Radiology of Asbestos-related Diseases

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Asbestos-related conditions

I. Benign Pleural Disease
   A. Pleural effusion
   B. Pleural plaques
   C. Diffuse pleural thickening
   D. Round atelectasis

II. Asbestosis

III. Malignant mesothelioma

IV. Bronchogenic carcinoma
Asbestos

- silicate mineral
- Fire-resistant, thermal & electrical insulator
- Insulation, brake pads, floor tiles, electric wiring, paints, cements.
- Serpentine fibers: chrysotile (>90%)
  - curly & flexible
- Amphibole fibers: crocidolite, amosite
  - stiff and straight
  - Coated w/ ferritin → ferruginous bodies
Imaging Modalities

- Chest radiograph: Screening tool
  - International classification system for PA CXR in reference to standard radiographs
  - Parenchymal dz: shape, size, profusion
  - Pleural thickening: site, width, extent, calcification

- HRCT: more sensitive than radiography
  - 97% sens., 100% spec. in detection of pleural dz
  - No international std
  - Reserved for further eval: clarifying pleural thickening, staging mesothelioma & lung CA, planning biopsy
I. Pleural effusion

- Earliest, w/n 10 yrs of exposure
- Hemorrhagic exudates
- Resolve over few MO’s
- Diffuse pleural thickening often follows
Bilateral pleural effusion

Layered pleural effusion

PA

L lateral decubitus
Pleural Effusion

Pt BR

Pleural calcifications & thickening

Pleural thickening

Pleural effusion

PACS, BIDMC
DDx of Exudative Pleural Effusion

- Parapneumonic effusion
- TB
- Malignancy
- PE
- Pancreatitis
- Connective tissue dz
- Trauma
- Azotemia
- drugs
II. Pleural Plaques

- Fibrosis due to inflammatory reaction
- Usual asymptomatic
- 20-30 years after exposure
- 10-15% calcify
- Conventional CT 95% sensitive, CXR 59%; HRCT 100%.
Distribution of plaques

- Usually from parietal pleura:
  - Posterolateral chest wall 7-10th ribs
  - Lateral chest wall 6-9th ribs
  - Dome of diaphragm (pathognomonic)
  - Mediastinal pleura

- Apices & costophrenic angles spared

- CT: anterior & paravertebral plaques

- Visceral plaques assoc’d w/ parenchymal dz:
  - Hairy plaques
  - Extensive opacities
Pleural Plaques

pleural plaques
Pleural Plaques

Pt SS

Pleural plaques
Pleural plaques

Bilateral pleural plaques
Pleural Plaques

Calcified pleural plaques
Pleural Plaques

Pt SS

Calcification

Pleural plaques

calcification
DDx Pleural Plaques

- Adipose tissue (HRCT)
- Rib fracture
- Companion shadows for ribs (soft tissue)
- Pleural masses, e.g. mets
III. Diffuse Pleural Thickening

- Less specific for asbestos exposure
- Benign effusion ➔ inflam., thickening & fibrosis of visc. pleura (lymphatics) ➔ fusion w/ parietal pleura
- Costophrenic angles & apices
- Irregular margins, continuous sheets, involves interlobar fissures (visc. pl.), resp. impairment: vs. plaques
- CT more sens. & spec. than CXR (100% vs. 70%)
Diffuse Pleural Thickening

Pt J M2

Pleural thickening
Diffuse Pleural Thickening

Pt BR

Pleural thickening
Diffuse Pleural Thickening

Pleural thickening
DDx Diffuse Pleural Thickening

- Organizing effusion
- Chronic infxn, e.g. TB
- Connective tissue dz
- Talcosis
- Pleural mets
- mesothelioma
IV. Round Atelectasis

- Inflam rxn & fibrosis in pleura → fibrous tissue contracts → pleura folds into lung → atelectasis
- aka “asbestosis pseudotumor” or Blesovsky Sx
- “comet tail” of bronchovascular struc’s
- Usu w/ pleural thickening, volume loss
- Stable or shrinks w/ time
- MRI: T1 signal similar to liver; vasculature, visc. pleura
- U/S: echogenic visc. pleura
Round Atelectasis

- Rounded atelectasis
- Pleural thickening
- Comet tail

CT supine
HRCT prone
Round Atelectasis

Pt WB

Round atelectasis w/ comet tail

Pleural thickening

PACS, BIDMC
DDx Round Atelectasis

- Lung CA
- Pseudotumor (pleural effusion)
- Infection (e.g. round pneumonia, aspergillosis, histoplasmosis, TB)
- sequestration
V. Asbestosis

