Imaging of Occupational and Environmental Disorders of the Chest

Learning Objectives

- To present the chest X-ray and CT findings of frequent occupational and environmental benign diseases of the chest
  - CWP and silicosis
  - Benign asbestos related diseases
- To discuss the roles and the limits of imaging methods in exposed individuals.
- To briefly introduce the role of imaging among other complementary methods

Imaging of Coal Worker's Pneumoconiosis and Silicosis

Coal Worker's Pneumoconiosis

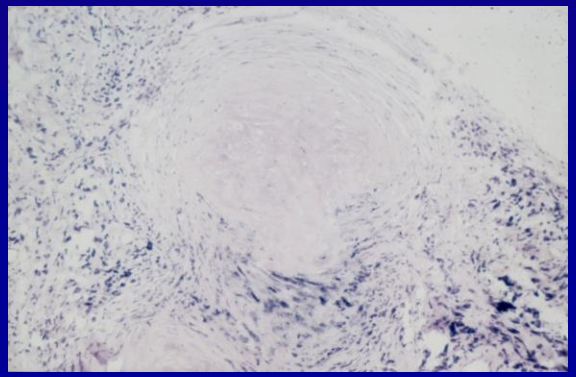
- Micronodules
- Confluences
- Progressive Massive Fibrosis (PMF)
- Necrosis of PMF
- Cavitation of PMF

Coal Worker's Pneumoconiosis Nodular Pattern

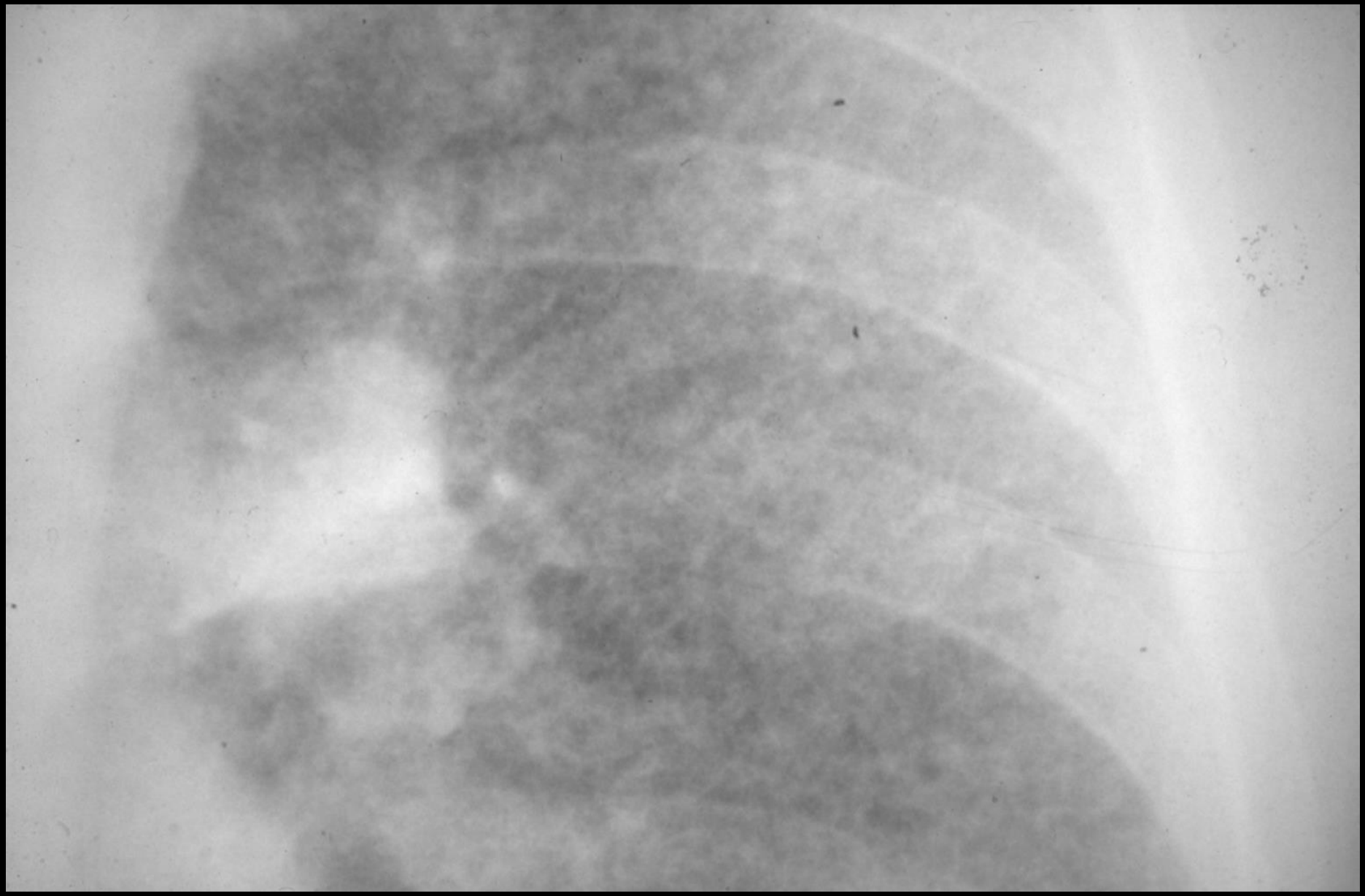
- Nodular lesions consist of dust laden macrophages in a fibrotic stroma composed of collagen and reticulin.

- College of American Pathologists:
  - Micronodules: up to 7 mm in diameter
  - Macronodules: from 7 to 20 mm in diameter
  - Progressive Massive Fibrosis: at least 2 cm in diameter

- Calcifications



Kleinerman *et al*. Arch Pathol Lab Med 1979; 103: 375-432



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Nodular Pattern: CWP and Silicosis

- Predominantly distributed in the posterior part of the right upper zone.
  - Regional differences in lymphatic flow result in poor clearance of particles from the posterior part of the right upper zone of the lung. This zone with poorest lymph flow is the most severely affected.

Remy-Jardin *et al.* Radiology 1990; 177: 133-139
Gurney *et al*. Radiology 1988; 167: 359-366
Gurney *et al*. Radiology 1990; 177: 363-371

Nodular Pattern: Upper predominance

- Pathologic Conditions Localized in the Upper Lobes due to Delayed Lymphatic Clearance:
  - Infection
    - Tuberculosis
    - Chronic Histoplasmosis
  - Inhaled antigen
    - Hypersensitivity pneumonia
    - Allergic bronchopulmonary aspergillosis
    - Bronchocentric granulomatosis

Gurney *et al*. Radiology 1988; 167: 359-366

Nodular Pattern: Upper predominance

- Pathologic Conditions Localized in the Upper Lobes due to Delayed Lymphatic Clearance:
  - Granulomatous disease
    - Sarcoidosis
    - Langerhans Cell Granulomatosis
    - Berylliosis
  - Pneumoconiosis
    - Silicosis
    - CWP
    - Hard metal disease
    - Stannosis
    - Kaolinosis, …

Gurney *et al*. Radiology 1988; 167: 359-366

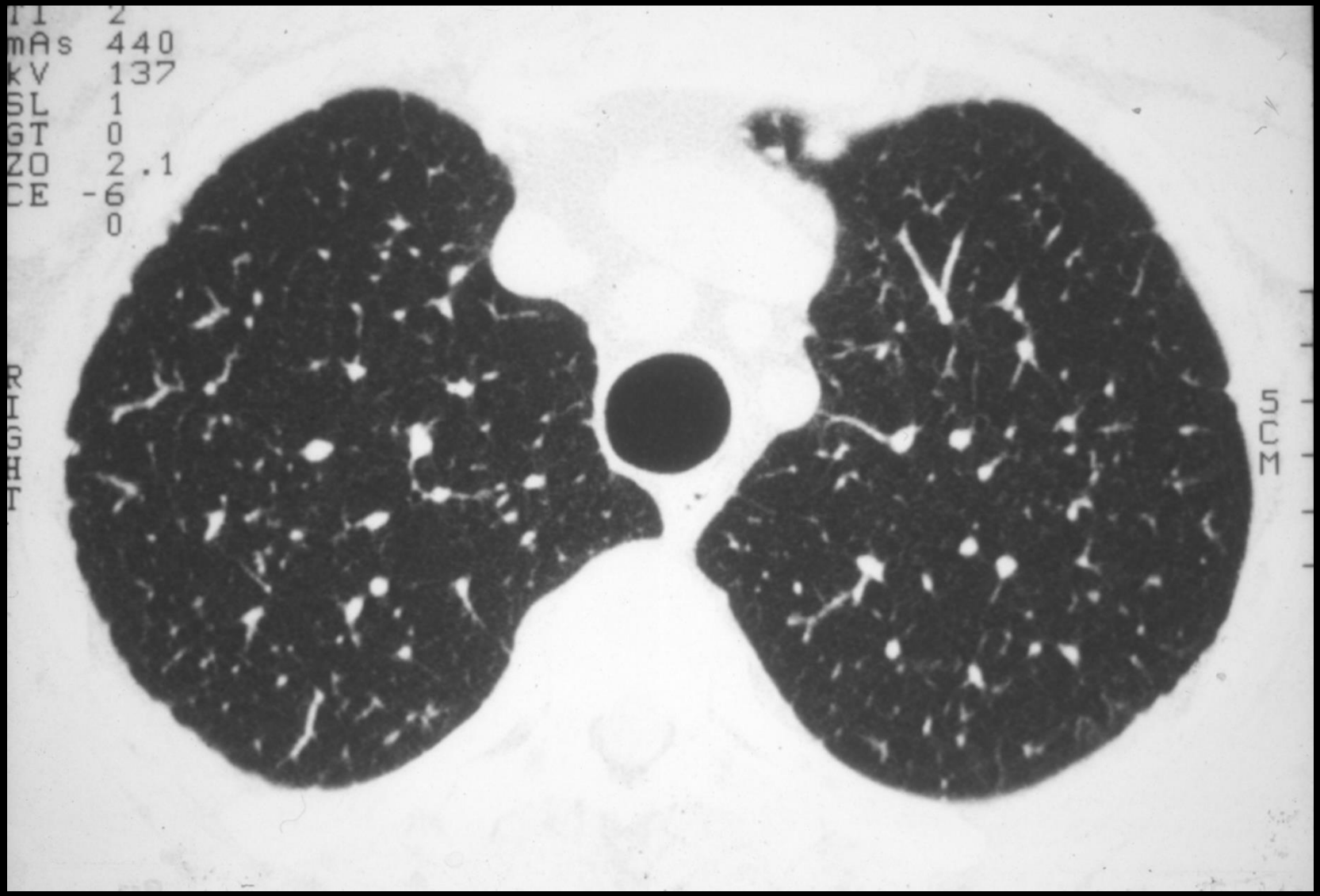
Nodular Pattern: Subpleural Micronodules

- In the lung parenchyma immediately beneath the visceral pleura, along the concavity of the chest wall and along the fissures.

- Related to subpleural lymphatic system
- Three main pathologic causes:
  - CWP
  - Pulmonary lymphangitic carcinomatosis
  - Sarcoidosis

*Remy-Jardin *et al.* Radiology 1990; 177: 133-139

Nodular Pattern: Subpleural Micronodules



Nodular Pattern: Subpleural Micronodules

- 14% of healthy control subjects
  - Cigarette smoking
  - Urban living

- "*Subpleural micronodules have no diagnostic value when observed as an isolated CT finding but may suggest the diagnosis of pneumonociosis, lymphangitic carcinomatosis or sarcoidosis when observed in association with mild parenchymal lesions*."

*Remy-Jardin *et al.* Radiology 1990; 177: 133-139

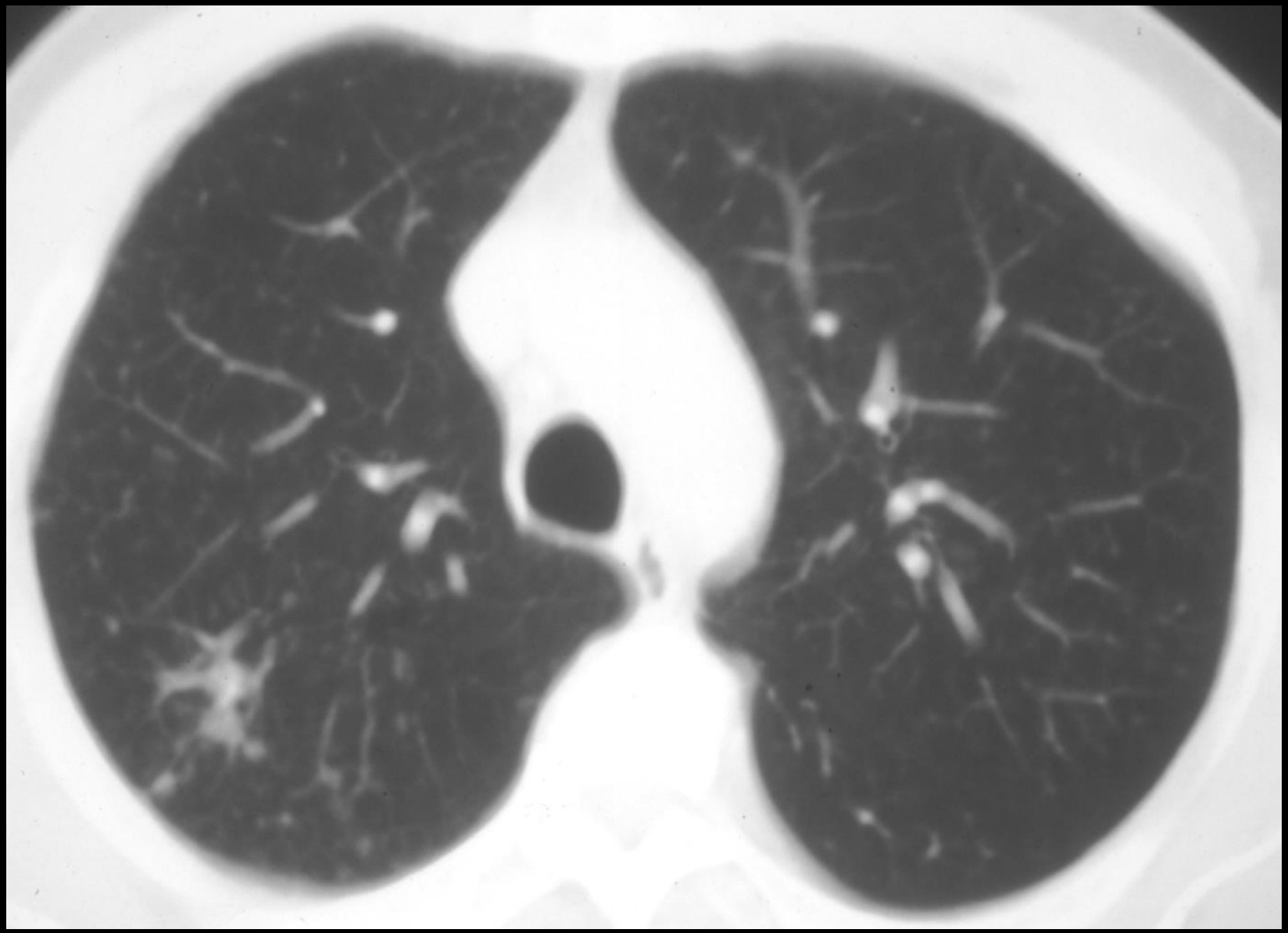
Nodular Pattern

- CWP
- Silicosis
- Silicatosis

- Kaolinosis
- Siderosis
- Barytosis
- Beryliosis
- Talcosis

Remy-Jardin *et al.* Radiology 1990; 177: 133-139
Bégin *et al*. Am Rev Respir Dis 1991; 144: 697-705

Confluence



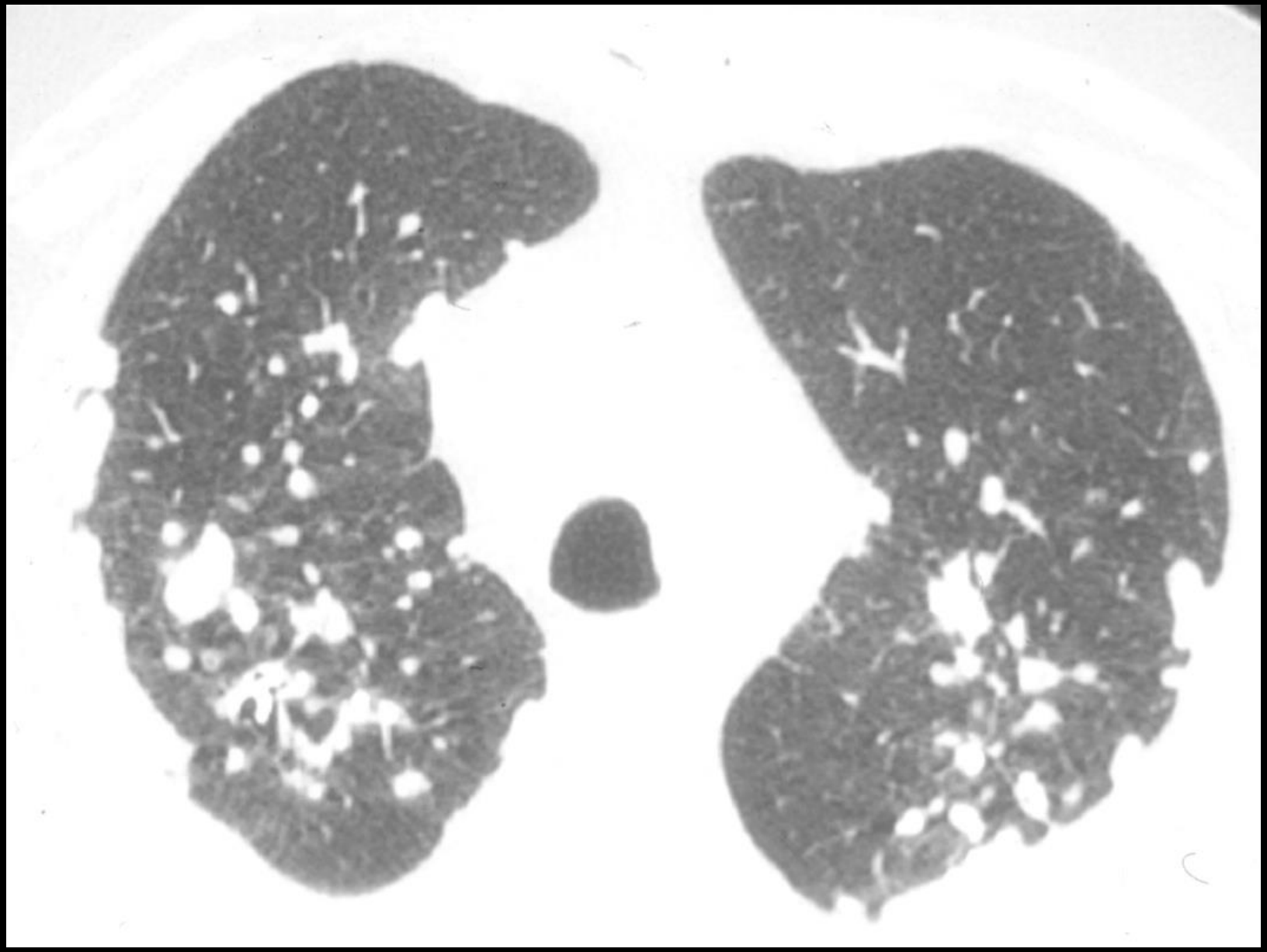
Confluence

Nodular Pattern: Subpleural Micronodules

- Confuence in pseudoplaques (< visceral pleura)
- Interposition of lung between the pleura and the pseudoplaque
- Associated with parenchymal micronodules
- Predominantly located in the posterior part of the right upper zone

*Remy-Jardin *et al.* Radiology 1990; 177: 133-139

Nodular Pattern: Subpleural Micronodules



Coal Worker's Pneumoconiosis

- Micronodules
- Confluences
- Progressive Massive Fibrosis (PMF)
- Necrosis of PMF
- Cavitation of PMF

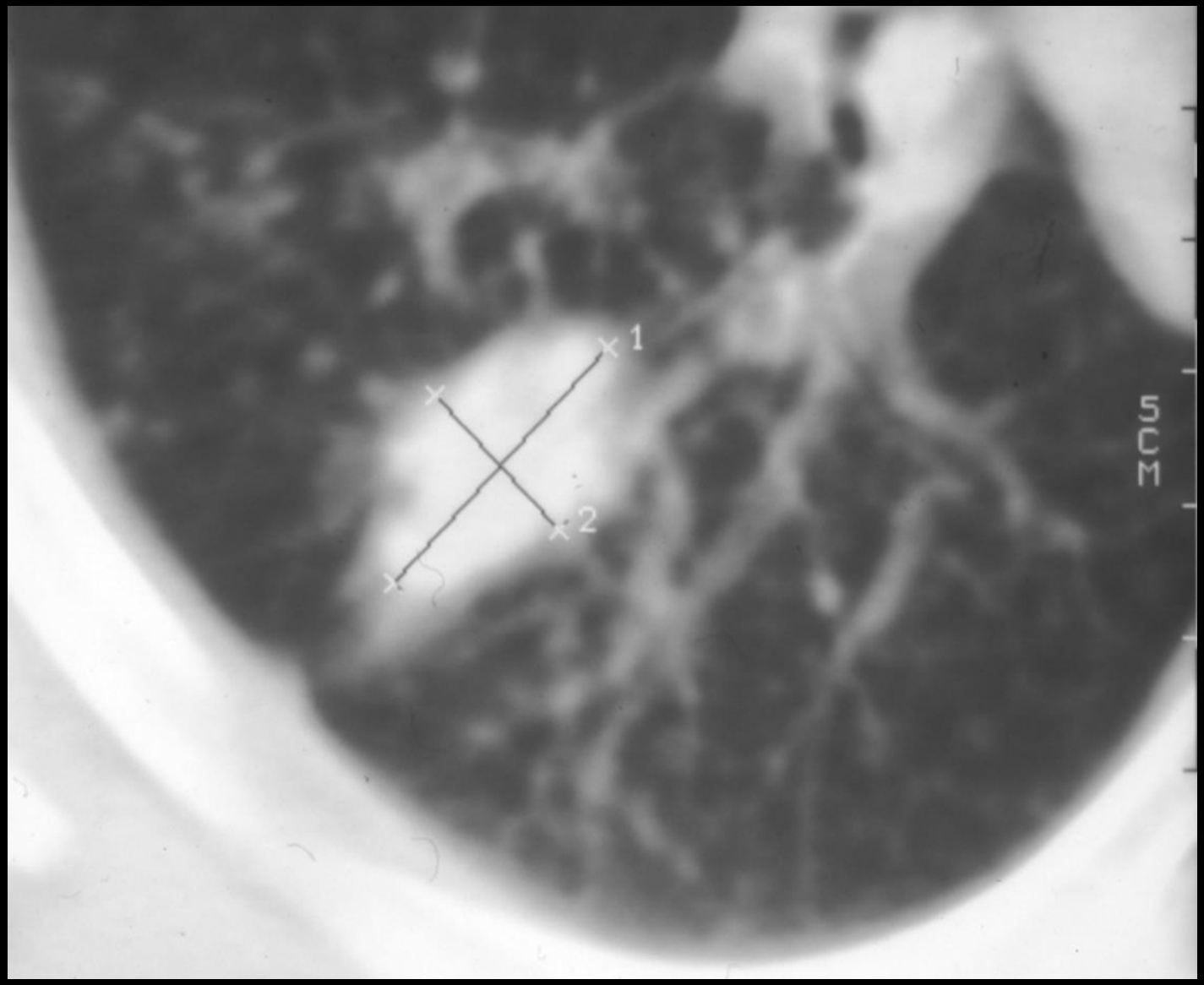
Progressive Massive Fibrosis

- Most typical but not pathognomonic appearance:
  - Irregular borders
  - Calcifications
  - Surrounding areas of emphysema

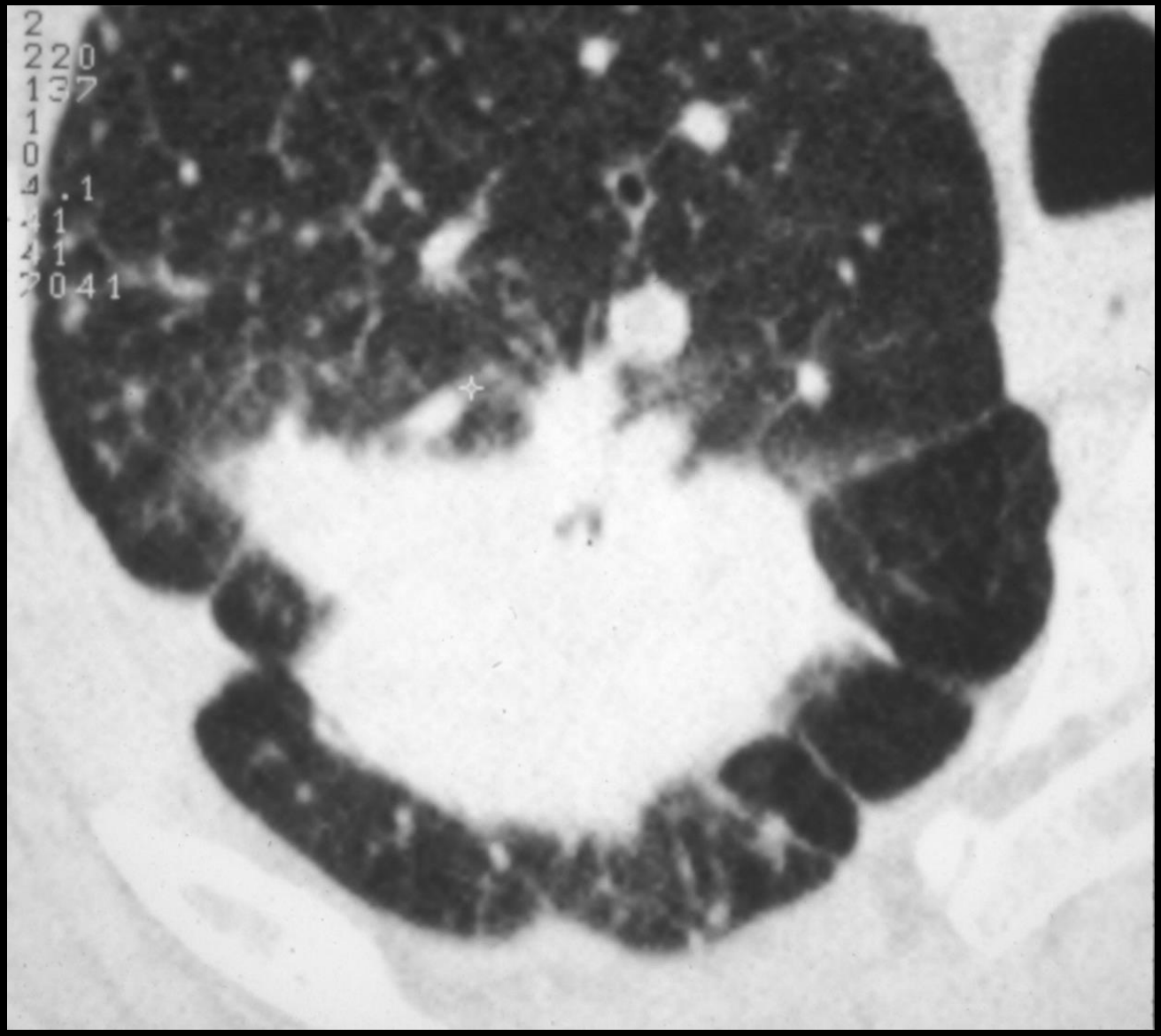
Remy-Jardin *et al.* Radiology 1990; 177: 133-139

Remy-Jardin *et al*. Radiol Clinics North Am 1992; 30: 115-117

Confluence - PMF



Pulmonary Massive Fibrosis



Progressive Massive Fibrosis

- Always observed on a background of simple nodular pattern
- Predilection for the upper and posterior portions of the lungs
- However, PMF exclusively located in the posterior part of the lower zones of the lung may be observed.

