

Pneumoconiosis: Asbestos

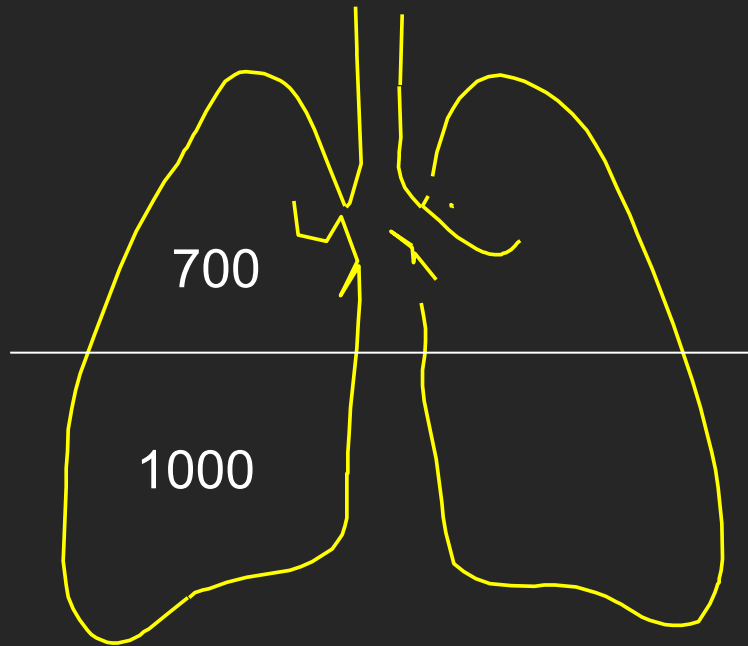
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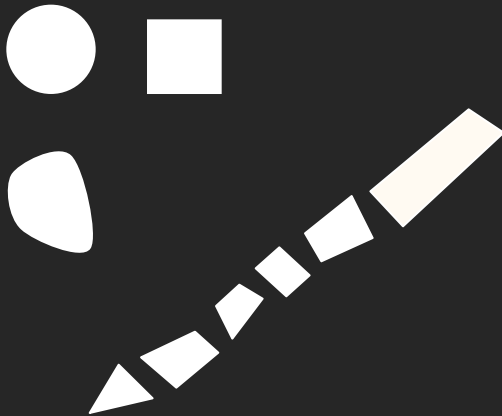
Aerosol Study: Asbestos



Shape

Aspect Ratio: long axis/short axis

Round



Silica
Coal
Organic dust

Fiber



Asbestos
Talc

Courtesy of Jud Gurney, MD

Asbestos

- Between 1940 and 1979, 40% of the US workforce (27 million) individuals exposed
- Deaths from asbestosis have increased from less than 100 in 1968 to over 1250 annually in 1999
- Asbestosis accounts for one third of all pneumoconiosis deaths

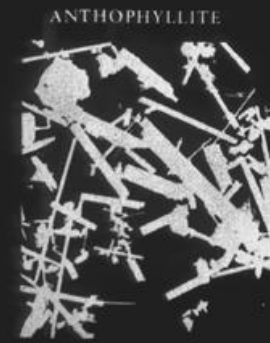
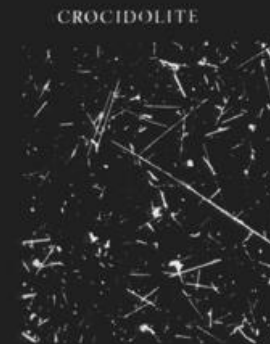
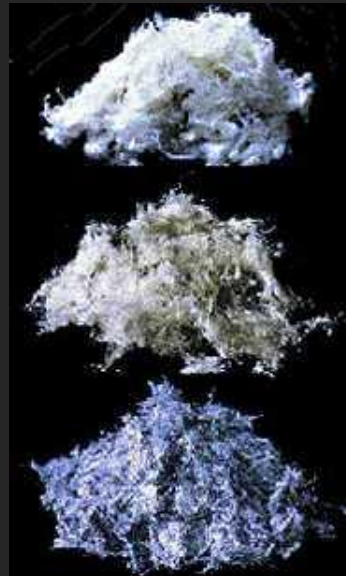
Asbestosis Deaths by Industry Exposure*

▪ Construction	24.6%
▪ Ship building	6.0%
▪ Industrial Chemicals	4.3%
▪ Railroads	3.1%
▪ Nonmetallic/stone products	2.6%
▪ Government	2.5%
▪ Electric light and power	1.9%
▪ Elementary and secondary schools	1.9%
▪ Miscellaneous	45.0%

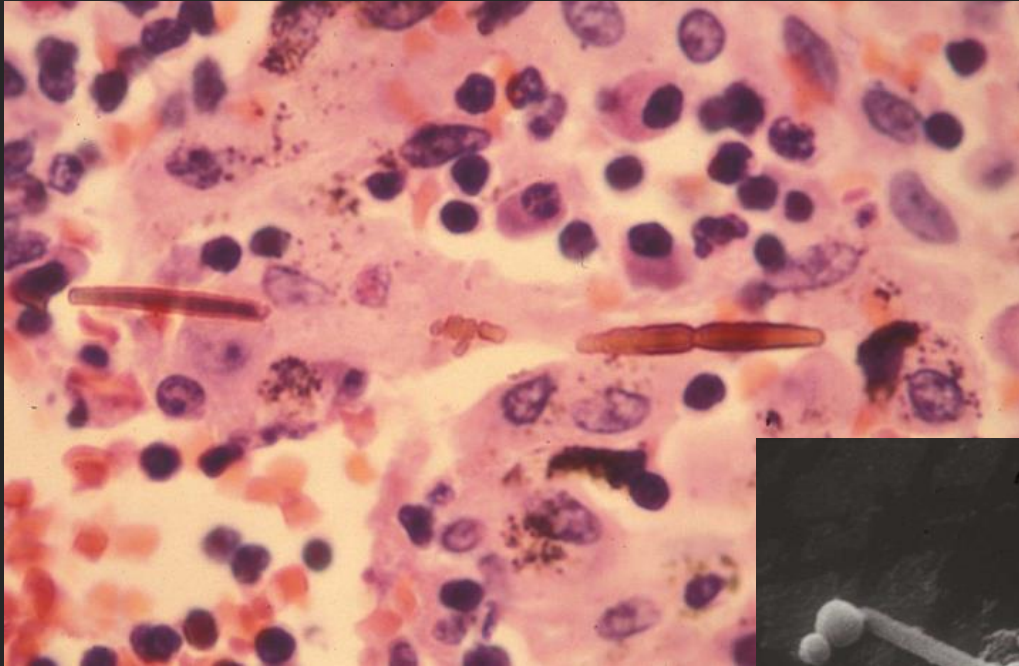
*Work-Related Lung Disease Surveillance Report 2007, CDC

Asbestos Fibers

- **Serpentine – curly, chemically soluble**
 - Chrysotile (white) - 90% of commercial asbestos
- **Amphiboles – straight, rigid, needle-like**
 - Crocidolite (blue)
 - Amosite (brown)
 - Anthophyllite



Ferruginous Body



Macrophage
deposition of iron and
protein on fiber
surface renders it inert

Finding asbestos
bodies in the BAL
sample of a patient
with fibrosis has a high
specificity for
asbestosis



Asbestos

- Pleural plaque
- Diffuse pleural thickening
- Round atelectasis
- Asbestosis
- Malignancy
 - Mesothelioma
 - Lung cancer

Pleural Effusion

- 3-7% of exposed workers
- Earliest manifestation within 5-10 years of exposure
- Pleuritis involves the visceral and parietal pleura
- Fluid is exudative and blood-tinged
- Resolves in 2-3 months

Localized Pleural Plaque

- Most common (16-80%)
- 15-30 years after exposure.
- Textbook answer: not dose dependent. Recent work supports dose response relationship*
- Acellular collagen in a basketweave pattern on the parietal pleura
- Association of plaque with increased lung cancer risk is controversial

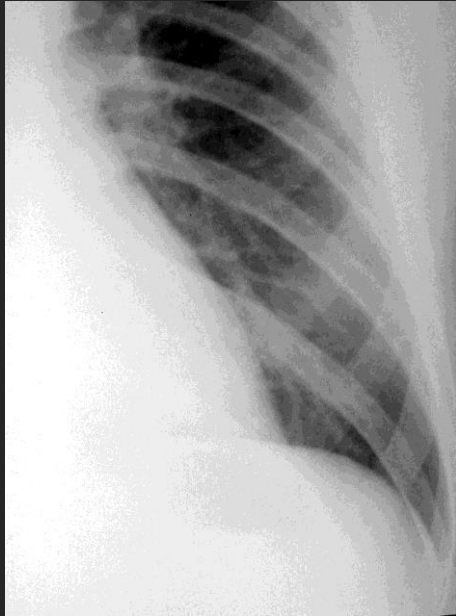
*Rohs AM et al. Am J Respir Crit Care Med 2008; 177: 630

