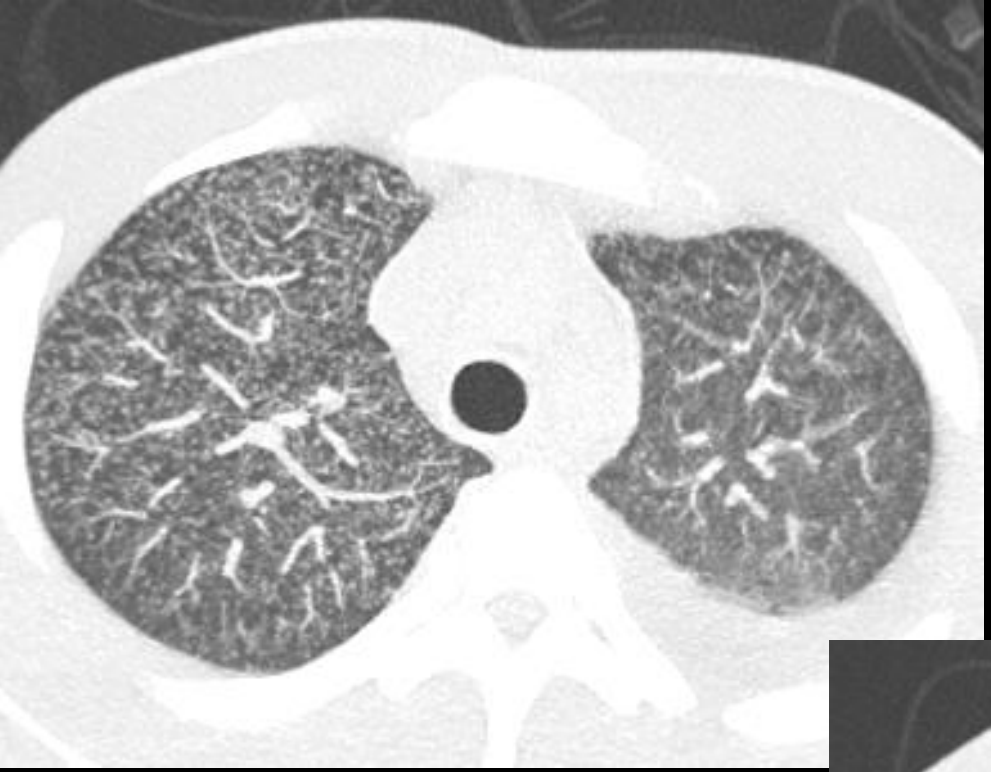
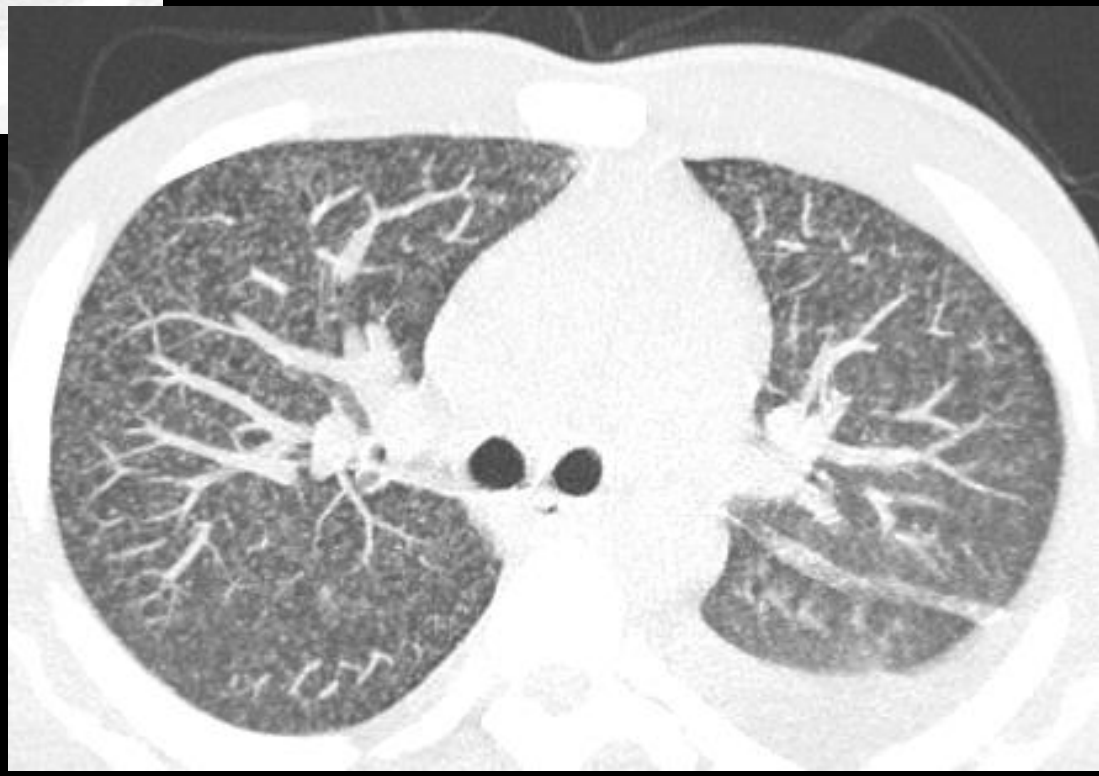

Micronodulation
Sous pleurale ?
oui
non
Péri lymphatique
Diffuse
centrolobulaire
Arbre en bourgeons
Sans AeB
Sarcoïdose Lymphangite
Miliaire Hématogène
(BK, Tumorale, candida)
BK, MBA Muco
AAE, RB-ILB, oedème

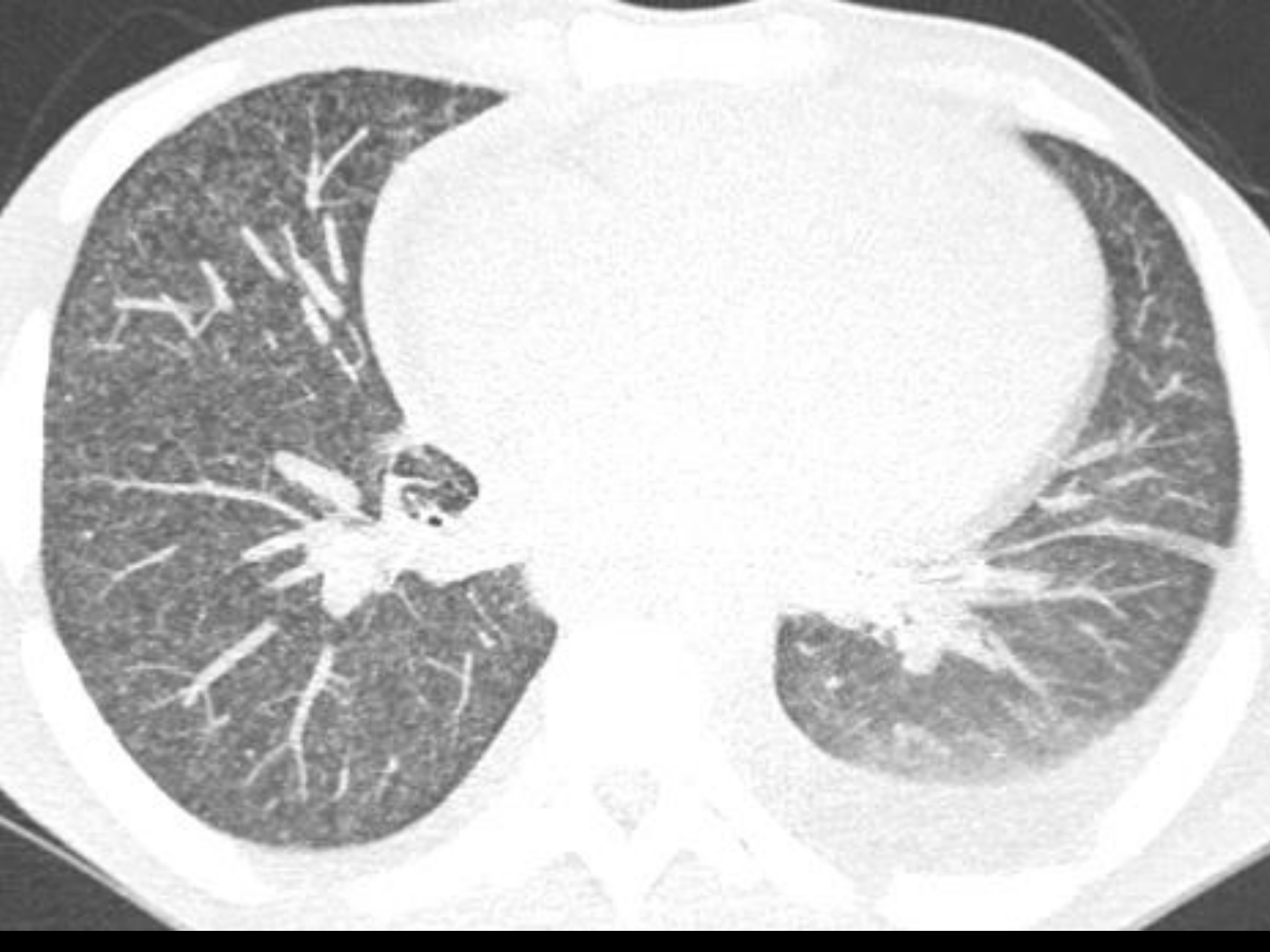
# Exercices pratiques

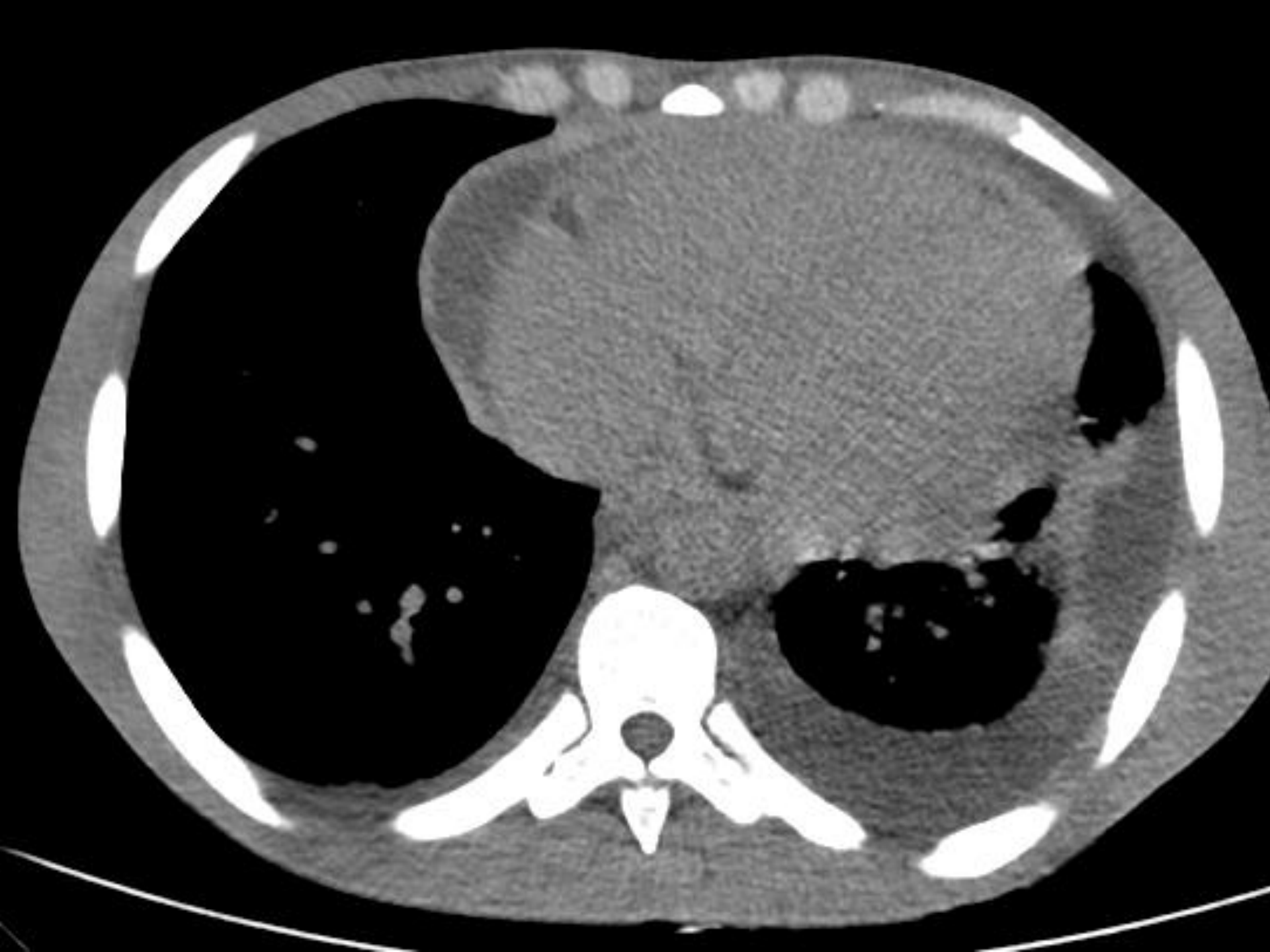
# Cas Nr1

- CB 3651W
- CT du 02/05/2012
- Localisation des lésions
- Type de nodules
- Hypothèses diagnostiques