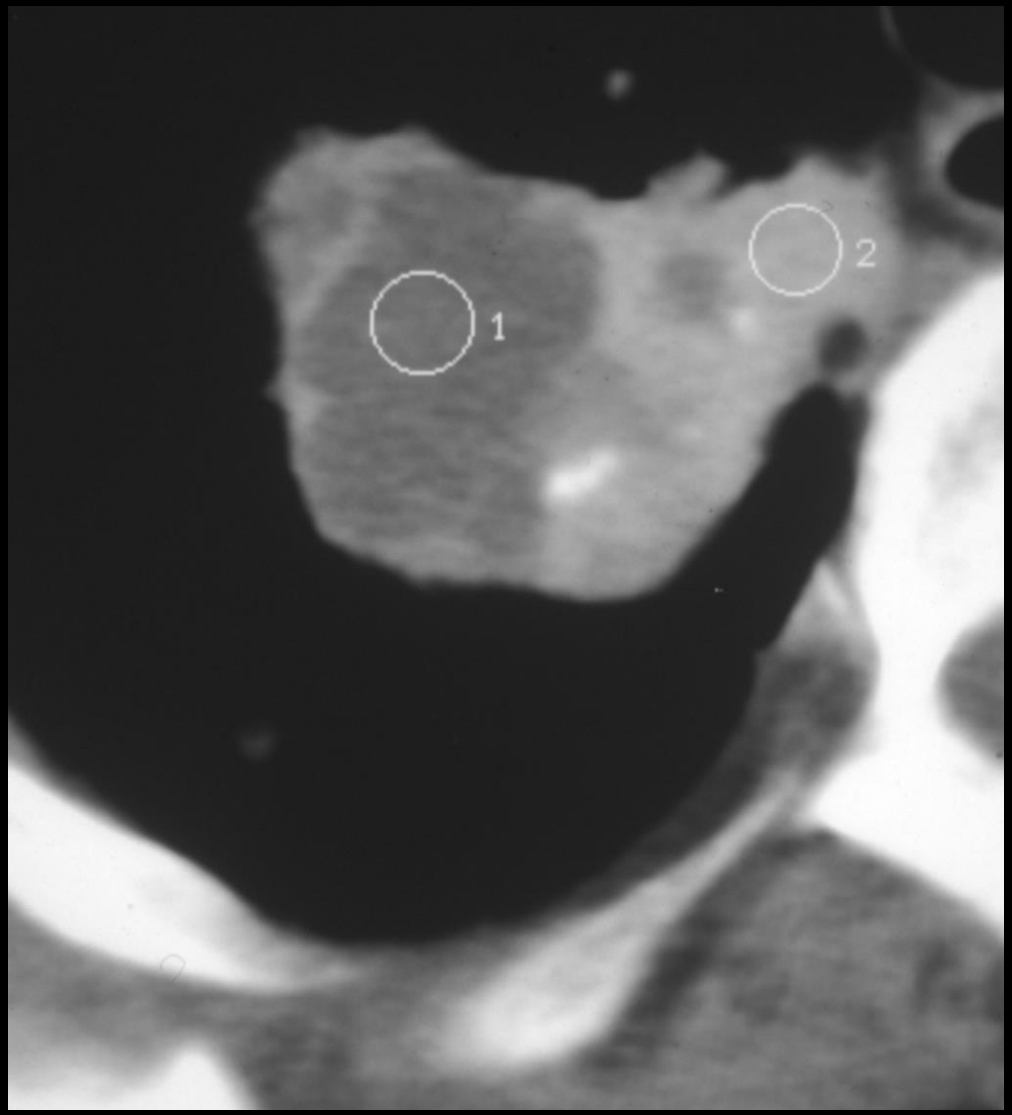
Remy-Jardin *et al*. Radiol Clinics North Am 1992; 30: 115-117

Progressive Massive Fibrosis

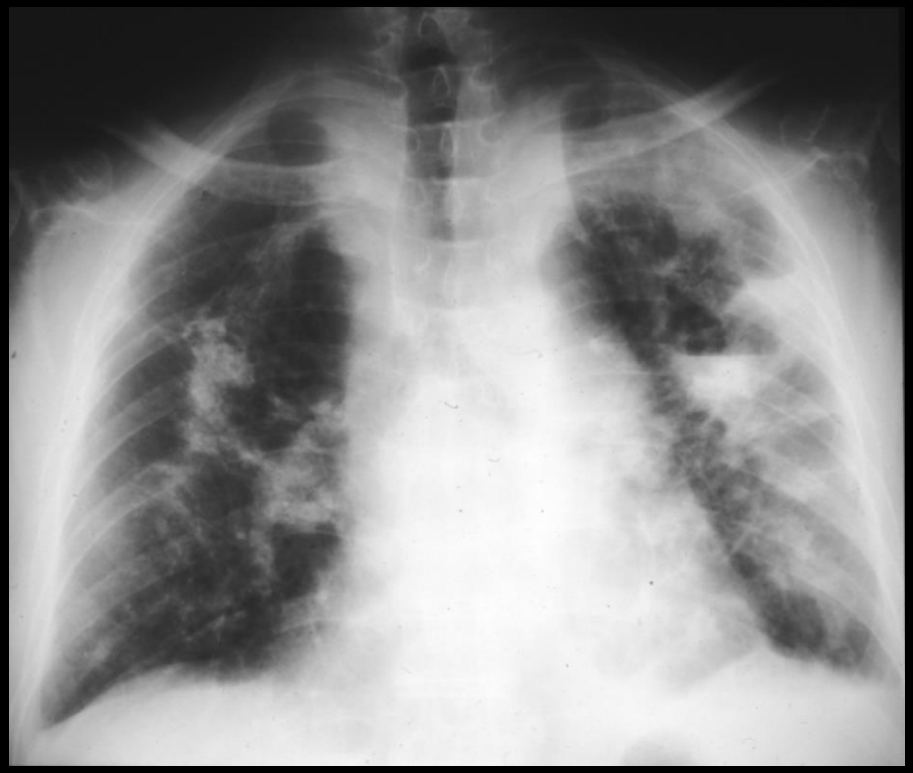
- Aseptic necrosis – liquefaction (liquid attenuation)
  - > 4 cm in diameter
  - With or without cavitations (air attenuation)
- Excavated masses (air attenuation)
  - Infections: Tb and aspergilloma

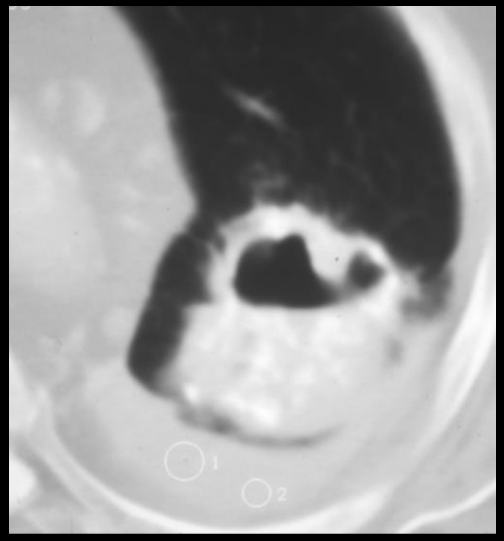
Remy-Jardin *et al.* Radiology 1990; 177: 133-139
Remy-Jardin *et al*. Radiol Clinics North Am 1992; 30: 115-117

Pulmonary Massive Fibrosis: Liquefaction



Pulmonary Massive Fibrosis: Cavitation





Progressive Massive Fibrosis Differential Diagnosis with other Diseases

- Bronchial carcinoma
- Tuberculosis

- Morphological criteria are not sufficient!
  - Comparative follow-up CT scans
  - CT-guided biopsies

- PMF is always observed on a background of nodular CWP. In other words, the diagnosis is very unlikely if there is no surrounding micronodules

Remy-Jardin *et al.* Radiology 1990; 177: 133-139

CWP and Silicosis: The Roles of CT

- To detect or to confirm the presence of micronodules
- To detect or to confirm the presence of confluences
- To detect or to confirm the necrosis and the cavitation in PMF
- To detect and to quantify pulmonary emphysema as a cause of physiologic impairment

Remy-Jardin *et al.* Radiology 1990; 177: 133-139
Begin *et al*. Am Rev Respir Dis 1991; 144: 697-705
Gevenois *et al*. Acta Radiol 1994; 35: 351-356

CWP and Silicosis: The Roles of CT

- No references for normal CT scans
- No ILO type films for the CT scans

- Significant reduction of inter-reader variability

Begin *et al*. Am Rev Respir Dis 1991; 144: 697-705

Imaging of Benign Asbestos-Related Diseases

Asbestos Related Diseases

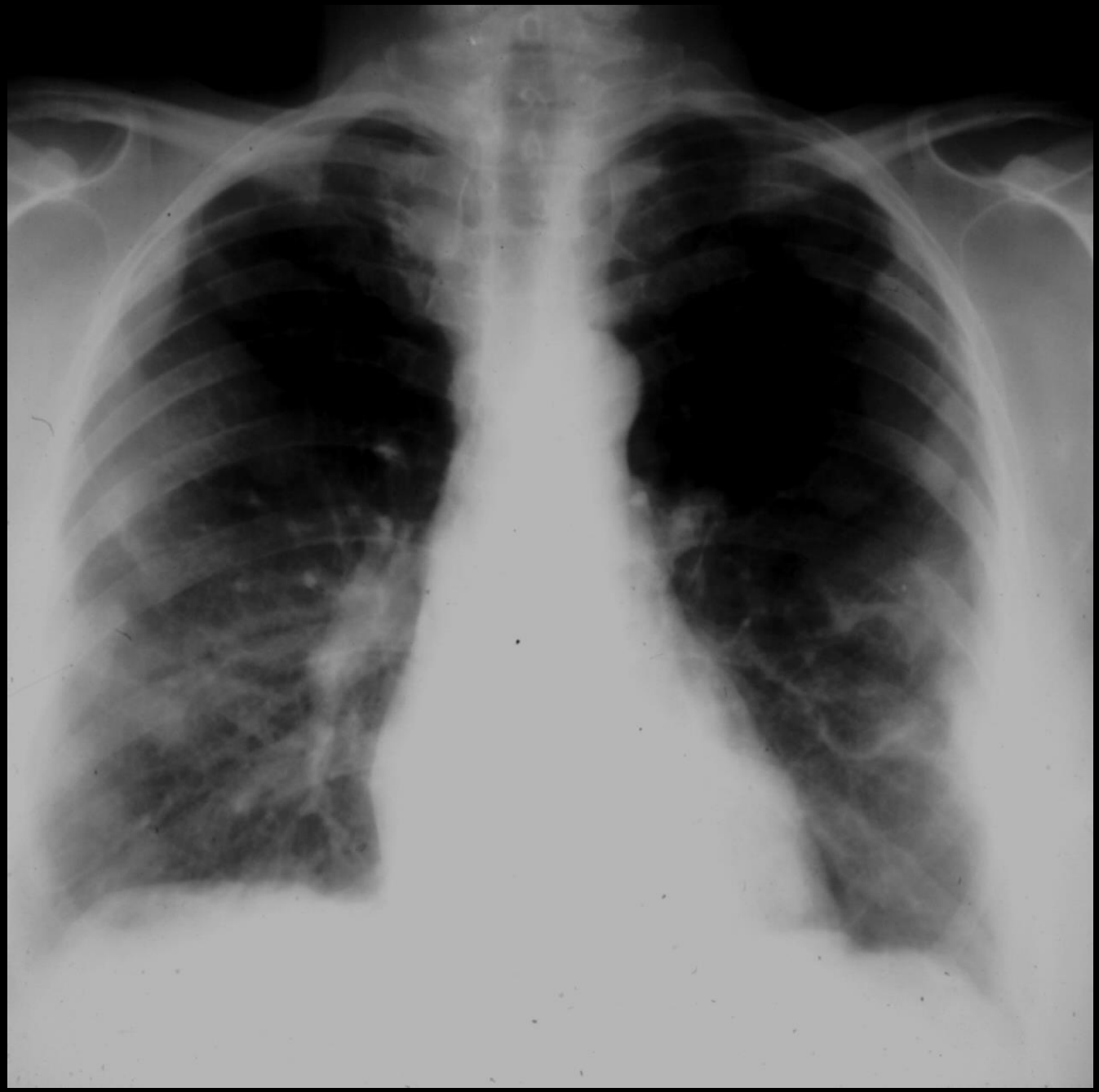
- Pleural Diseases
  - Pleural plaques
  - Benign asbestos pleural effusion
  - Diffuse pleural thickening
    - Rounded atelectasis
    - Crow's feet
  - Malignant mesothelioma
- Pulmonary Diseases
  - Asbestosis (fibrosis)
  - Bronchial carcinoma

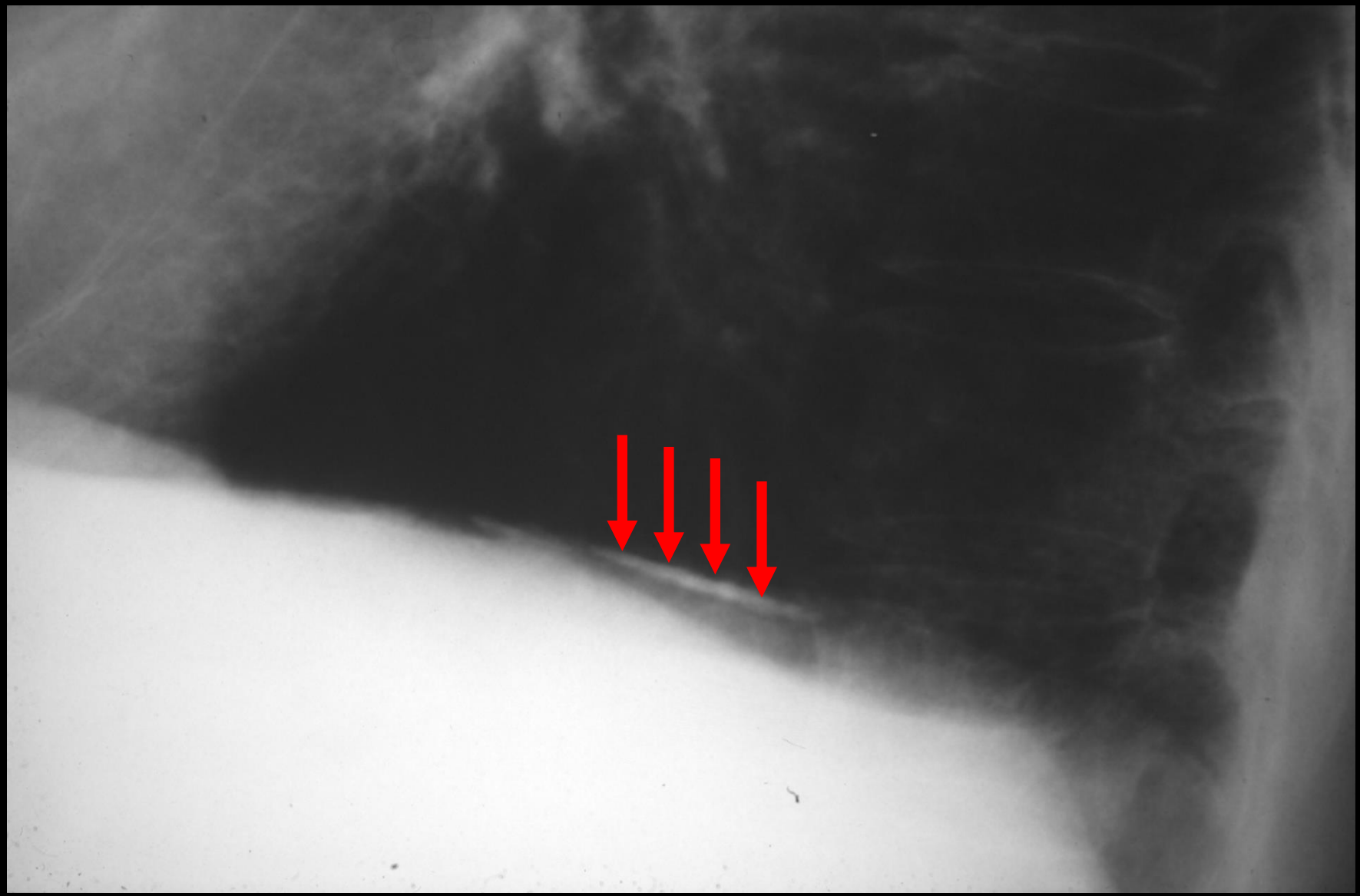
Pleural Plaques

- The most common asbestos-related disorder
- Parietal pleura
- Mostly bilateral
- Collagen – calcium
- Diaphragm – Posterior aspect of the chest
- Mediastinum
- No functional consequence*
  - With the exception of lung collapse and fibrosis due to "mechanical stress" (see below)

*Van Cleemput *et al.* Am J Respir Crit Care Med 2001; 163: 705-710

*Copley *et al.* Radiology 2001; 220: 237-243

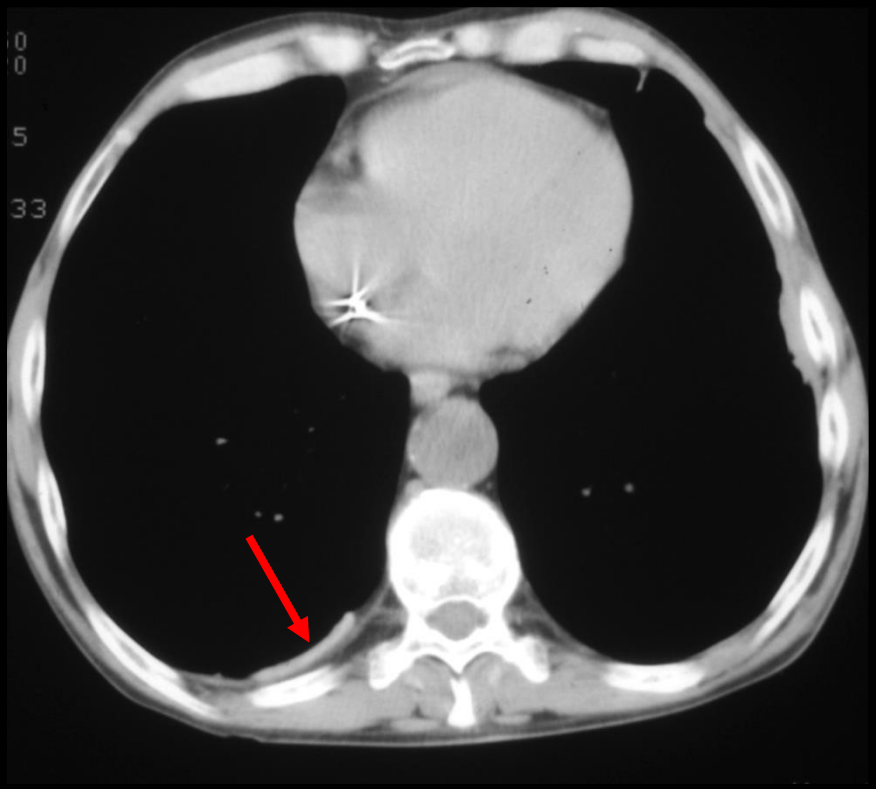


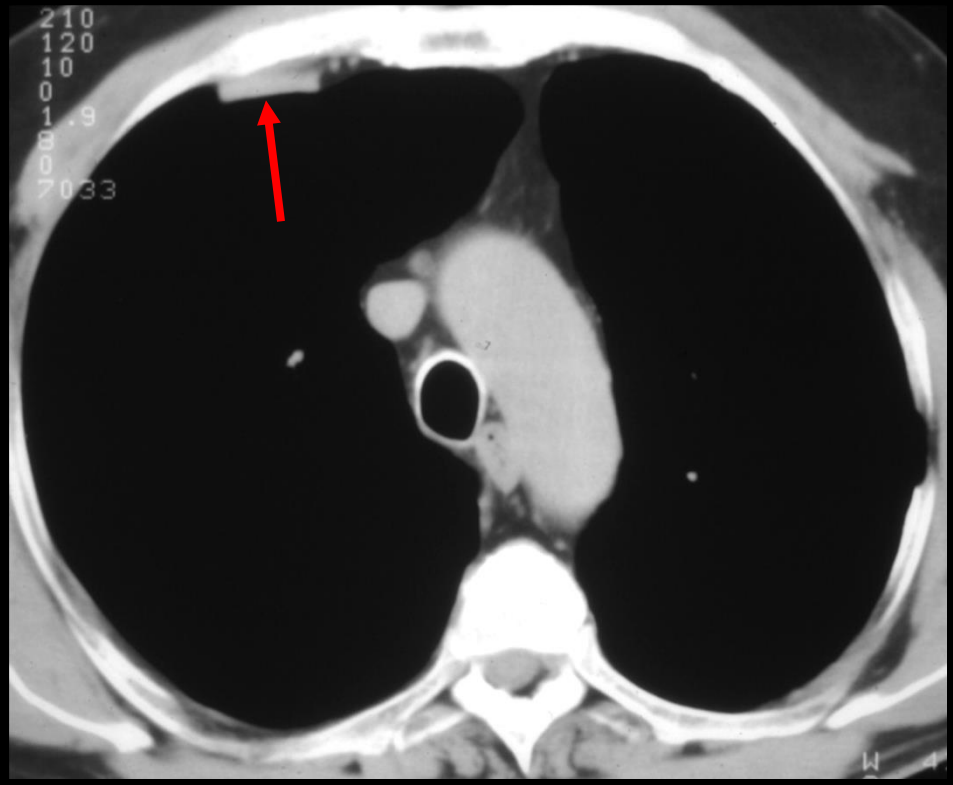


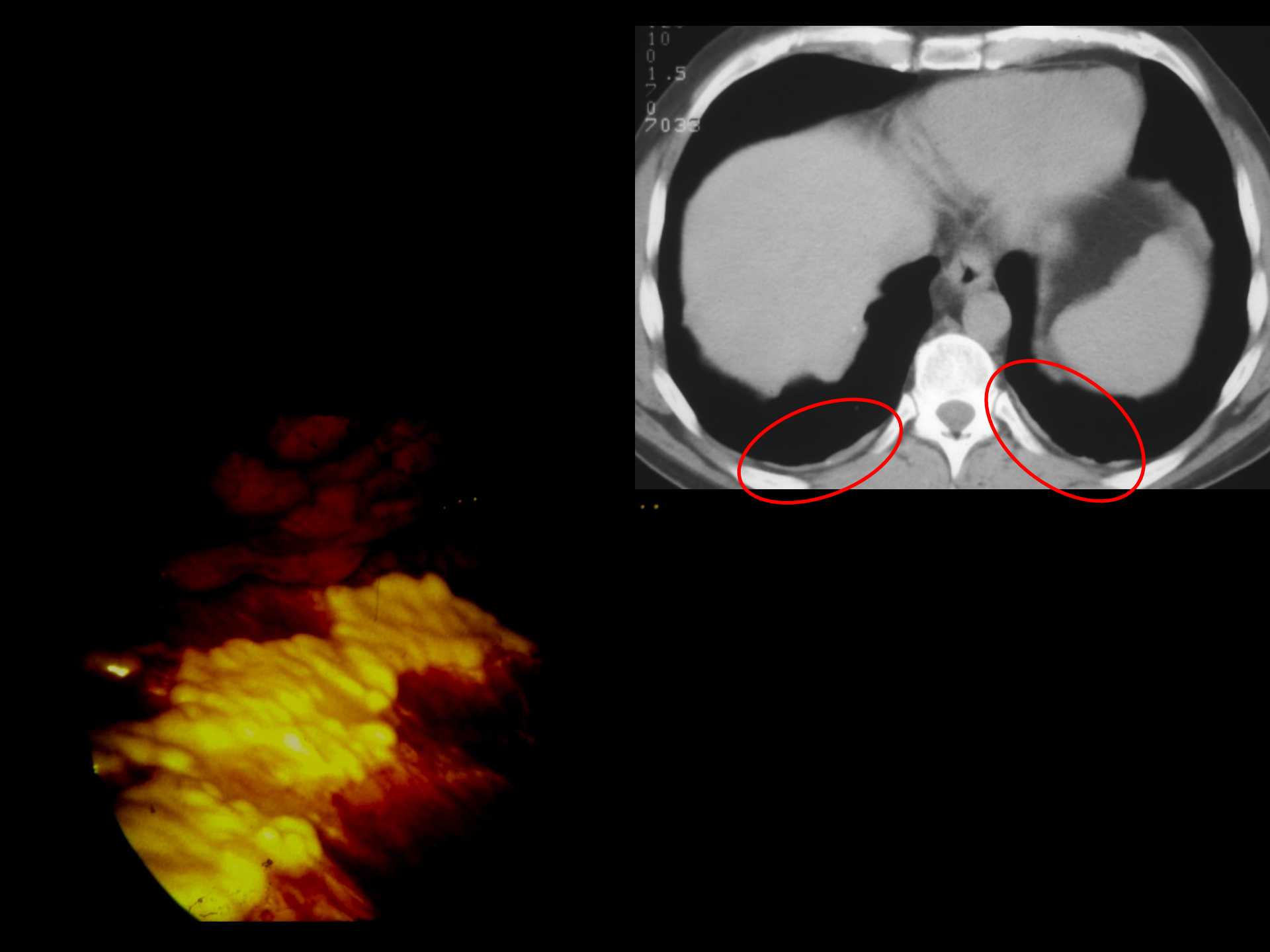
Pleural Plaques: CT Scan

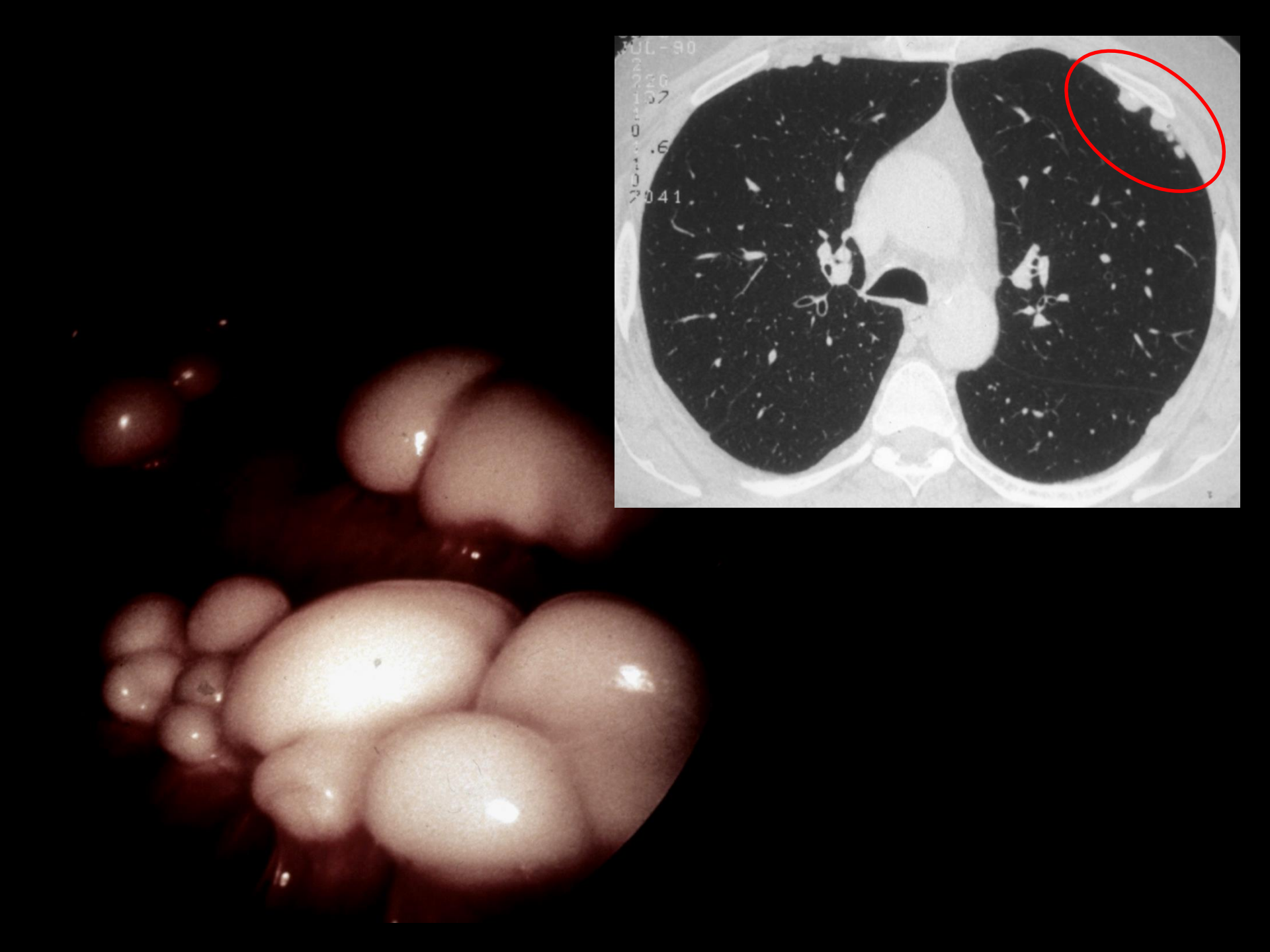
- Smooth linear or nodular shape
- 2 – 5 mm
- Postero-inferior
- Less frequently anterior or superior
- Multiple and bilateral
- Calcium or soft tissue attenuation values
- Normal adjacent lung parenchyma*

*Gevenois *et al.* Eur Respir J 1998; 11: 1021-1027









Pleural Plaques

- Usually bilateral
  - BUT: unilateral in 1/4 -1/3 of cases*
  - the bilateralism is not mandatory to accept the relationship with asbestos exposure (medico-legal relevance)

*Neri *et al.* Occup Environ Med 1994; 51: 239-243

*Gevenois *et al.* Eur Respir J 1998; 11: 1021-1027

Pleural plaques

- In 50 symptom free workers exposed to amosite who had normal chest radiograph and pulmonary function tests, and had been examined by CT :

- 32 had pleural plaques :

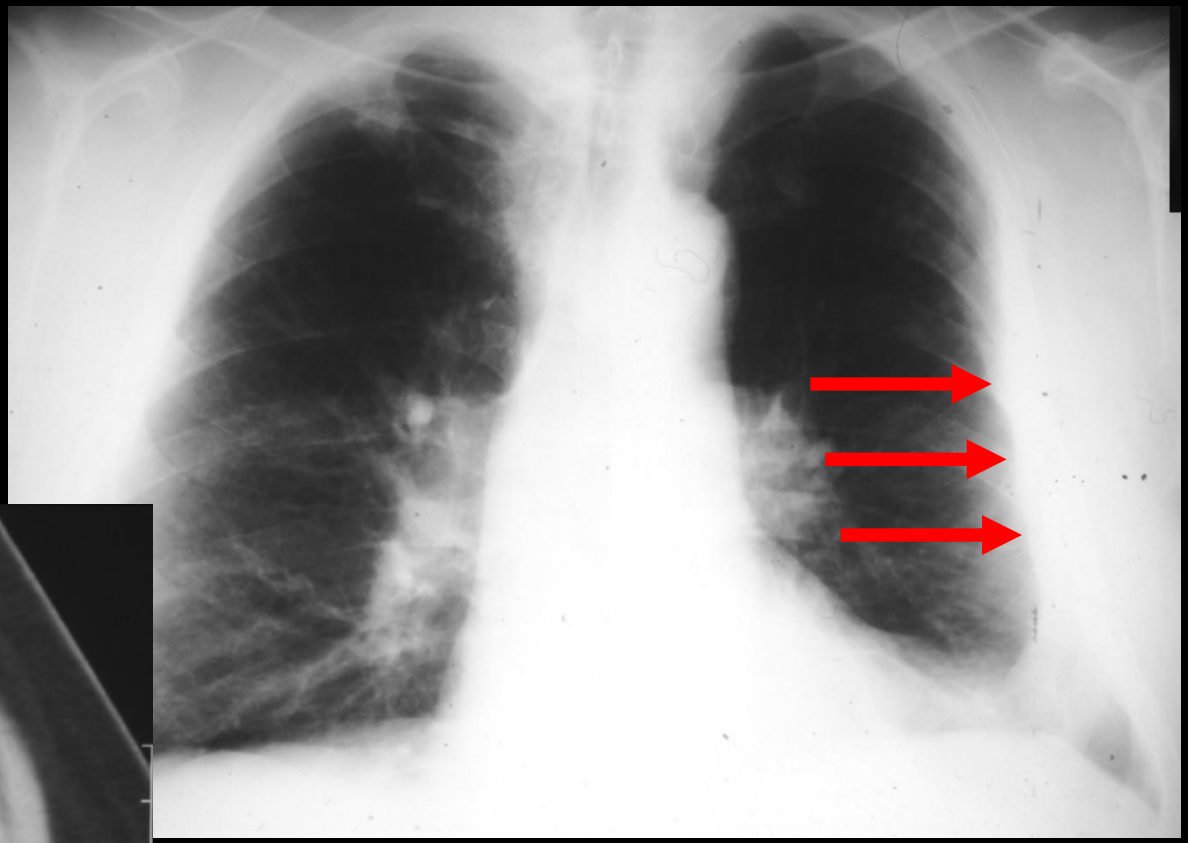
    - 23 bilateral (72 %)
    - 9 unilateral (28 %)

Neri *et al.* Occup Environ Med 1994; 51: 239-243

Detection of Pleural Plaques : The Roles of CT scan

- more sensitive and more specific than chest X-ray
- extra-pleural fat
- *calcifications*: 85% of pleural plaques are calcified on histological examination but only 15% are calcified on chest X-ray.
- 48% of “pleural thickenings” described on chest X-rays correspond to extrapleural fat on CT scans*.