Localized Pleural Plaque

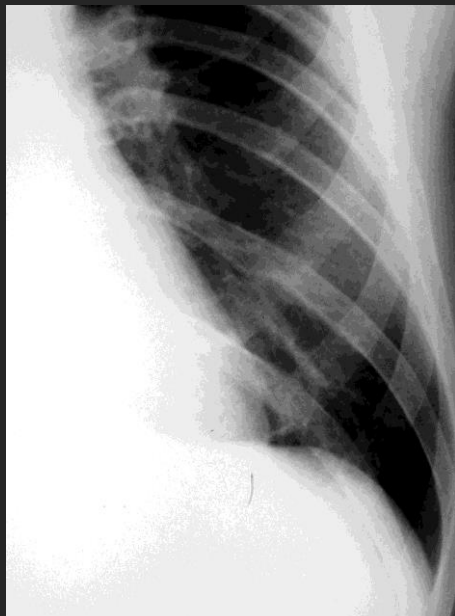


- Typically, bilateral
- Calcification (20% at CXR, 50% at CT)
- Location: posterolateral ribs 6-9, domes of diaphragms, apices and CP angles spared!
- A minimum width of 3 mm required for an in-profile plaque to be recorded per ILO guidelines

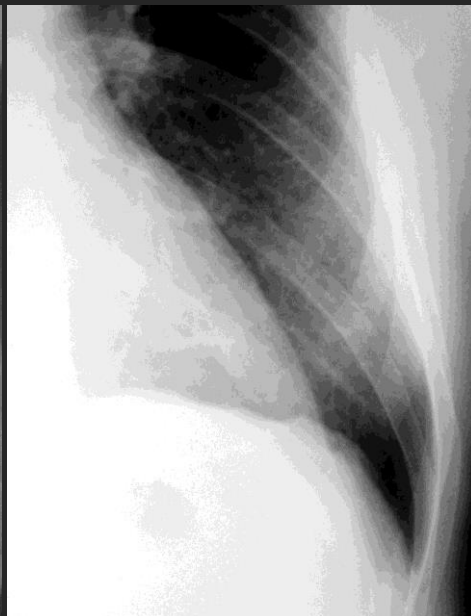
Evolution of Pleural Plaque



Baseline



+7 years



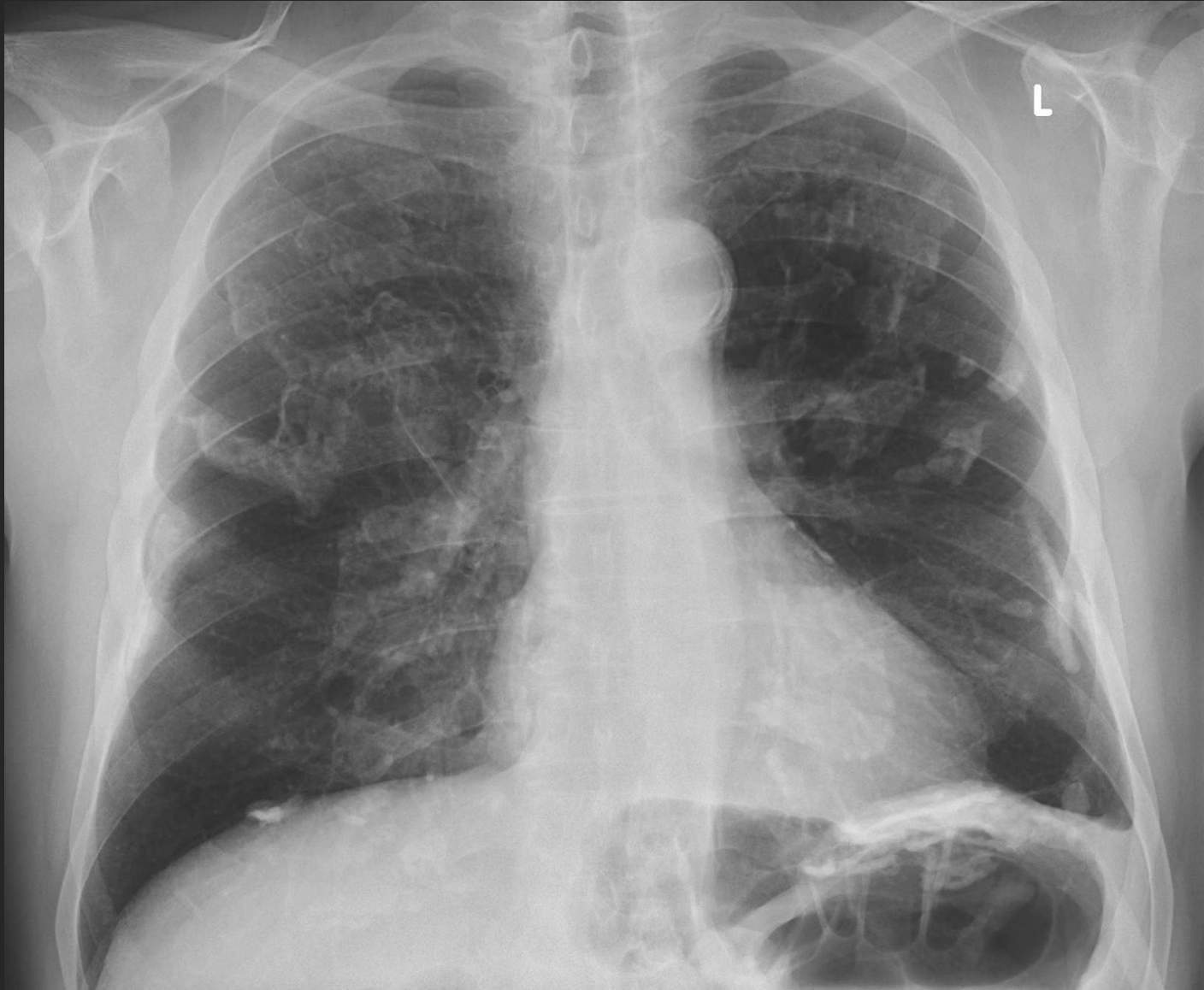
+15 years



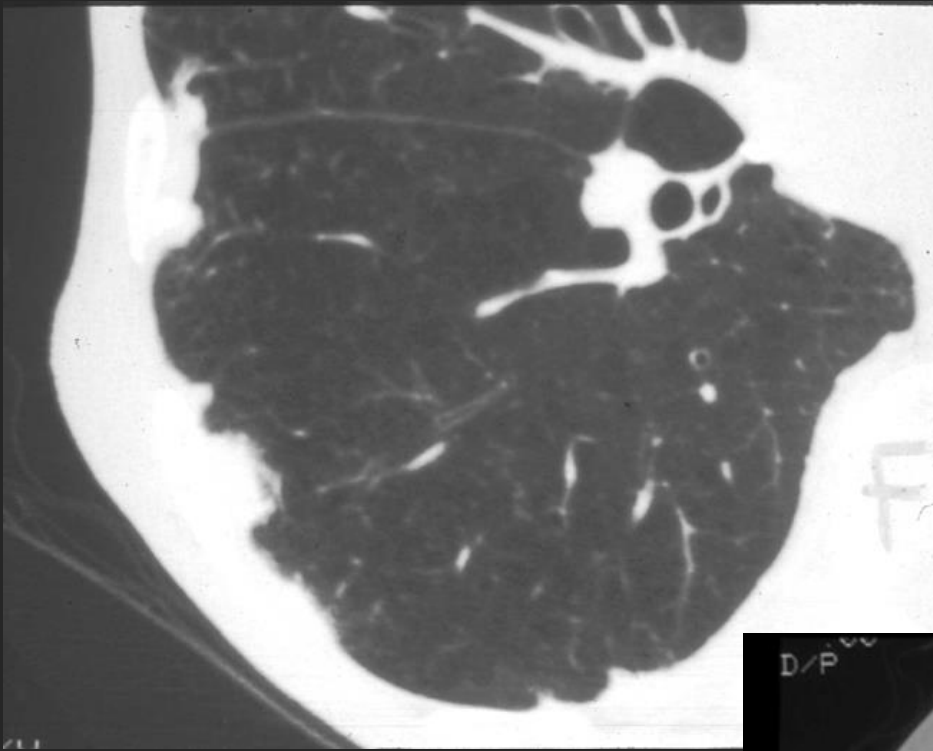
+31 years

Larson TC et al. Radiology 2010; 255: 924-933.