# Mise au point et suivi

- Tamponnade
- Ponction
- Péricardite lymphocytaire
- Mise en évidence de BK à l'examen direct dans pct-biopsie ganglion rétropéritonéal
- R/ Quadrithérapie

# Pulmonary Tuberculosis: Role of Radiology in Diagnosis and Management[1]

*Arun C. Nachiappan, MD*
*Kasra Rahbar, MD*
*Xiao Shi, MD*
*Elizabeth S. Guy, MD*
*Eduardo J. Mortani Barbosa, Jr, MD*
*Girish S. Shroff, MD*
*Daniel Ocazionez, MD*
*Alan E. Schlesinger, MD*
*Sharyn I. Katz, MD*
*Mark M. Hammer, MD*

Tuberculosis is a public health problem worldwide, including in the United States—particularly among immunocompromised patients and other high-risk groups. Tuberculosis manifests in active and latent forms. Active disease can occur as primary tuberculosis, developing shortly after infection, or postprimary tuberculosis, developing after a long period of latent infection. Primary tuberculosis occurs most commonly in children and immunocompromised patients, who present with lymphadenopathy, pulmonary consolidation, and pleural effusion. Postprimary tuberculosis may manifest with cavities, consolidations, and centrilobular nodules. Miliary tuberculosis refers to hematogenously disseminated disease that is more commonly seen in immunocompromised patients, who present with miliary lung nodules and multiorgan involvement. The principal means of testing for active tuberculosis is sputum analysis, including smear, culture, and nucleic acid amplification testing. Imaging findings, particularly the presence of cavitation, can affect treatment decisions, such as the duration of therapy. Latent tuberculosis is an asymptomatic infection that can lead to postprimary tuberculosis in the future. Patients who are suspected of having latent tuberculosis may undergo targeted testing with a tuberculin skin test or interferon-γ release assay. Chest radiographs are used to stratify for risk and to assess for asymptomatic active disease. Sequelae of previous tuberculosis that is now inactive manifest characteristically as fibronodular opacities in the apical and upper

**Abbreviations:** AFB = acid-fast bacilli, HIV = human immunodeficiency virus, PA = posteroanterior

**RadioGraphics** 2017; 37:52–72

**Published online** 10.1148/rg.2017160032

**Content Codes:** CH CT

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**Table 3: Imaging Findings of Active Tuberculosis and Previous (Inactive) Tuberculosis**

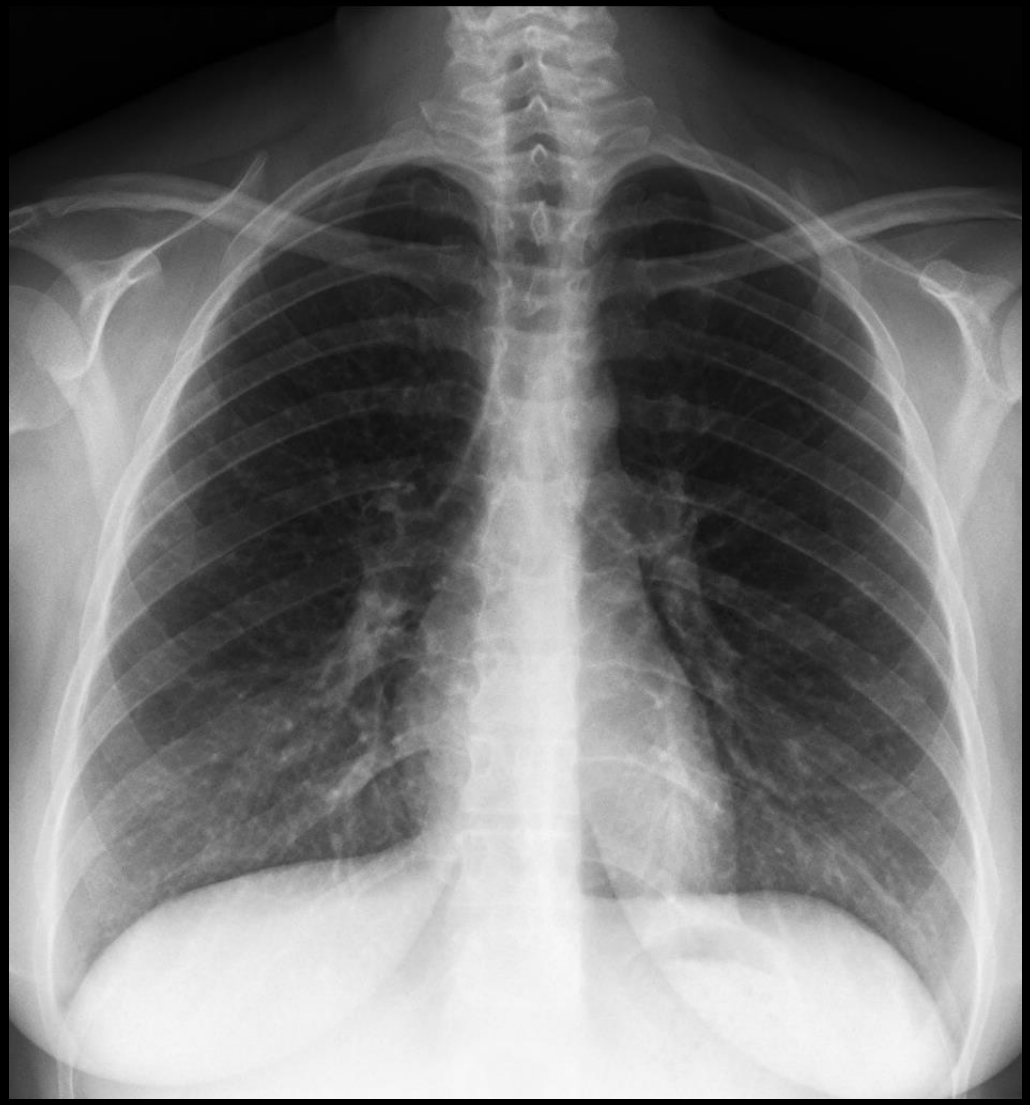
| |
|---|
| Active tuberculosis |
| Cavitation |
| Consolidation |
| Centrilobular and tree-in-bud nodules |
| Miliary nodules |
| Lymphadenopathy |
| Pleural effusion |
| Previous (inactive) tuberculosis |
| Fibronodular scarring* |
| Peribronchial fibrosis |
| Well-defined nodular opacities |
| Traction bronchiectasis |
| Apical and upper lung zone volume loss |
| Calcified granulomas or lymph nodes† |

*Findings must be stable for at least 6 months.
†If calcified granulomas or lymph nodes are the only finding, this finding would represent latent tuberculosis infection.

# Cas Nr 2

- L18855X
- Femme de 40 ans
- CT pour mise au point de multiple nodules pulmonaires
  - CT 29/11/2013
  - CT 09/05/2012

# Rx thorax: 19/04/2012

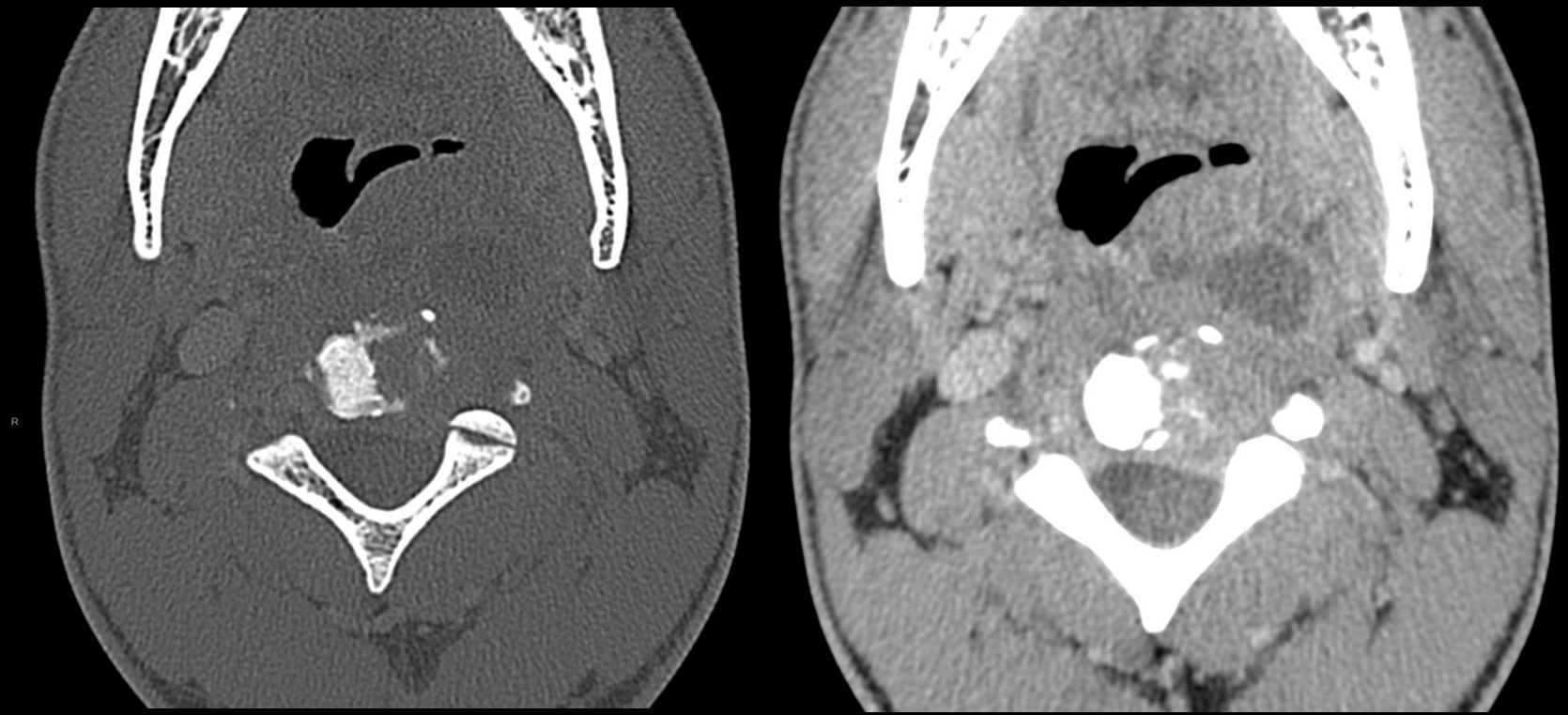


# Cas Nr 3

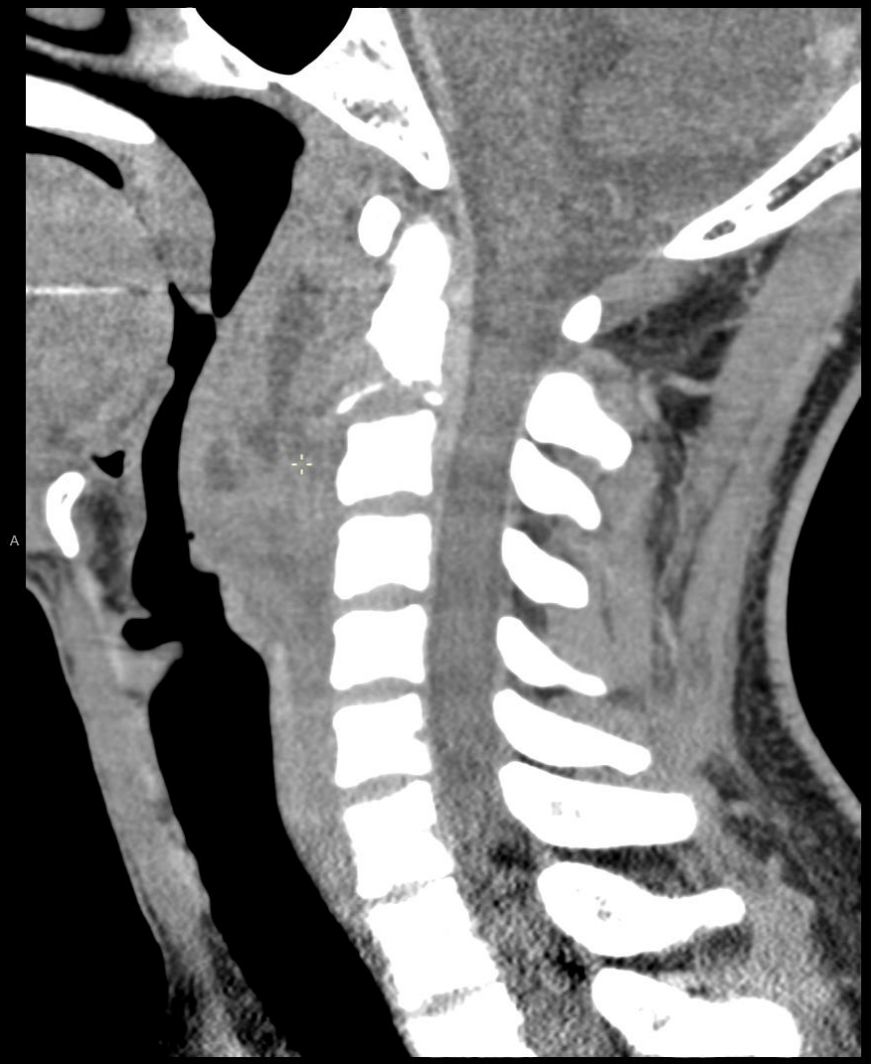
- T10645A
- CT 10/05/2012
- Homme de 30 ans
- Douleurs cervicales
- CT cervical: ostéolyse de C2 avec tuméfaction des tissus mous et débord postéro-latéral gauche responsable d’un comblement du foramen gauche
- Difficultés respiratoires