*Sergent *et al.* Radiology 1984; 152: 273-277

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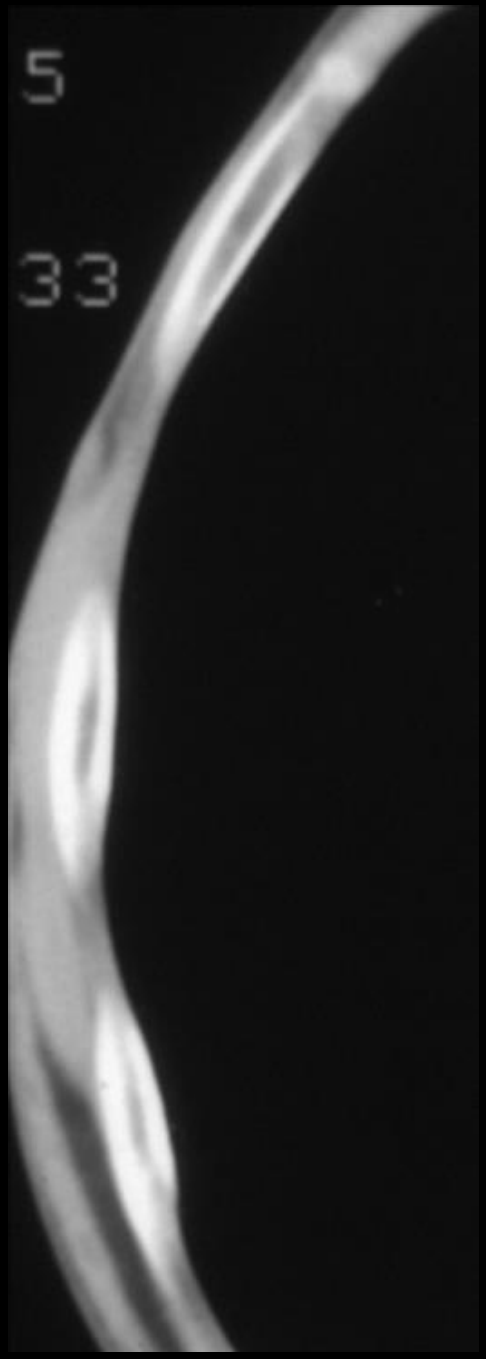
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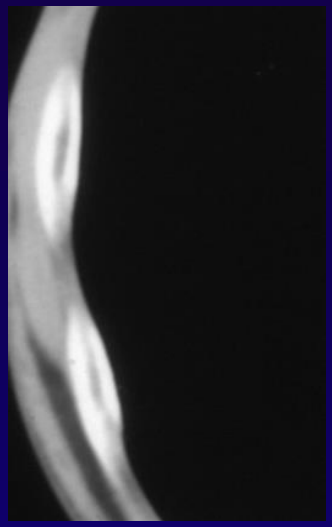
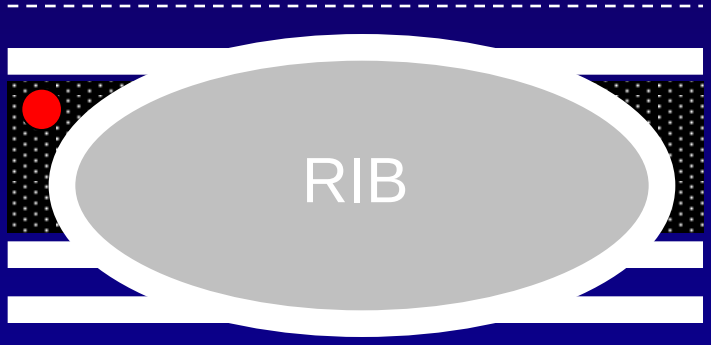
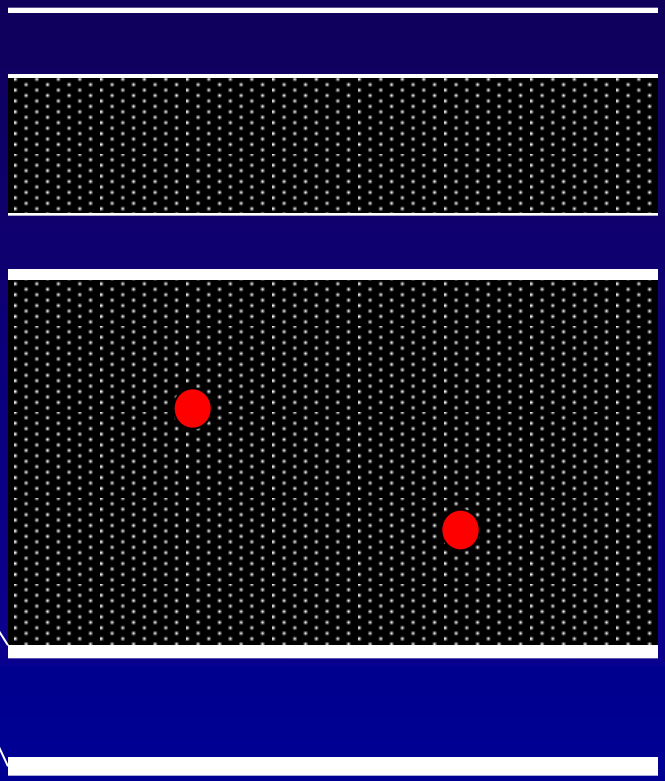
Normal Costal Pleura







Visc. Pleura

Pariet. Pleura

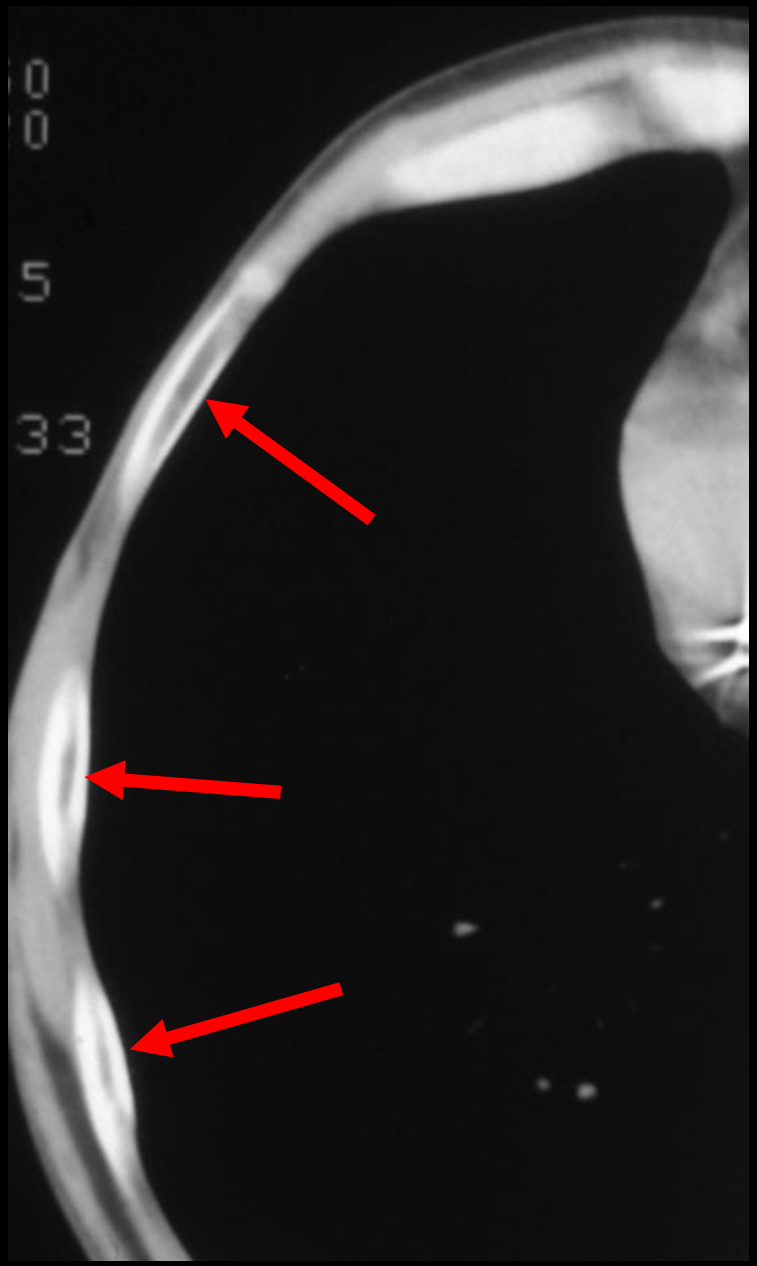
Fat Pad

Endothor. F.

Innermost intercotal m.

Intercostal fat and vessels

Intercotal muscles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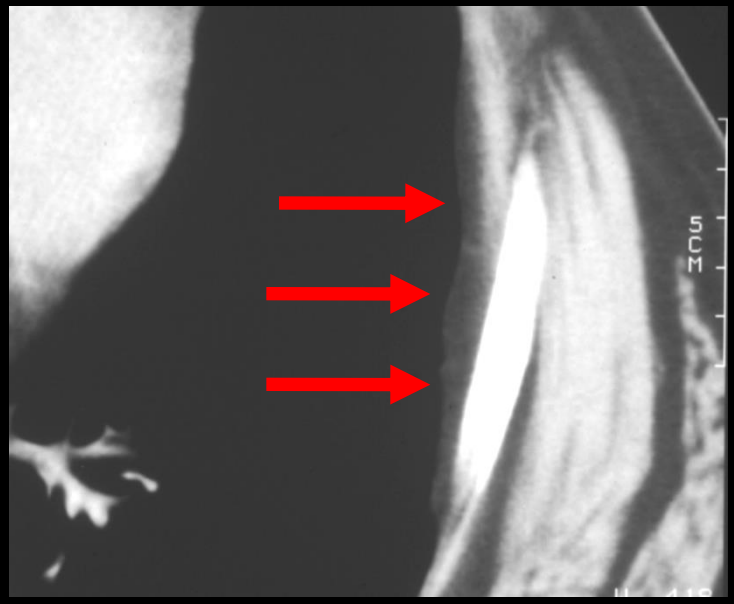
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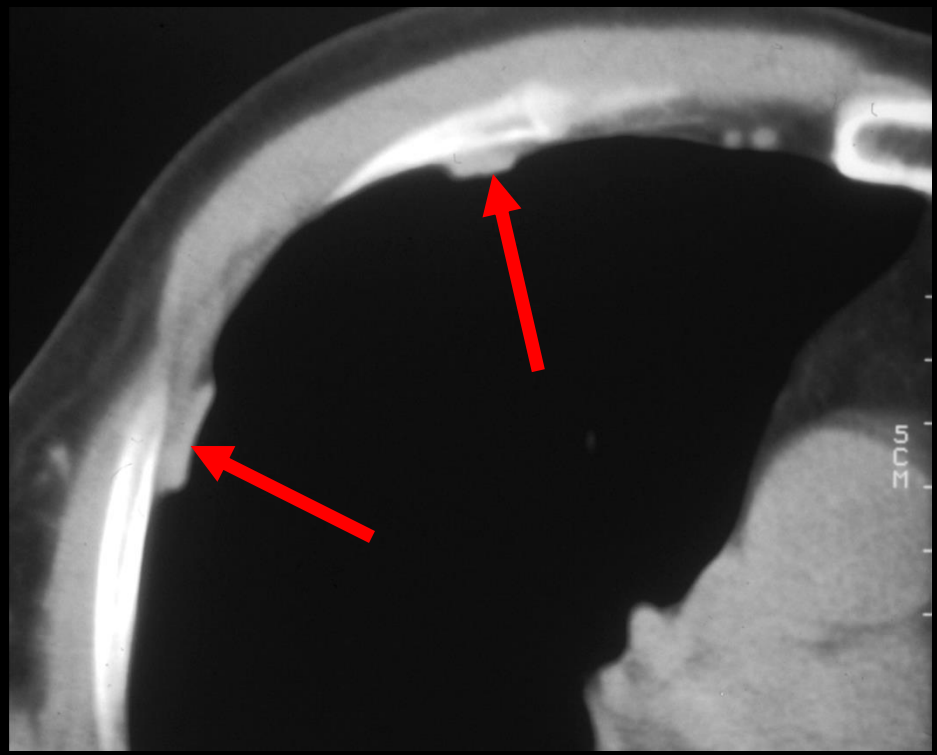
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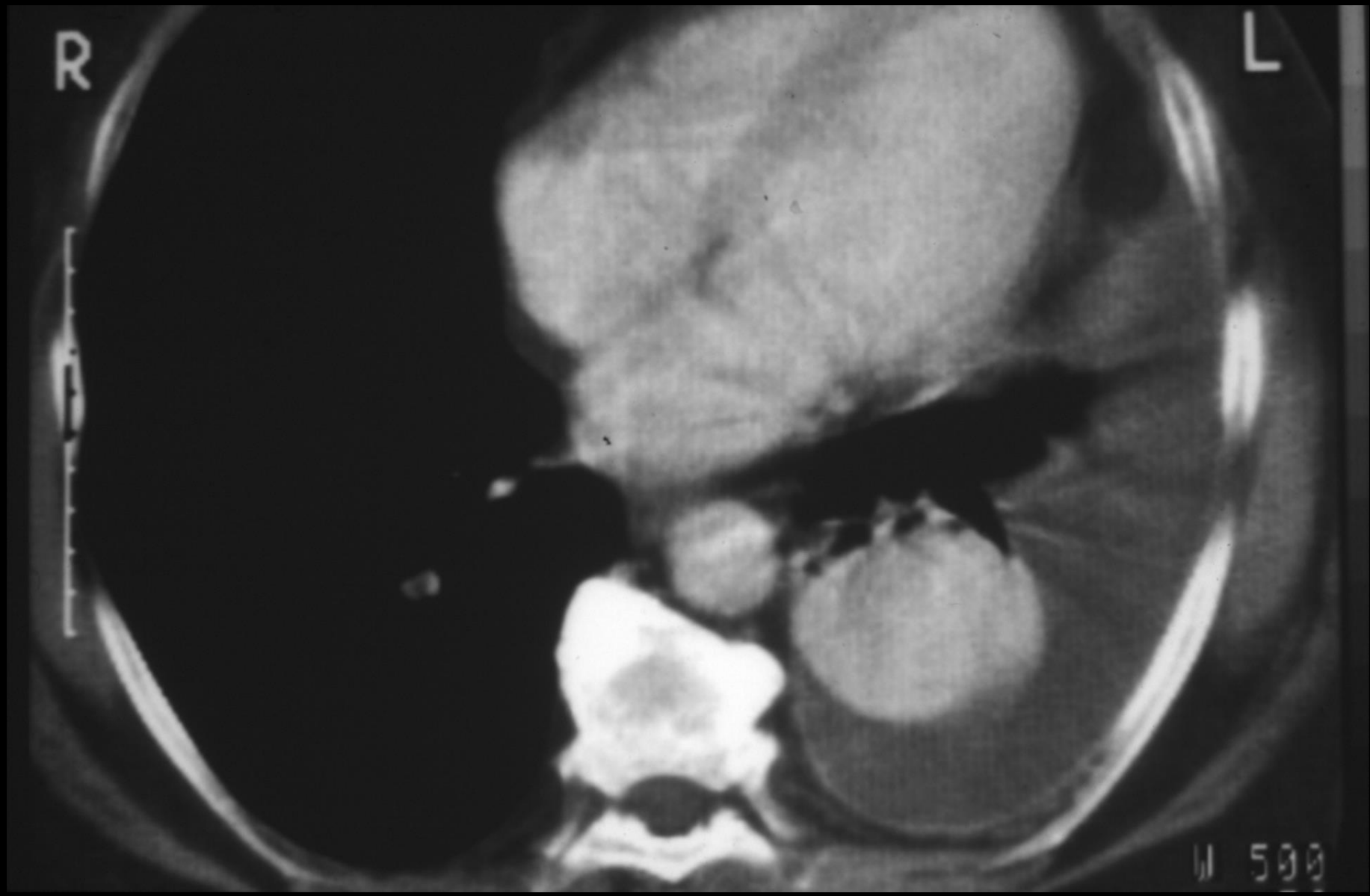
Benign Pleural Effusion

- benign pleural fluid collection
- recurrent
- sometimes hemorrhagic

- from 2 to 3 years of benign evolution are required for the diagnosis

- diffuse pleural thickening / visceral pleural fibrosis
  - rounded atelectasis
  - crow’s feet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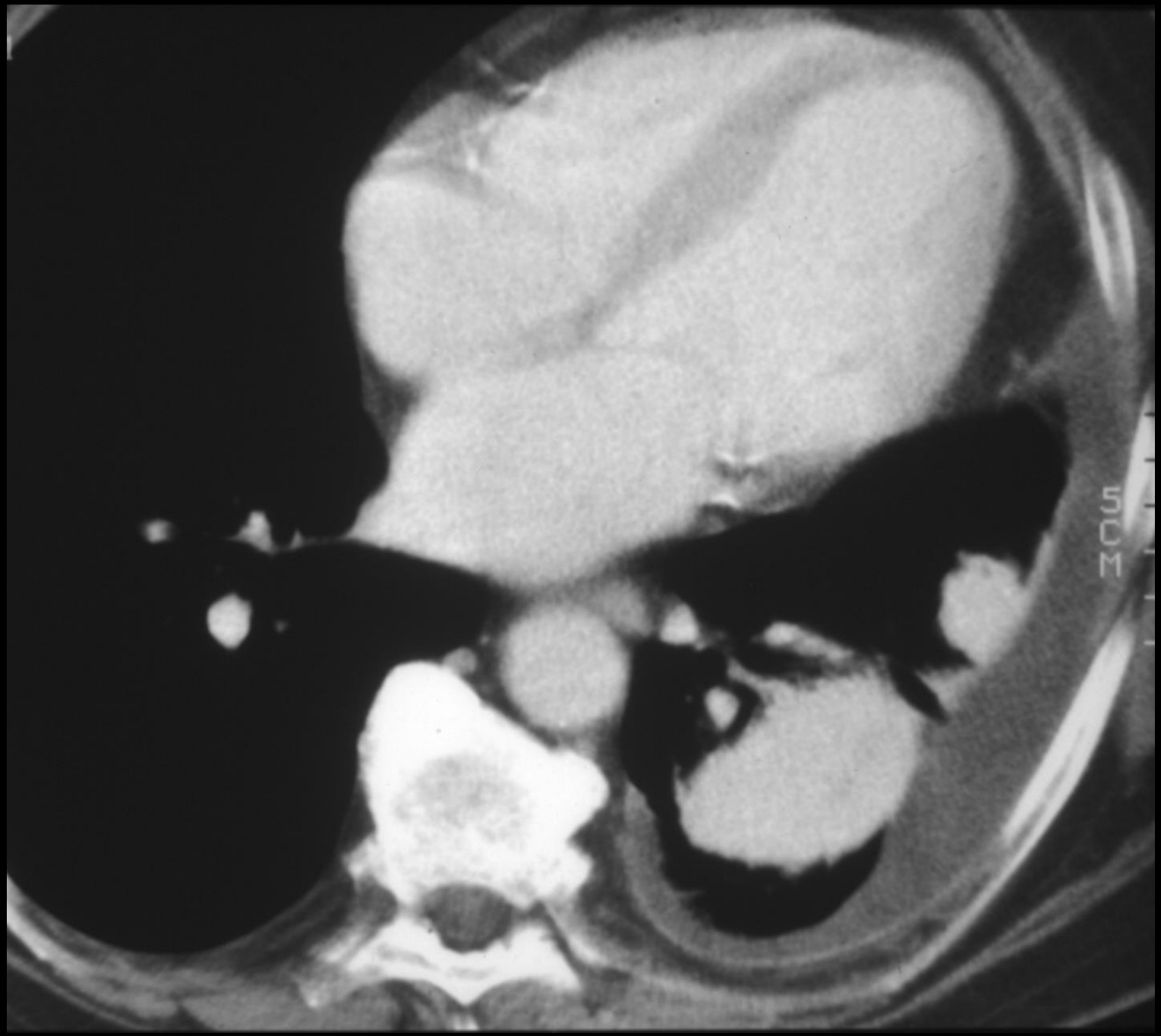
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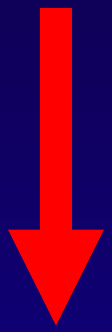
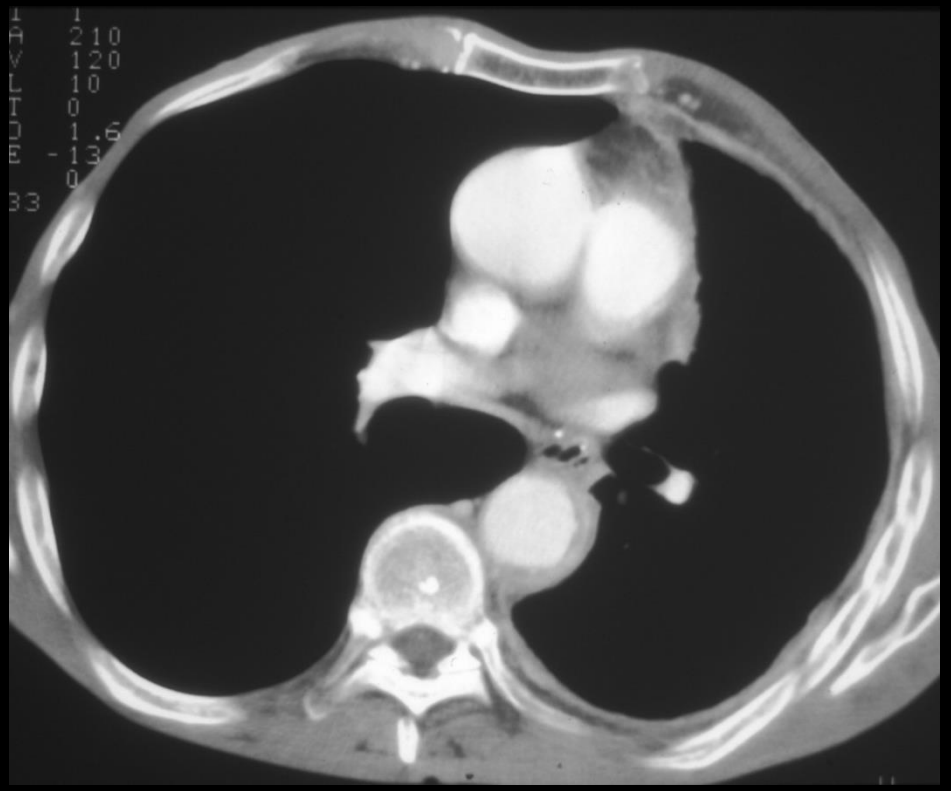
Benign pleural effusion



Fibrotic Pleural Disease

Rounded Atelectasis

Cohen *et al.* J Comput Assist Tomogr 1993;8: 309-312

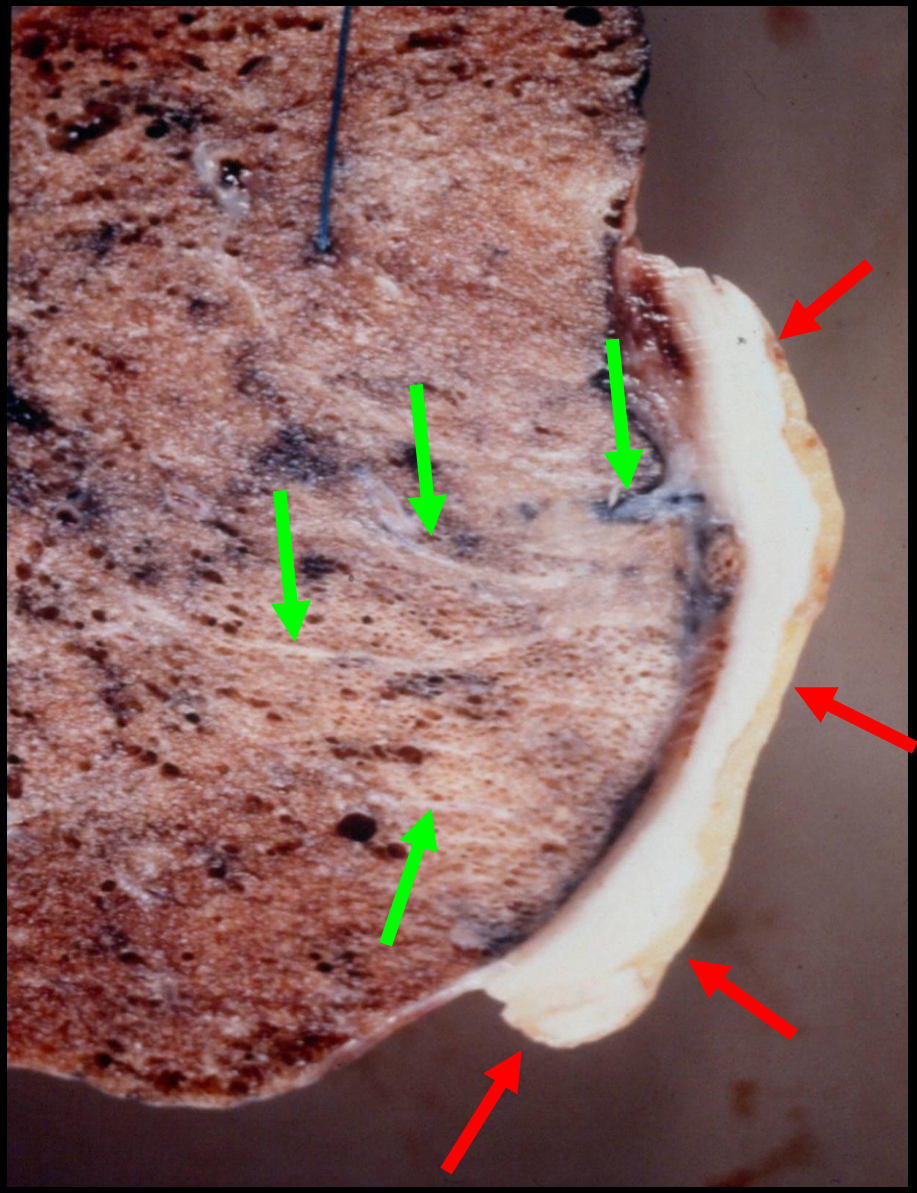


Diffuse Pleural Thickening
Visceral Pleural Fibrosis

- fibrosis of the visceral pleura
- history of pleurisy in 30% of cases
- involvement of the costo-phrenic sulcus
- uni or bilateral
- associated with restrictive disorder / extent*
- abnormal adjacent lung parenchyma**
  - rounded atelectasis
  - crow's feet