Pleural Plaque: CXR



“Hairy” Pleural Plaque



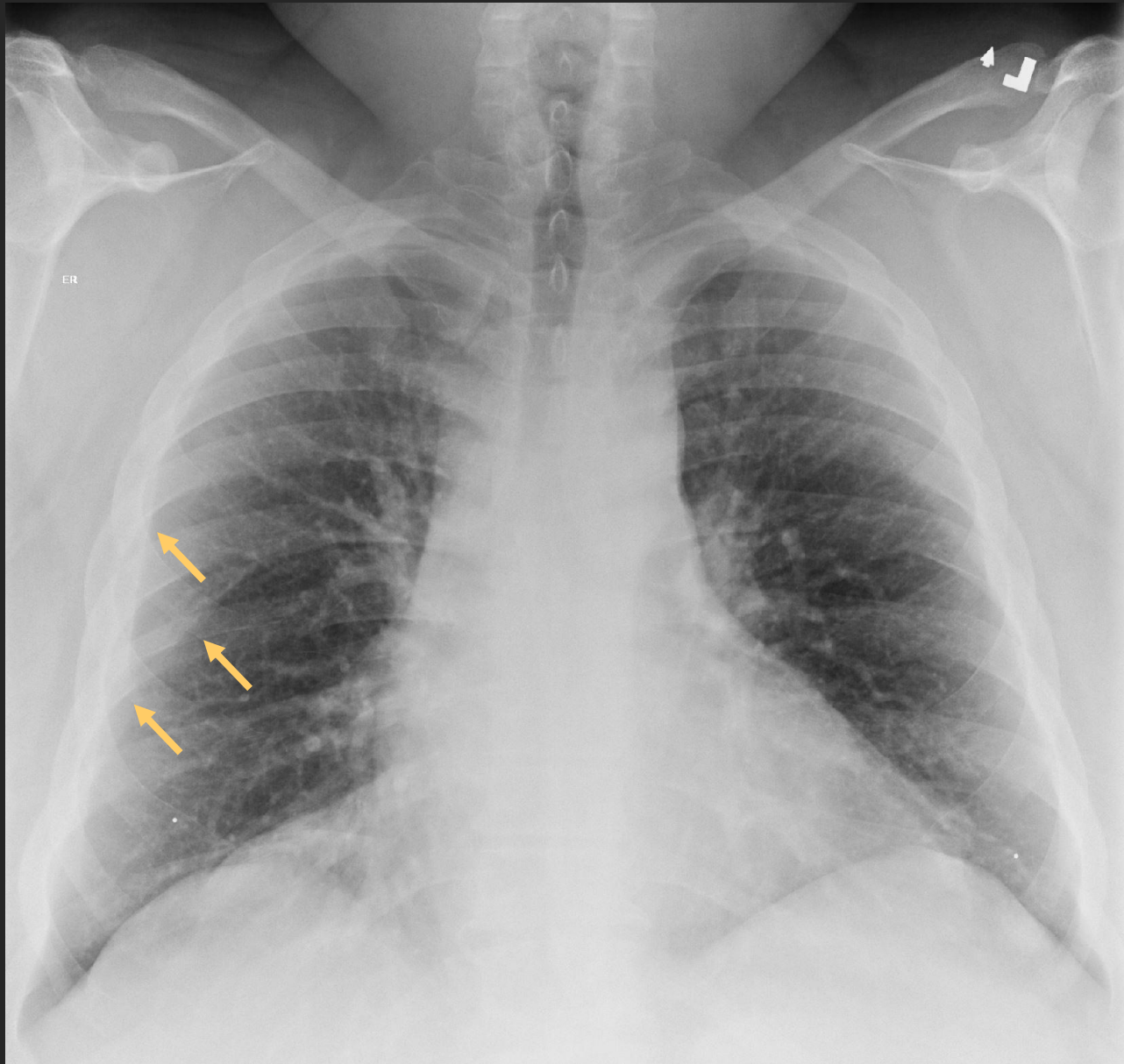
“Hairy” Plaque



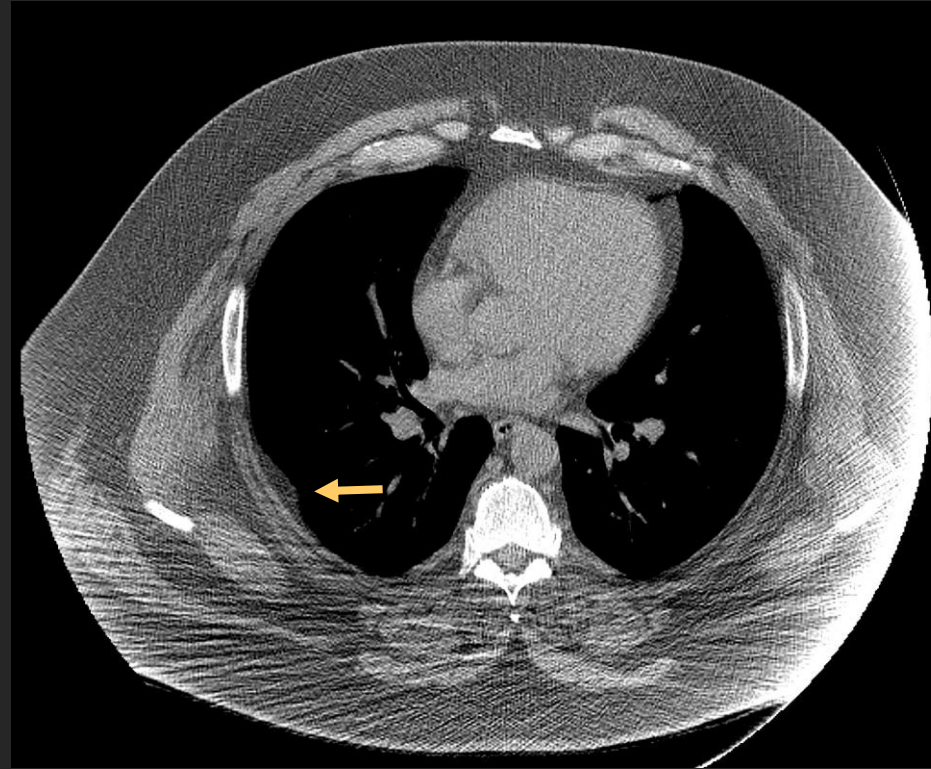
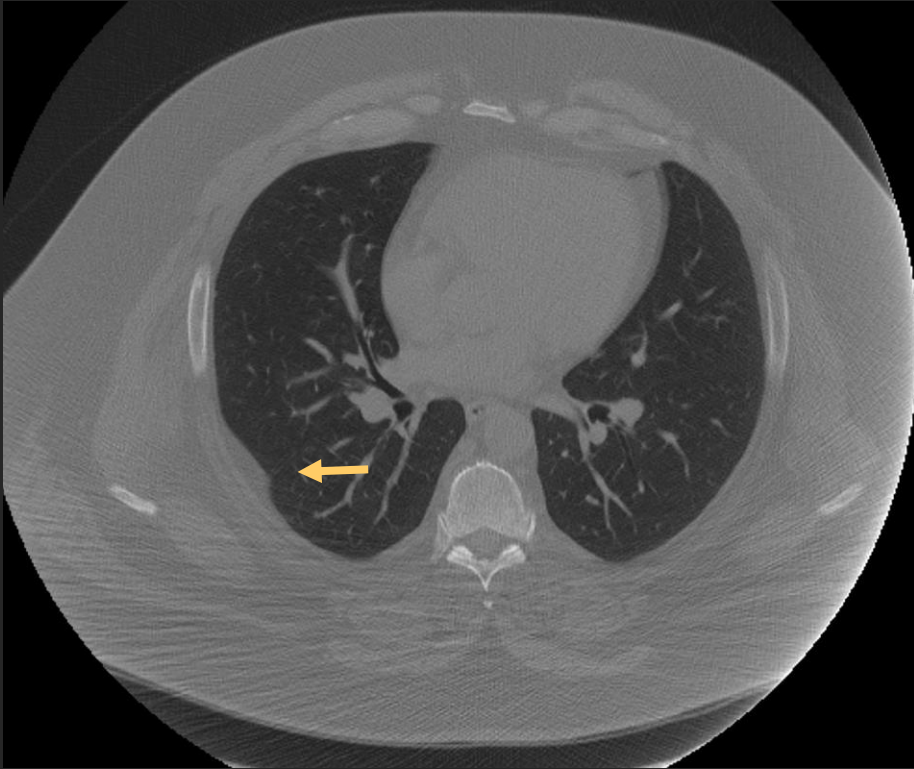
Pleural Fat