# CT colonne cervicale

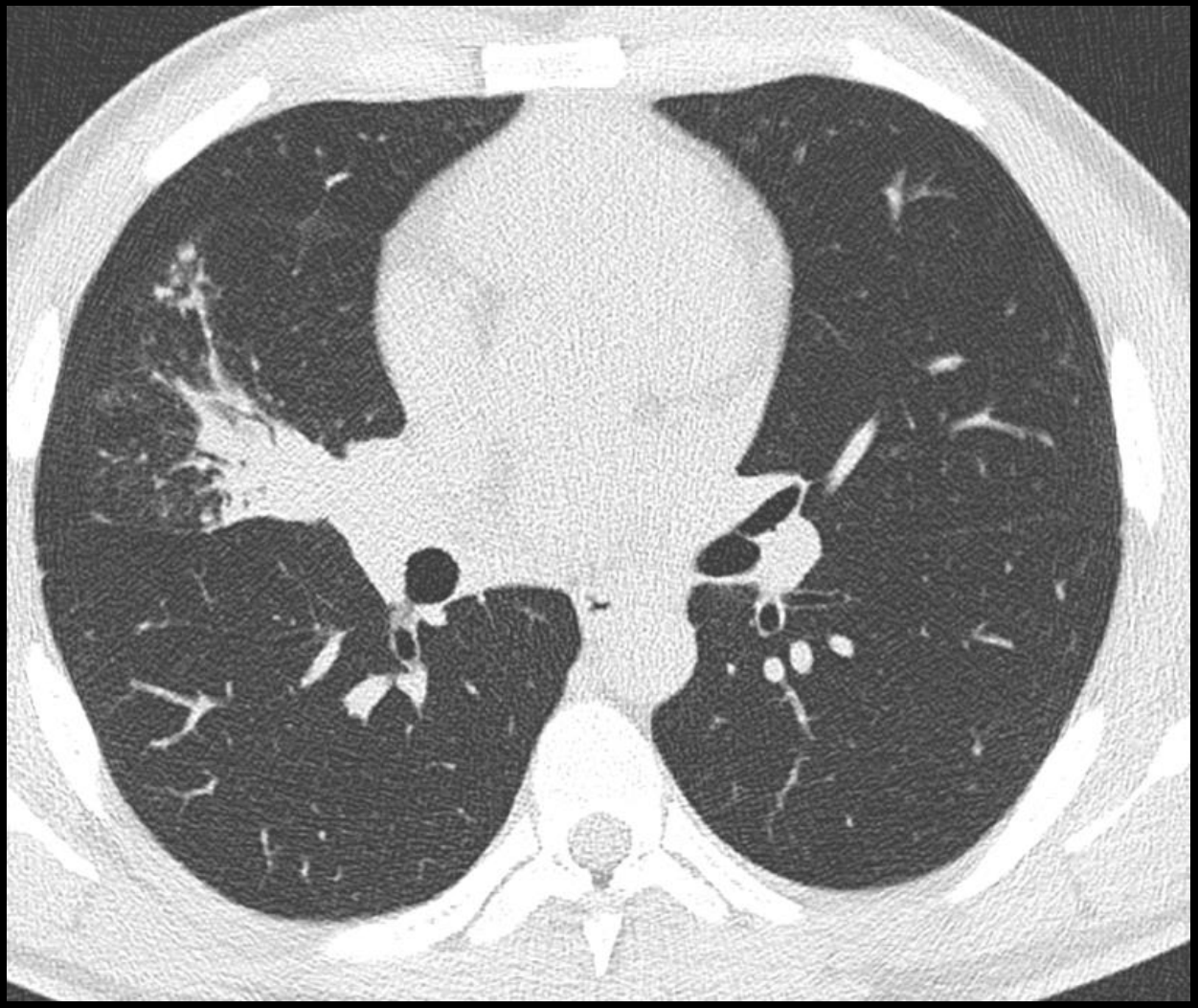
- 03/04/2012



# MPR



# CT thorax: 10/05/2012



# Tree-in-bud pattern

- Peripheral airway disease
  - Infection
    - Bacterial
      - *Mycobacterium tuberculosis*
      - *M avium-intracellulare* complex
      - *Staphylococcus aureus*
      - *Haemophilus influenzae*
    - Fungal
      - *Aspergillus*
    - Viral
      - Cytomegalovirus
      - Respiratory syncytial virus
  - Congenital disorders
    - Cystic fibrosis
    - Kartagener syndrome
  - Idiopathic disorders
    - Obliterative bronchiolitis
    - Diffuse panbronchiolitis
  - Aspiration
  - Inhalation
    - Toxic fumes and gases
  - Immunologic disorders
    - Allergic bronchopulmonary aspergillosis
  - Connective tissue disorders
    - Rheumatoid arthritis
    - Sjögren syndrome
- Peripheral pulmonary vascular disease
  - Neoplasms
    - Gastric cancer
    - Breast cancer
    - Ewing sarcoma
    - Renal cancer

Previous Article

**May-June 2005**
Volume 25, Issue 3

Next Article

**RSNA Education Exhibits**

## Tree-in-Bud Pattern at Thin-Section CT of the Lungs: Radiologic-Pathologic Overview

**Santiago Enrique Rossi, MD, , Tomas Franquet, MD, , Mariano Volpacchio, MD, , Ana Giménez, MD, and , Gabriel Aguilar, MD**

[1]From the Department of Radiology, Centro de Diagnostico Dr Enrique Rossi, Arenales 2777, CP 1425, Buenos Aires, Argentina (S.E.R., M.V., G.A.); and the Department of Radiology, Hospital de Sant Pau, Universidad Autónoma de Barcelona, Barcelona, Spain (T.F., A.G.).
Recipient of a Certificate of Merit award for an education exhibit at the 2003 RSNA Scientific Assembly. Received May 26, 2004; revision requested August 26 and received November 29; accepted December 6. All authors have no financial relationships to disclose.

DOI: http://dx.doi.org/10.1148/rg.253045115

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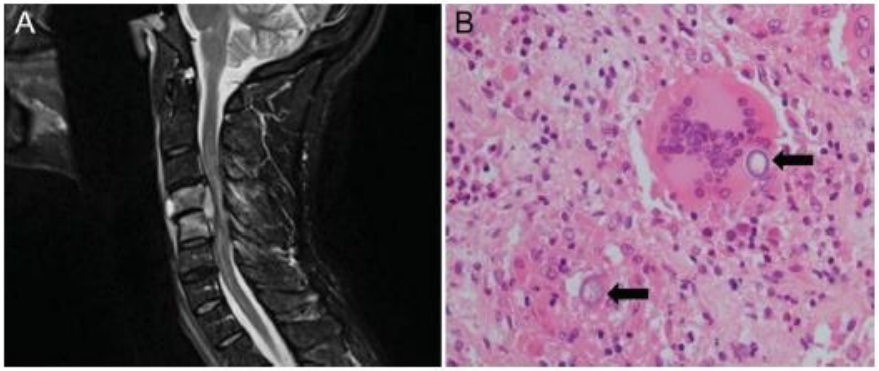
Divyanshu Dubey, MD
Ram N. Narayan, MD
Afaq Motiwala, MD
Puneet Gupta, MD

Correspondence to
Dr. Dubey:
divyanshudubey87@gmail.com

**Figure** MRI and histologic findings in a case of vertebral coccidioidomycosis




(A) Cervical MRI (T2, sagittal) demonstrates hyperintense extradural mass and hyperintensities involving C4 and C5 vertebral bodies consistent with osteomyelitis. There was marked contrast enhancement within the paraspinal and epidural region, along with cord compression and abnormal cord signal. (B) Hematoxylin & eosin–stained vertebral biopsy specimen depicts granulomatous inflammation with a giant cell–containing spherule inside (arrow) and an adjacent extracellular spherule (arrow).

A 39-year-old African American immunocompetent man with frequent travels to Mexico presented with progressive descending weakness over 2 weeks. Physical examination revealed chest ulcers, cervical lymphadenopathy, spastic quadriparesis, decreased sensation to touch and pain up to C7 dermatome, hyperreflexia, and bilateral positive Hoffman and Babinski sign. MRI of the spine showed multilevel osteomyelitis and paraspinal abscesses involving the cervical and thoracic regions (figure, A). He underwent surgical debridement. Vertebral biopsy showed necrotizing, granulomatous inflammation and numerous thick-walled spherules (figure, B). Culture confirmed coccidioidomycosis. The patient was initiated on amphotericin B for 6 weeks, followed by fluconazole, and showed gradual clinical improvement.[1]

## STUDY FUNDING

No targeted funding reported.

## DISCLOSURE

The authors report no disclosures relevant to the manuscript.

## REFERENCE

1. Tan LA, Kasliwal MK, Nag S, O'Toole JE, Traynelis VC. Rapidly progressive quadriparesis heralding disseminated coccidioidomycosis in an immunocompetent patient. J Clin Neurosci 2014;21:1049–1051.

# Pulmonary Coccidioidomycosis: Pictorial Review of Chest Radiographic and CT Findings

*Cecilia M. Jude, MD • Nita B. Nayak, MD • Maitraya K. Patel, MD • Monica Deshmukh, MD • Poonam Batra, MD*

**RadioGraphics 2014;** 34:912–925 • **Published online** 10.1148/rg.344130134 • **Content Codes:** CH CT

**Page 913**
The lungs are the target organ in coccidioidomycosis and are involved in a wide spectrum of clinical and imaging manifestations that are categorized as acute, disseminated, or chronic disease. Acute coccidioidomycosis is responsible for up to 29% of cases of community-acquired pneumonia in endemic areas and is mostly self-limited. Disseminated or chronic disease occurs in a minority of cases and is associated with significant morbidity and mortality.

**Page 913**
Suppression of cellular immunity is a major risk factor for increased disease severity and dissemination. The most substantial risk factors are HIV infection, immunosuppressive medications, and high-dose glucocorticoid administration.

**Pages 914–915**
Thoracic manifestations of acute coccidioidomycosis include pulmonary parenchymal abnormalities, intrathoracic adenopathy, and pleural effusion. Pulmonary parenchymal abnormalities occur in most symptomatic cases and consist of consolidation, nodules, cavities, and peribronchial thickening.

**Page 917**
The classic pulmonary manifestation of disseminated coccidioidal infection is miliary nodules caused by hematogenous spread. The original focus of parenchymal consolidation is seen occasionally, and hilar and mediastinal adenopathy is usually present. The lung nodules often progress to confluent opacities. Acute respiratory distress syndrome (ARDS) is an infrequent complication that usually occurs in immunocompromised hosts.

**Page 919**
Imaging manifestations of chronic coccidioidomycosis include residual nodule, chronic cavity, persistent pneumonia with or without adenopathy, pleural effusion, and regressive changes. Uncommon complications of a cavitary lesion are mycetoma, abscess formation, and bronchopleural fistula.