*Al Jarad *et al*. Respir Med 1991; 85: 203-208
*Schwartz *et al*. J Appl Physiol 1990; 68: 1932-1937
*Schwartz *et al*. J Clin Invest 1993; 91: 2685-2692
**Gevenois *et al.* Eur Respir J 1998; 11: 1021-1027

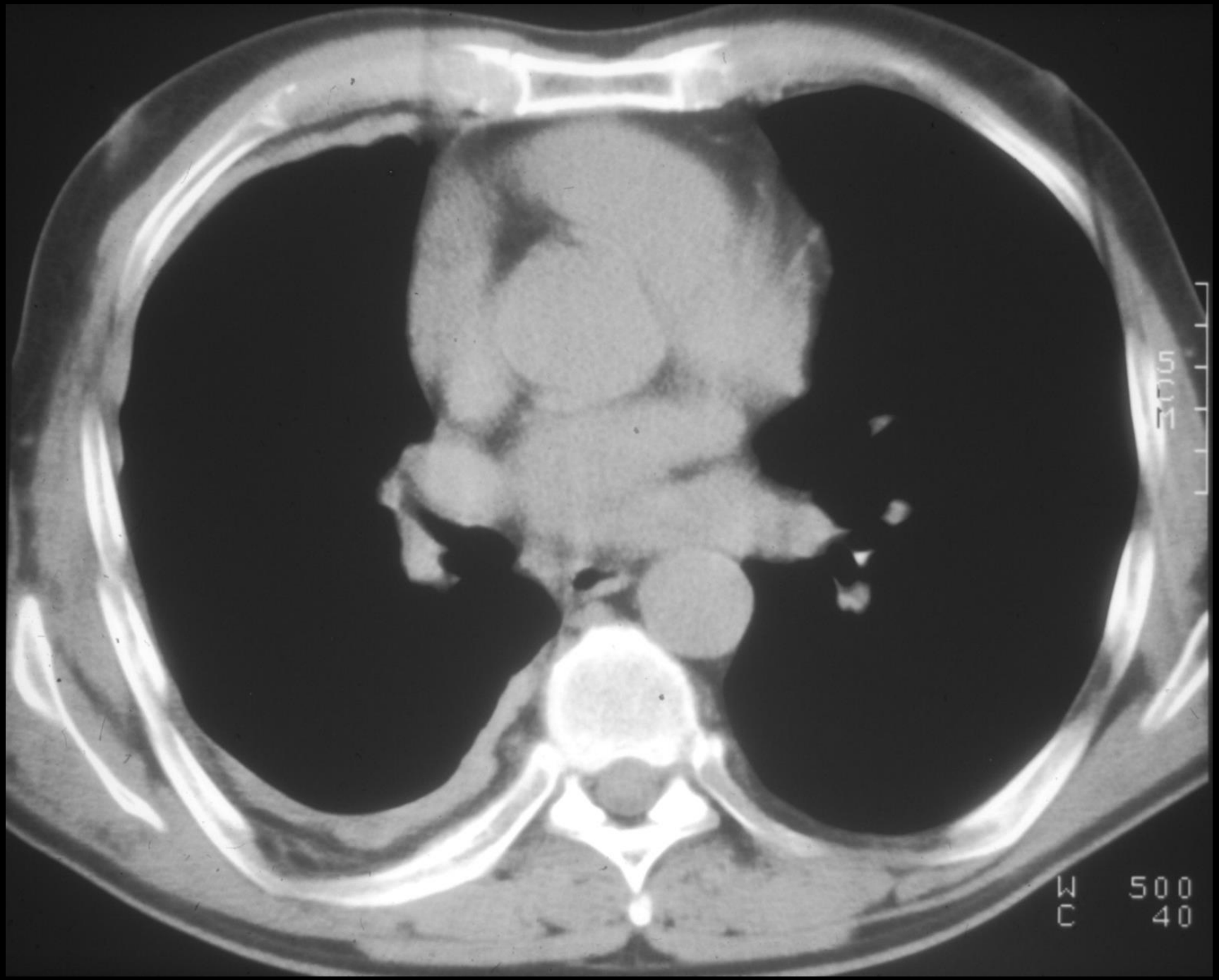
Diffuse Pleural Thickening



Diffuse Pleural Thickening: CT scan

- large and diffuse
- irregular in shape
- wide (> 1cm)
- involvement of costo-phrenic sulcus
  - thickness: > 3 mm*
  - width: > 5 cm
  - height: > 8 cm

*Lynch *et al.* Radiographics 1989; 9: 523-551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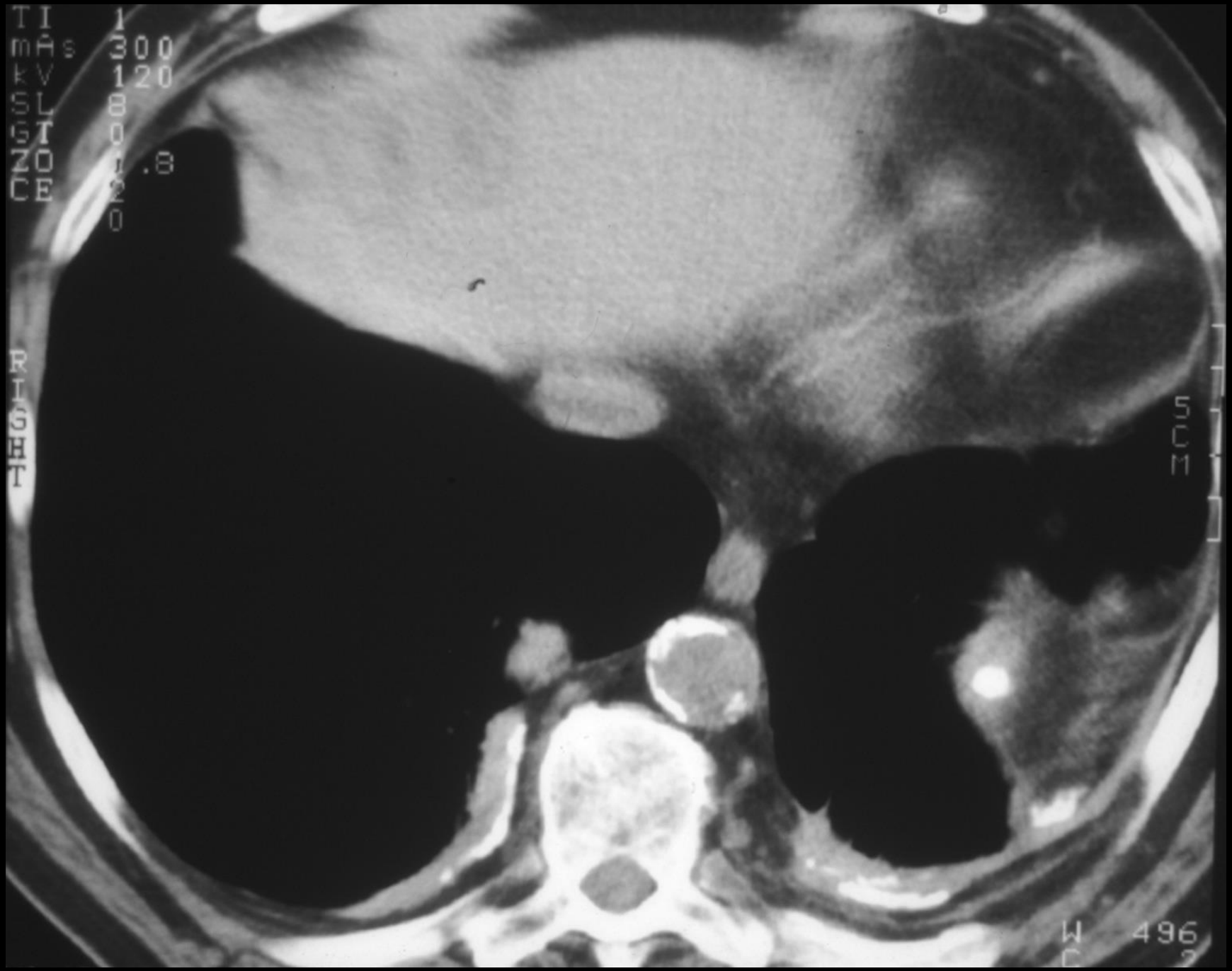
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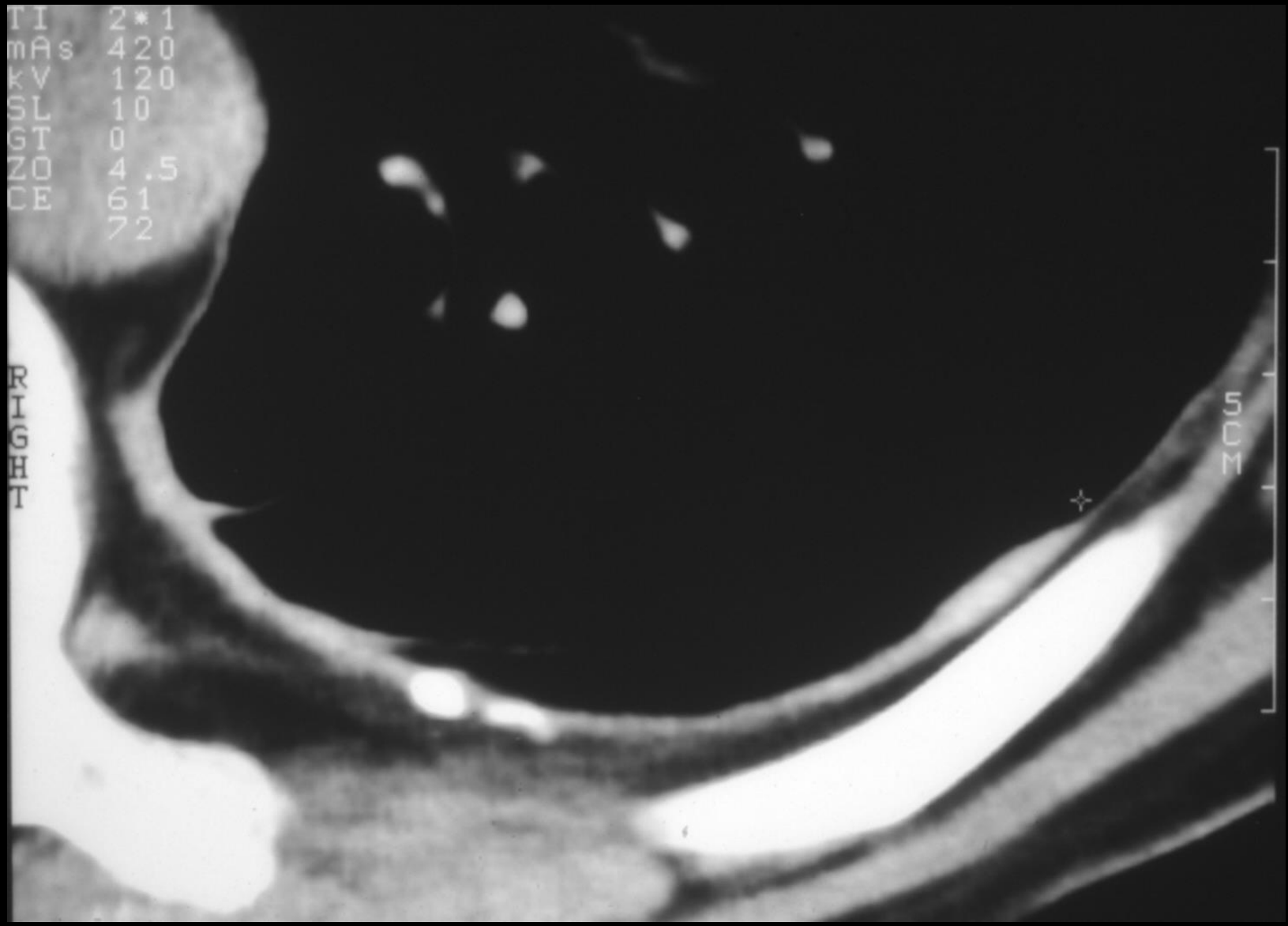
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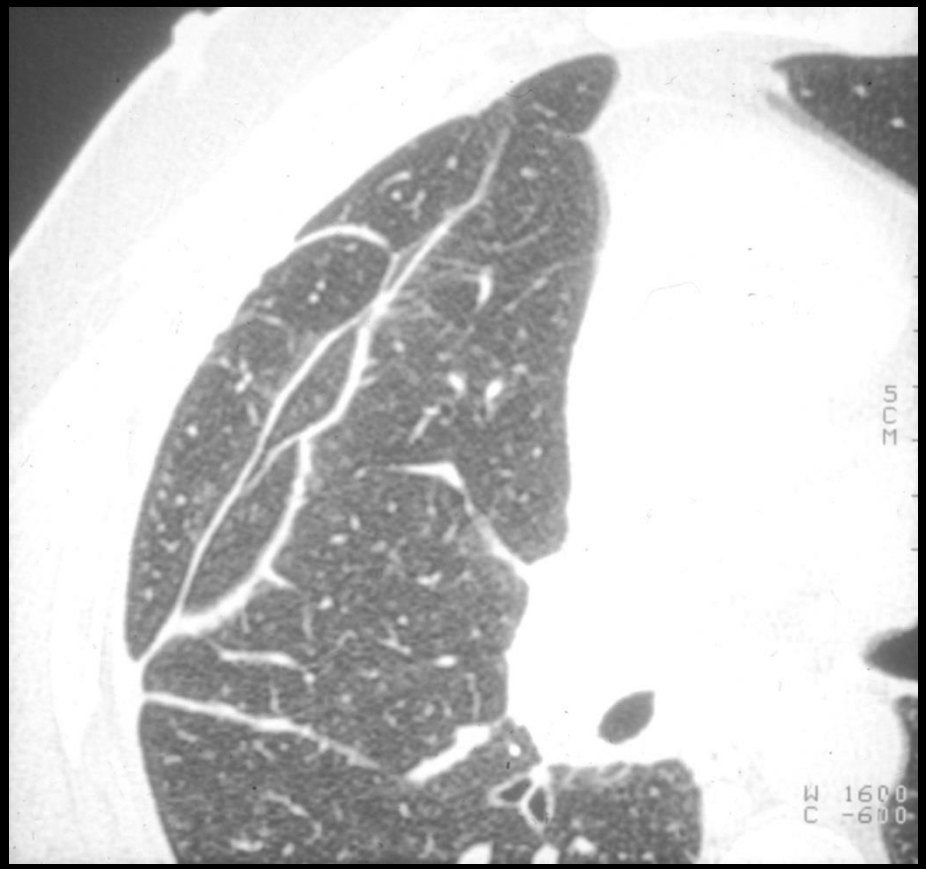
Parenchymal Band: CT scan

- Linear, non tapering densities
- 2-5 cm in length
- Extended through the lung
- Contact with the pleural surface

Aberle *et al*. Radiology 1988; 166: 729-734
Aberle *et al*. AJR 1988; 151: 883-891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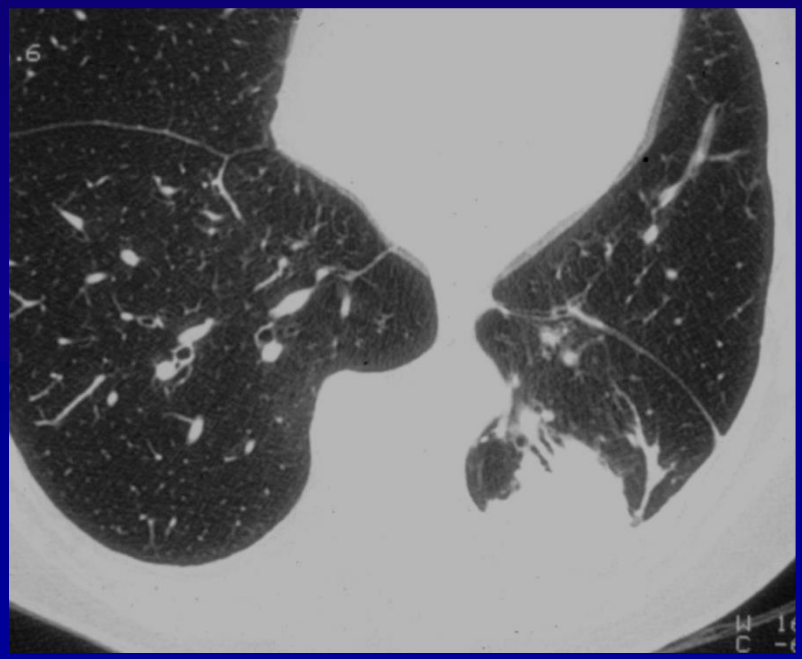
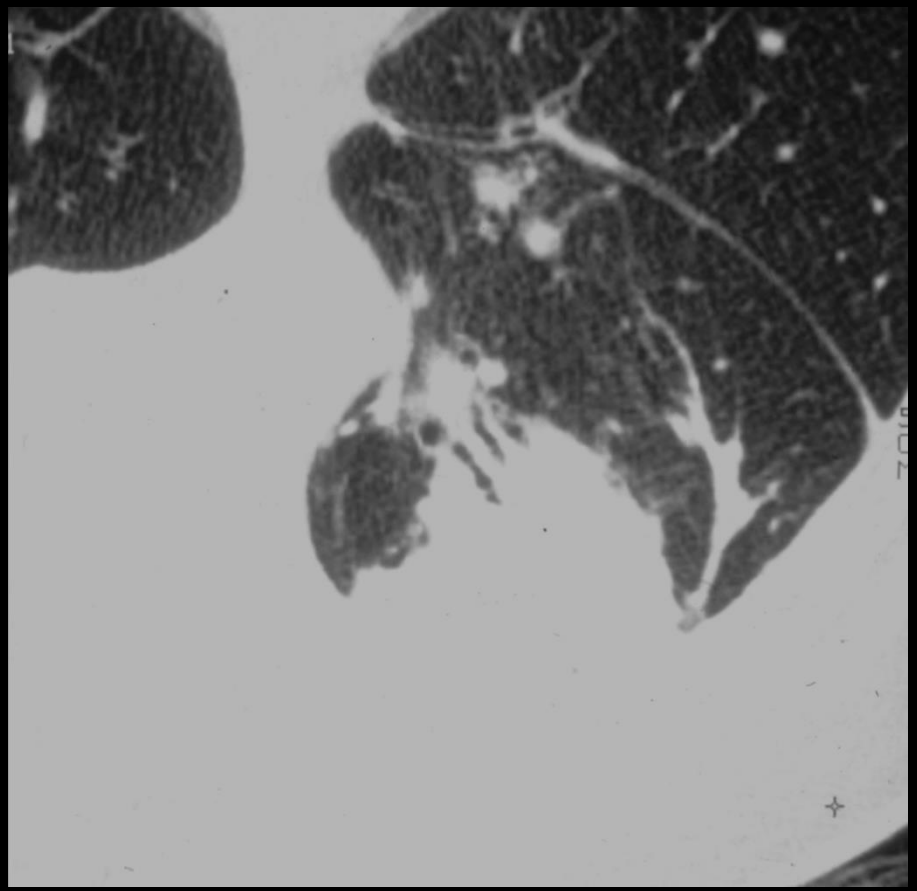
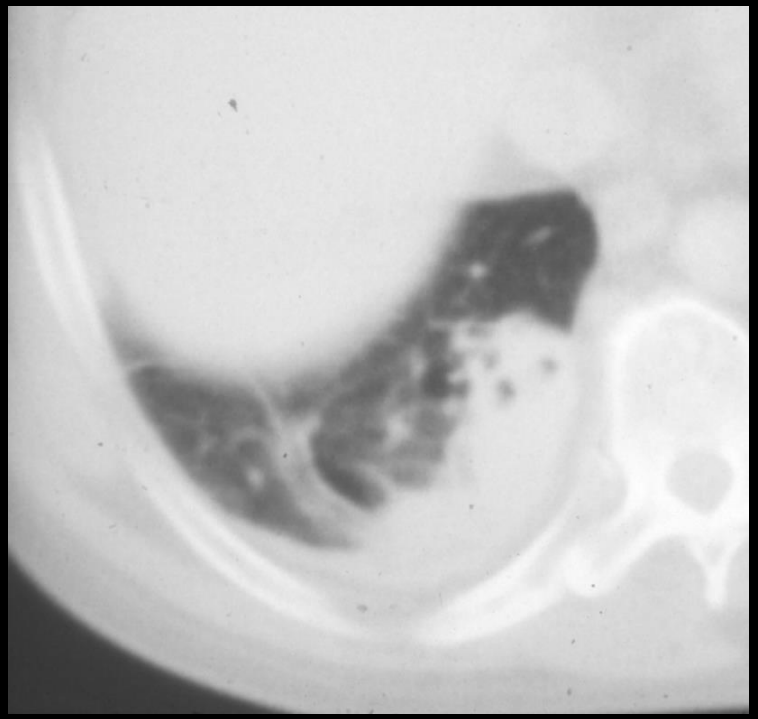
Rounded Atelectasis: CT scan

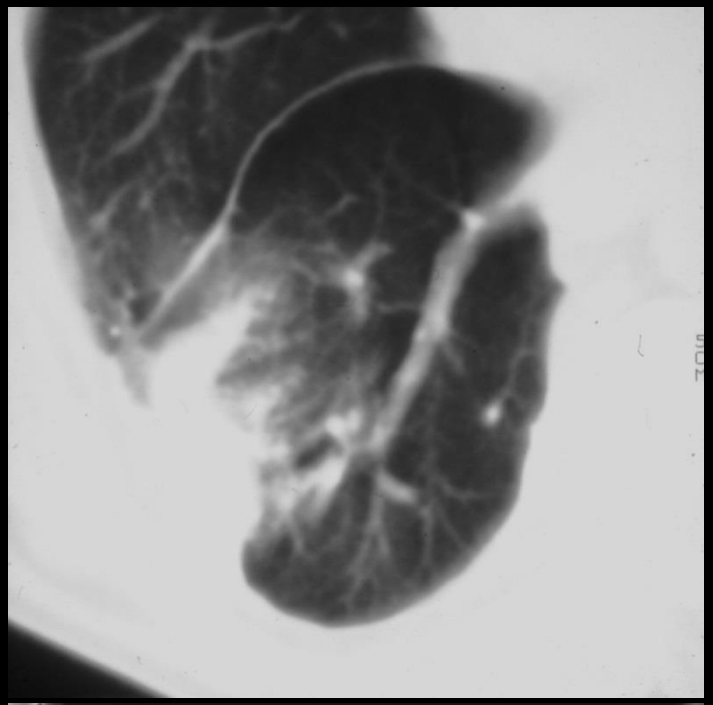
- mass related to a pleural abnormality
- volume loss in the surrounding lung
- partial interposition of lung between pleura and mass
- visible “comet tail” of vessels and bronchi sweeping into the median and/or the lateral aspect of the mass
  - air bronchogram
  - calcifications