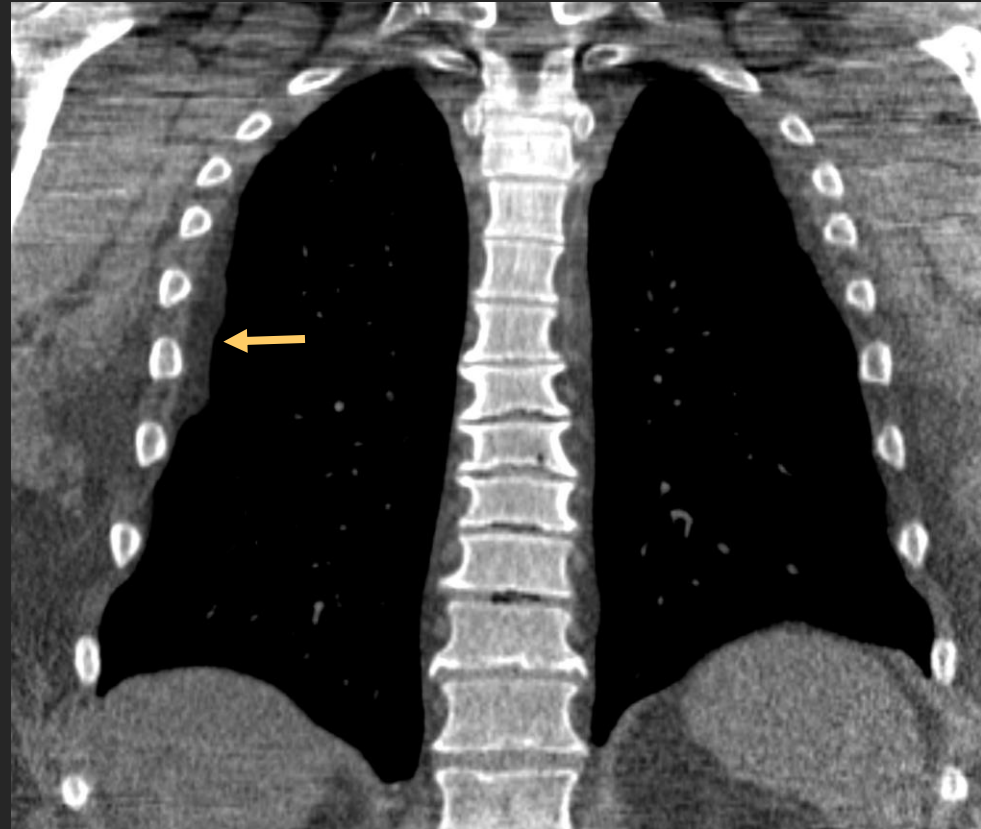
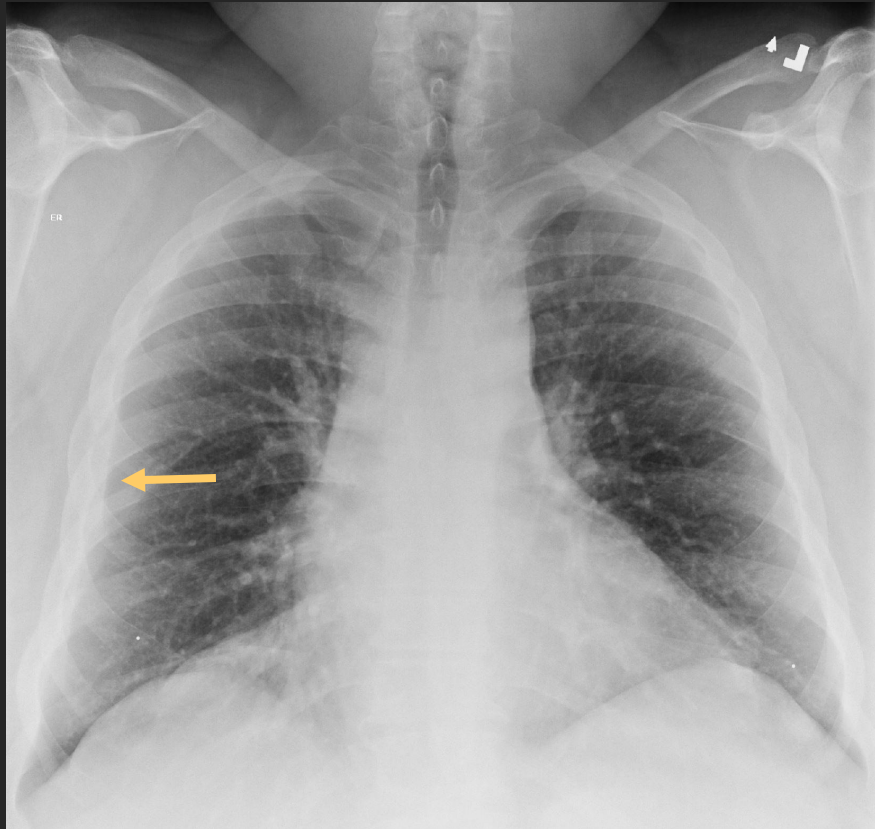
Pleural Fat



Pleural Fat



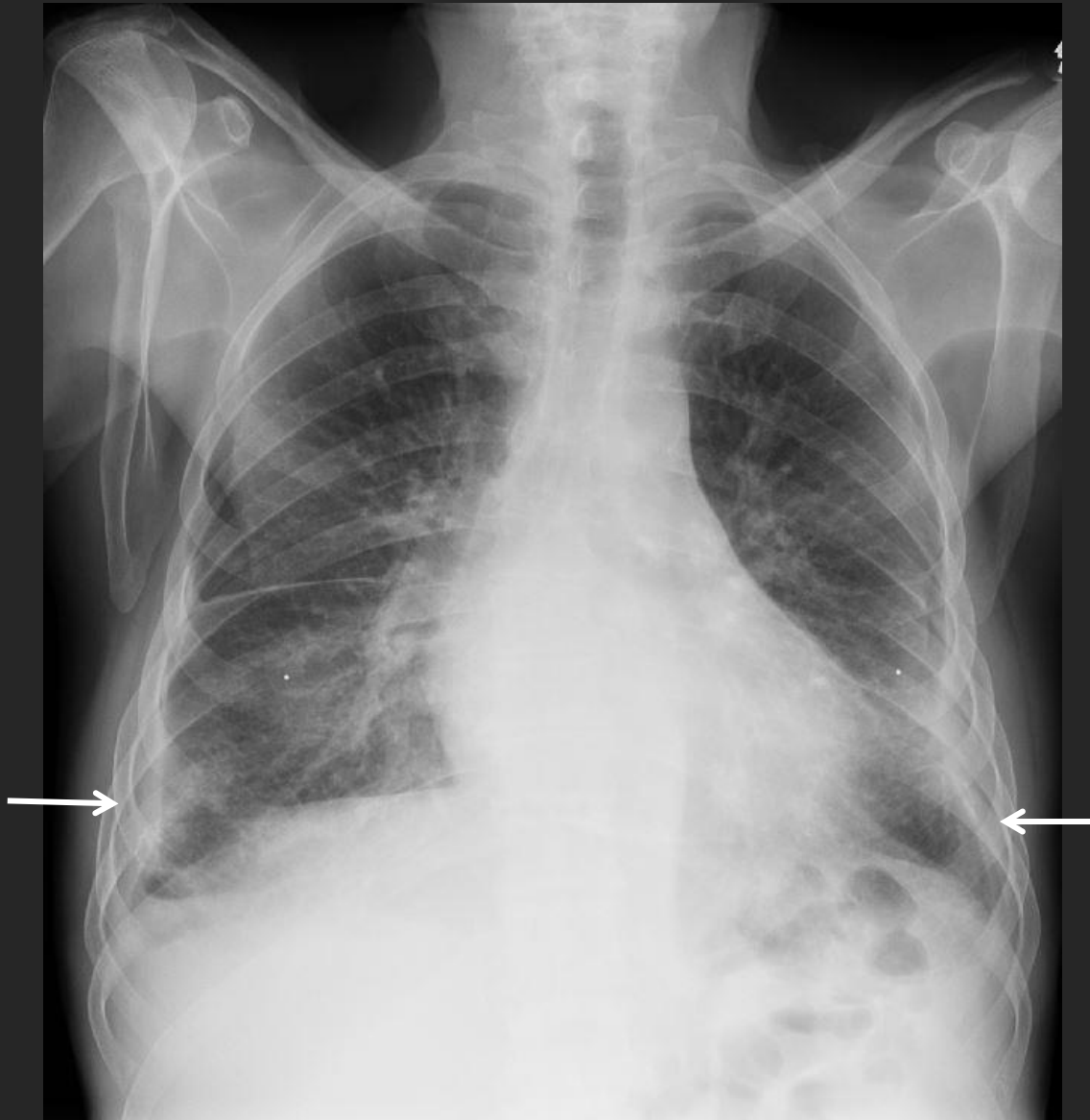
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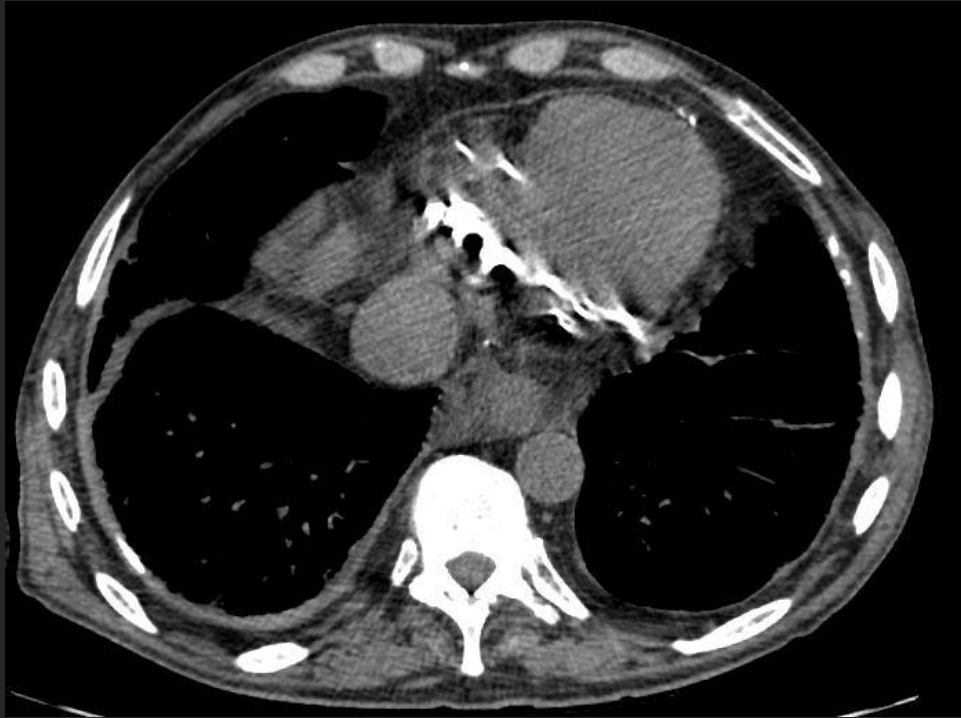
Diffuse Pleural Thickening

- Up to 13% of exposed individuals
- Asbestos-related pleural effusion sequela
- Visceral and parietal pleural layers fuse
- Restrictive PFT's
- Defined by the Digital ILO standard: "CP Angle"