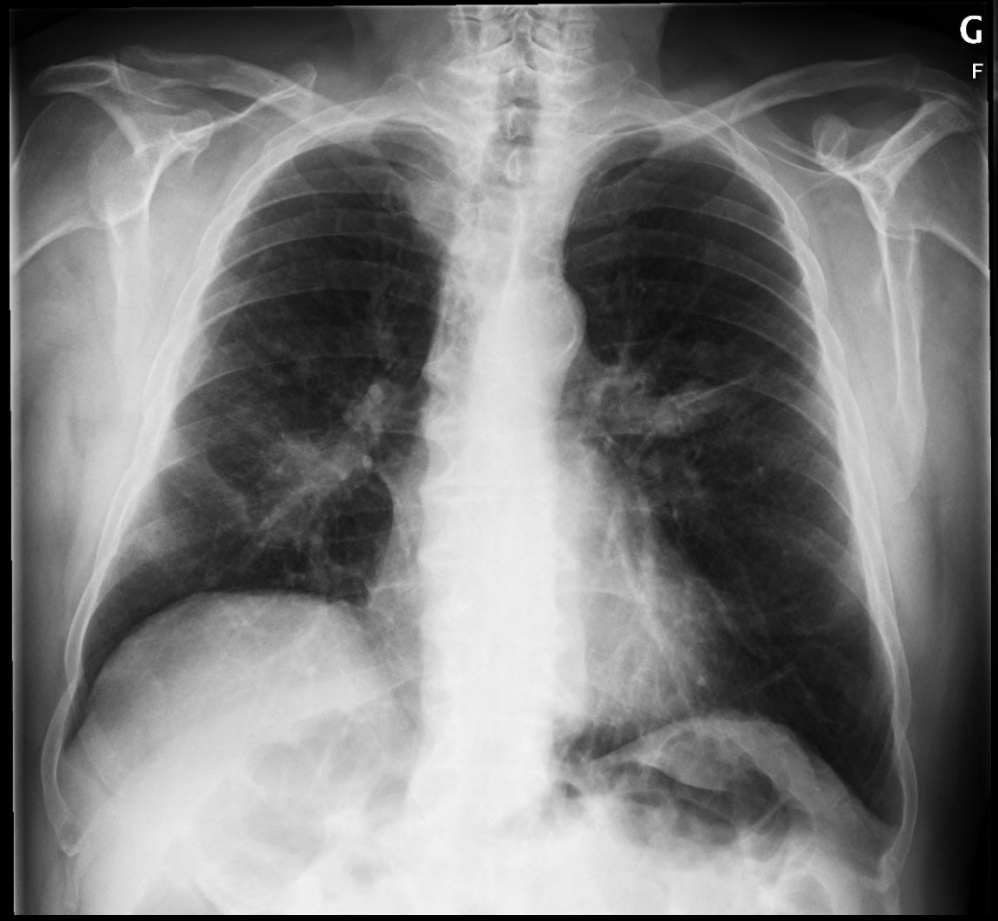
# Mise au point et suivi

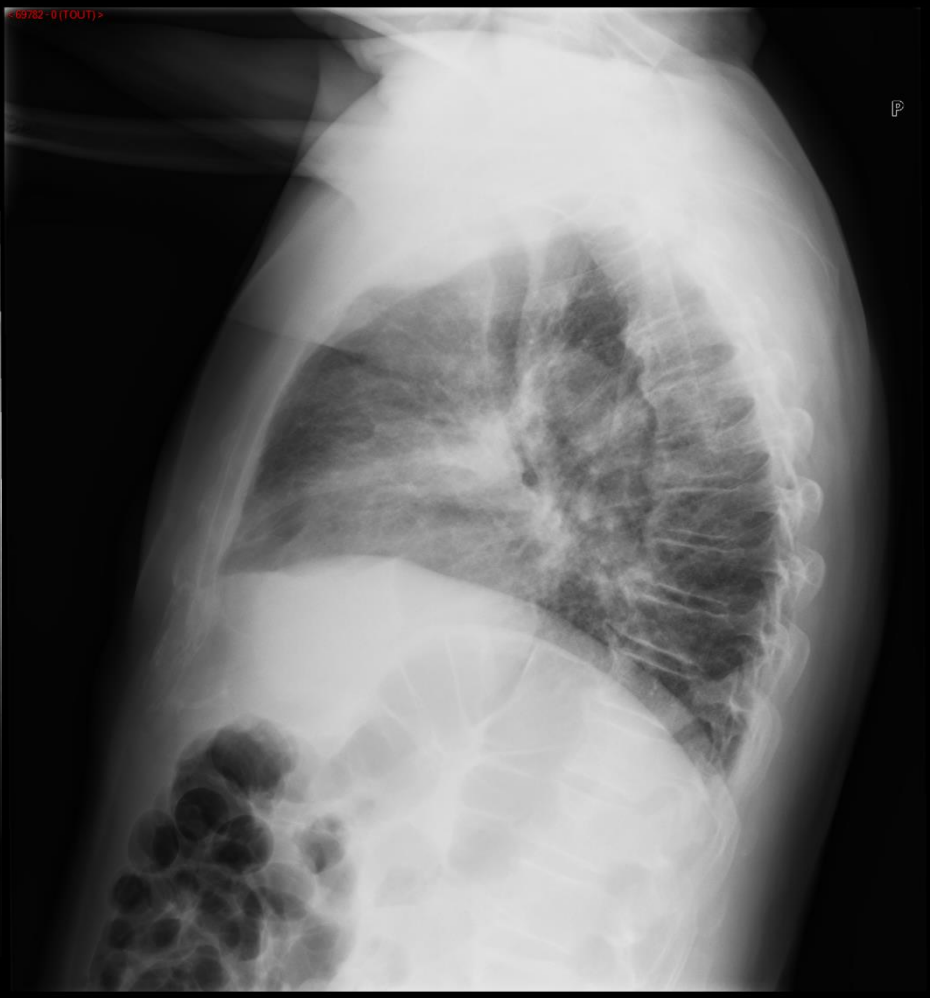
- Contrôle CT cervical
  - 15/03/2013
- Prélèvement abcès rétropharyngé
  - Coccidioidomycosis immitis

# Cas Nr 4

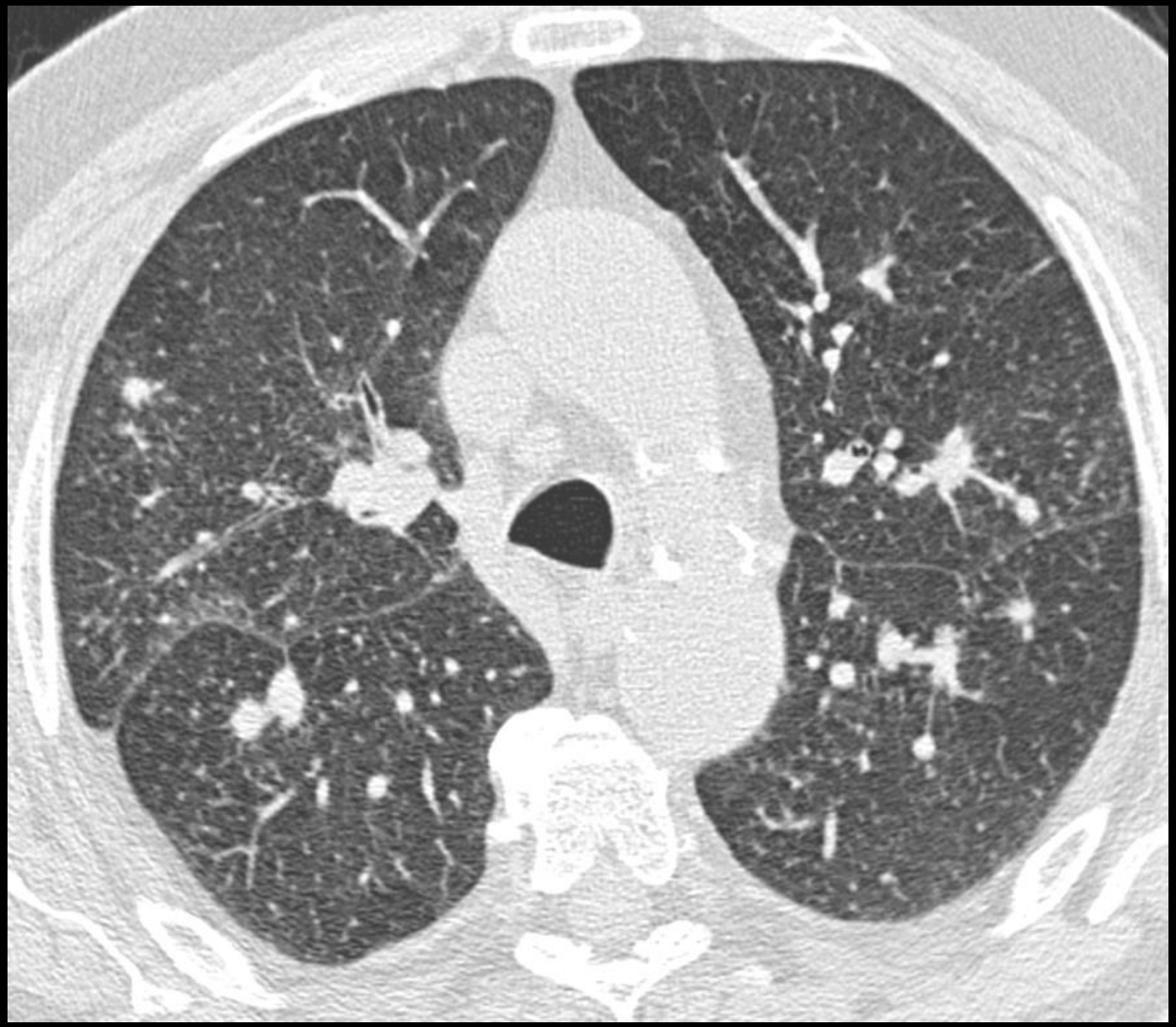
- M29639U
- Homme de 82 ans
- Toux grasse
- Glaires blanc-verdâtres
- R/Duovent
- CT 23/03/2015
- CT 14/11/2012
- 07/01/2010