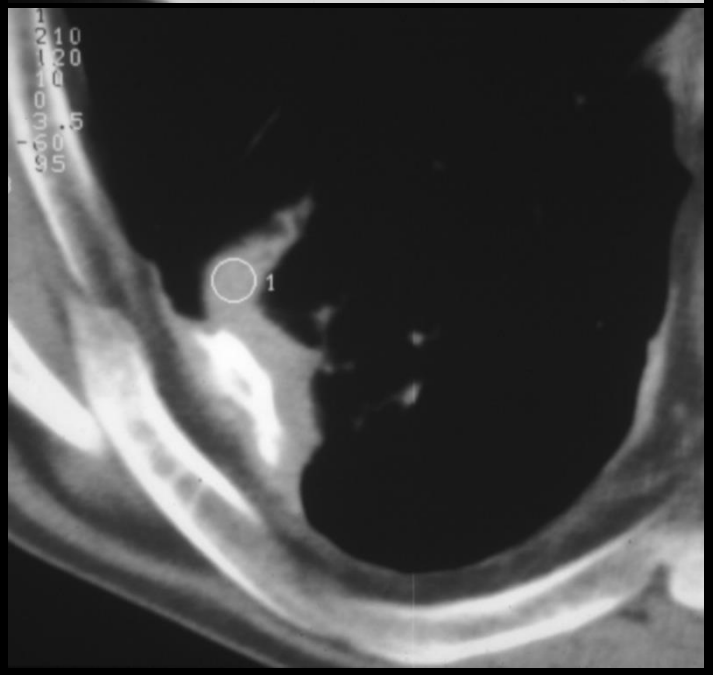


Doyle & Lawler AJR 1984; 143: 225-228





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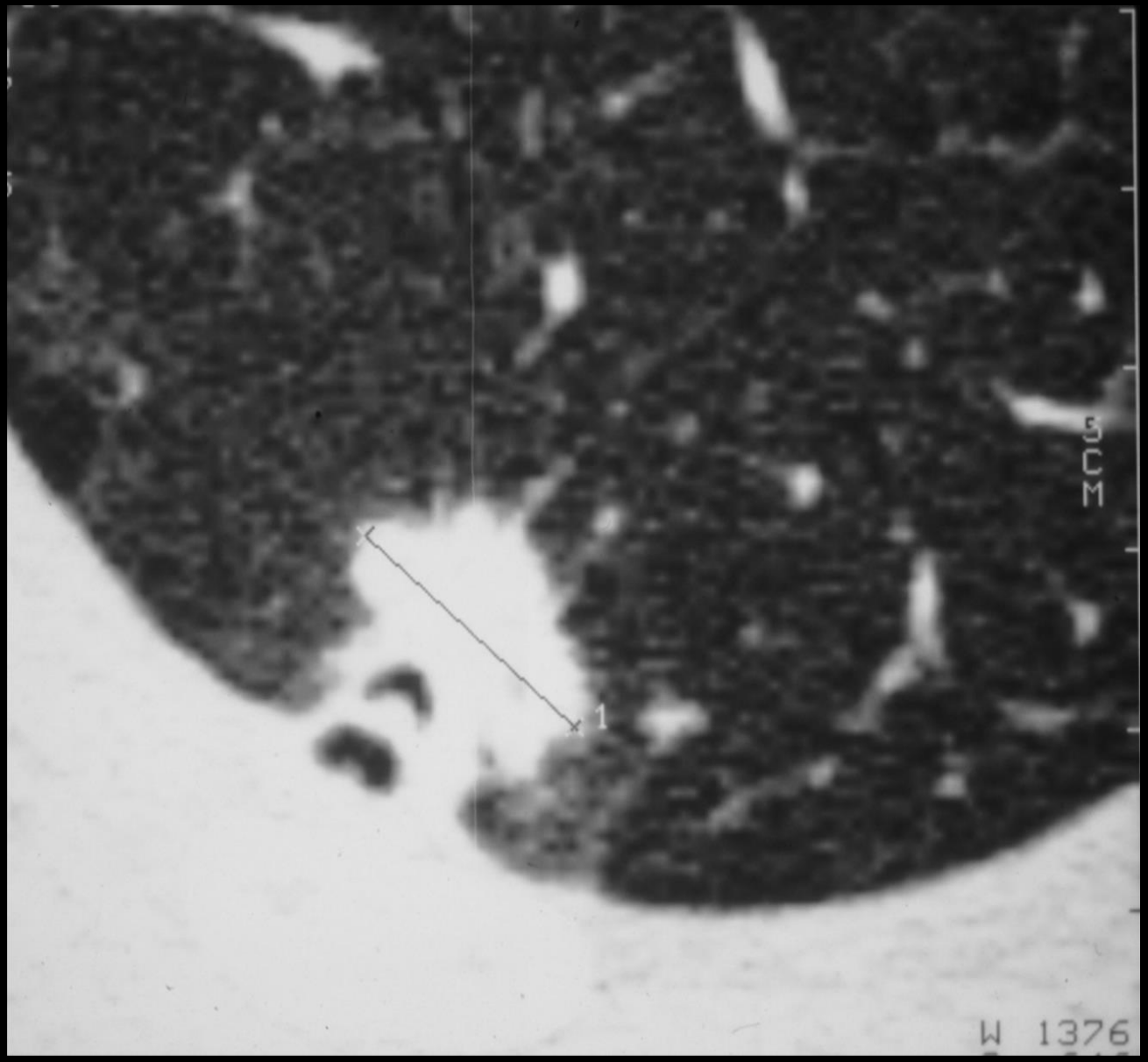
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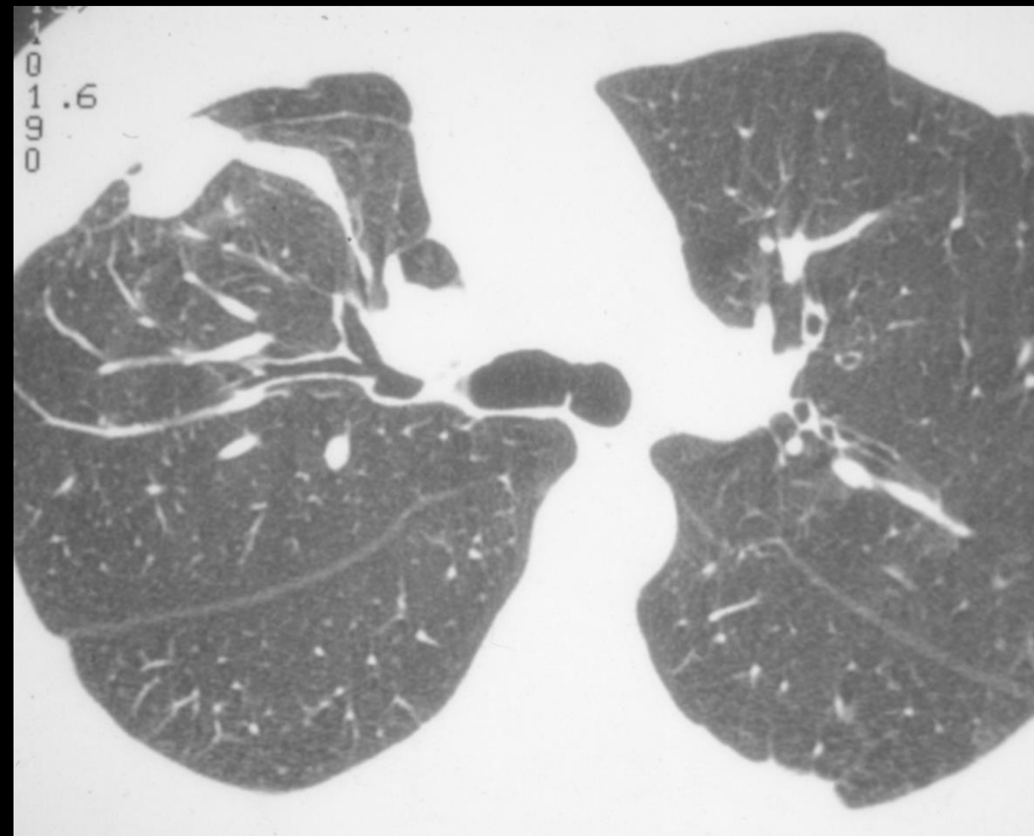
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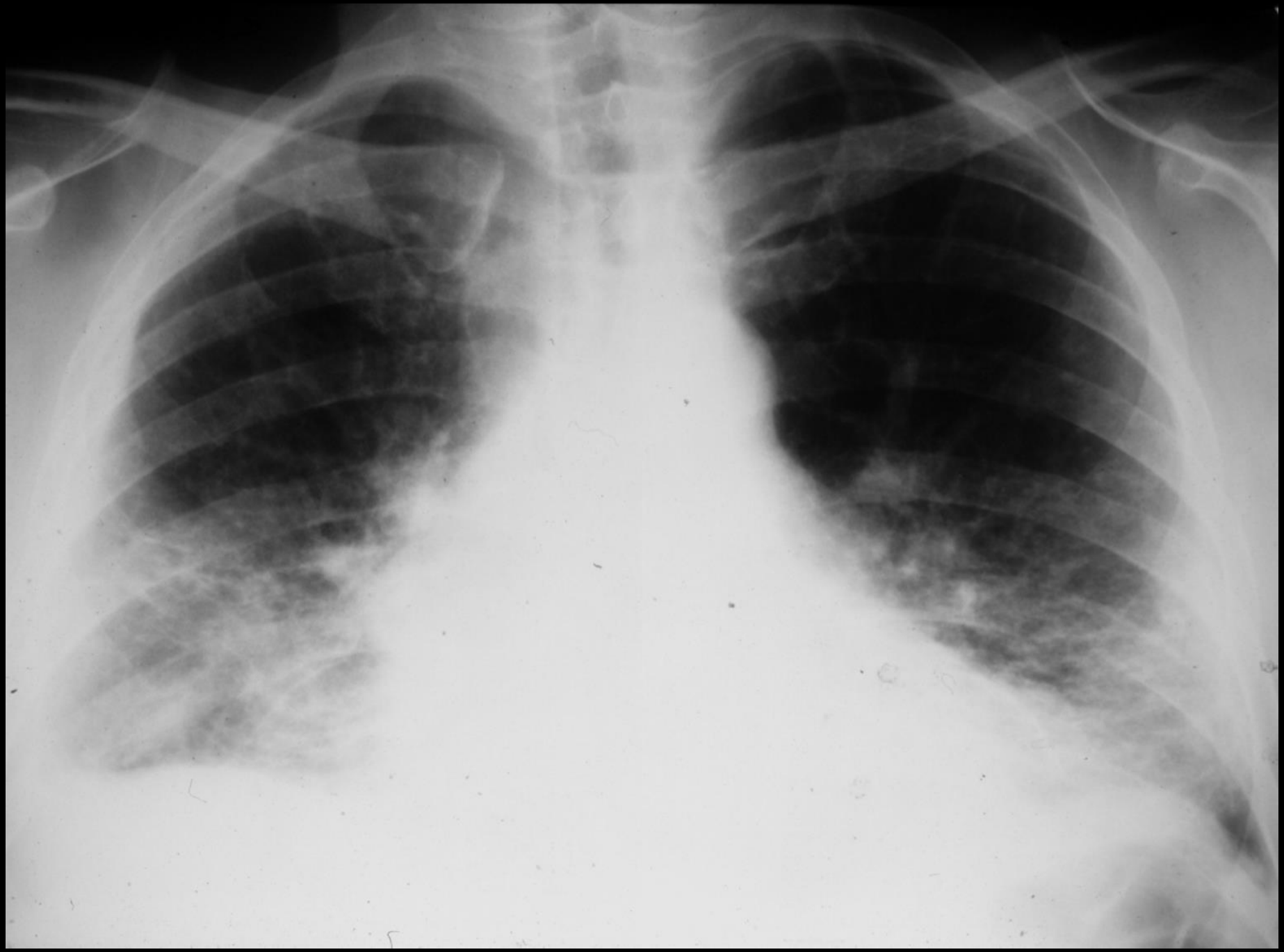
Asbestos Related Diseases

- Pleural Diseases
  - Pleural plaques
  - Benign asbestos pleural effusion
  - Diffuse pleural thickening
    - Rounded atelectasis
    - Crow's feet
  - Malignant mesothelioma
- Pulmonary Diseases
  - Asbestosis (fibrosis)
  - Bronchial carcinoma

Asbestosis

- Lung fibrosis secondary to asbestos inhalation (exposure markers), with plausible latency.
- Lung fibrosis with asbestos bodies within the fibrotic areas

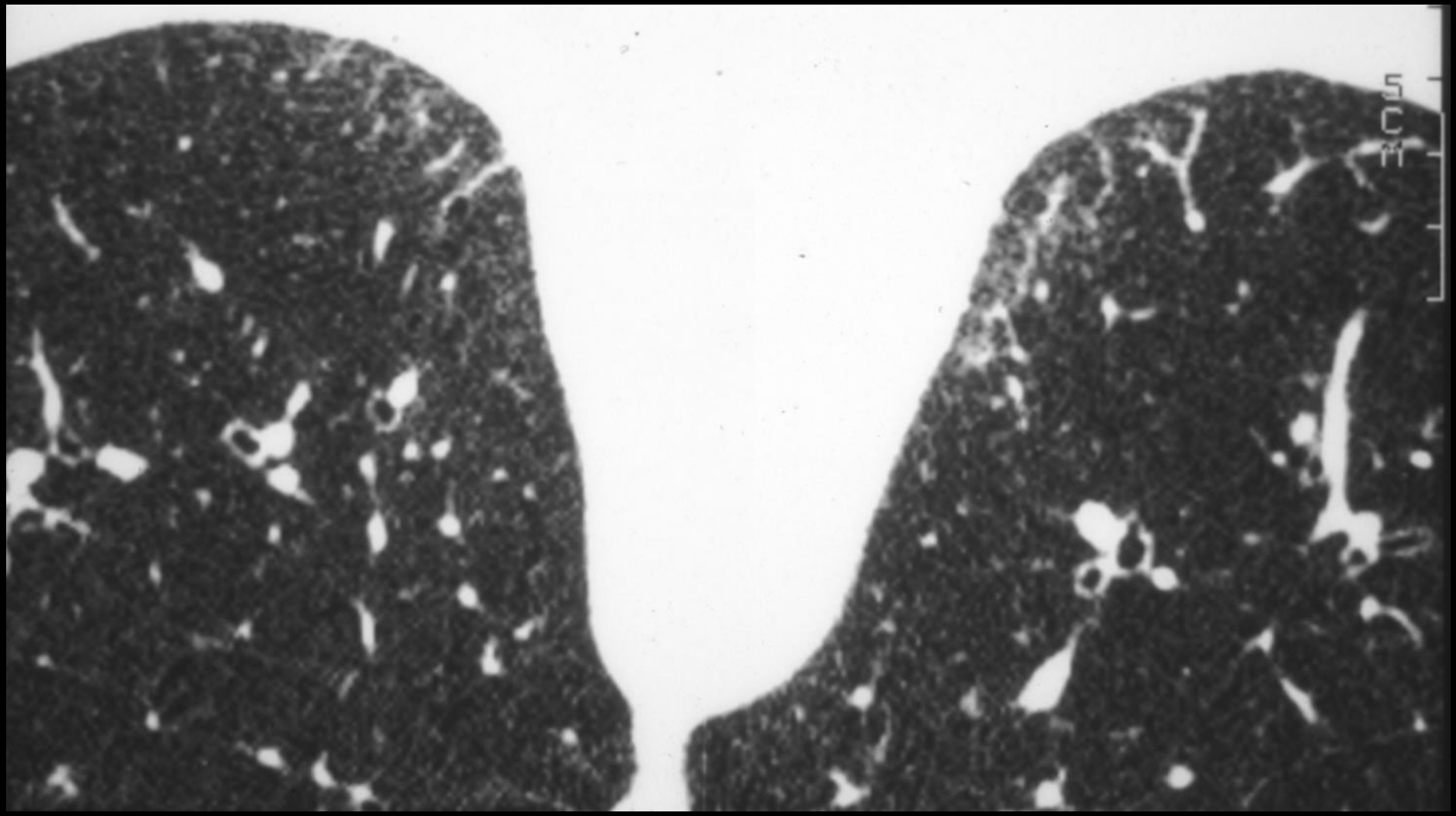


Asbestosis: Thin-section CT

- Septal lines
- Intralobular non septal lines – core structures
- Subpleural curvilinear lines
- Honeycombing

- No groung glass opacity
- Micronodules ?

Aberle *et al*. Radiology 1988; 166: 729-734
Aberle *et al*. AJR 1988; 151: 883-891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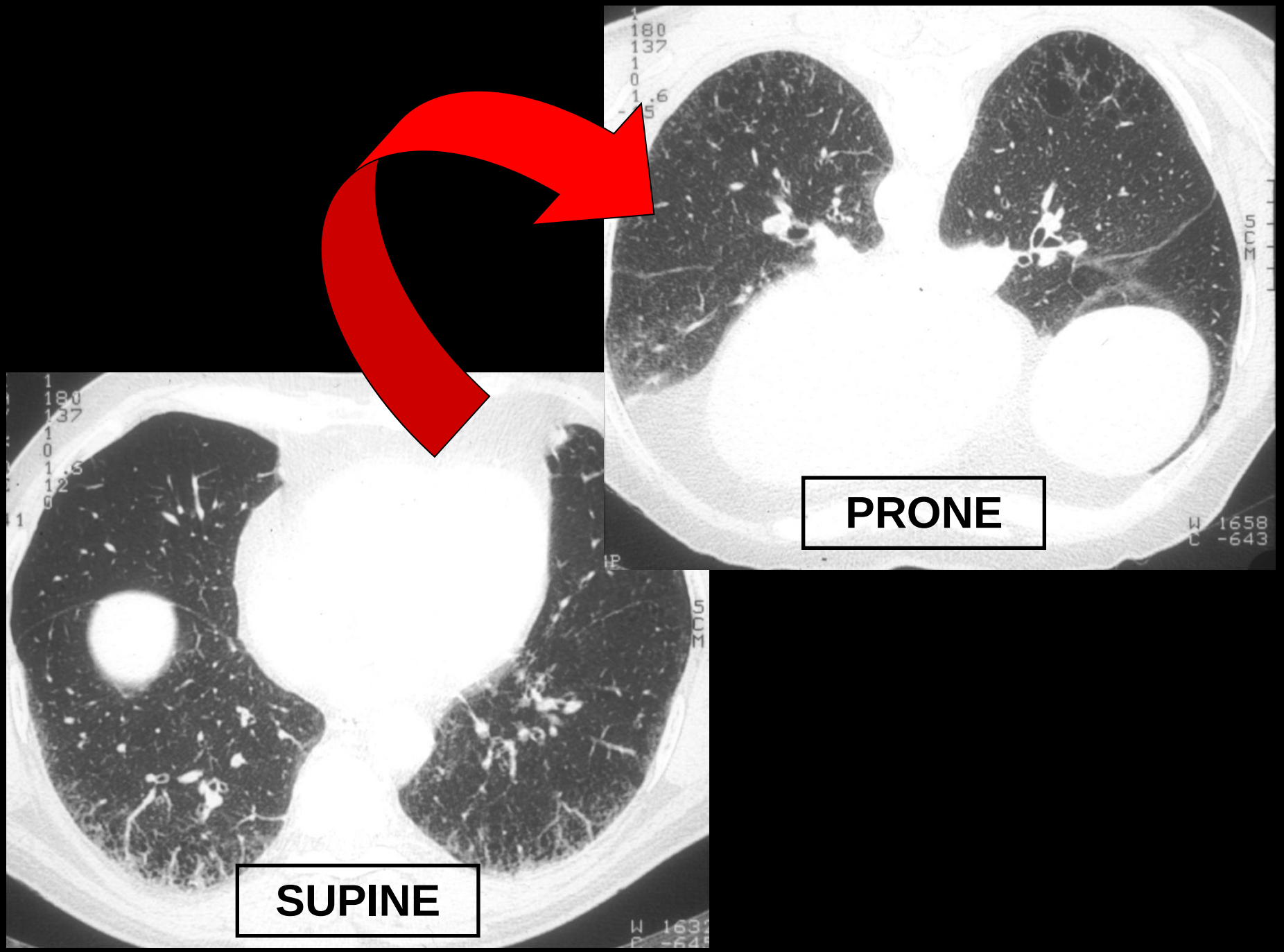
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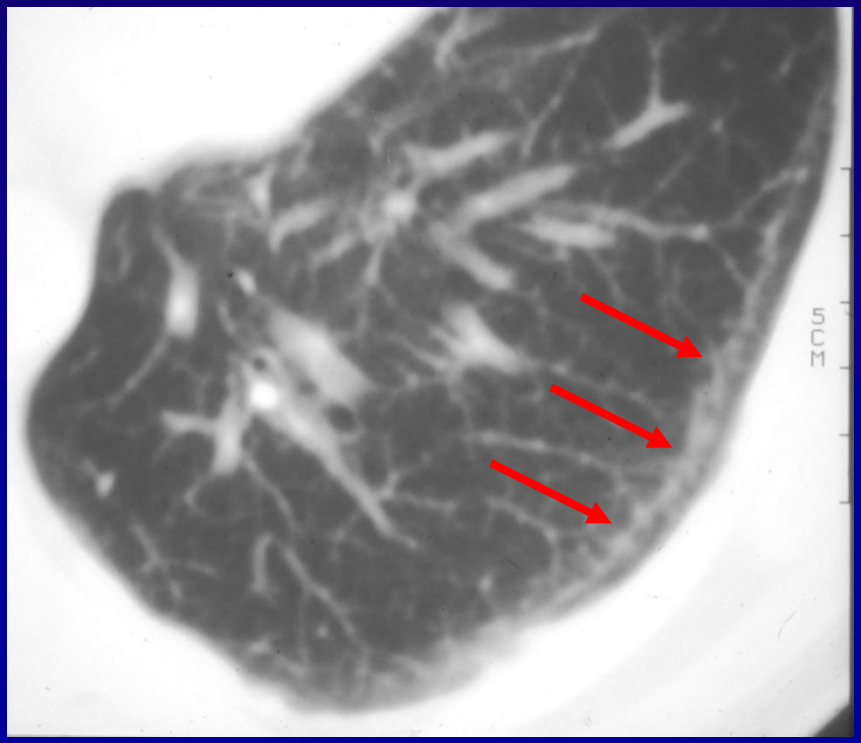
SUPINE

Asbestosis: Supleural Curvilinear Lines

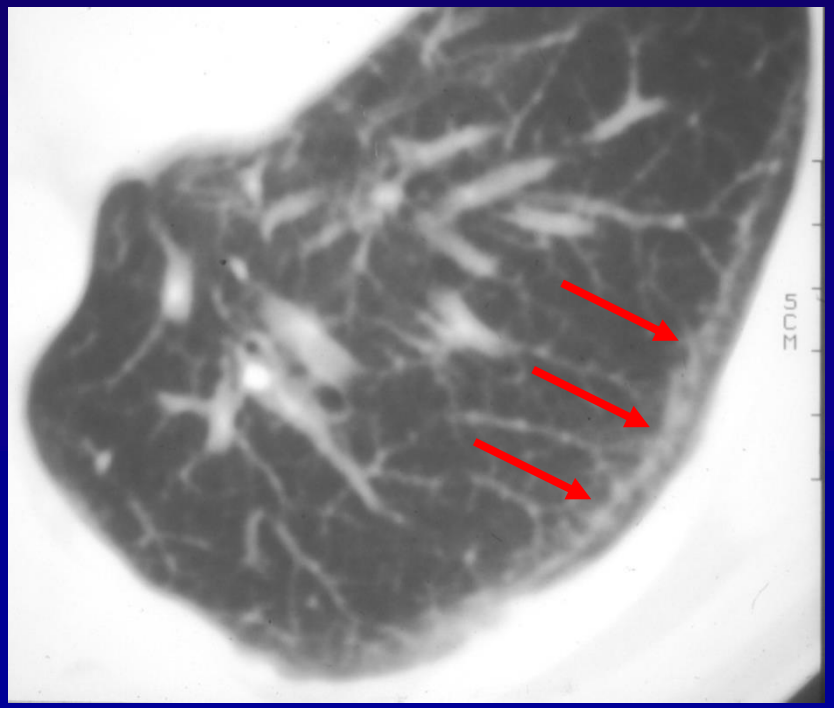
- Linear density within 1 cm of the pleura and parallel to the inner chest wall
- Most commonly seen in the posterior portion of the lung



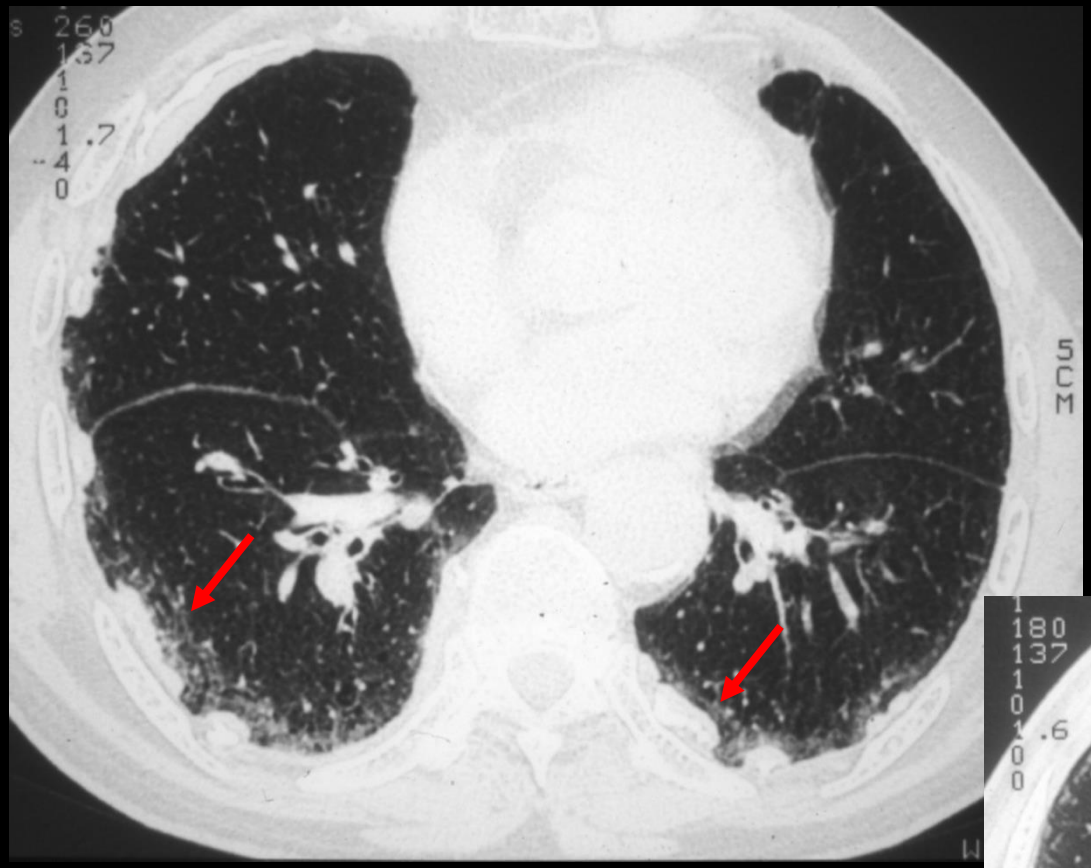
Aberle *et al*. Radiology 1988; 166: 729-734
Aberle *et al*. AJR 1988; 151: 883-891
Yoshimura *et al*. Radiology 1986; 158: 653

Asbestosis: Subpleural Curvilinear Lines

- Very rarely seen in asbestos-exposed individuals
- Also reported in various conditions, including normal subjects.



Gevenois *et al.* Eur Respir J 1998; 11: 1021-1027
Pilate *et al*. Radiology 1987; 164: 584 [letter]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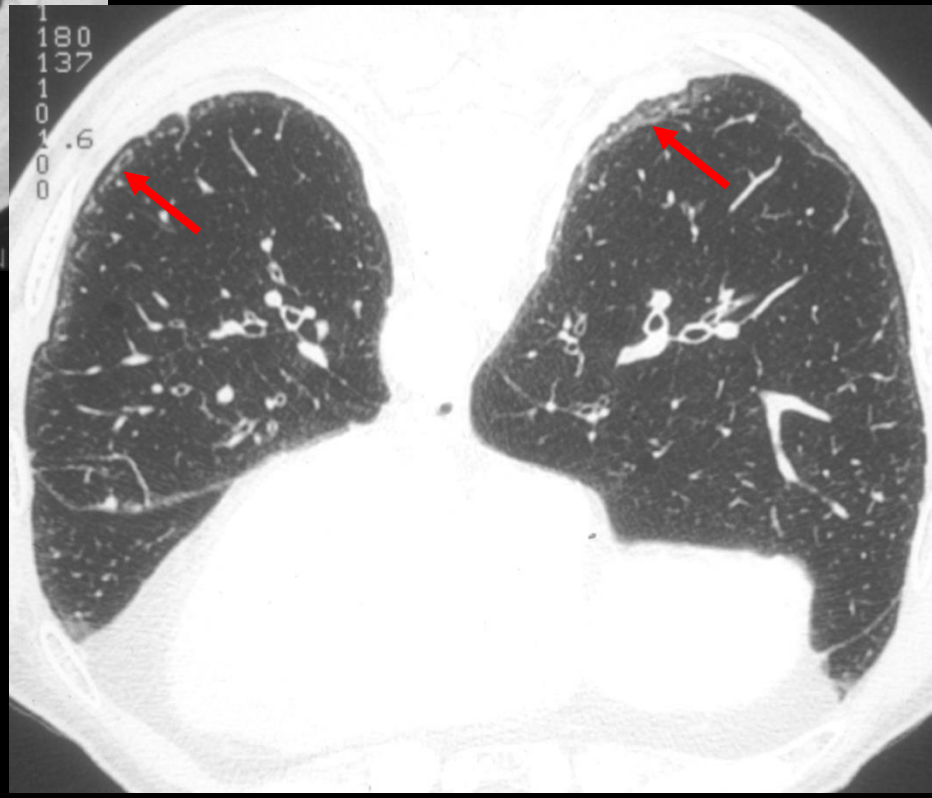
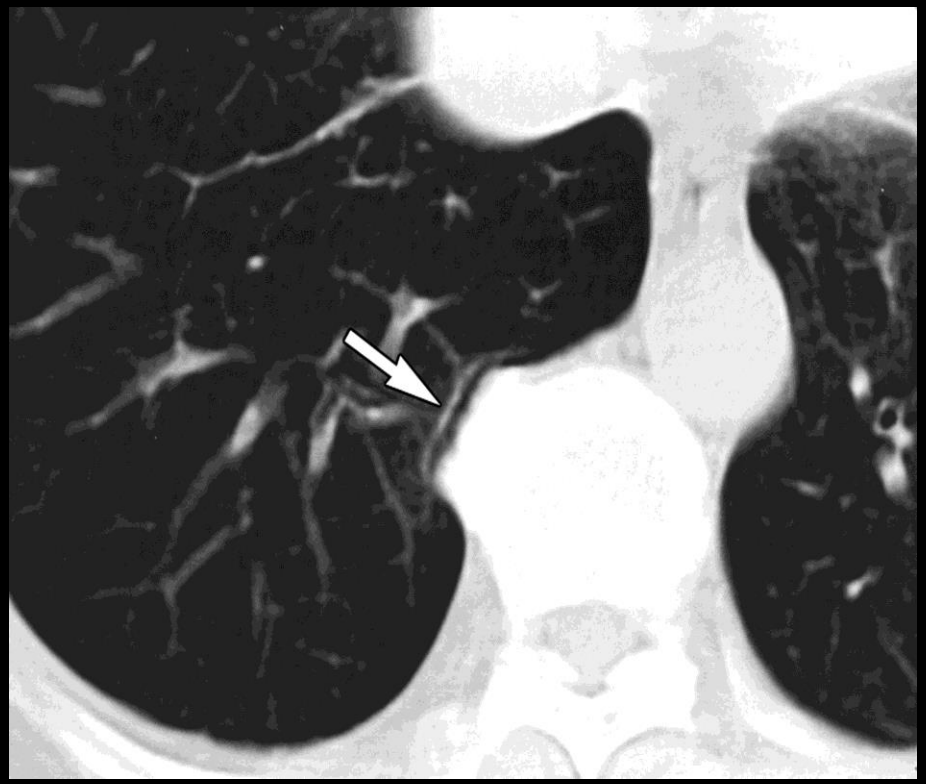
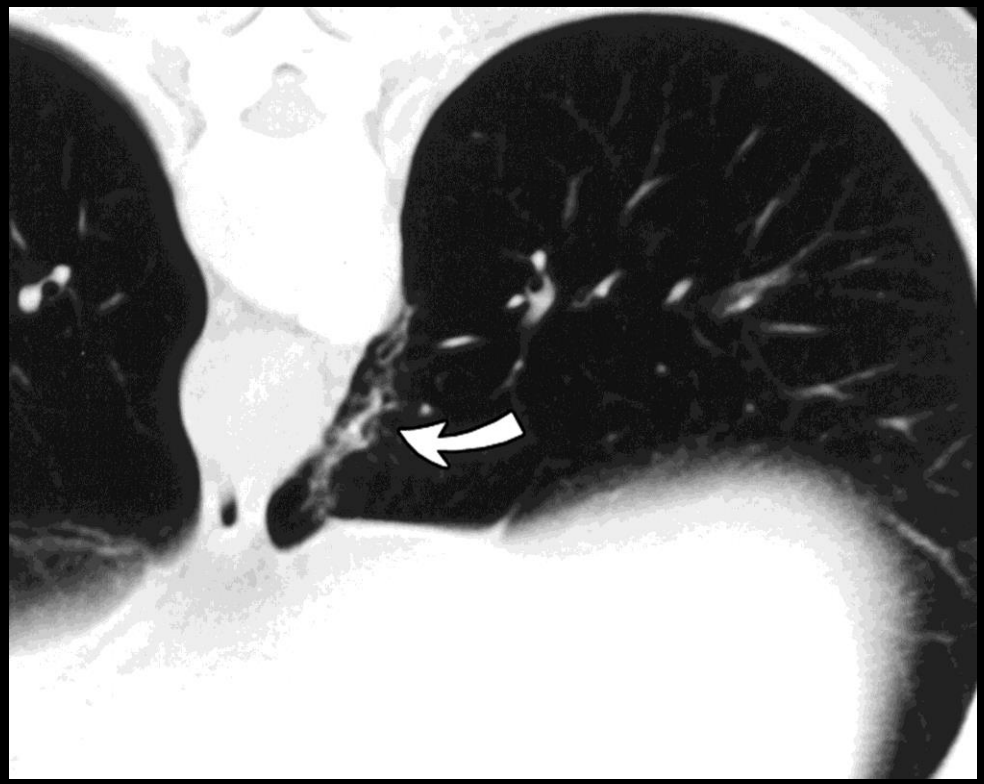