Diffuse Pleural Thickening: CXR



Diffuse Pleural Thickening: CT



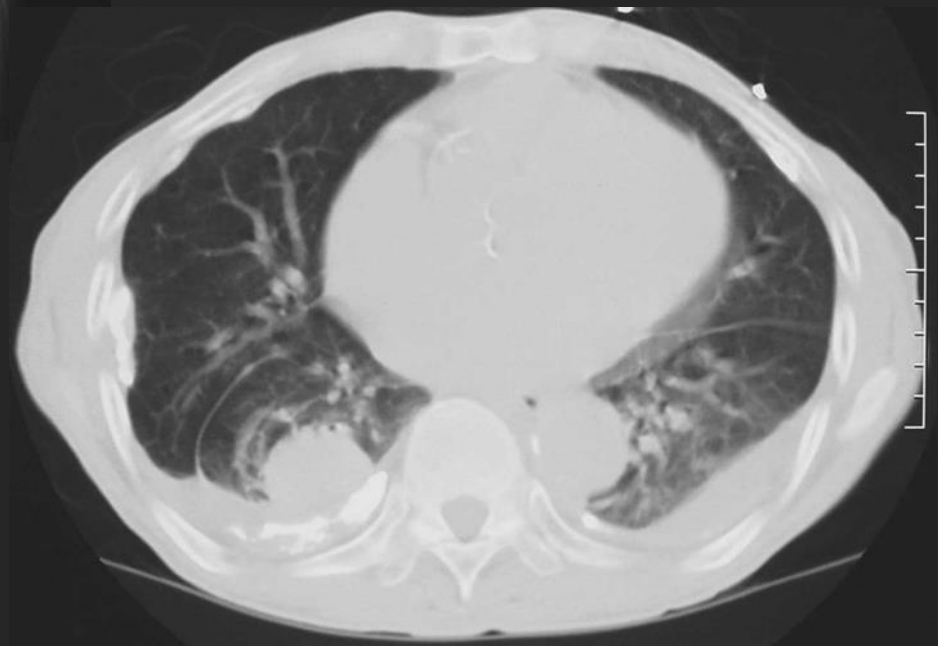


Round Atelectasis

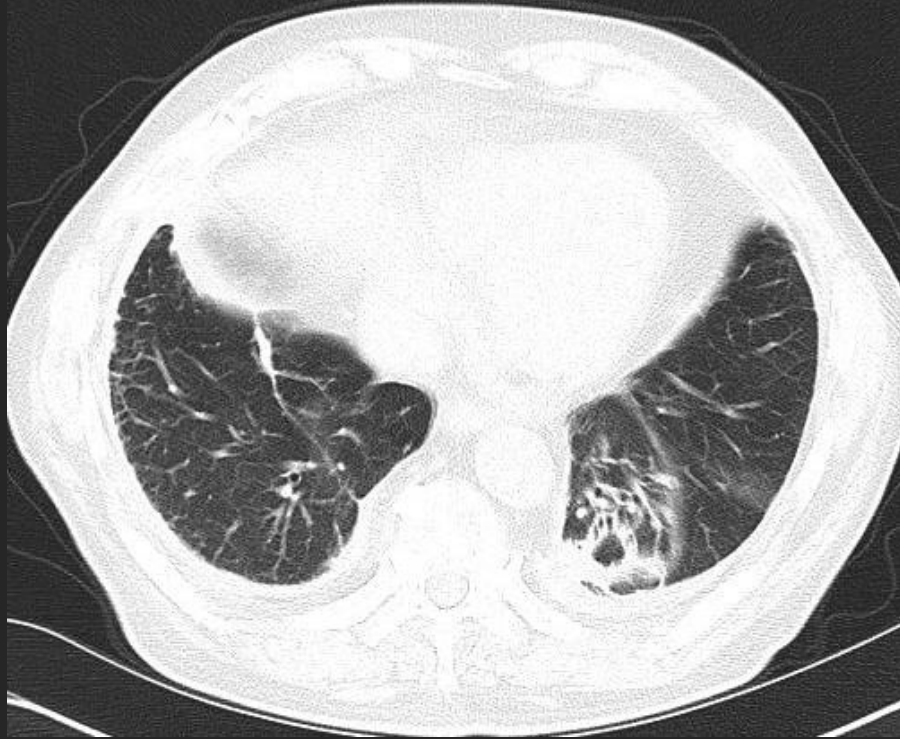
Pleural thickening

Volume loss

Comet tail/swirling
vessels



Round Atelectasis and DPT

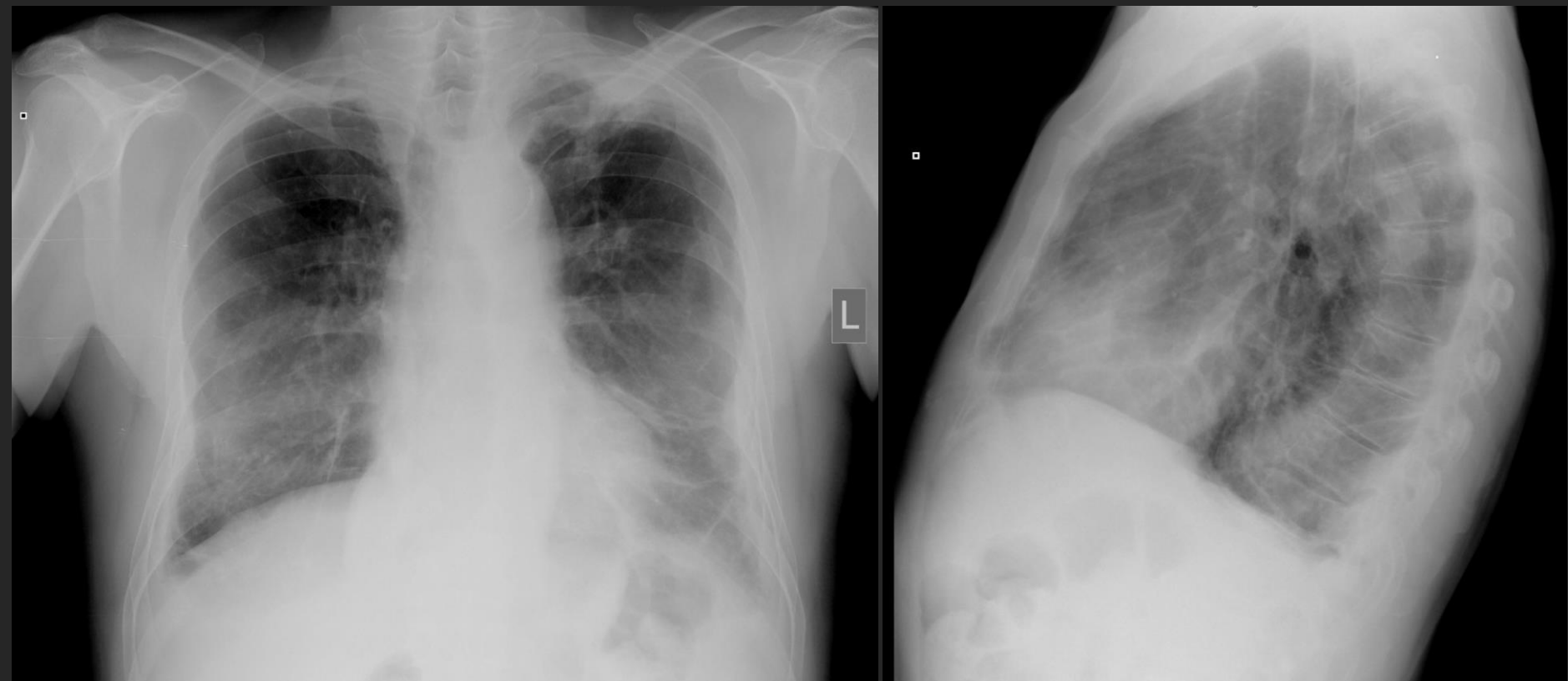


Volume loss

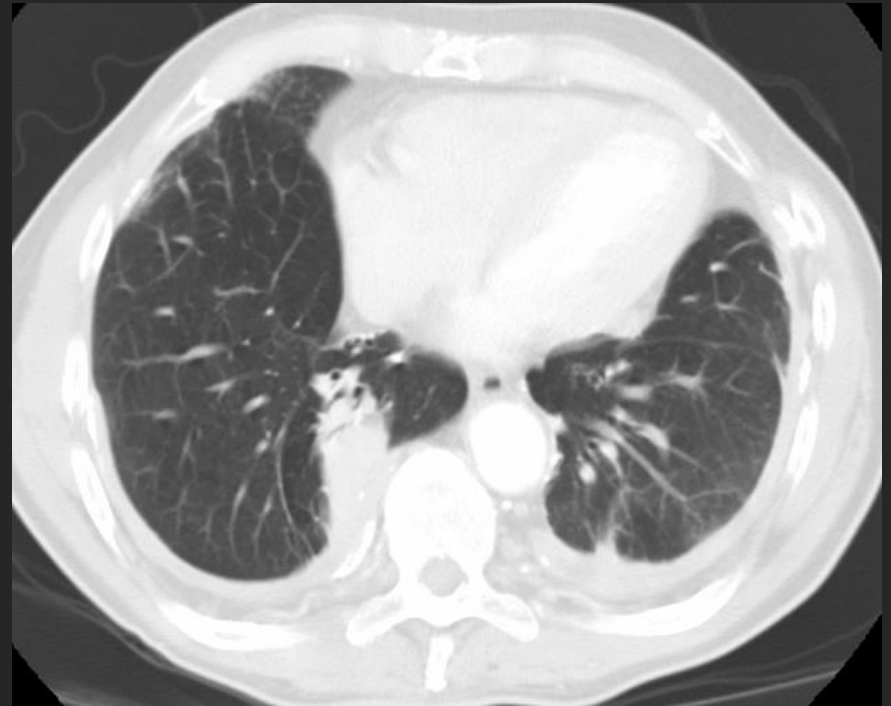
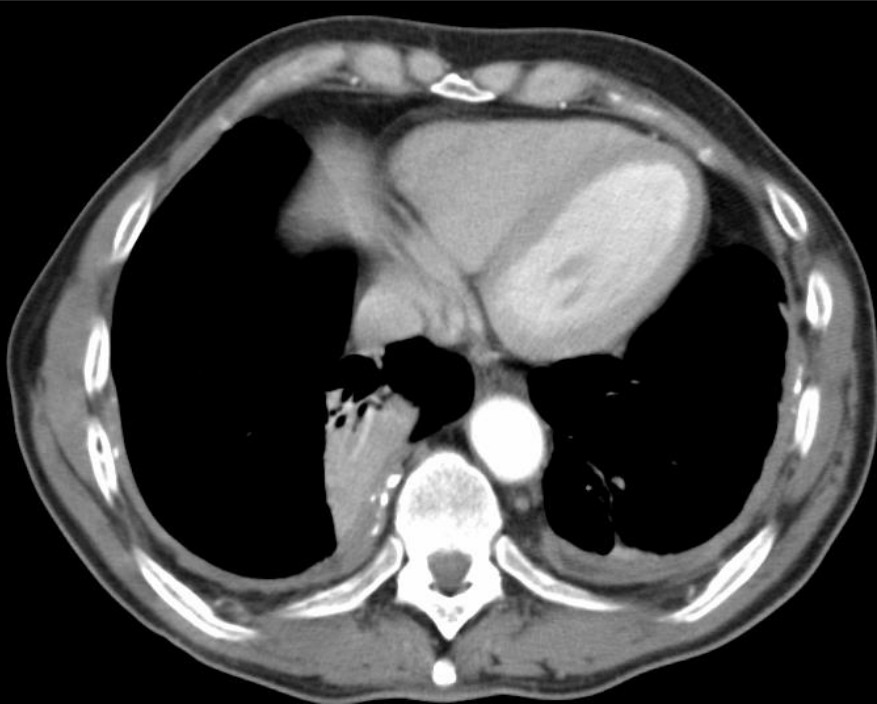
Pleural Thickening

Comet tail sign

Round Atelectasis (RA)



DPT and Round Atelectasis



Asbestosis: Clinical

- Insidious onset with long latency 10-30 years
- Symptoms: dry cough, exertional dyspnea