# Rx thorax: 05/01/2010





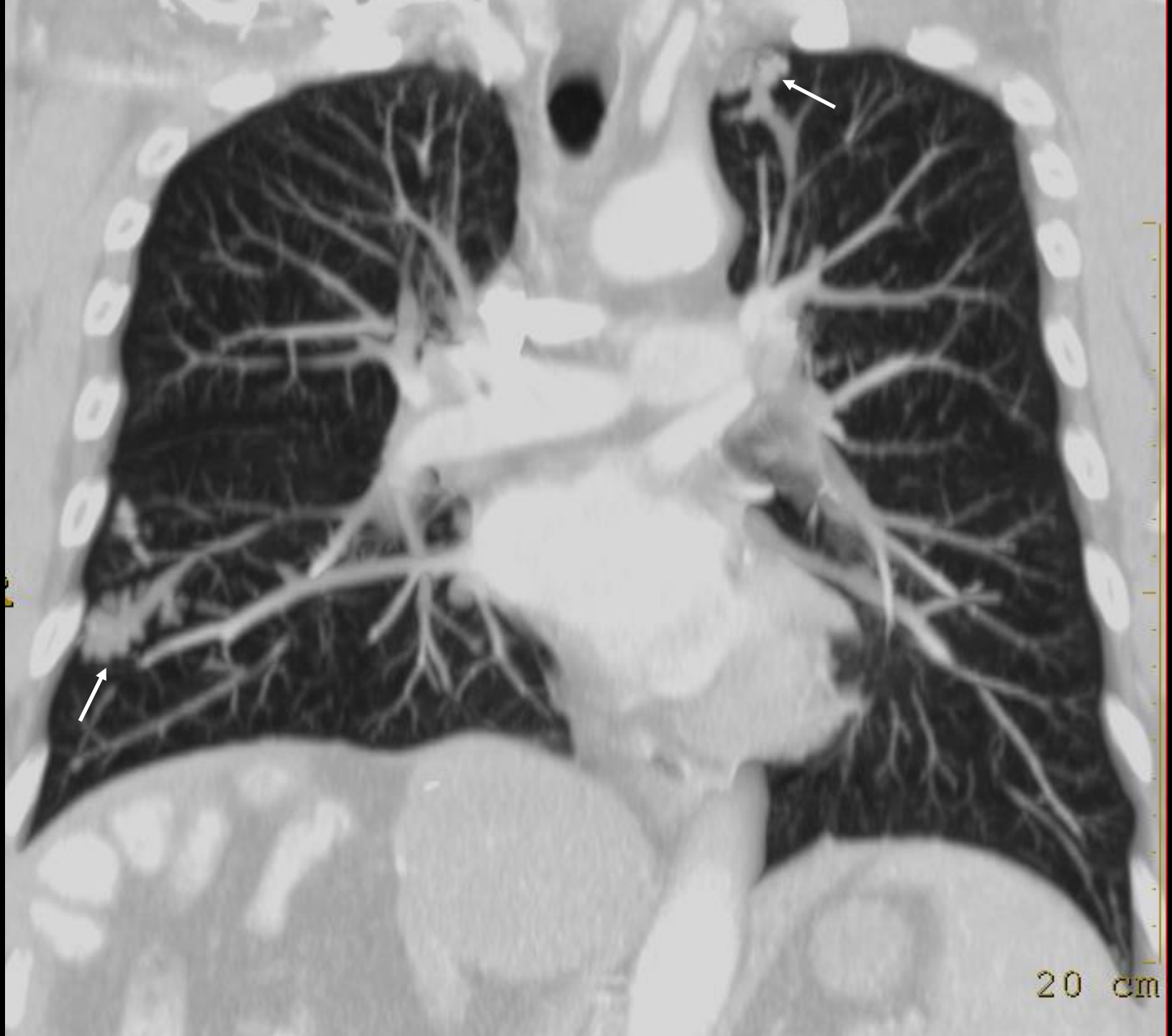
# CT: 07/01/2010 et 23/03/2015

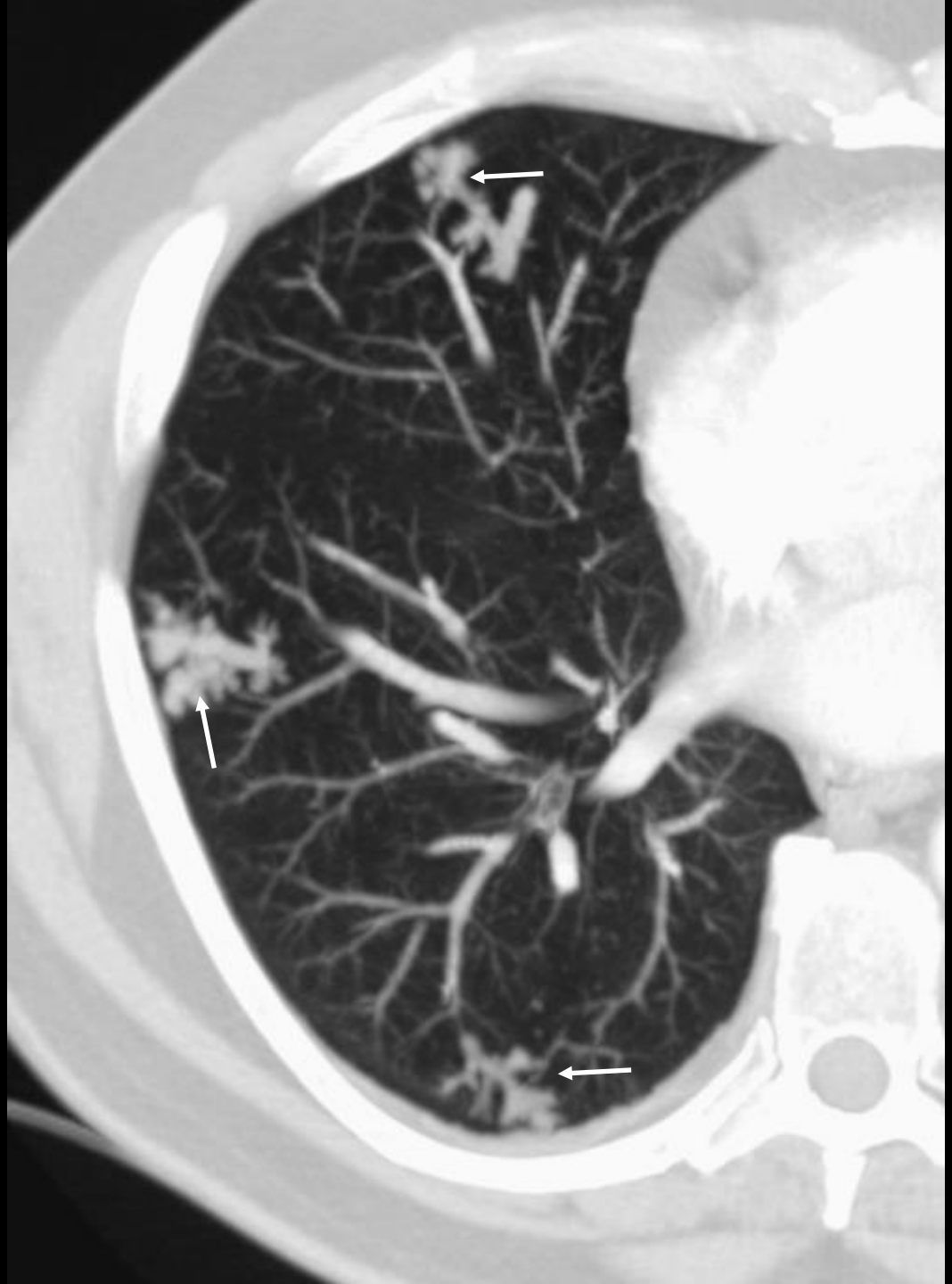


Surinfection pseudomonas

# Cas Nr 5

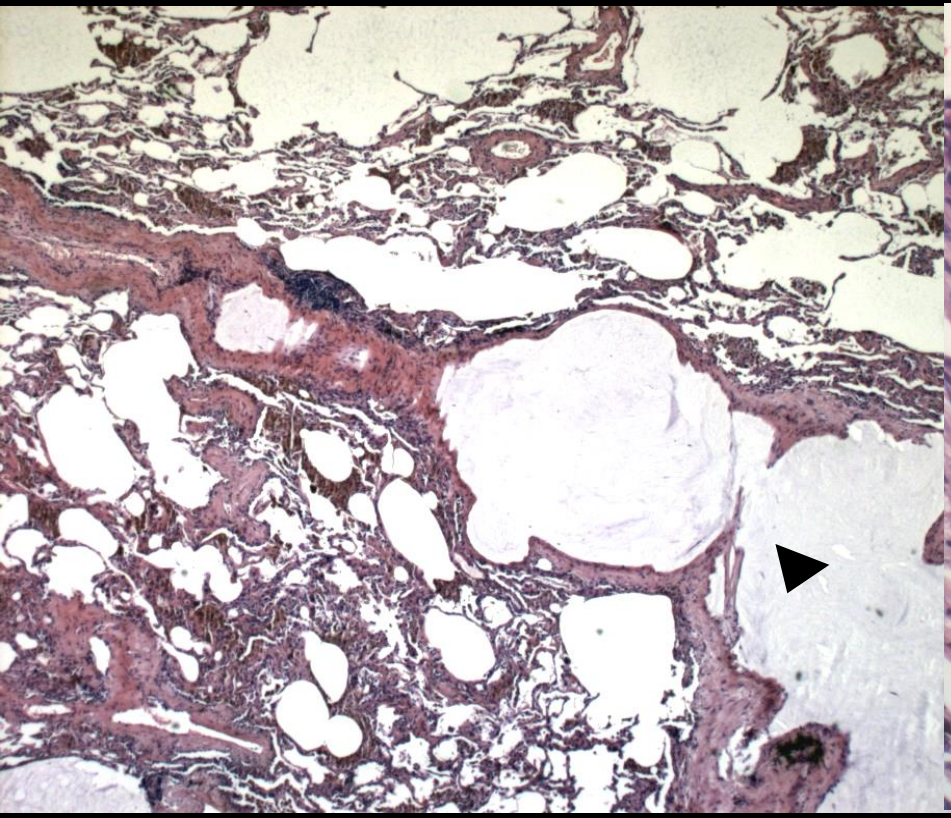
- K09833X
- **A 60-year-old man presented for routine follow-up colon tumor surgically resected 15 years ago. Clinical examination, laboratory tests, including CEA and inflammatory parameters and chest X-Ray were normal**
- 26/08/2005