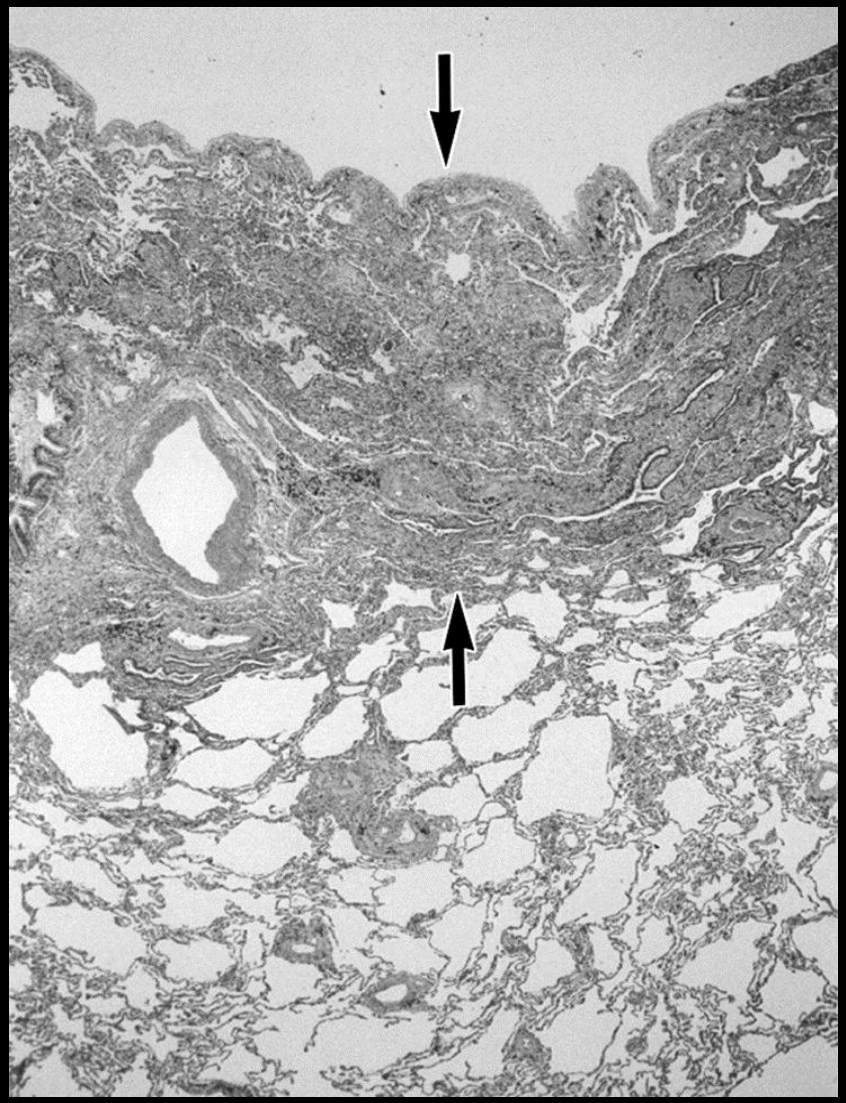
Subpleural Curvilinear Lines

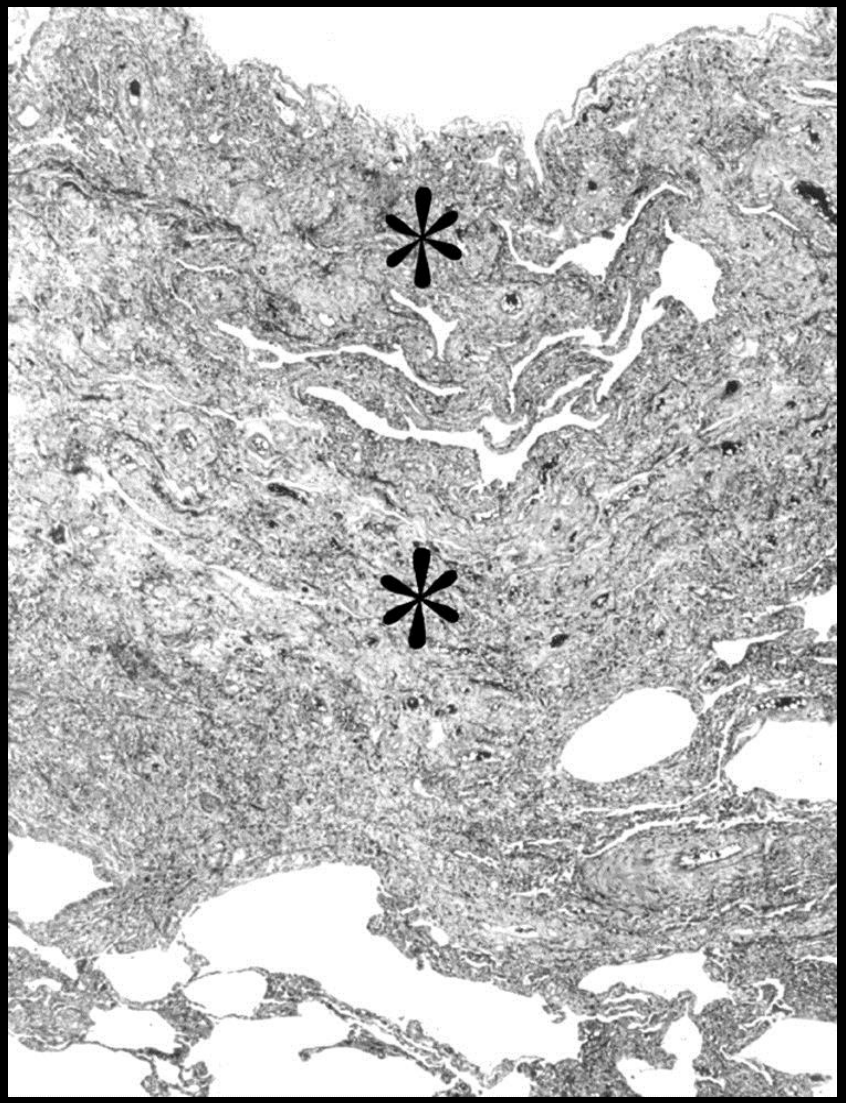




S. Otake *et al*. AJR 2002; 179: 893-896

Subpleural Curvilinear Lines





S. Otake *et al*. AJR 2002; 179: 893-896

Asbestosis: Subpleural Curvilinear Lines?

- Very rarely seen in asbestos-exposed individuals
- Also reported in various conditions, including normal subjects.

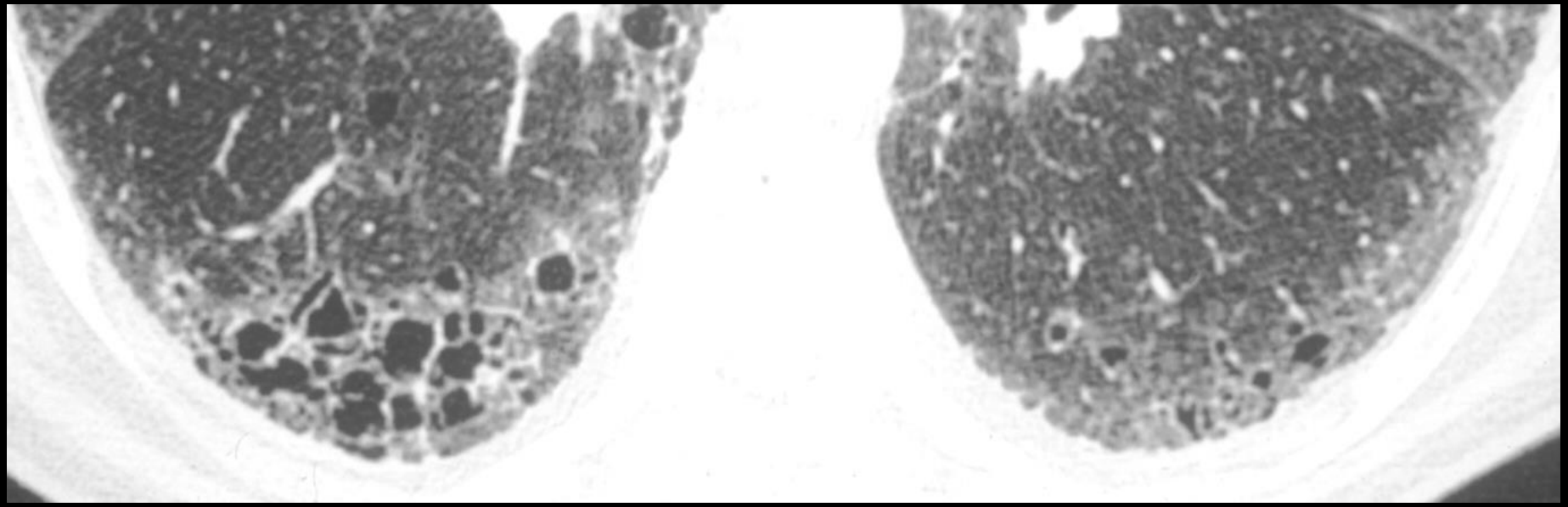
- Associated with osteophytes in degenerative spondylosis
- Related to lung collapse and fibrosis due to mechanical stress

- By extension, a mechanical consequence of pleural plaques
- No relation with real asbestosis (= lung fibrosis containing asbestos bodies in the fibrosis foci)

Gevenois *et al.* Eur Respir J 1998; 11: 1021-1027
Pilate *et al*. Radiology 1987; 164: 584 [letter]
S. Otake *et al*. AJR 2002; 179: 893-896

Asbestosis: Honeycombing

- Small (< 1 cm) cystlike spaces with thick walls and containing air
- Most commonly in the supleural and postero-inferior regions of the lung
- The contiguous pleura is often subtly thickened

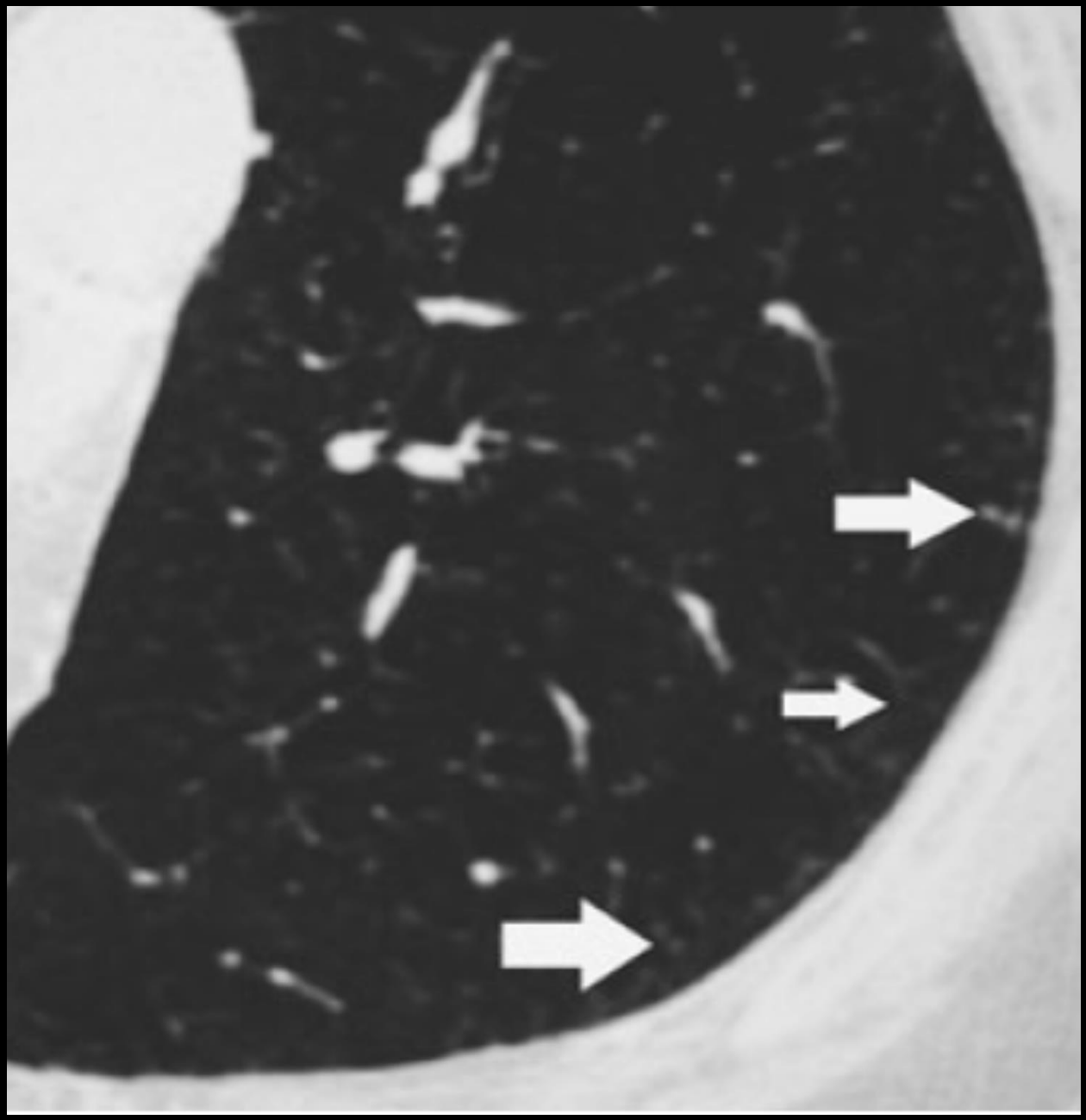


Diagnosis of Asbestosis: The Roles of CT scan

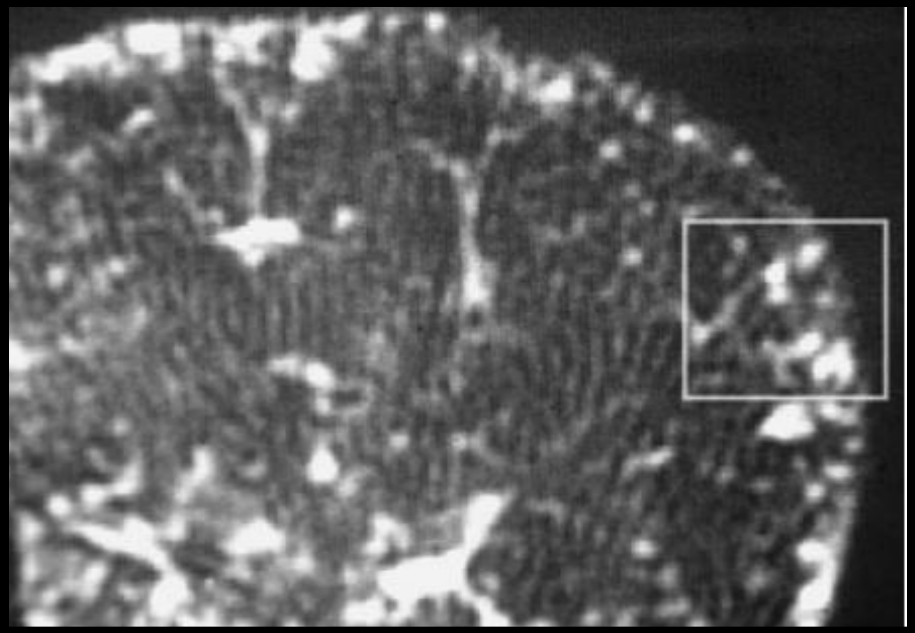
- Is CT more sensitive than radiography?
  - 159 asbestos-exposed workers
  - Latency time > 10 yrs
  - Normal chest radiograph
  - CT: thick- and thin-sections
  - CT revealed signs compatible with asbestosis in 20 subjects (12.6%).

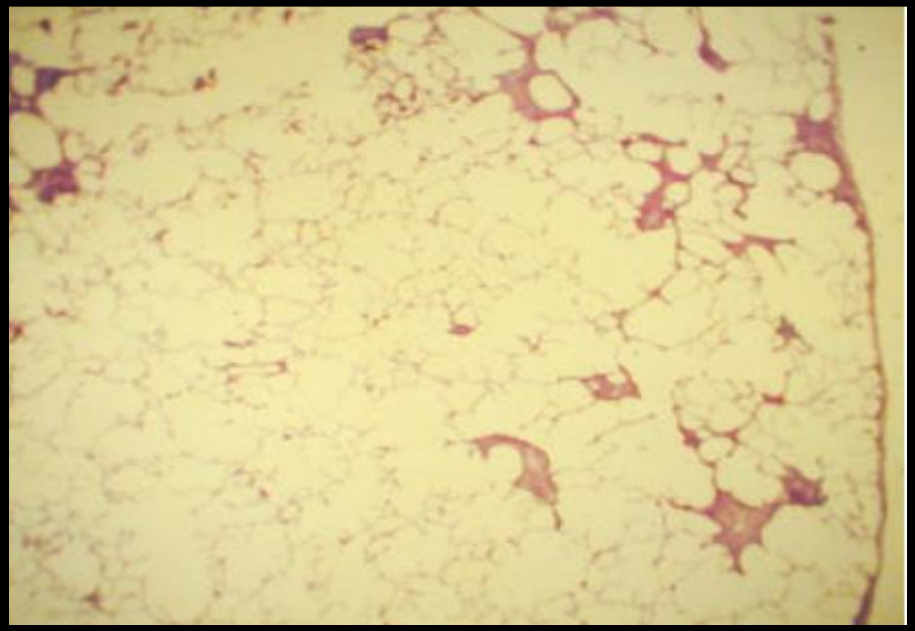
➢ These results suggest that CT is more sensitive than chest radiograph.

P.A. Gevenois *et al.* Acta Radiol 1994; 35: 226-229



S.J. Copley. Asbestosis. *In P.A. Gevenois & P. De Vuyst (Eds),* Springer. 2005, 207-221





M. Akira *et al.* Radiology 1991; 178: 409-416

Diagnosis of Asbestosis: The Roles of CT scan

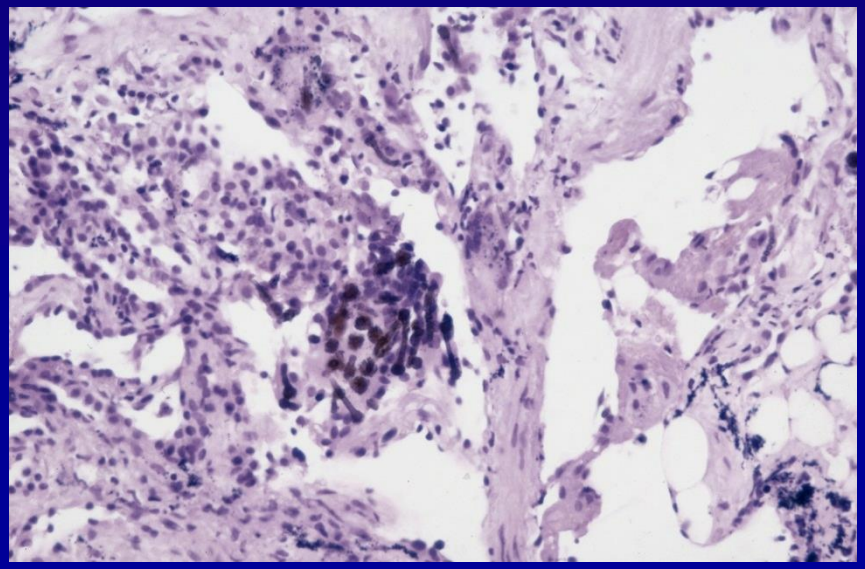
- Is CT as sensitive as pathology?
  - 25 asbestos-exposed workers
  - Thin-section CT
  - Pathology demonstrating asbestosis
  - Normal thin-section CT scans in 5 workers (20%).

➢ Thin-section CT is less sensitive than pathology since CT can be normal in individuals with pathologic features of asbestosis.

G. Gamsu *et al.* AJR 1995; 164: 63-68

Asbestosis

- Asbestosis can be present histopathologically with a normal thin-section CT scan.
- The absence of pleural plaques on CT does not exclude asbestosis.



Gamsu and Aberle. AJR 1995; 165: 486-487 [letter]
Lynch. AJR 1995; 164: 69-71 [commentary]

Diagnosis of Asbestosis: The Roles of CT scan

In summary:

- Thin-section CT is more sensitive than chest radiograph.
- Thin-section CT does not overcome completely the lack of sensitivity of chest radiograph as compared to pathology standard of reference.
- Is the sensitivity of thin-section CT “clinically” sufficient?

Diagnosis of Asbestosis: The Roles of CT scan

- Is the sensitivity of thin-section CT “clinically” sufficient?
- Have the small opacities detected by thin-section CT an impact on lung function?

  – 169 asbestos-exposed workers

  – Chest radiograph < 1/0

  – Thin-section CT:

    1. Normal or nearly normal: n = 76
    - Abnormal but undetermined for asbestosis: n = 36 (excluded)
    2. Abnormal and suggestive of asbestosis : n = 57

C.A. Staples *et al.* Am Rev Respir Dis 1999; 139: 1502-1508

Diagnosis of Asbestosis: The Roles of CT scan

- Have the small opacities detected by thin-section CT an impact on lung function?
  1. Normal or nearly normal: n = 76
  - Abnormal but undetermined for asbestosis: n = 36 (excluded)
  2. Abnormal and suggestive of asbestosis : n = 57

- Groups 1 et 2 were not significantly ≠ for
  - Duration of exposure, latency, smoking habits
  - FEV1 and FEV1/VC

- DLCO group 2 (78.2%) < DLCO group 1 (87.1%) (p = 0.024)
- VC group 2 (79.0%) < VC groupe1 (86.2%) (p = 0.005)

C.A. Staples *et al.* Am Rev Respir Dis 1999; 139: 1502-1508

Diagnosis of Asbestosis: The Roles of CT scan

In summary:

- ✓ Thin-section CT seems sufficiently sensitive in clinical settings as it detects the lung abnormalities that allows the recognition – among asbestos-exposed workers – of those who have an impaired lung function.

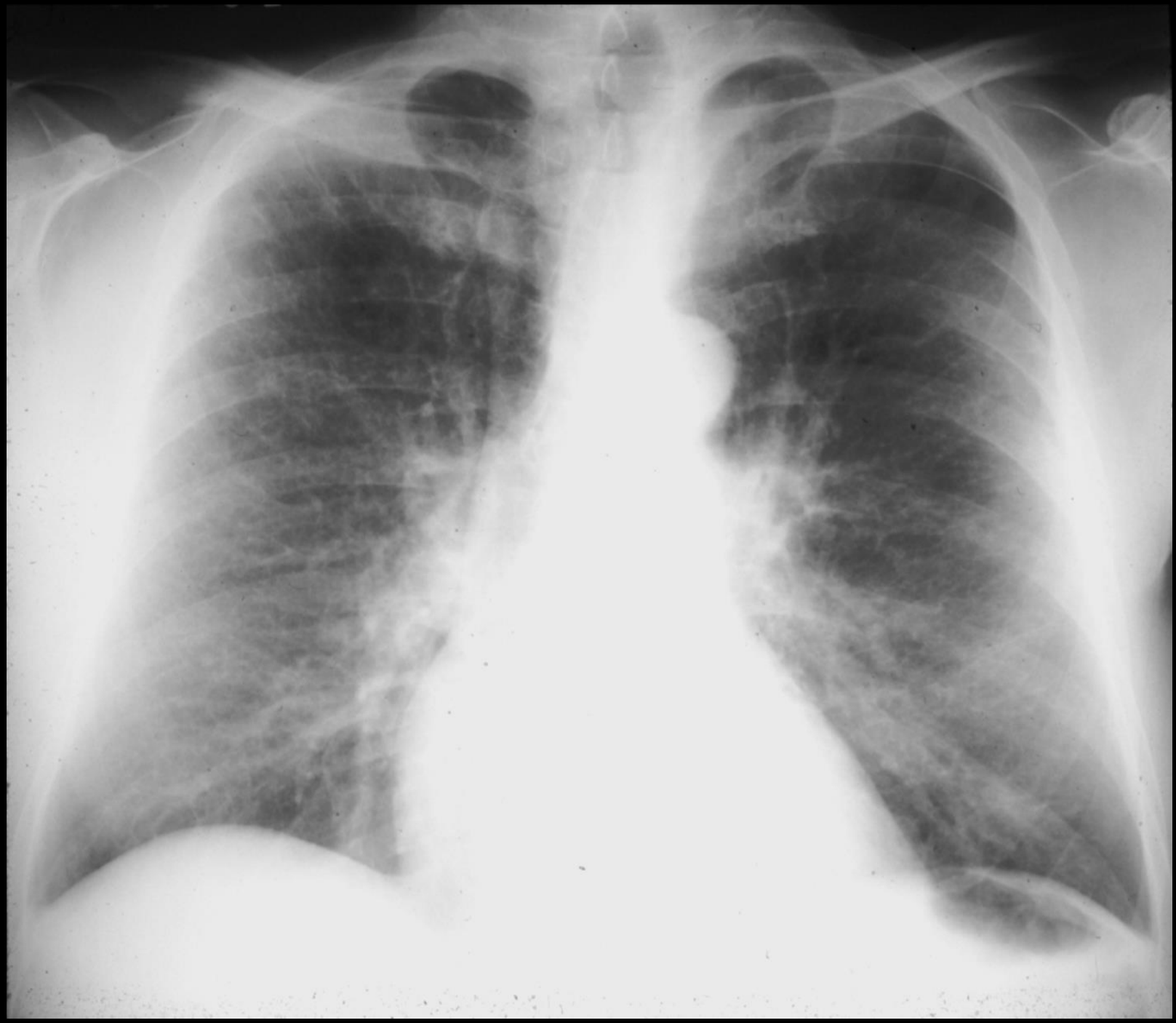
C.A. Staples *et al.* Am Rev Respir Dis 1999; 139: 1502-1508

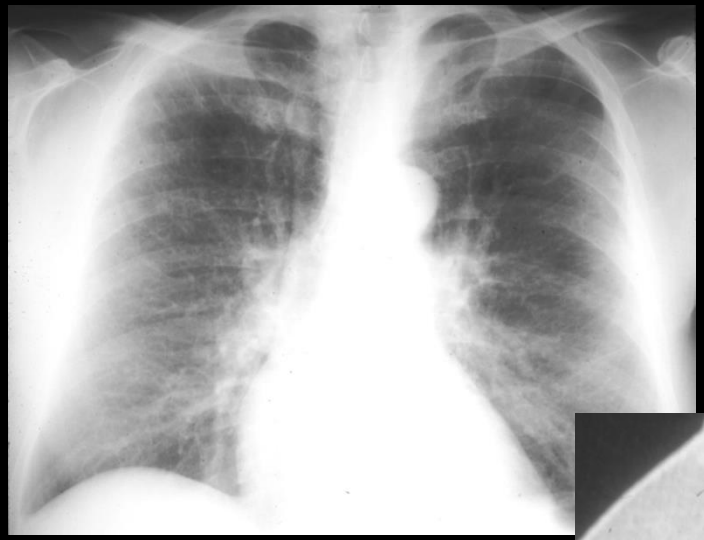
Diagnosis of Asbestosis: The Roles of CT scan

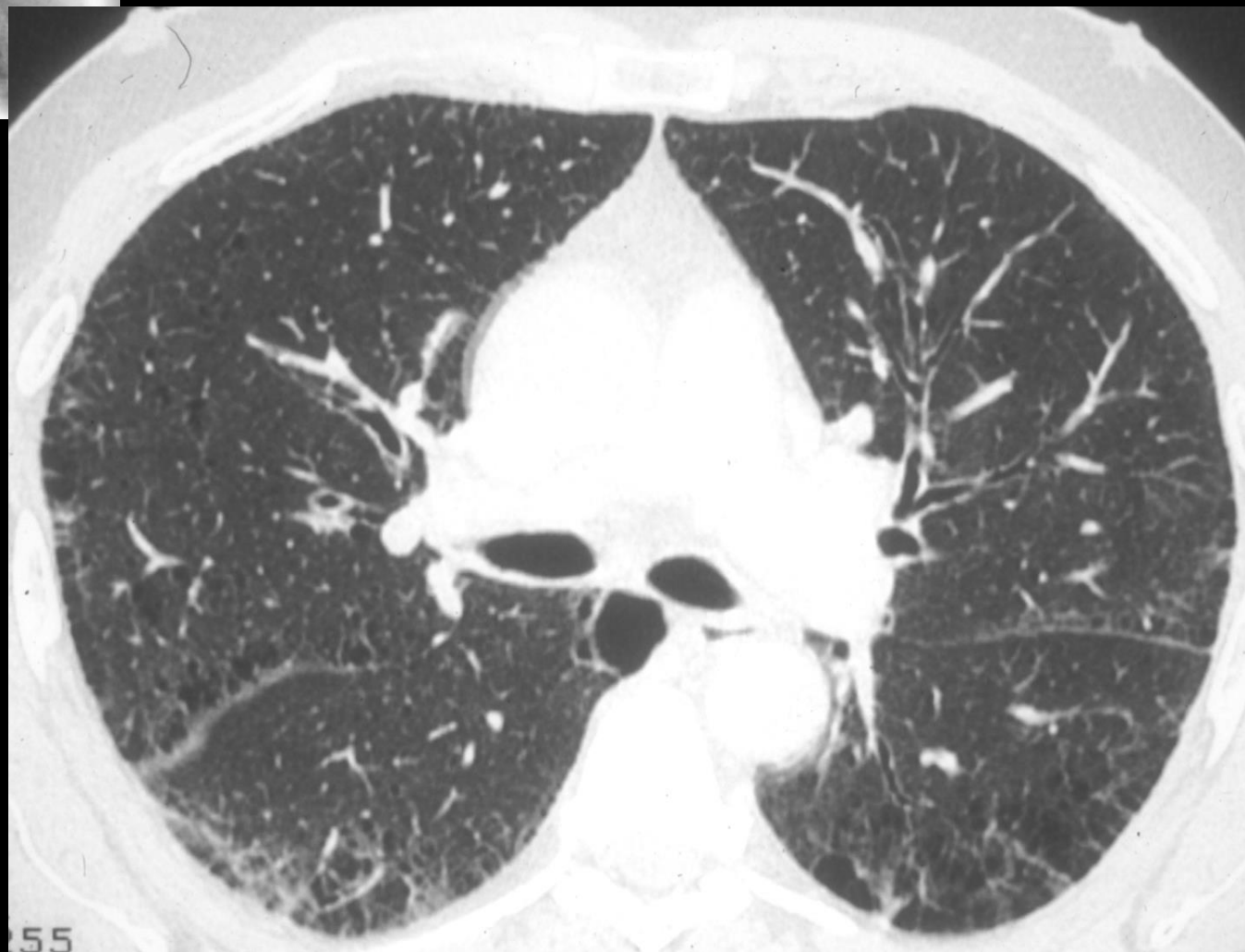
- Is CT more specific than radiography?