- Pulmonary function tests are restrictive with decreased DLCO.
- Lung biopsy is rarely necessary
- Treatment is supportive

Asbestosis

- Pulmonary fibrosis in an asbestos exposed individual
- Dose response relationship
- 20 years after exposure
- Incidence 15-30%
- Rare in the absence of pleural disease

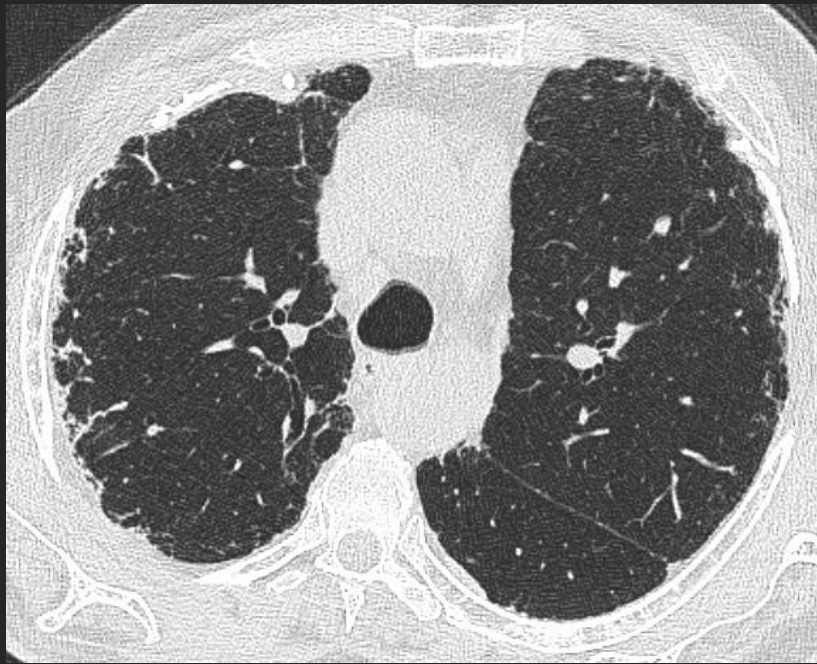
Asbestosis: CXR



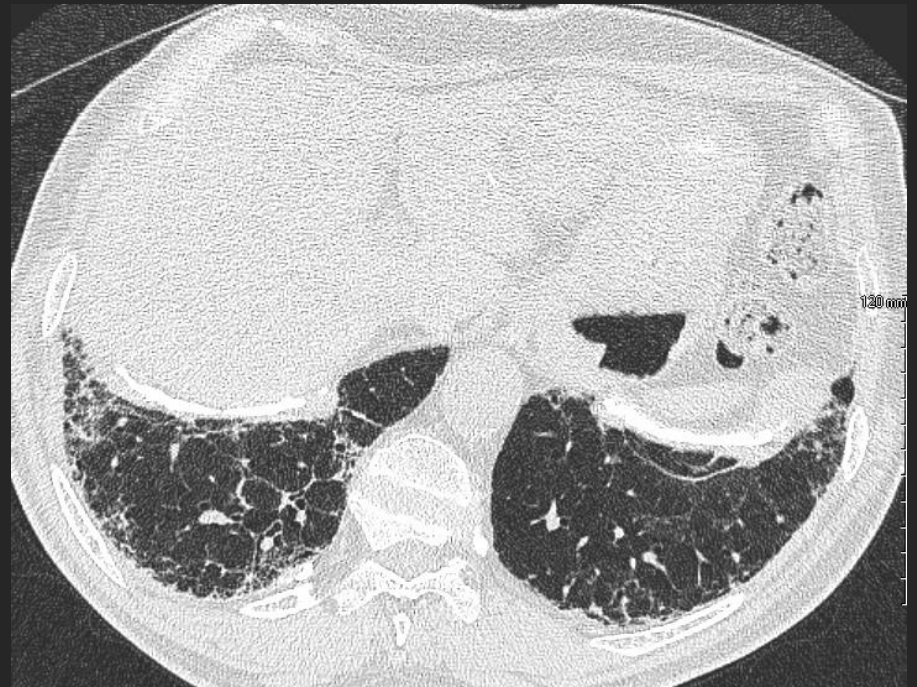
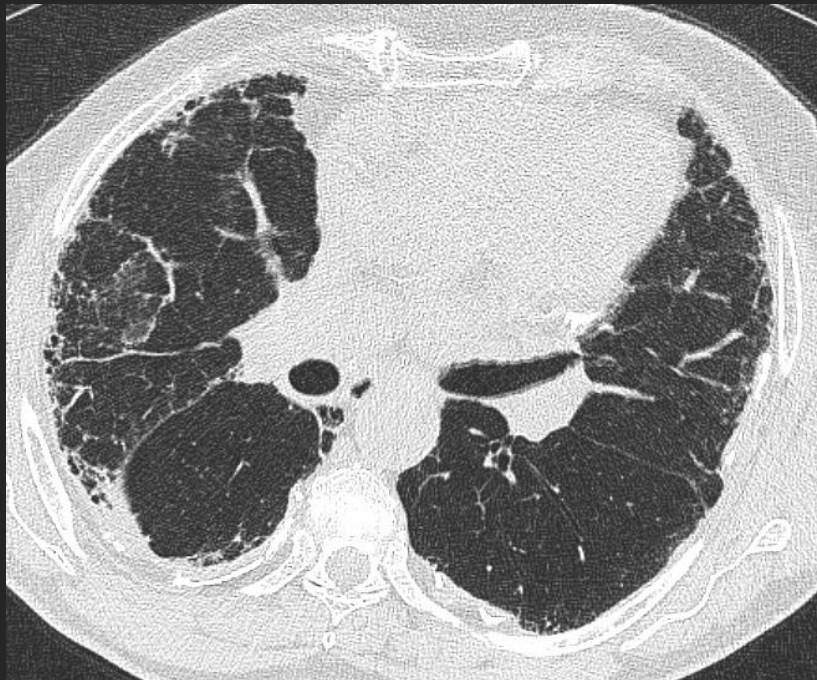
Asbestosis: HRCT findings

- Septal thickening
- Honeycomb lung
- Traction bronchiectasis
- Curvilinear subpleural lines*
- Parenchymal bands*