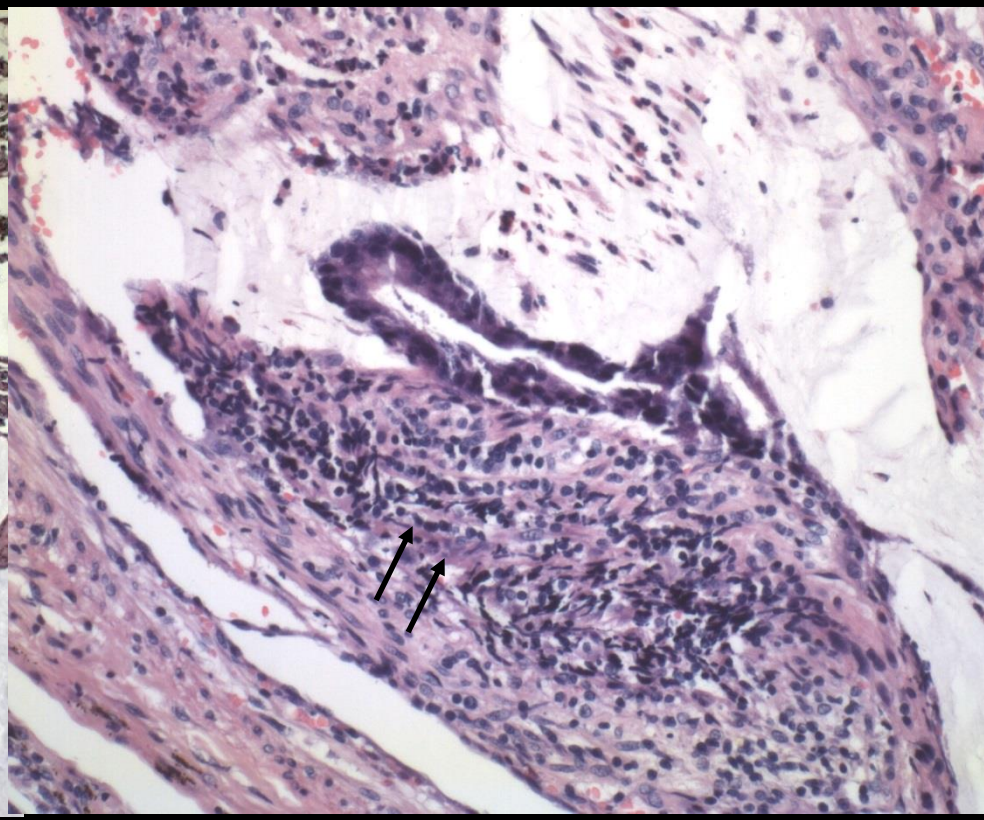

20 cm



# Suivi CT

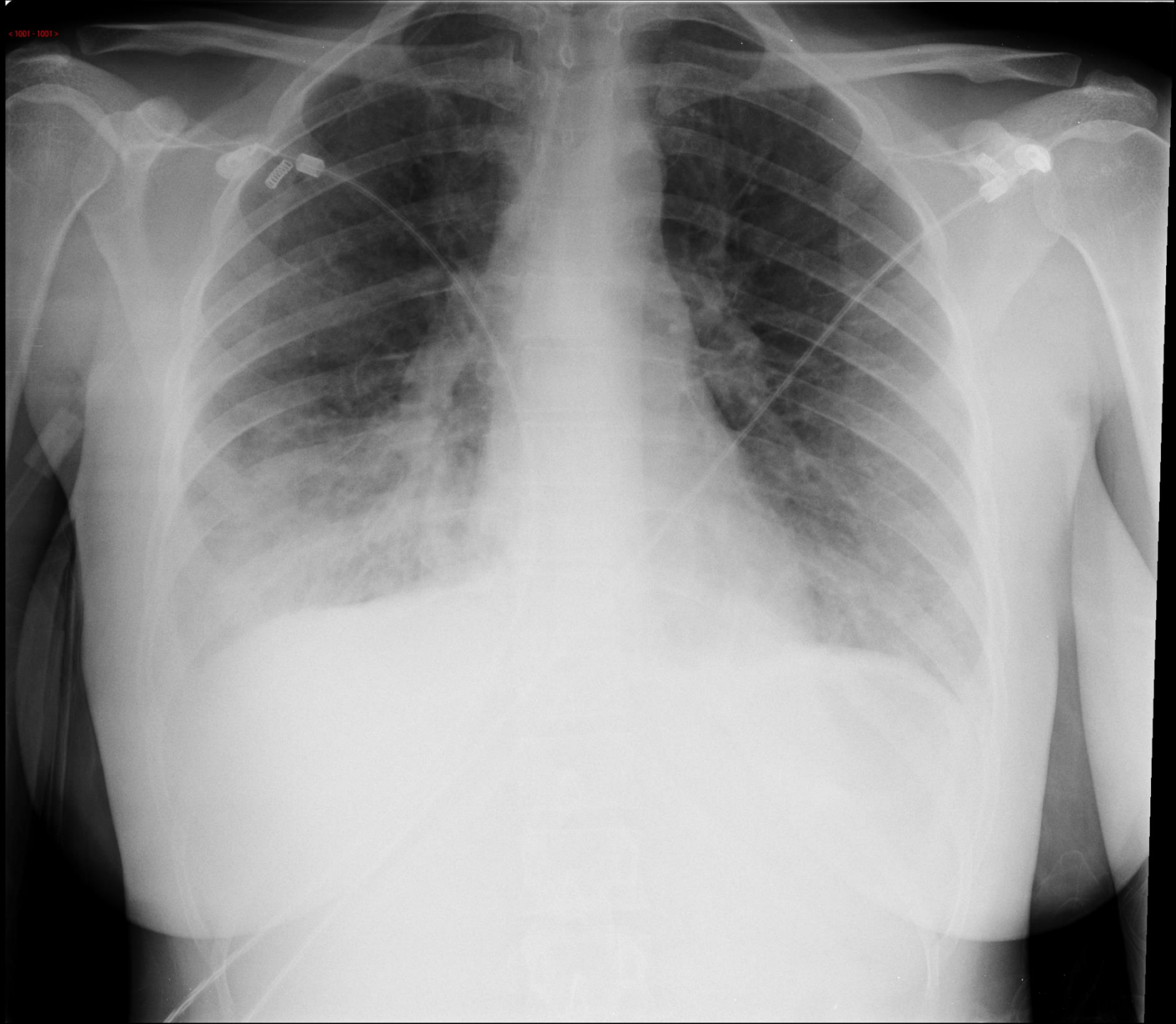
- CT du 29/03/2012
- CT du 14/01/2016

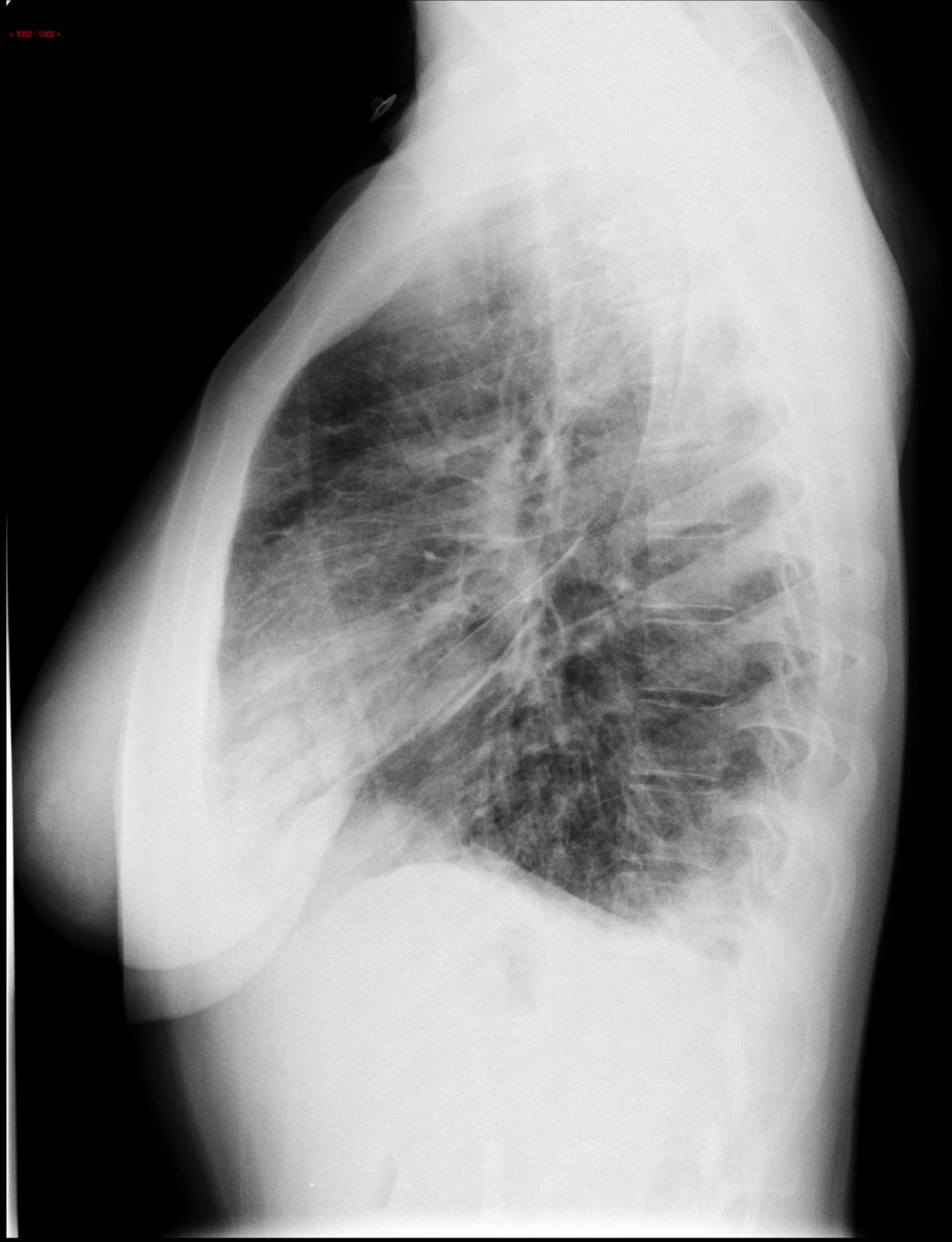


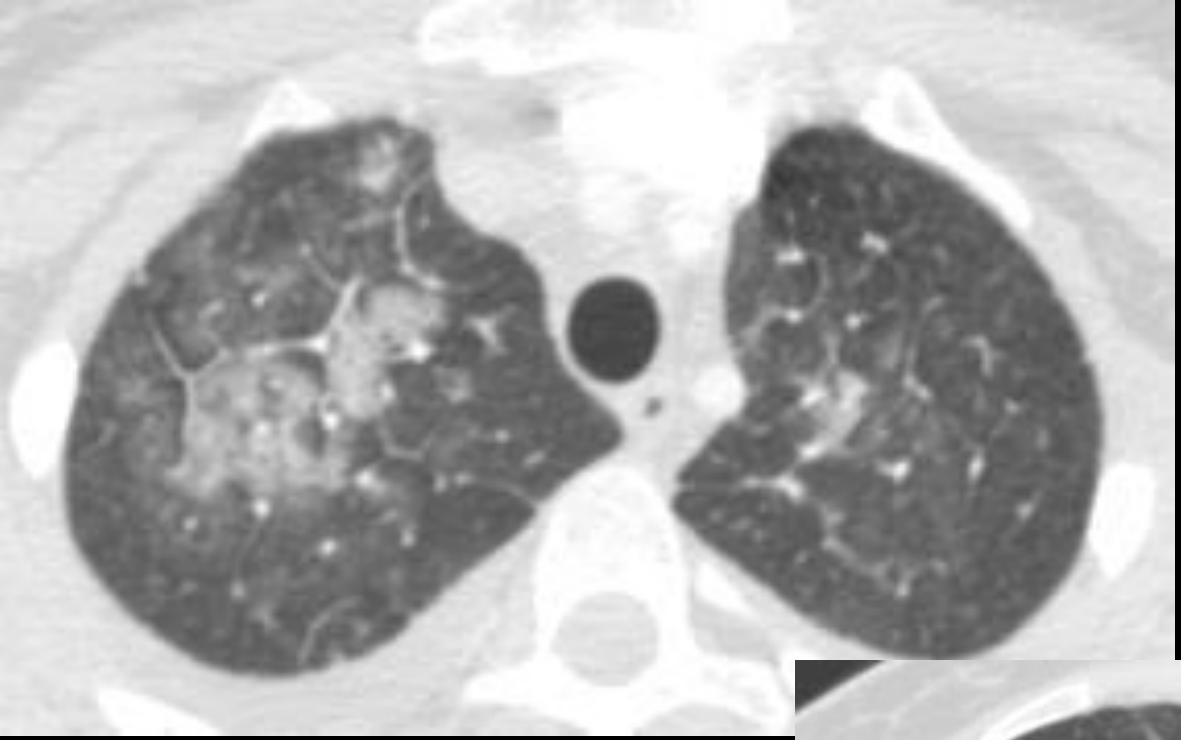


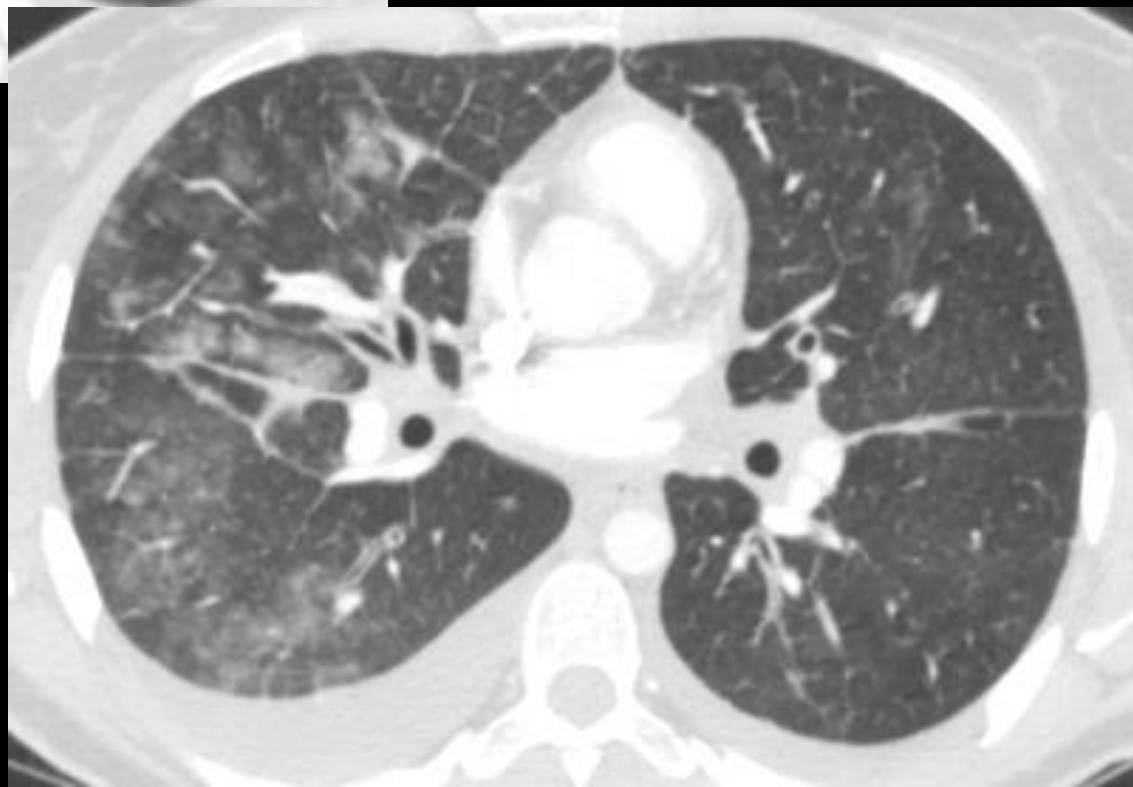
# Cas Nr 6

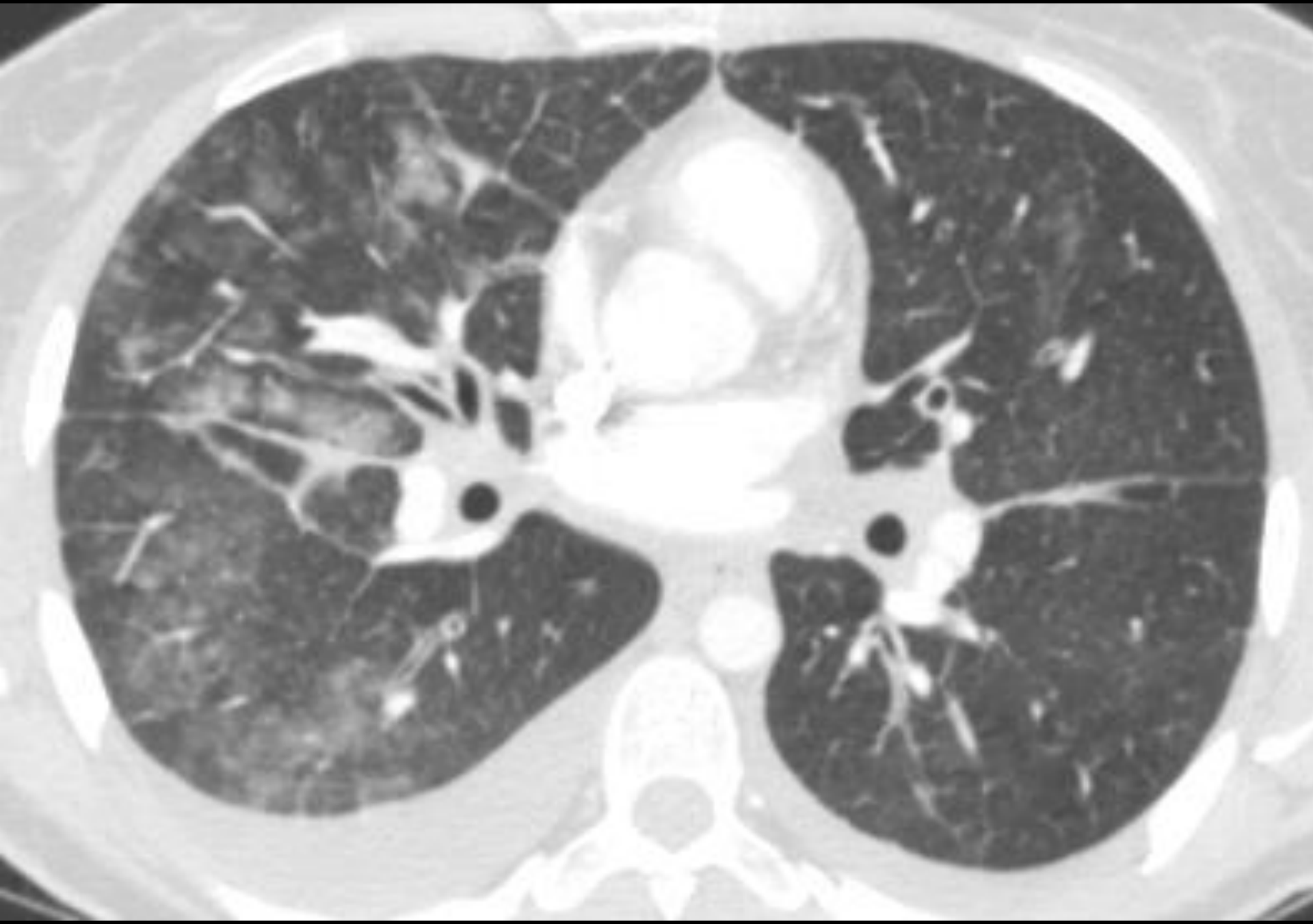
- R04489W
- Femme de 24 ans
- Dyspnée
- Douleurs thoraciques
- T: 37,5° C
- Biologie: CRP: 9,7 mg/dL