- Irregular opacities on chest X-ray :
  - Walls of little bullae of pulmonary emphysema
  - Bronchiectasis
  - Increased vascular markings

- CT also will identify and quantify emphysema as a cause of physiologic impairment







Diagnosis of Asbestosis: The Roles of CT scan

- Is CT more specific than radiography?

- All CT features are predominantly located in the posterior parts of the lower zones of the lungs, as in many other fibrotic disorders.

- All CT features are non specific: they are also seen in other chronic infiltrative lung diseases (UIP, connective tissue diseases, etc.)

Asbestosis

- *“The CT abnormalities seen in asbestosis occur as isolated and as combined in patients with a variety of underlying diseases or in conditions unrelated to asbestosis and, by themselves, are nonspecific findings”*

Bergin *et al*. AJR 1994; 163: 551-555

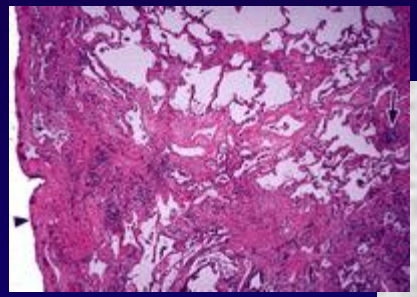
Asbestosis

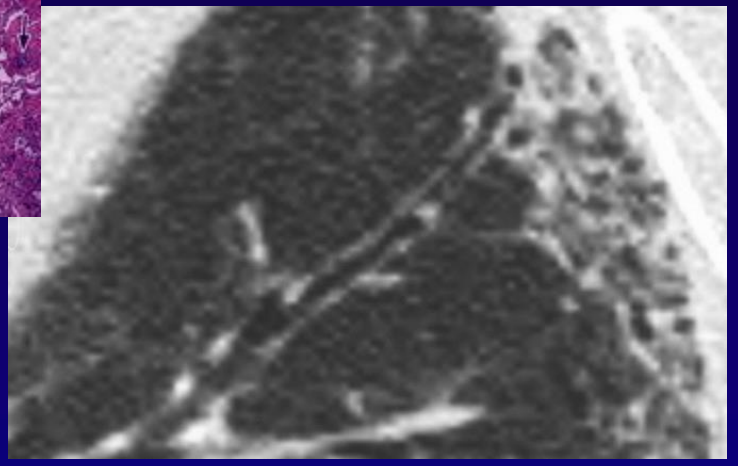
- *"The CT abnormalities seen in asbestosis occur as isolated and as combined in patients with a variety of underlying diseases or in conditions unrelated to asbestosis and, by themselves, are nonspecific findings"*

- Differential diagnosis
  - Asbestosis
  - IPF
  - NSIP

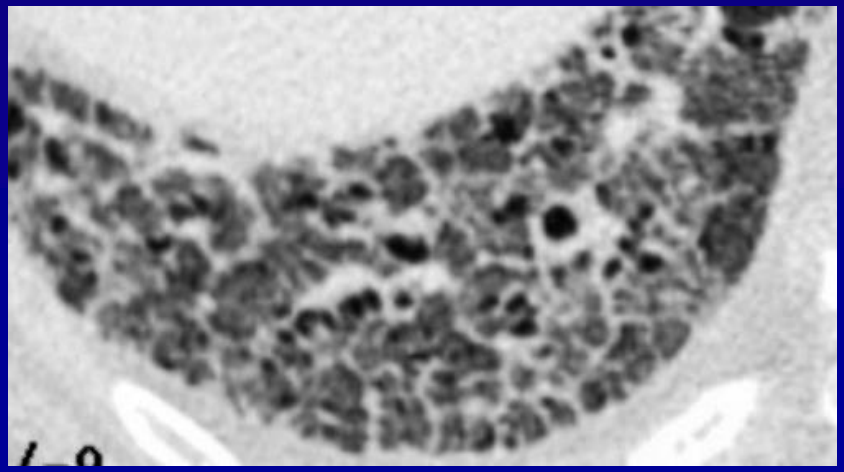
Bergin *et al*. AJR 1994; 163: 551-555

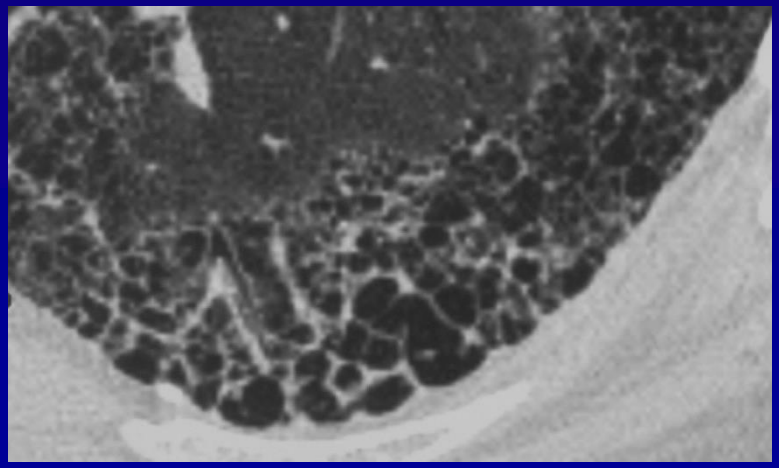
Idiopathic Pulmonary Fibrosis (IPF)





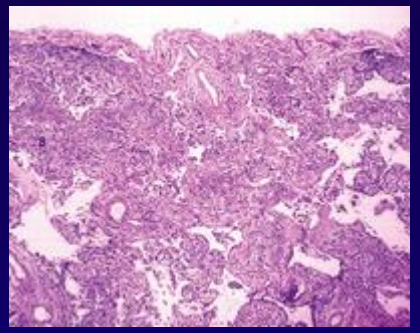
- Reticular opacities
- Honeycombing
- Traction bronchiectasis
- Basal and peripheral predominance
- Heterogeneous distribution
- ✓ GGO < reticular opacities



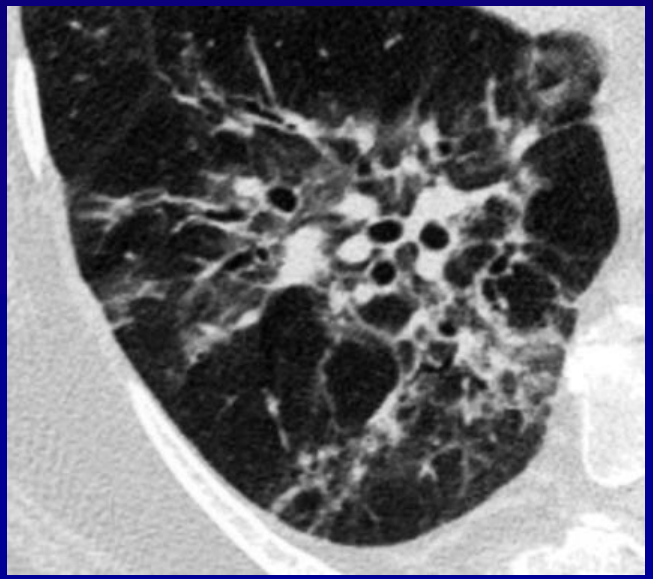


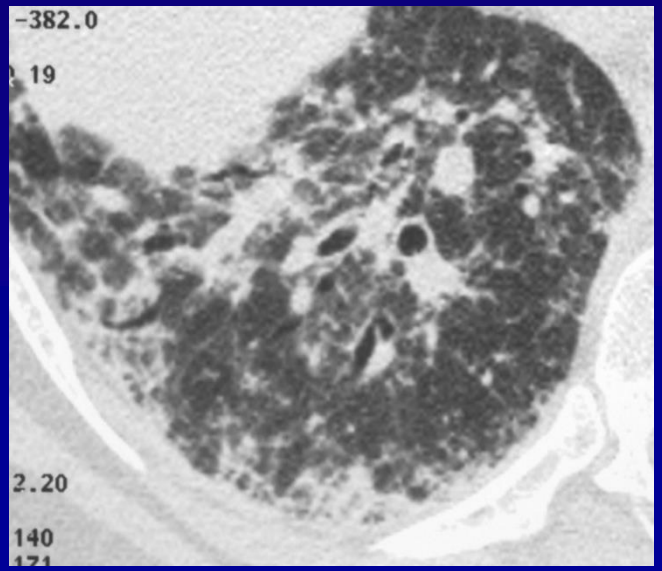
D. Lynch *et al.* Radiology 2005; 236: 10-21

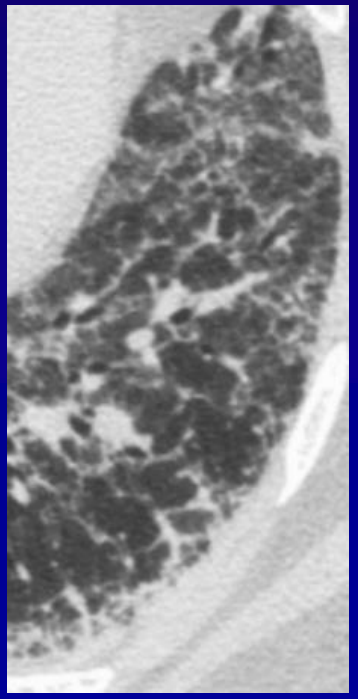
Non Specific Interstitial Pneumonia (NSIP)



- GGO
- Reticular opacities
- Traction bronchiectasis
- Basal, peripheral and/or peribronchovascular predominance
- Reversible







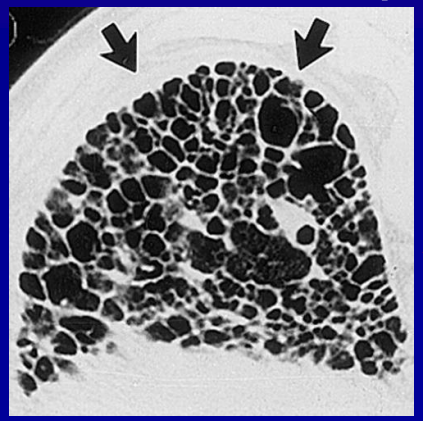
D. Lynch *et al.* Radiology 2005; 236: 10-21

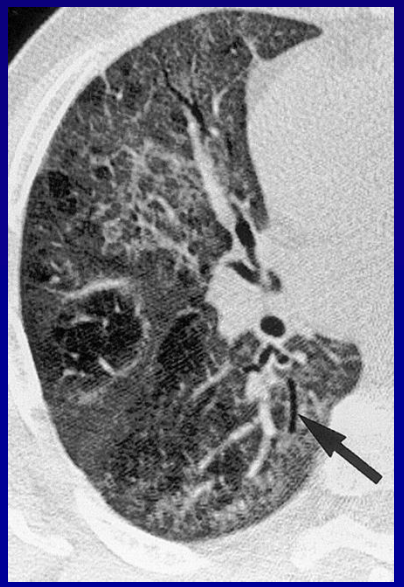
IPF / NSIP / Asbestosis

- In early studies, IPF and NSIP have not been distinguished.
  N. Al-Jarad *et al.* Thorax 1992; 47: 645-650 / M. Akira *et al.* AJR 2003; 181: 163-169

➢ Asbestosis > < IPF
➢ Asbestosis > < NSIP

- Comparisons based on pathological standards of reference
- Grading of reticular pattern
  - Grade 0: GGO
  - Grade 3: reticular pattern with macrocystes





S.J. Copley *et al.* Radiology 2003; 229: 731-736

IPF / NSIP / Asbestosis

- Asbestosis > < IPF
- Asbestosis > < NSIP

- Comparisons based on pathological standards of reference
- Grading of reticular pattern
  - Grade 0: GGO
  - Grade 3: reticular pattern with macrocystes

- Asbestosis = IPF
- Asbestosis >>> NSIP

S.J. Copley *et al.* Radiology 2003; 229: 731-736

IPF / NSIP / Asbestosis

- Asbestosis ≈ IPF

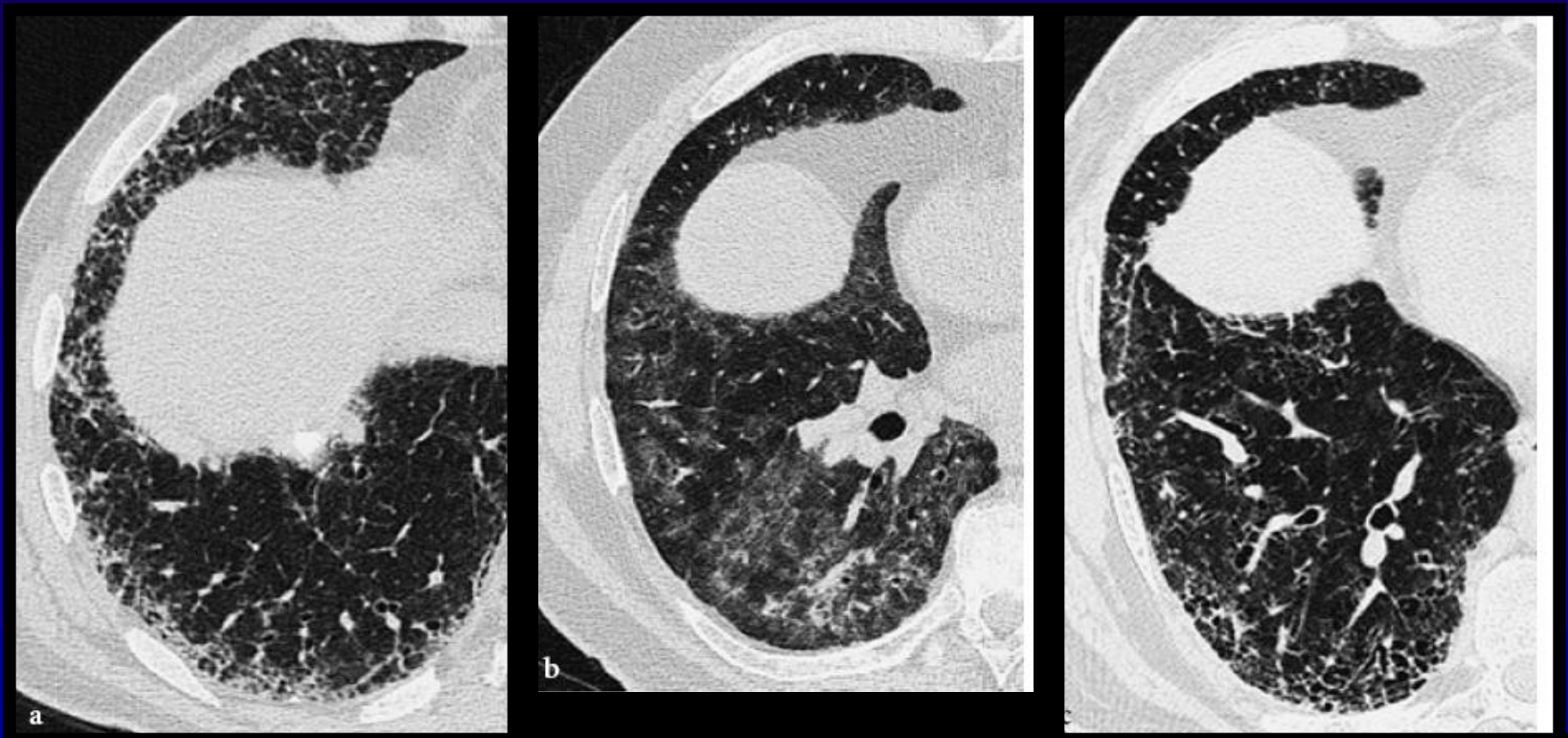


Fig. 7.14a-c. Examples of the thin-section computed tomography differences between asbestosis (**a**) and the histopathological subtypes of idiopathic pulmonary fibrosis, non-specific interstitial pneumonitis (NSIP) (**b**) and usual interstitial pneumonitis (UIP) (**c**). The pattern of fibrosis is finer in NSIP but similar to UIP (note the pleural plaques on the diaphragm in asbestosis)

S.J. Copley. Asbestosis. *In P.A. Gevenois & P. De Vuyst (Eds),* Springer. 2005, 207-221

Diagnosis of Asbestosis: Is CT-Scan Enough?

- Yes, in terms of sensitivity.
- No, in terms of specificity.
- The lack of specificity is probably due to the fact that the lung reacts to various aggressions with a limited number of patterns.
- Clinical and/or medico legal impact
- Huge importance of additional information about exposure

Diagnosis of Asbestos-Related Disorders: Is CT-Scan Enough?

- Huge importance of additional information about exposure.
  - Environmental and professional questionnaire
    - Jobs, hobbies, etc.
  - Industrial inquiries
  - Markers of exposure
    - Lung metrology on BAL and/or lung biopsies
  - Pathological sample from lung biopsies

Idiopathic Interstitial Pneumonias

ATS-ERS 2002 Consensus: Key Messages

12. « *The final diagnosis should be rendered only after the pulmonologist, radiologist, and pathologist have reviewed all the clinical, radiological, and pathological data obtained from the patient.* »

ATS-ERS. AJRCCM 2002; 165: 277-304

Idiopathic Interstitial Pneumonias

ATS-ERS 2002 Consensus: Key Messages

12. « *The final diagnosis should be rendered only after the pulmonologist, radiologist, and pathologist have reviewed all the clinical, radiological, and pathological data obtained from the patient.* »

- This recommendation should be extended to occupational respiratory disorders by taking into account complementary skills (occupational physician, mineralogist, etc.)!

ATS-ERS. AJRCCM 2002; 165: 277-304

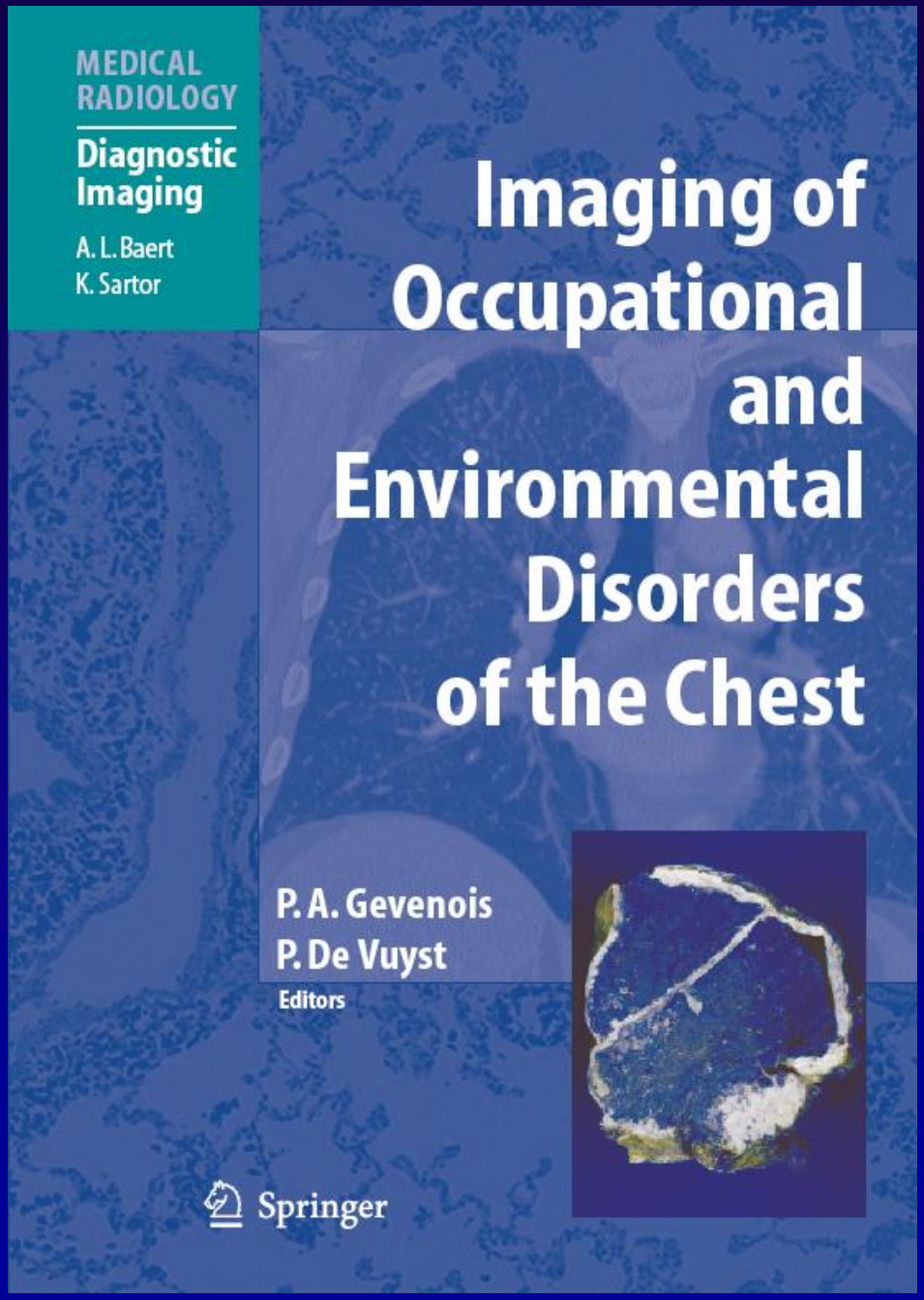
Asbestosis

- *“In the absence of pathologic proof, the diagnosis of asbestosis must be based on a thoughtful evaluation of the likelihood of asbestosis by use of all available clinical, physiologic, and radiological information*.”

Lynch. AJR 1995; 164: 69-71 [commentary]

What have we learned?

- The findings detectable at chest X-ray and CT scans in dust-exposed subjects with benign diseases.
- The roles and limits of imaging methods in the assessment of the disease in exposed subjects.
- The complementary roles of other diagnostic methods.



November 2005

ISBN: 3-540-21343-0

L'alvéolite allergique extrinsèque

ou

la pneumonie d'hypersensibilité

L’alvéolite allergique extrinsèque ou pneumonie d’hypersensibilité

- Pneumopathies de mécanisme immunoallergique complexe, dues à l'inhalation chronique de substances antigéniques, le plus souvent organiques.

L’alvéolite allergique extrinsèque ou pneumonie d’hypersensibilité

- Alvéolite
  - inflammation du parenchyme pulmonaire (alvéoles, bronchioles et interstitium)
  - Anomalies de la formule cytologique du LBA
- Allergique
  - sensibilisation (réponse hyperimmune) après contact prolongé ou répété avec un antigène
  - ≠ fièvre d'inhalation
- Extrinsèque
  - de cause extérieure : agent inhalé
  - médicaments?