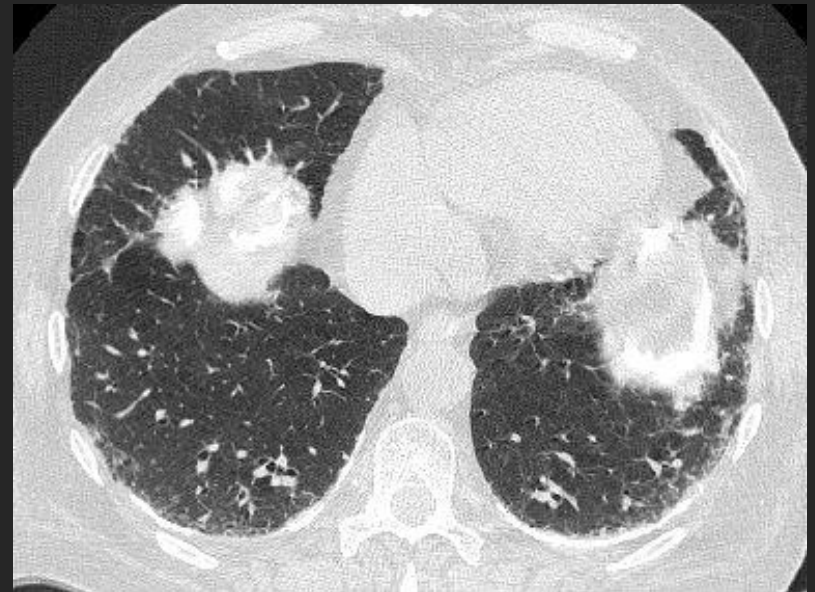
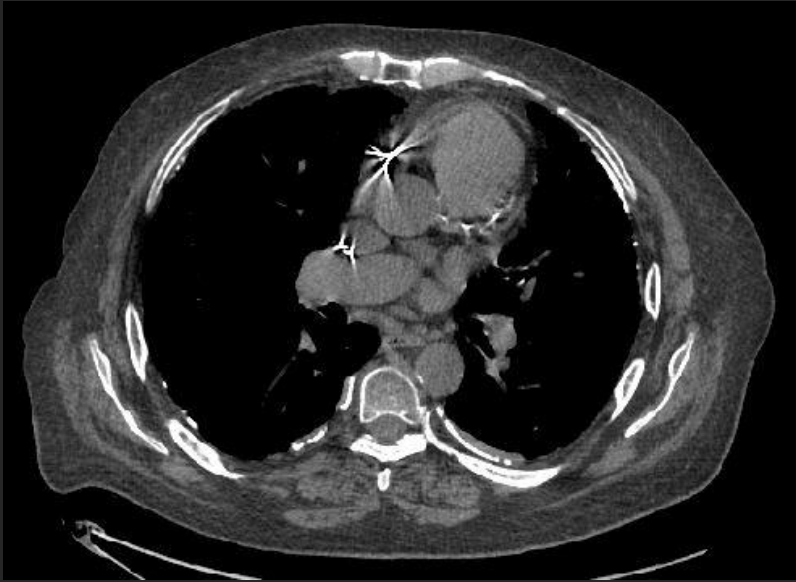
* More common in asbestosis than IPF and related to visceral pleural fibrosis



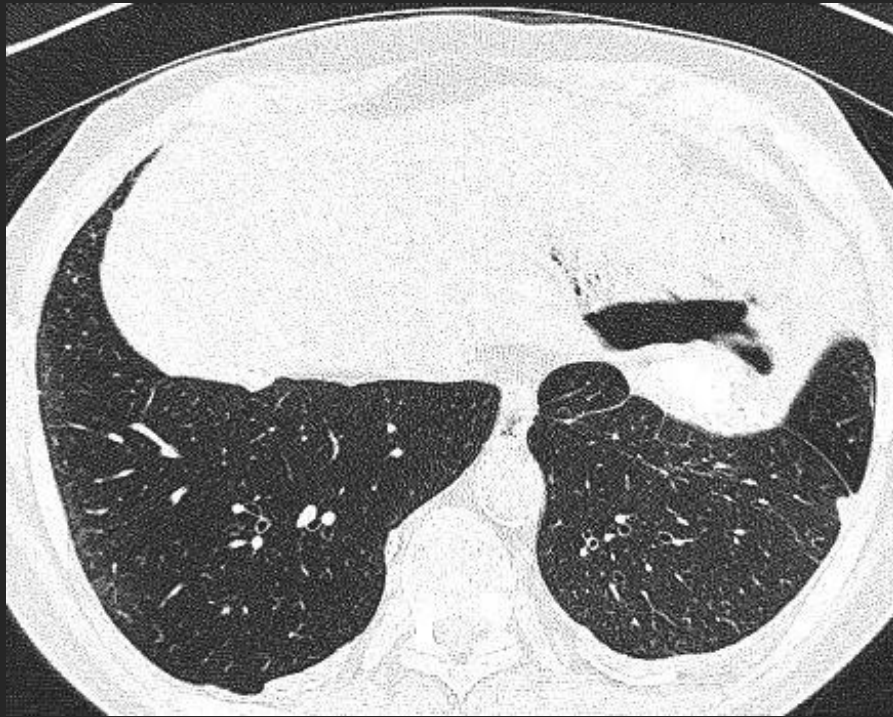
HRCT: Asbestosis



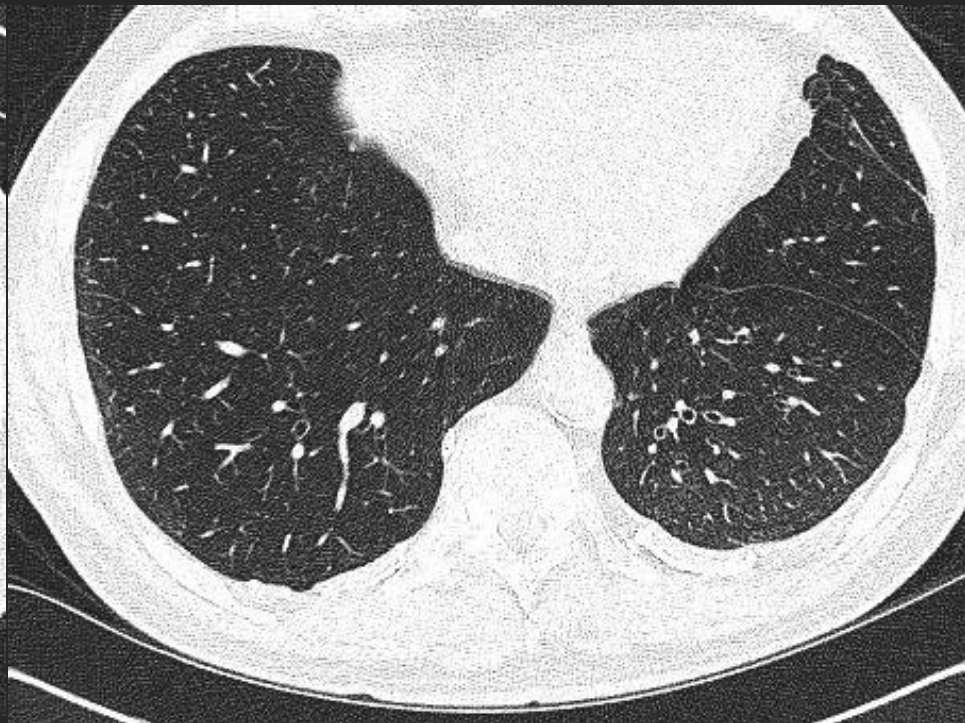
HRCT: Asbestosis



Asbestosis: HRCT Position



Prone



Supine

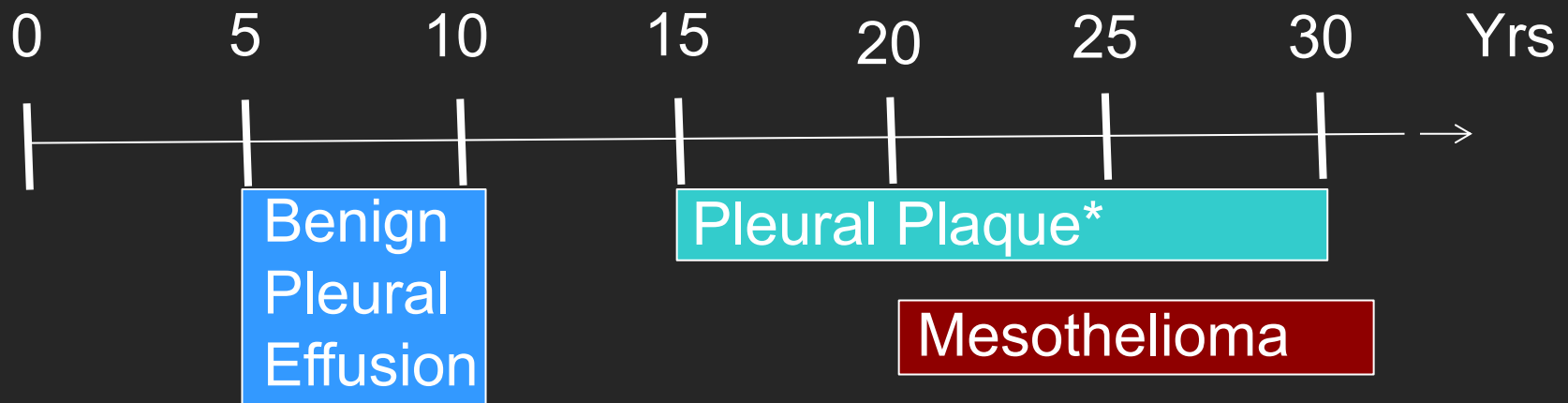
Asbestos and Malignancy

- Lung cancer and mesothelioma peak between 2010 and 2030
- Combined 30,000 cancers/year.
- Lung cancer develops in up to 25% of heavily exposed individuals
- Latency of 15-20 years
- Risk with smoking is multiplicative 50-80X