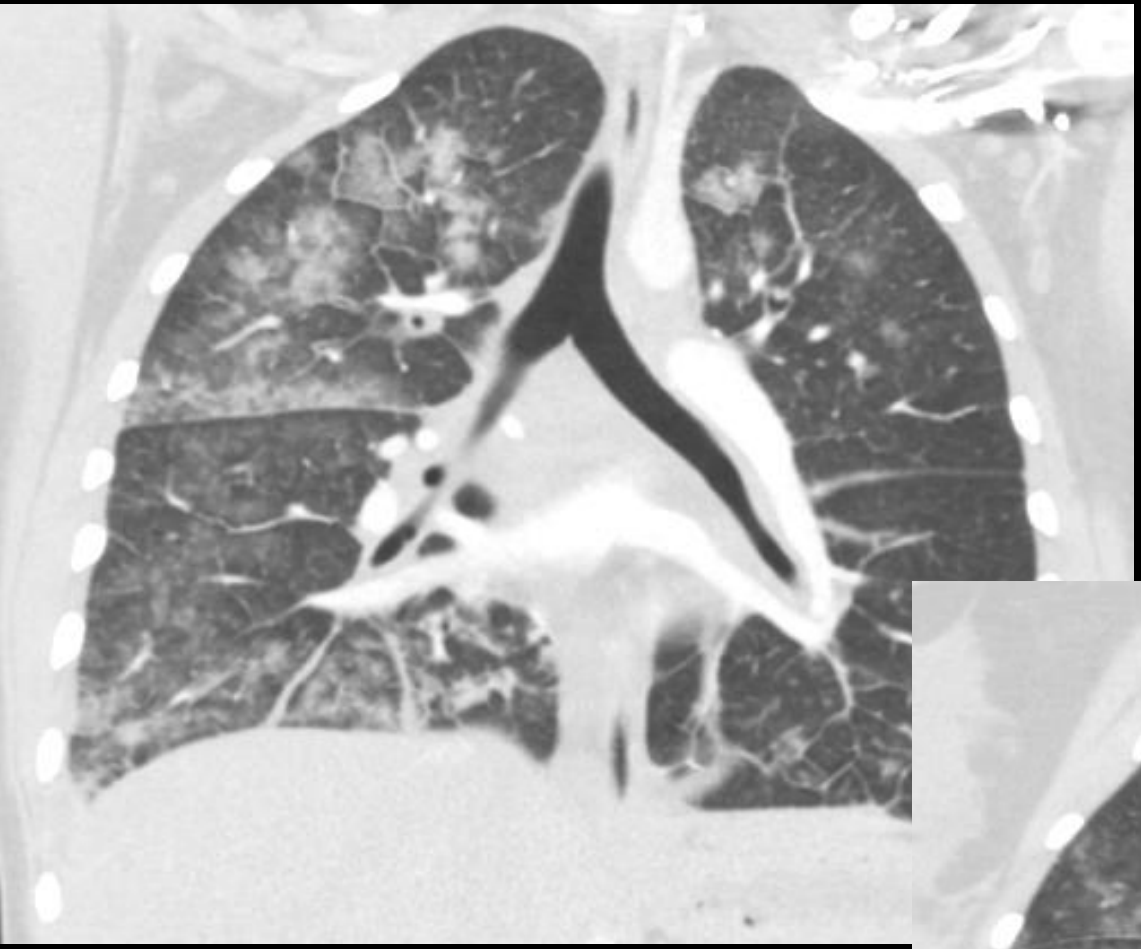


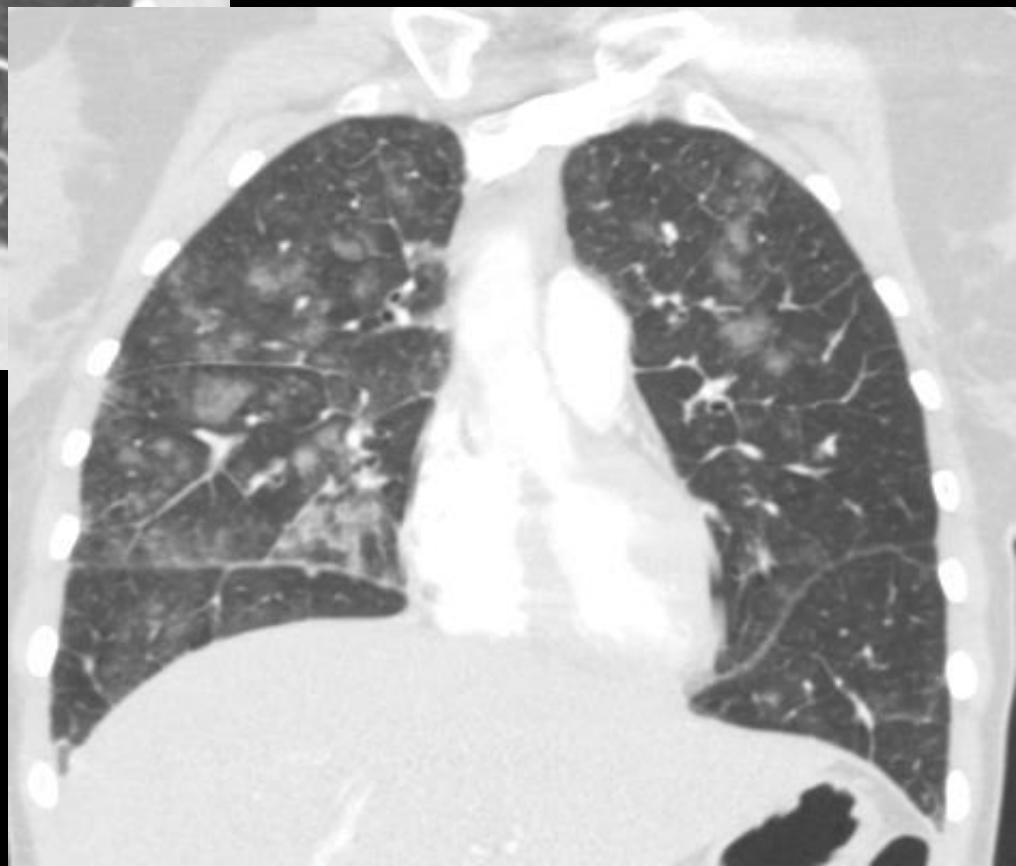








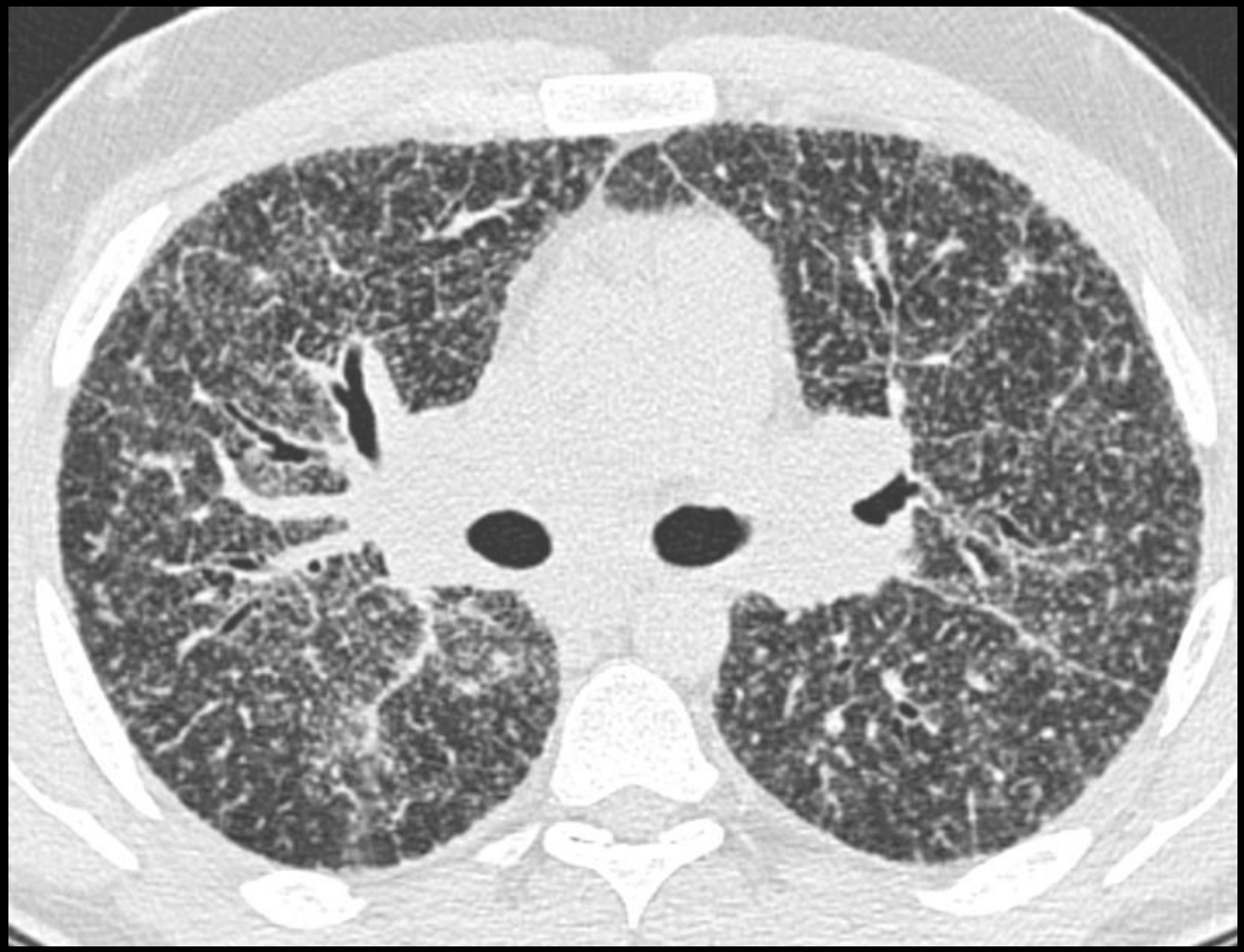




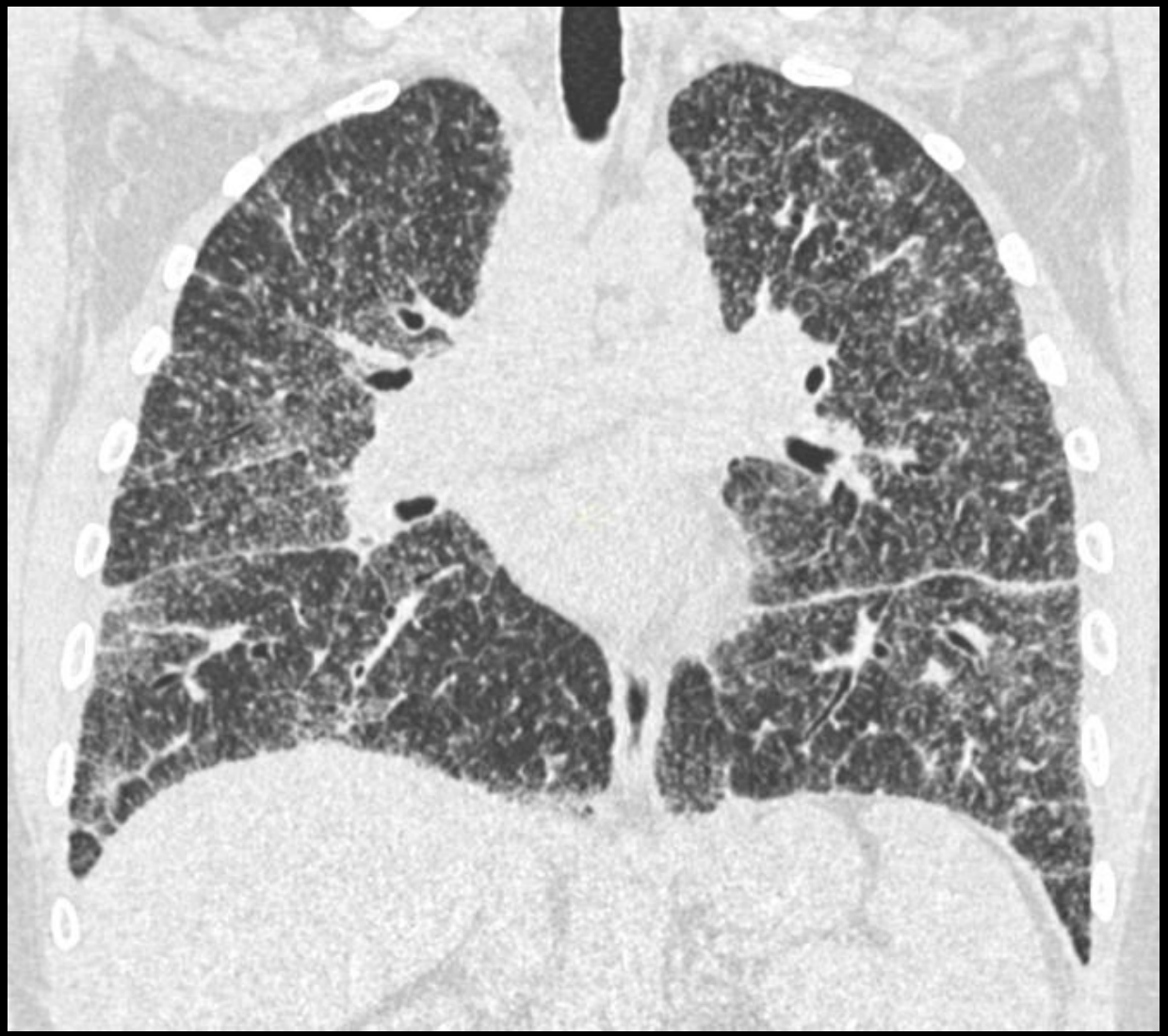
# Cas Nr 7

- M09028Z
- Homme de 34 ans
- Ingénieur sidérurgie
- Non fumeur
- Dyspnée progressive
- Erythème noueux avril-mai 2009 d'évolution spontanément favorable
- BAL le 15/10/2009