L’alvéolite allergique extrinsèque
Etiologies principales

- Maladie des éleveurs d'oiseaux

  Réaction aux déjections, sérum et plumes d'oiseaux
  - Pigeons, perruches, perroquets, canaris, …
  - Oies, poules, canards, ... (rapaces, …)

- Maladie du poumon de fermier

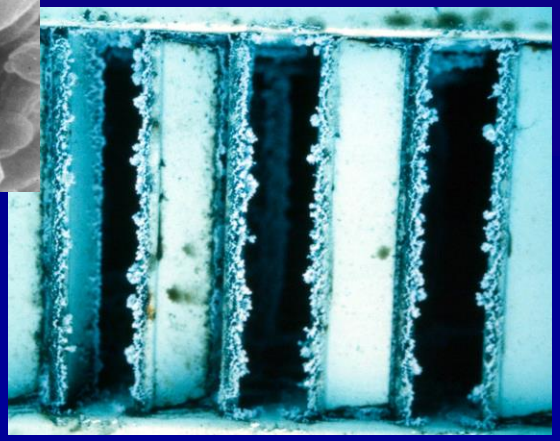
  Réaction aux foin, paille, compost moisis
  - *Aspergillus*, *penicillium*, …
  - Actinomycètes thermophiles

L'alvéolite allergique extrinsèque
Etiologies rares: travail, loisirs, habitat

- Maladie des
  - Fromagers, brasseurs
  - Cultivateurs de champignons
  - Scieurs de bois (*Merulus*)
  - Vignerons (*Botrytis cinerea*)
  - …

- Maladie des
  - Humidificateurs
  - Climatiseurs
  - Jacuzzi, douches (*Mycobacterium avium*)

  contaminés par des moisissures domestiques



L'alvéolite allergique extrinsèque
Epidémiologie

- Dépend des critères diagnostics considérés
  - Questionnaires surestiment
  - Cas cliniques sous-estiment (cas les plus sévères seulement)
- Critères stricts: (questionnaire + sérologie + imagerie + EFR)
  - Fermiers: 0.2 à 1.5%
  - Eleveurs d'oiseaux: 5 à 20%
- Cas pédiatriques

L'alvéolite allergique extrinsèque
Facteurs de risque

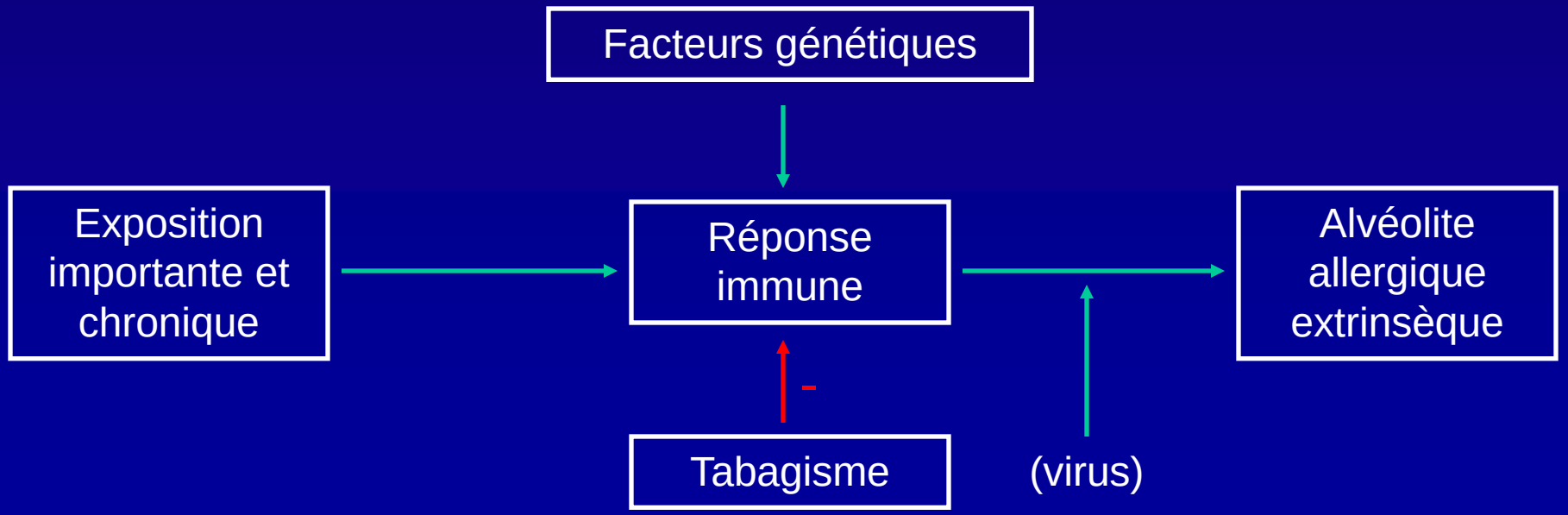
- Dose cumulée
  - Concentration en micro-organismes et durée d'exposition (relation dose-effet malgré une hypersensibilité)
- Géographie
  - Poumon de fermier est plus fréquent dans les régions humides et froides (étés pluvieux et hivers longs)
  - Eleveurs d'oiseaux: 5 à 20%
- Saisons
  - Poumon de fermier: fin de l'hiver
  - Eleveur d'oiseaux: été (saison « sportive »)

L'alvéolite allergique extrinsèque
Facteurs de risque

- Absence de tabagisme
  - Effet immuno-modulateur de la nicotine
- Facteurs génétiques
  - Polymorphisme dans les gènes du complexe d'histocompatibilité et du TNFα
- Maladie parfois précipitée par des cofacteurs infectieux
  - *Influenza*, mycoplasme, …

L'alvéolite allergique extrinsèque
Physiopathologie

- Maladie immunitaire complexe
- Divers mécanismes impliqués
  - Parfois IgE, éosinophiles, mastocytes
  - IgG (IgM): précipitines, sérum et LBA, immuncomplexes
  - Lymphocytes activés (CD4 et CD8)
  - Cytokines: TNFα, IFNγ, …



L’alvéolite allergique extrinsèque
Présentations cliniques

- Forme aiguë
  - « Grippe » 4 à 8 heures après le contact
  - Symptômes grippaux dominent
- Formes subaiguë
  - Dyspnée et toux
  - Symptômes respiratoires dominent
- Forme chronique
  - Séquelle des deux formes précédentes
  - Déficit fonctionnel domine

L’alvéolite allergique extrinsèque « Séquelles »

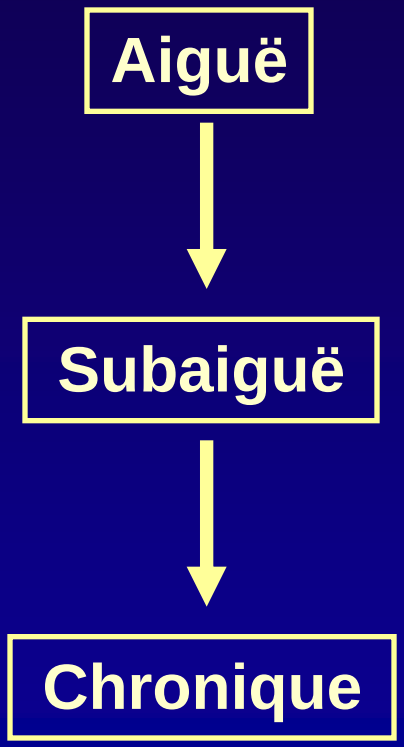
- Fibrose pulmonaire
  - Déficit respiratoire restrictif
  - Diminution de la capacité de diffusion du CO
  - Surtout dans les AAE aviaires
- Emphysème pulmonaire
  - Déficit respiratoire obstructif
  - Diminution de la capacité de diffusion du CO
  - Surtout dans les AAE du poumon de fermier

L'alvéolite allergique extrinsèque
Histopathologie

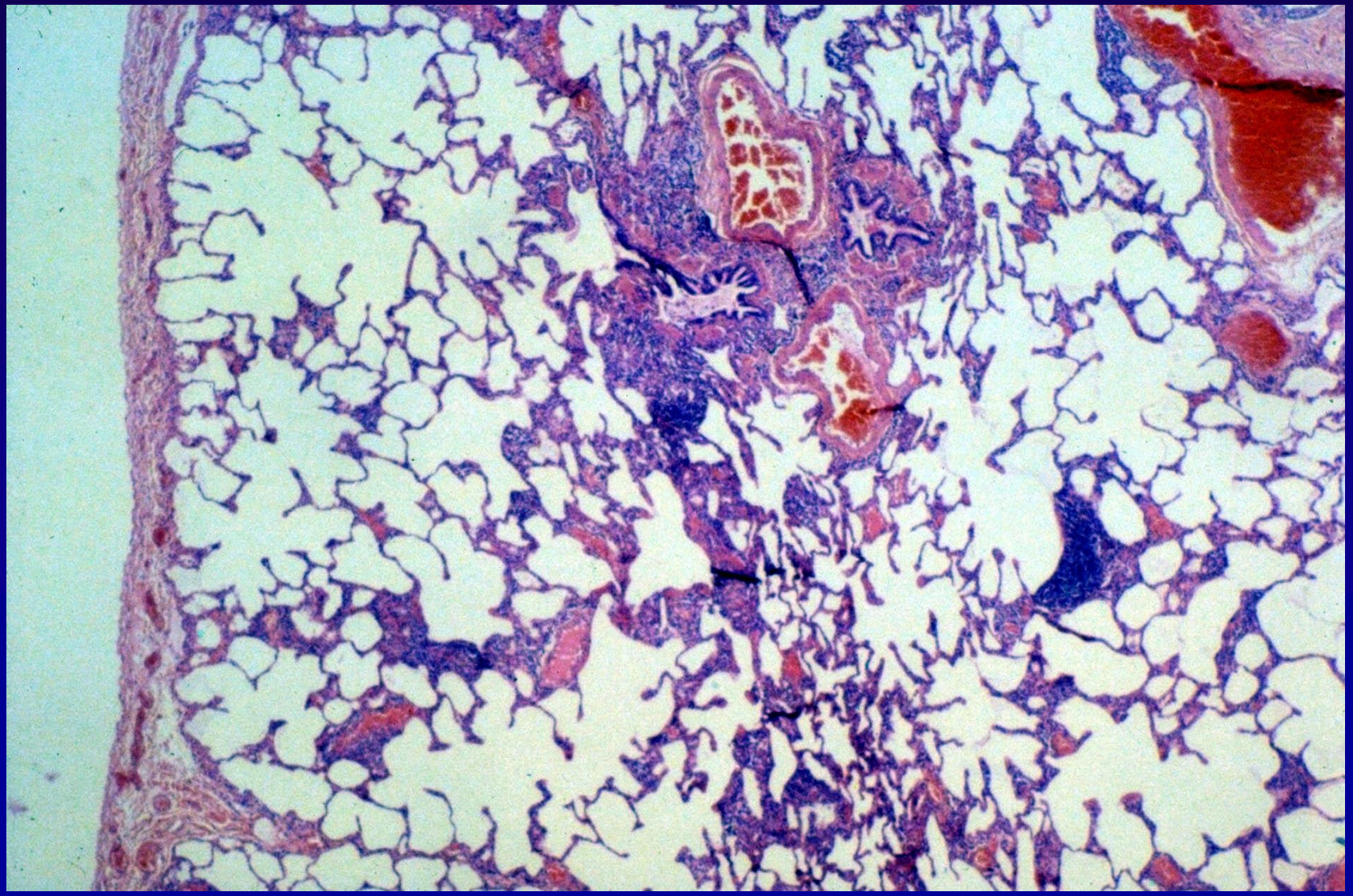
- Œdème, dépôt de fibrine, polynucléaires

- Lymphocytes et plasmatocytes

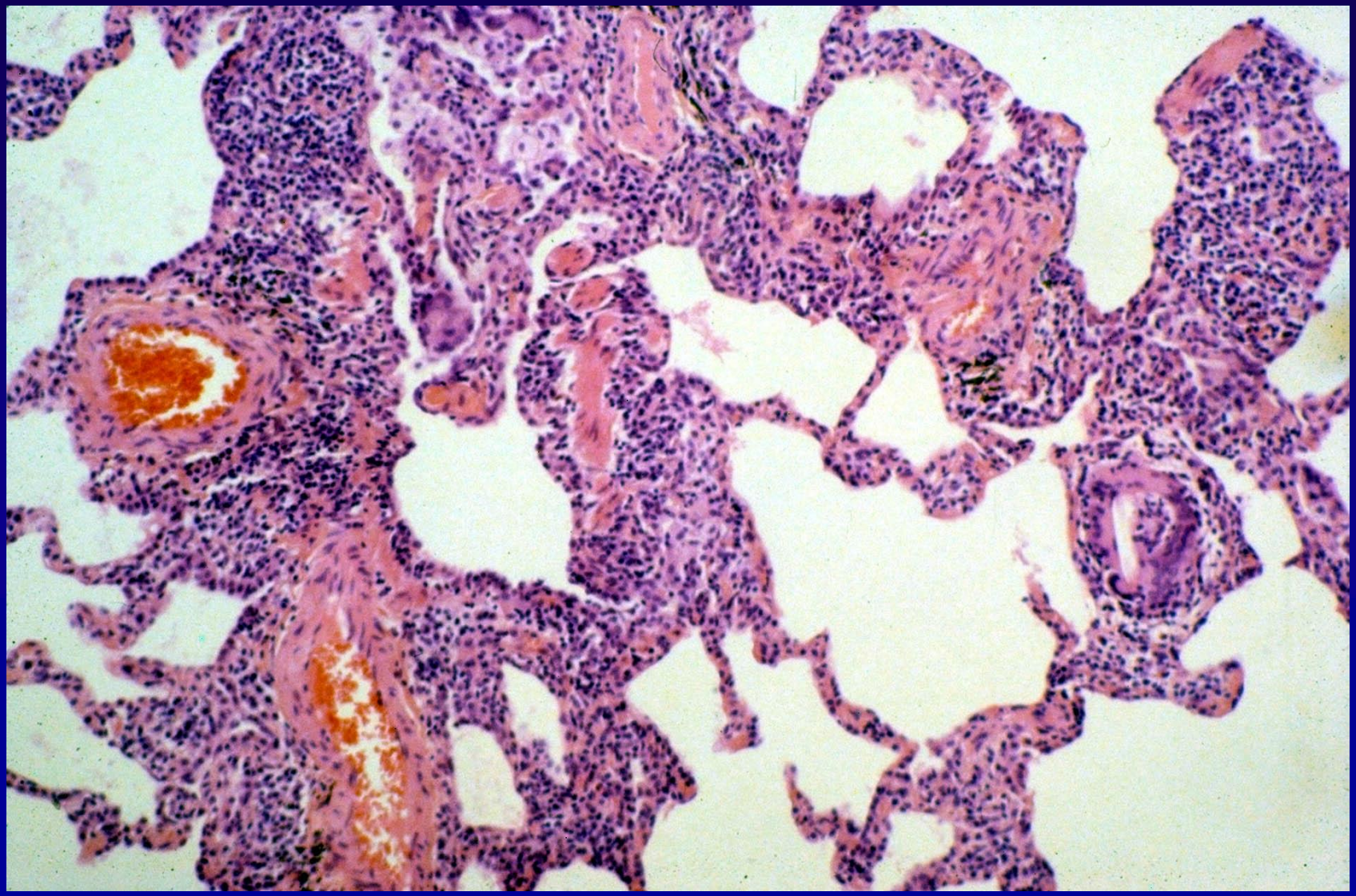
- Granulomes centrolobulaires
- Bronchiolites (br. terminales et respiratoires)
- BOOP/PINS
- Fibrose
- Emphysème



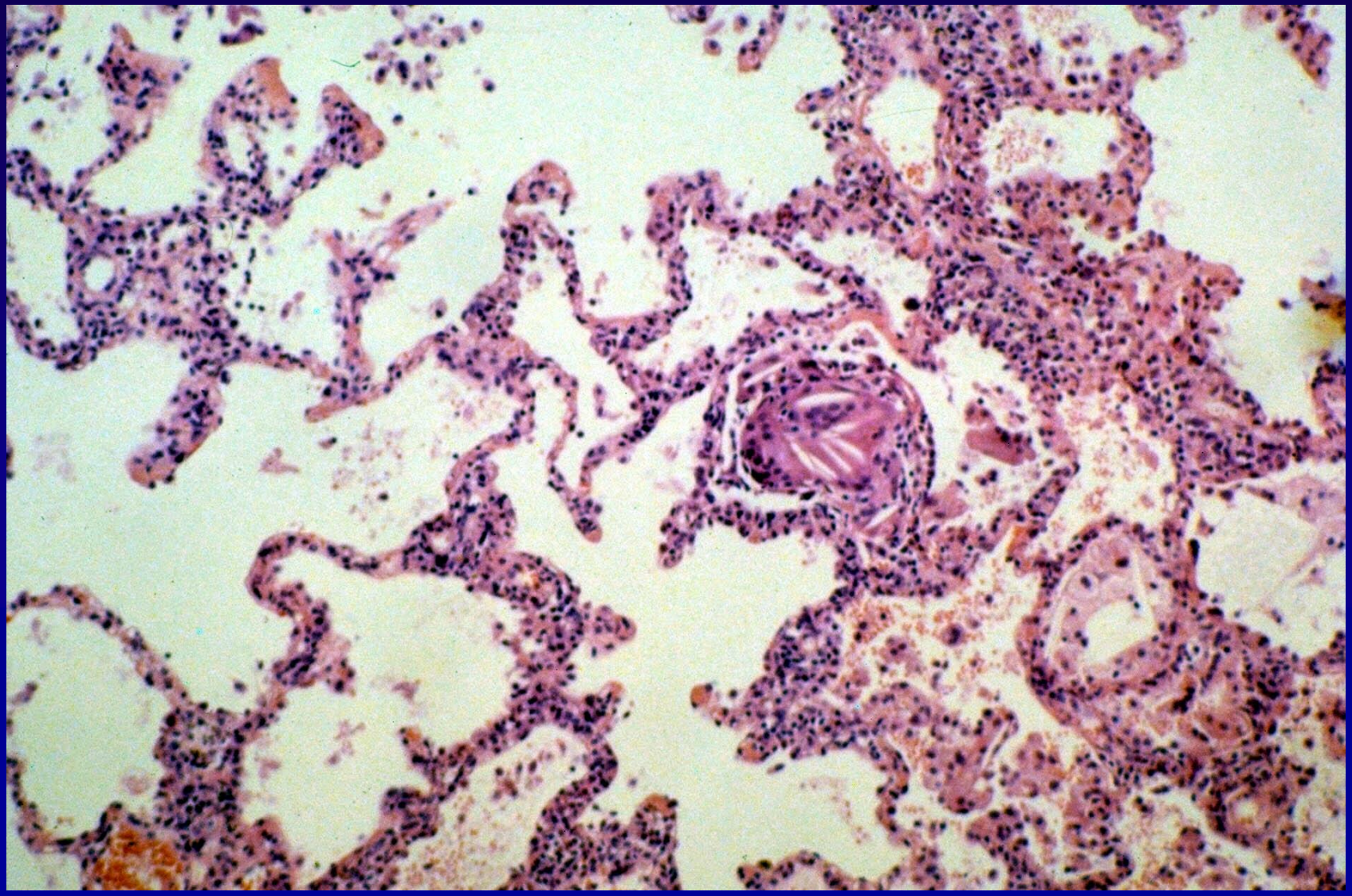
L’alvéolite allergique extrinsèque
Histopathologie



L’alvéolite allergique extrinsèque
Histopathologie

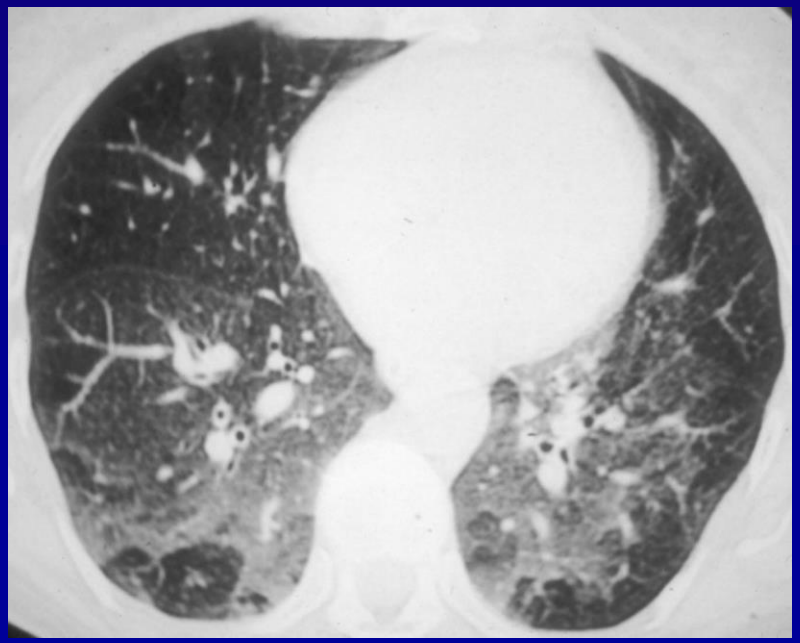


L’alvéolite allergique extrinsèque
Histopathologie



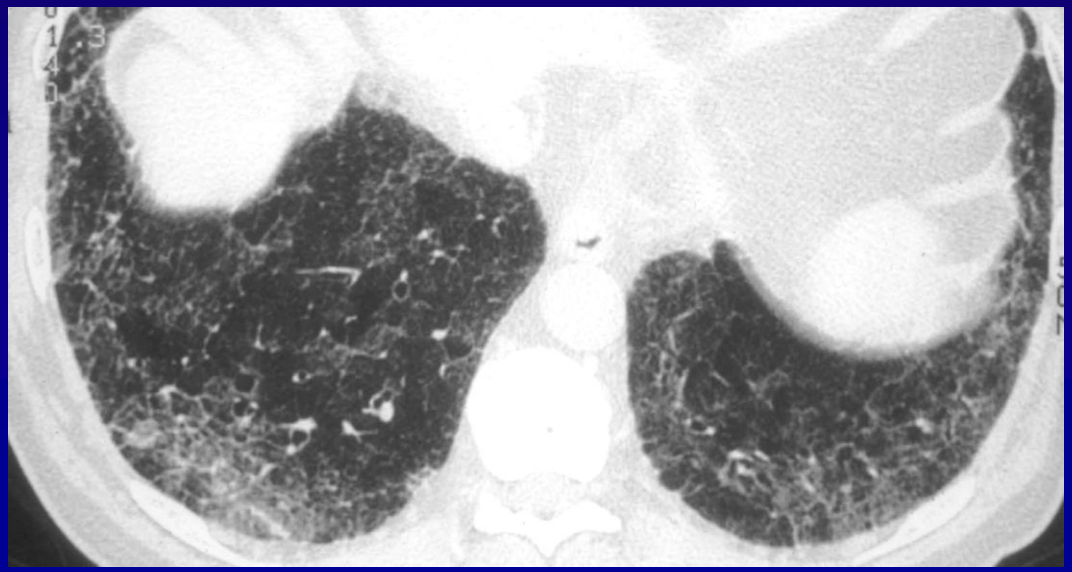
L’alvéolite allergique extrinsèque
Tomodensitométrie

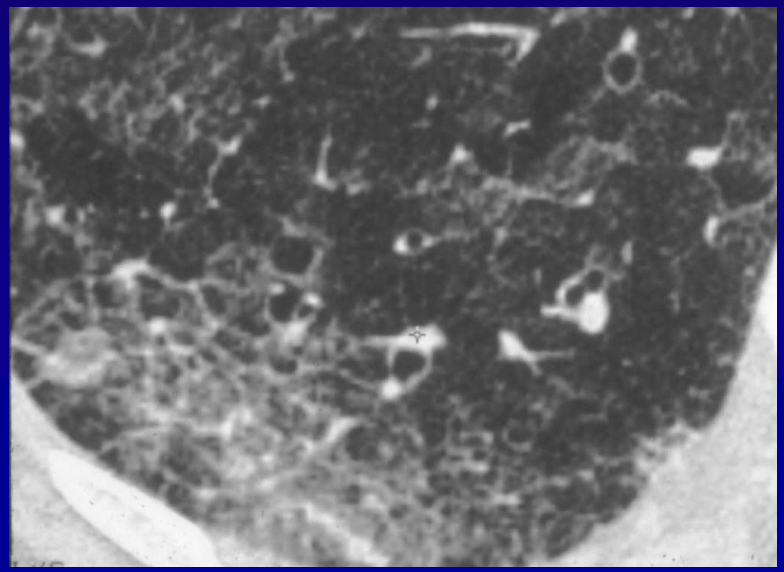
- Forme aiguë et subaiguë
  - OVD
  - Micronodules centrolobulaires, peu denses et à limites floues
  - Aspect en mosaïque
  - Trappage expiratoire
  - Condensation (BOOP)
  - PINS



L’alvéolite allergique extrinsèque
Tomodensitométrie

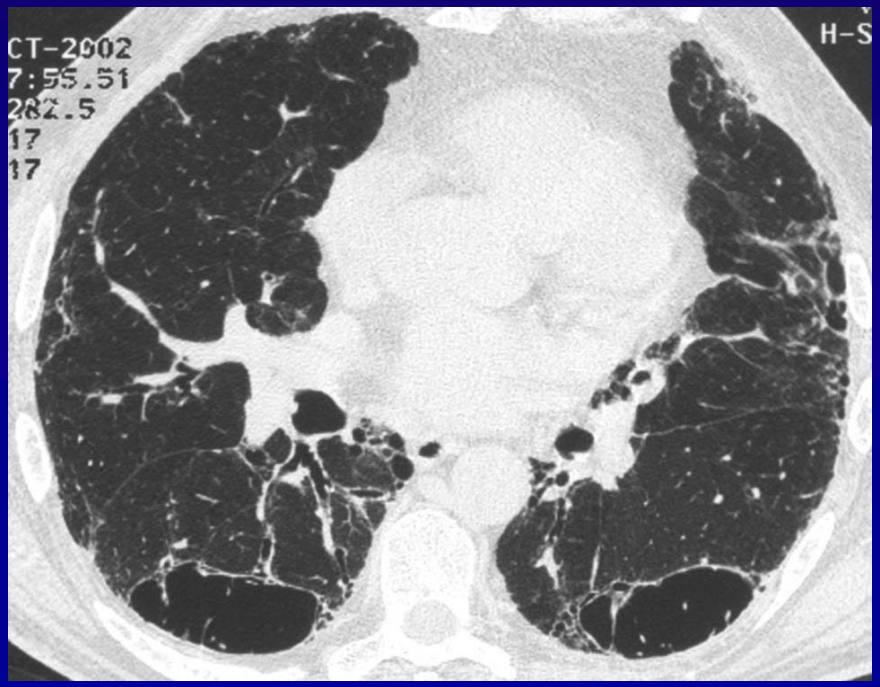
- Forme chronique
  - **Fibrose**: opacités linéaires, condensation, bronchectasies de traction, rayon de miel
  - Emphysème

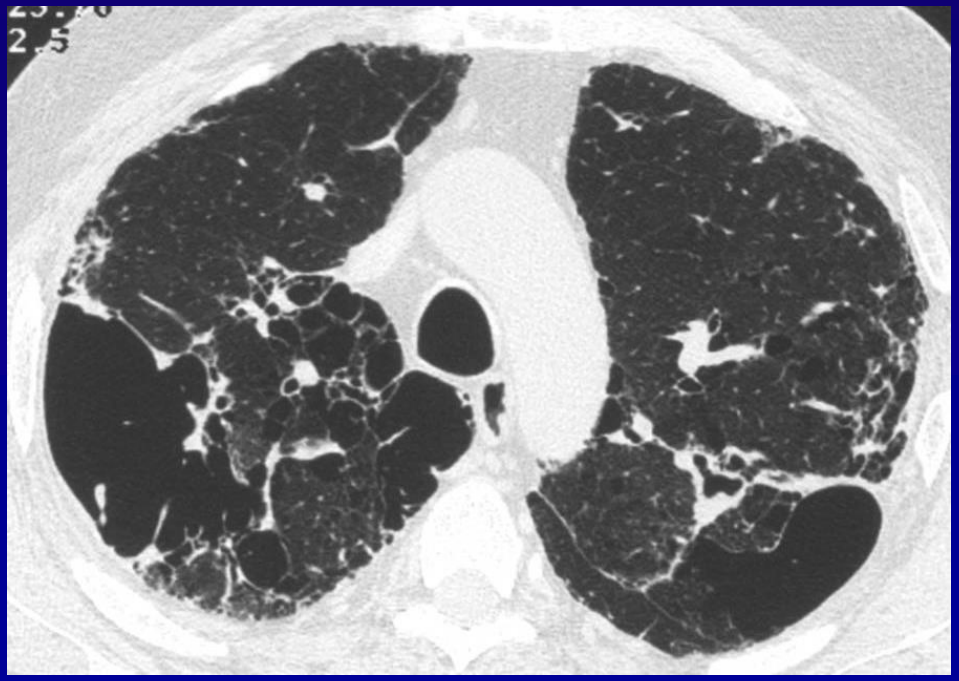




L’alvéolite allergique extrinsèque
Tomodensitométrie

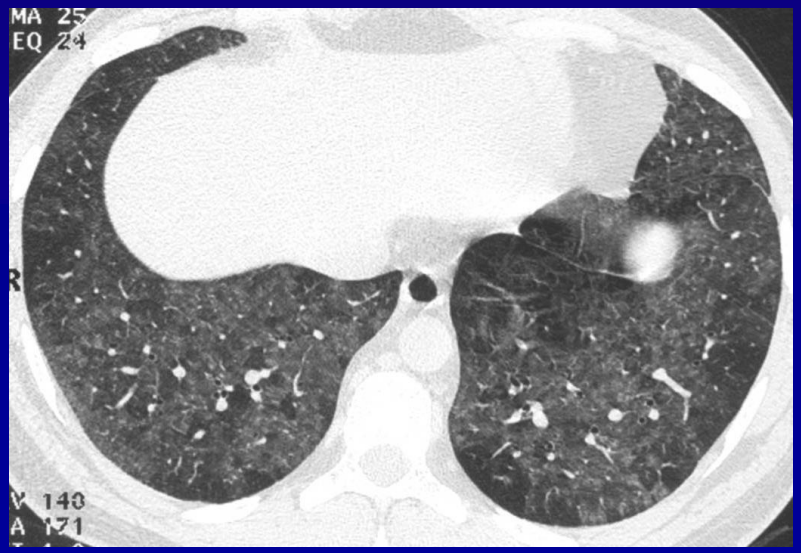
- Forme chronique
  - Fibrose: opacités linéaires, condensation, bronchectasies de traction, rayon de miel
  - **Emphysème**





L'alvéolite allergique extrinsèque
Rôles de la Tomodensitométrie

- Proposer un diagnostic spécifique d'alvéolite allergique extrinsèque
- Suggérer de reprendre l'anamnèse et faire rechercher des précipitines spécifiques en fonction des expositions suspectées
- Suivre l'effet du traitement (éviction et CCS)? (EFR)



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