Mesothelioma

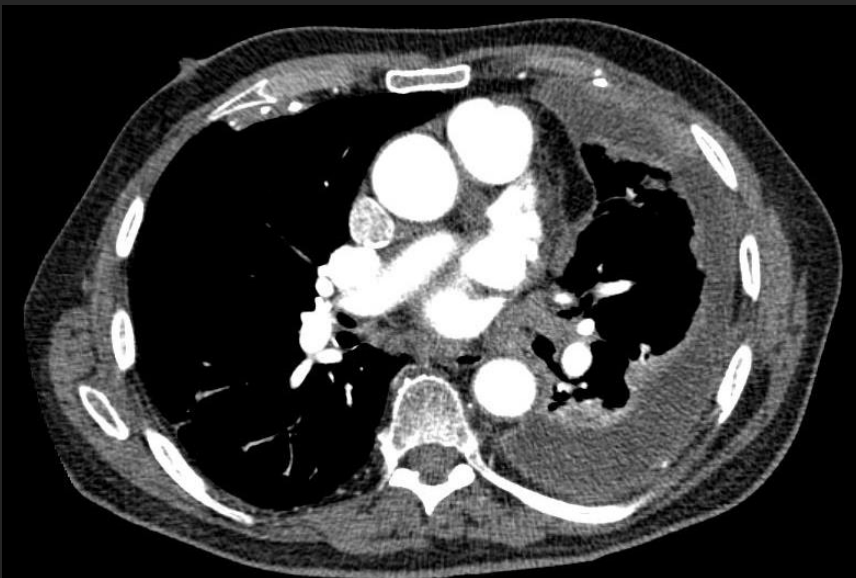
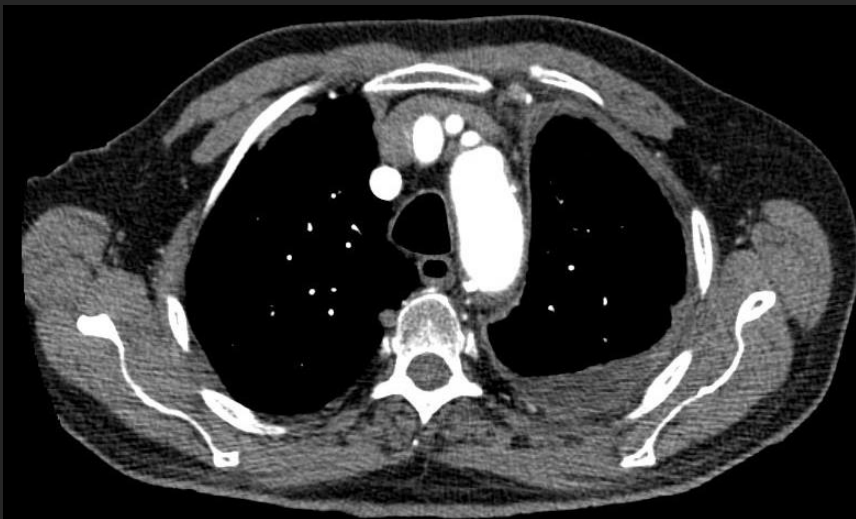


Timing of Asbestos Pleural Changes

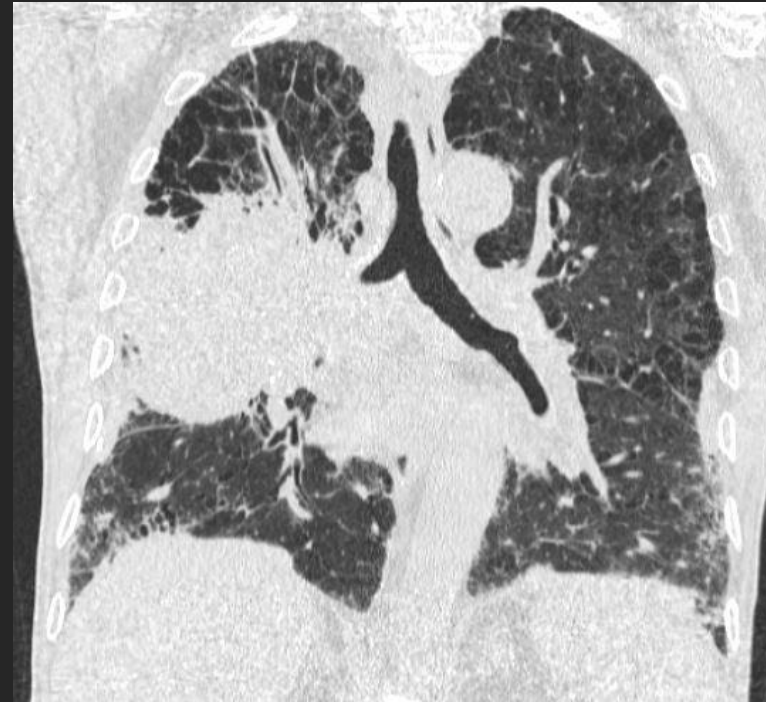


*Note: benign pleural effusion and pleural plaque are temporally separated.

Mesothelioma



Asbestosis and Lung Cancer



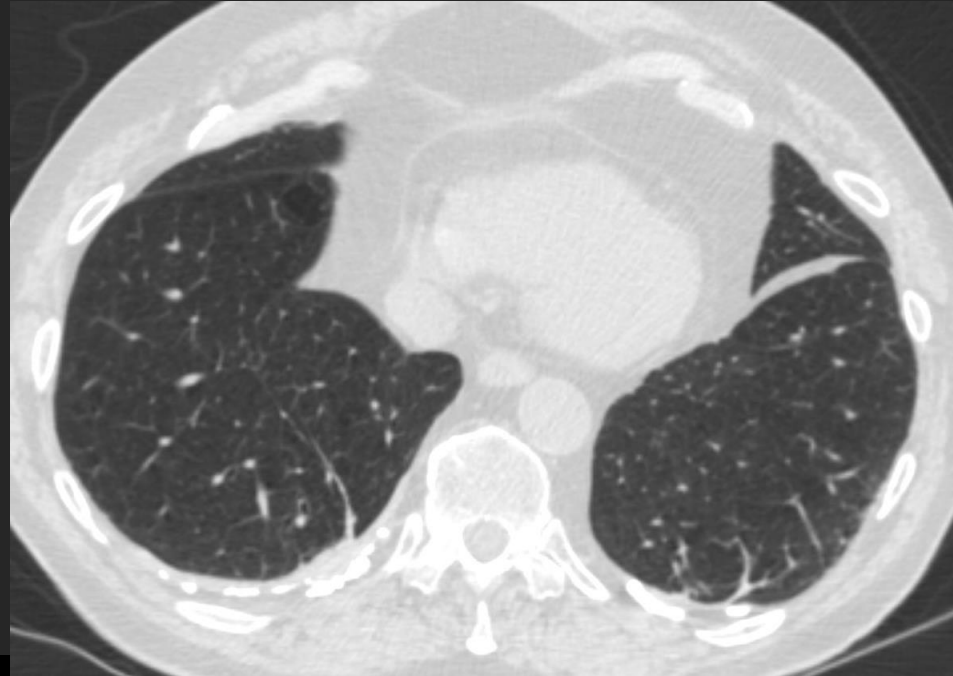
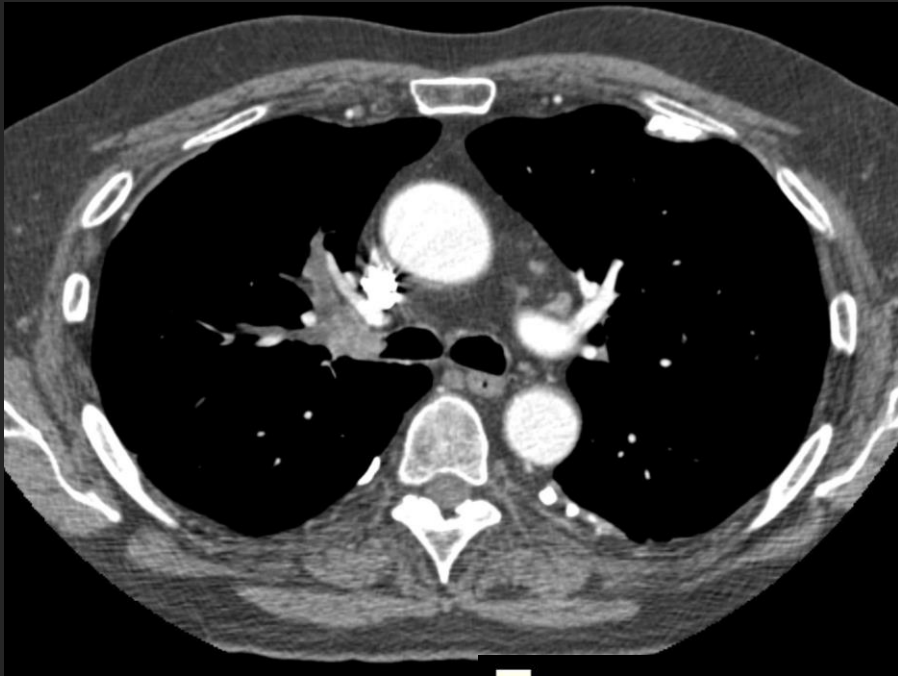
Asbestos and Lung Cancer



Asbestos and Lung Cancer



Asbestos and Lung Cancer



Summary: Asbestos

- Pleural plaque
- Diffuse pleural thickening
- Round atelectasis
- Asbestosis
- Malignancy
 - Mesothelioma
 - Lung cancer