# CT thorax: 08/01/2009



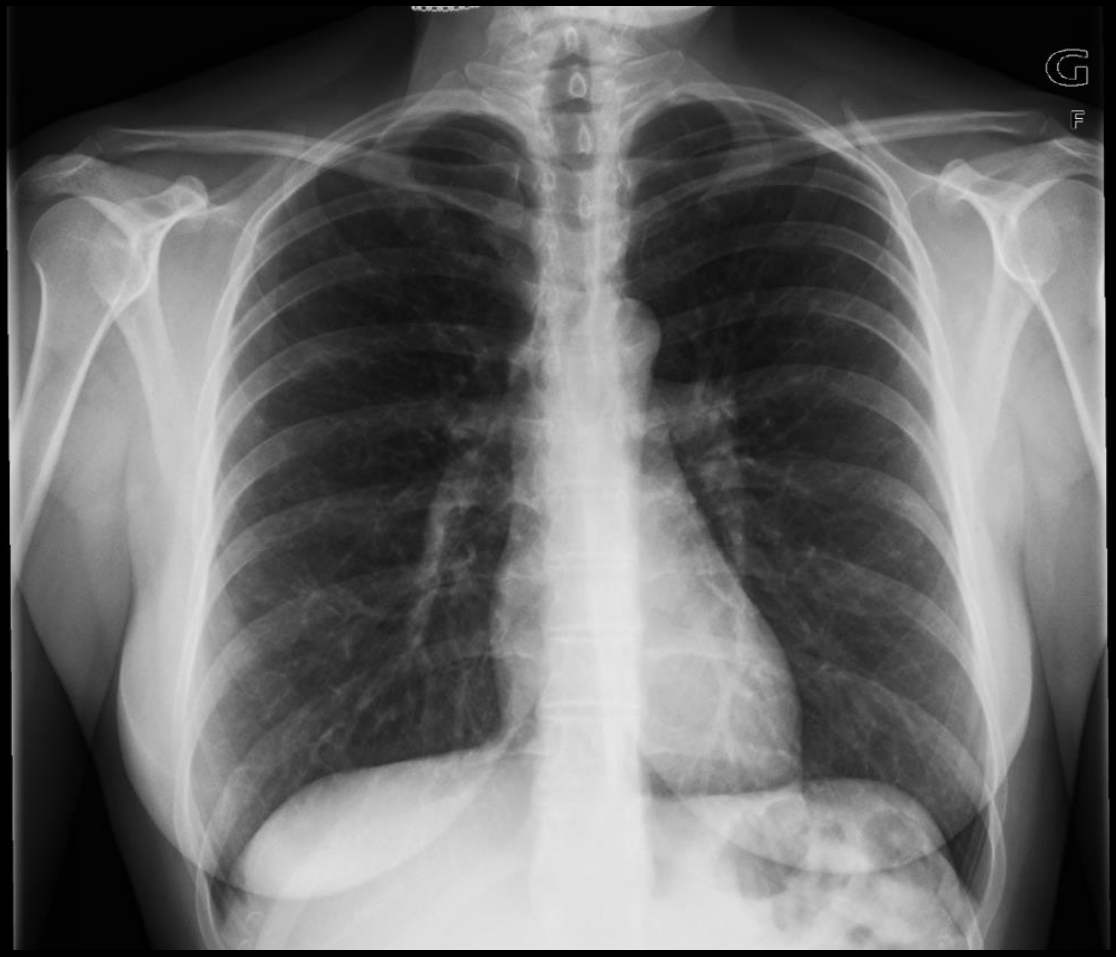
# CT thorax: 08/01/2009

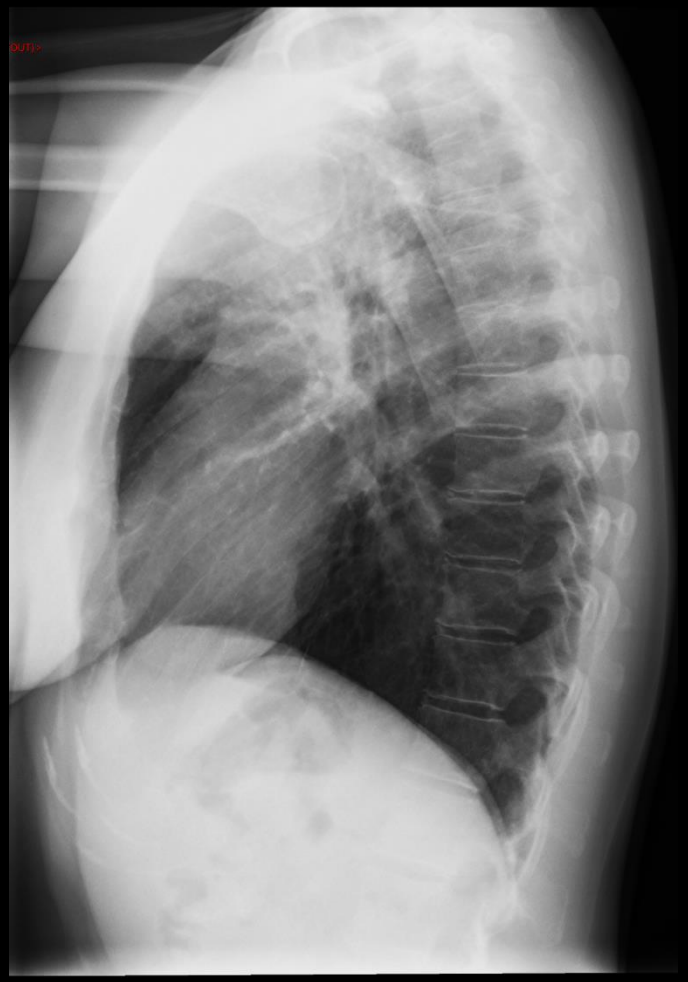


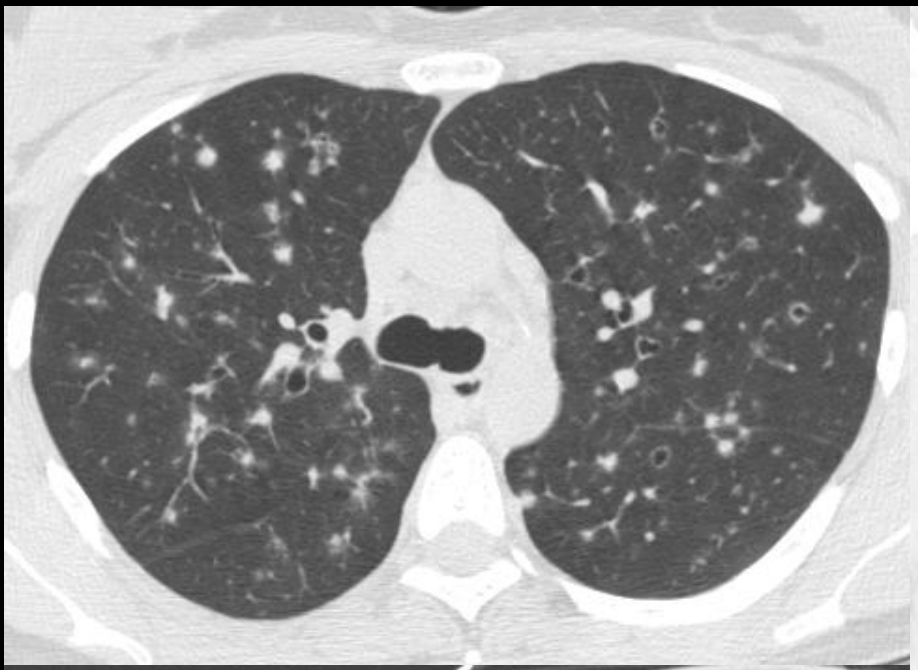
# Cas Nr 8

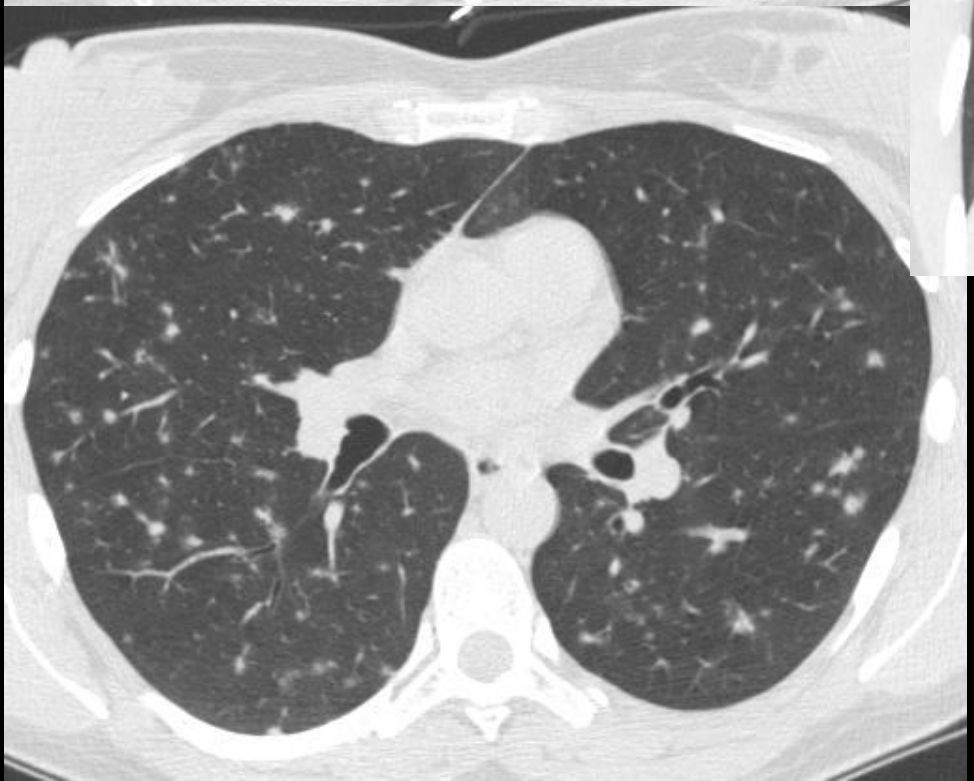
- L03502B
- Femme de 43 ans
- Toux chronique
- Infiltration nodulaire péri-hilaire à la RX thorax
- Tabac: ½  à 1 paquet/j

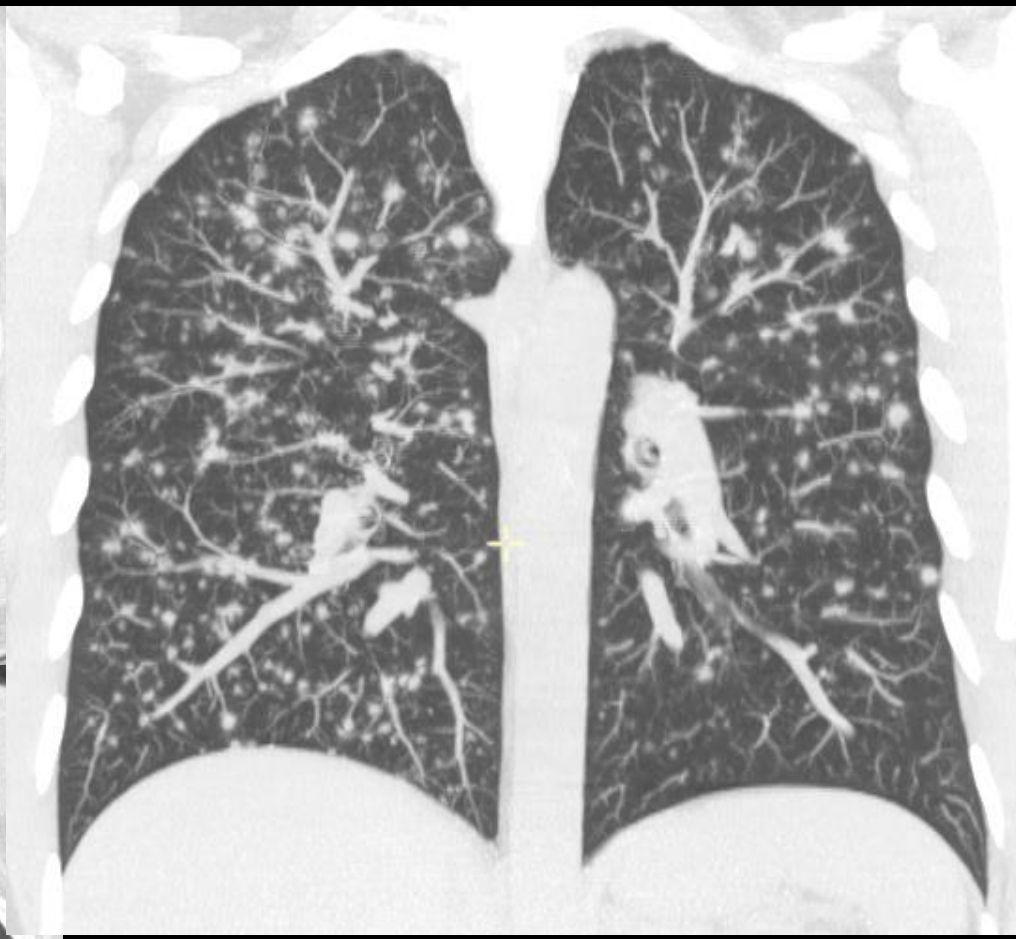
# RX thorax











05/12/2005