Interstitial Lung Disease

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Disclosure

• I have no relevant commercial relationships to disclose.

Objectives

• To review basic HRCT Patterns and the distribution of these patterns
• To develop an approach to differential diagnosis based on HRCT patterns and distribution of abnormalities for the evaluation of interstitial lung disease

Technique

• Thin collimation (1 mm)
• Inspiration (volumetric)
• Expiration (incremental q 2 cm)
• Prone (1-2 cm, lower chest)
• High-spatial frequency reconstruction algorithm

Small Airways Disease

Inspiratory vs. Expiratory Imaging

Inspiratory

Expiratory
Tracheomalacia

Inspiratory  Expiratory

HRCT Patterns

- Reticular Abnormality
- Nodules
- Tree-in Bud
- Ground Glass attenuation
- Mosaic attenuation

Reticular Abnormality

- Inter and intralobular septal thickening
- Traction bronchiectasis
- Honeycombing

- Associated findings
  - peribronchial interstitial thickening
  - thickening of fissures
  - prominence of centrilobular arteries

Interlobular Septal Thickening

Smooth
- Interstitial infiltration
- no distortion

Nodular
- perilymphatic distribution
- Pulmonary edema
- Lymphangitis
- NSIP
- Amyloid (rare)
- Sarcoildosis
- Lymphangitis
- NSIP
- Chronic HP
- Sarcoidosis
- Asbestosis
- Drugs

Irregular
- Lung distortion strongly suggestive of FIBROSIS
Interlobular Septal Thickening

- Distribution
  - Central vs. Peripheral

- Predominant in:
  - Upper lobes
  - Along bronchovascular bundles?
  - Lower lobes

Interlobular Septal Thickening - Smooth

Pulmonary Edema

Interlobular Septal Thickening - Nodular

Lymphangitis

Inter and intralobular Septal Thickening - Irregular

Traction Bronchiectasis

- Bronchi -
  - irregular/corkscrew dilatation of small peripheral bronchioles
  - mucous plugging absent

- associated with reticular pattern or lung distortion (occasionally honeycombing)

- D/D
  - NSIP/UIP - IPF
  - Collagen Vascular disease
  - Sarcoidosis
  - Chronic Hypersensitivity pneumonitis
**NSIP**
- ground-glass attenuation
- fine reticulation
- traction bronchiectasis
- peripheral predominance
- basal predominance
- NO honeycombing
- Better prognosis than UIP

**Chronic HP**

**Sarcoidosis**

**Drug Toxicity - Gemcytobine**

**Honeycombing**
- Extensive pulmonary fibrosis, alveolar destruction, irreversible
  - thick-walled air filled cysts (3mm-1cm)
  - cysts share walls
  - several layers at pleural surface
  - secondary pulmonary lobules difficult to recognize
  - +/- traction bronchiectasis
- D/D
  - IPF - UIP / Collagen Vascular Disease
  - Drugs
  - Chronic hypersensitivity pneumonitis
  - End stage sarcoidosis
  - Asbestosis
IIP Prognosis: UIP & NSIP
Flaherty et al. Thorax 2003:58:143-8

HRCT accuracy
• 27/27 (100%) def/prob UIP on HRCT had UIP histologically
• 18/44 (41%) with def/prob NSIP on HRCT had NSIP histologically

Nodules - Distribution
Nodules - Anatomic Distribution (Colby)
• lymphatic
• random
• bronchiolocentric
• angiocentric

HRCT
• Perilymphatic
• Random
• Centrilobular

Perilymphatic nodules

Perilymphatic Nodules
• Perilymphatic nodules
  – sarcoidosis
  – lymphangitic tumor
  – silicosis or coal workers pneumoconiosis
  – Lymphocytic interstitial pneumonia (LIP)*
  – amyloidosis*

• Bronchoscopy - diagnostic
• Clinical history may obviate Bx

Perilymphatic nodules

Lymphangitic Spread of Tumor
**Random Nodules**
- Random distribution relative to structures of secondary pulmonary lobule
- Diffuse and uniform, well-defined
- Subpleural nodules often seen
- Bronchoscopy - often diagnostic

**Differential Diagnosis**
- Miliary TB
- Hematogenous metastases
- Fungal Infection
- Sarcoid (rare)
- BACC

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**Centrilobular Nodules**
- Bronchiolar/peribronchiolar abnormality in relation to centrilobular bronchiole/artery
  - Centered 5-10 mm from pleura
  - Ill-defined
  - Evenly spaced
  - Diffuse/patchy
- Centrilobular nodules - predominant finding (small airways disease – HP)
- Trans bronchial Bx/BAL - diagnostic

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**Hypersensitivity Pneumonitis**

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**Respiratory Bronchiolitis**
- Poorly defined centrilobular nodules
- GGO
- UL > LL
- Smokers!
**Tree-in-bud**

- centered 5-10 mm from pleural surface
- airway disease - impaction of small CL bronchi
- Diagnosis
  - sputum culture
  - BAL
- Almost always - infection
- **Differential Diagnosis**
  - Infection
    - TB
    - MAC
    - Fungus
    - Bacteria
  - Airways Disease
    - CF
    - Bronchiectasis
  - Endobronchial spread of tumor (rare)

**Ground-glass attenuation**

- Hazy increase in lung attenuation, not associated with vascular obscuration
- Abnormality below resolution of CT
- Minimal interstitial thickening or minimal airspace filling
- GGO non-specific, but important
  - active infl process - potentially reversible
  - fibrosis - potentially irreversible

**Desquamative Interstitial Pneumonitis**

- Rare
- 90-95% cigarette smokers
- ground glass opacity
- +/- mild septal lines
- subpleural 60%; diffuse 40%
- no lower lobe predominance
Crazy Paving

- Ground-glass attenuation and septal thickening
- Differential Diagnosis
  - Alveolar proteinosis (subacute symptoms)
  - Pneumocystis or viral pneumonia
  - Edema
  - Hemorrhage
  - ARDS

Mosaic Attenuation

Mosaic Attenuation/Perfusion

- Patchy areas of decreased lung attenuation
  - abnormal bronchi in lucent lung regions
  - vessels small in lucent regions
  - vessels and bronchi normal in relatively high attenuation regions, or greater in size and number

Mosaic Attenuation/Perfusion

- Airways disease
  - B.O.
  - Bronchiectasis
  - HP
  - Air trapping on expiration

- Pulmonary Vascular Disease
  - Chronic PTE
  - Enlarged main pulmonary A
Inspiratory Expiratory

Mosaic Attenuation
• Pulmonary vascular disease (Chronic PE)

High Resolution CT Diagnosis
• Pattern of abnormality
• Distribution of disease
  – Unilateral vs. bilateral
  – Upper vs. lower lobe predominance
  – Peripheral vs. central
• Associated findings
• Clinical history
• Prior probability

Summary
• Recognize High resolution computed tomography (HRCT) patterns of diffuse lung disease.
• Generate a differential diagnosis based on the HRCT pattern and distribution of findings.

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