- Lung fibrosis caused by asbestos dusts, +/- pleural fibrosis
- Dose responsive
- Lag 20 - 40 yrs (short as 3 yrs w/ heavy expo)
- Neutrophils & macrophages release fibrogenic mediators → fibrosis spreads from resp. bronchioles & alveolar ducts
- Lower lobes & subpleural → middle lobe & lingula → upper lobe in advanced dz
- 7-17% honeycombing (adv. dz)
CXR features of Asbestosis

- Ground Glass Opacities
- Small nodules
- Shaggy cardiac silhouette
- Ill-defined diaphragmatic contours
- Adv. dz: honeycombing, volume loss
- 80% coexisting pleural dz (100% HRCT)
- Fibrous bands radiate inward from pleura
Asbestosis

Pt JM2

Lossy Compressed

Pleural thickening

Shaggy cardiac silhouette

Interstitial fibrosis

Pleural plaques

PACS, BIDMC
HRCT for Asbestosis

- More sensitive than CXR
- Interstitial lines
- Parenchymal bands
- Early: subpleural curvilinear opacity (peribronchiolar fibrosis)
- GGO (alv. wall fibrosis)
- Subpleural dotlike nodular opacities
- Thickened interlobular septa
- Honeycombing
Asbestosis

Pt JM2

Calcified pleural plaques

GGO

honeycombing

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Asbestosis

Pt WB

Parenchymal band

Septal thickening

Pleural thickening
DDx Asbestosis

- Usual interstitial pneumonitis:
  - Idiopathic pulmonary fibrosis
  - Chronic drug toxicity
  - Fibrosis due to collagen vascular dz (e.g. RA)
VI. Malignant Mesothelioma

- Pleura & peritoneum, can - pericardium or tunica vaginalis testis
- Most common primary neoplasm of pleura
- Crocidolite, amosite
- Latency 35-40 yrs
- Most pts die w/n 1 yr of dx.
- Either pleural layer
- CXR: usu. w/ effusion, pleural thickening → retraction of chest wall
- Direct spread into surrounding mesothelial sacs, LN, hematogenous met
Malignant Mesothelioma

Pt LF

mesothelioma

Pleural plaque

PACS, BIDMC
CT: Malignant Mesothelioma

- contraction of hemithorax, extension along fissures, invasion.
Malignant Mesothelioma

Pt LF

Pleural effusion

Mesothelioma (nodular thickening of pleura)

PACS, BIDMC
Invasion

Pt LF

Endobronchial invasion of distal left main bronchus

Loculated pleural effusion

Pericardial invasion

PACS, BIDMC
Infradiaphragmatic Invasion

Pt LF

Left diaphragm

spleen

Possible infradiaphragmatic extension adj. to spleen

PACS, BIDMC
DDx Malignant Mesothelioma

- Benign Pleural thickening
  - infxn
  - Diffuse pleural thickening
- Met adenoCA
- Benign mesothelioma (solitary fibrous tumor)
VII. Bronchogenic Carcinoma

- Amphiboles (10-50x greater risk)
- Risk w/ combined asbestos exposure & smoking is multiplicative
- Variable latent period (~10-30 yrs)
- Anywhere in lungs
Bronchogenic CA

Pt J M1

Laxcy Compressed

Bronchogenic CA

PACS, BIDMC
Lymphadenopathy in Bronchogenic CA
Metastasis

Pt JM1

met

Met with blood products

T2

susce

PACS, BIDMC
Bronchogenic CA

Pt MF

RUL adenoCA
Fluorine-18 Fluorodeoxyglucose PET:

- Uptake of FDG in malignant mesothelioma & bronchogenic carcinoma much greater than benign pleural dz
- Nodal dz
- Less anatomic detail
F-18 FDG PET Tumor Imaging

Mediastinal lymph nodes

CA
After Chemo- & Radiation Therapy

Pt MF

CA with spiculation
18-F FDG PET after Chemo- & Radiation Therapy

Pt MF

Significant decrease in size & FDG intensity of mass

Esophagus, radiation induced changes

Lymph nodes

PACS, BIDMC
DDx Bronchogenic CA

- Pseudotumor
- Sequestration
- Round atelectasis
- Infection (fungal, granulomatous, e.g. TB)
- Sarcoid
- Scarring
- Hamartoma
- Intrapulmonary lymph node
- AVM
Other Asbestos-related Diseases

- Peritoneal mesothelioma
- CA larynx & kidney
- Nodular pulmonary amyloidosis (?)
Review: I. Pleural Effusion
Review: II. Pleural plaques
III. Diffuse Pleural Thickening
Review: IV. Round Atelectasis

Pt WB
Review: V. Asbestosis
VI. Malignant Mesothelioma
Review:

VII. Bronchogenic CA
Review: VIII. F-18 FDG PET Tumor Imaging

Pt MF
References

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