Usual Interstitial Pneumonia and Acute Exacerbation

Andrew Synn, HMSIII
Gillian Lieberman, MD, BIDMC Radiology
November 2008
Agenda

- Brief clinical history of our patient
- Review of usual interstitial pneumonia/idiopathic pulmonary fibrosis
- Radiologic approach to evaluating suspected idiopathic pulmonary fibrosis
- Clinical course of our patient and imaging of acute exacerbation of idiopathic pulmonary fibrosis
Our Patient JB: Clinical History

- JB is a 60M with a one-year history of progressive SOB and dry cough
- Pulse oximetry during exercise demonstrated desaturation to 84%
- PFTs showed mild/moderate restriction
- CXR was obtained
Our Patient JB: Initial chest radiograph

Findings:

- Slightly increased interstitial lung markings
- Low lung volumes
  - (arrow on 8th posterior rib)
- Given clinical suspicion for IPF, recommend CT

PA chest radiograph, patient JB.
Image source: BIDMC (PACS)
UIP: Terminology and Clinical Presentation

- **Terminology:**
  - Usual interstitial pneumonia (UIP) is a histopathologic term
  - Idiopathic pulmonary fibrosis (IPF) is the clinical syndrome associated with idiopathic UIP

- **Common clinical presentation:**
  - Male, > 50 y.o.
  - Progressively worsening dyspnea and nonproductive cough over >6 mo
  - Dry, bibasilar, inspiratory rales
  - Restrictive physiology on PFTs
UIP: Pathogenesis

Pathogenesis:
- Unknown primary insult that leads to fibrotic response
- Sequence of events: currently under revision
  - Previously thought to be due to chronic inflammation leading to widespread fibrosis
  - However, inflammation is not a prominent histopathologic finding in the large majority of cases of IPF/UIP
  - Currently thought to be result of repeated acute lung injury with aberrant wound healing, and resultant exuberant fibroblastic proliferation
UIP: Risk Factors

Risk Factors:
- Age
  - Rare below age of 40
  - 67% of patients are over 60 years of age at presentation
- Male gender
- Caucasian
- Smoking
  - Risk appears to increase with increasing pack-year history
- Familial syndromes have been described (rare)
Treatment:
- For many years, corticosteroids were mainstay of therapy
  - However, IPF is poorly responsive to steroids
  - Correlates with recent findings that IPF shows only minimal inflammation
- Anti-fibrotic agents currently under investigation
  - Pirfenidone, bosentan

Prognosis: generally quite poor
- Mean survival 2-3 years after diagnosis
- 20% 5-year survival rate
UIP: Diagnosis and DDx

- **Diagnosis:**
  - Radiography plays an important role!
    - UIP may be diagnosed without biopsy in patients with characteristic history, physical, and imaging findings
  - Correct diagnosis is important as other causes of fibrosis may be treatable and/or reversible
  - Surgical biopsy required for definitive diagnosis
- **DDx:**
  - Diseases that may have UIP pattern (but are not idiopathic): Drug-induced fibrosis, environmental exposures, infections, and connective tissue diseases
  - Other diseases: NSIP, hypersensitivity pneumonitis
UIP: Menu of Radiographic Tests

- Menu of tests used to approach suspected IPF:
  - CXR
  - Chest CT
CXR for Evaluating UIP

- Chest radiograph remains an appropriate initial radiographic test for suspected IPF
  - Cost-effective, widely available, less radiation
  - Sensitive
    - Only 5-10% of interstitial lung diseases will have normal chest radiograph throughout course
    - May be normal early in disease process
  - Non-specific findings
    - In general, CXR correlates poorly with histopathologic pattern, anatomic distribution of disease, and the severity of disease
Companion Patient #1: UIP on CXR

- Increased interstitial markings (nonspecific)
- Peripheral honeycombing (specific for UIP)
- Apico-basilar gradient (relatively specific for UIP)

PA chest radiograph, companion pt. #1.
Image source: BIDMC (PACS)
For further characterization of UIP, non-contrast chest CT is the most sensitive and specific radiologic modality.

High resolution CT (HRCT) uses very thin image slices (1mm) to obtain higher resolution of the lung parenchyma.

In appropriate clinical setting, HRCT findings may be sufficiently characteristic to preclude the need for surgical biopsy in IPF.
Characteristic Findings of UIP on Chest CT

- Characteristic findings:
  - Reticular opacities
  - Subpleural, macrocystic honeycombing and traction bronchiectasis
  - Apicobasilar gradient
  - Heterogeneity

- Findings that suggest alternative diagnosis:
  - Lack of any of above findings
  - Extensive ground glass opacities
  - Nodularity
Our Patient JB: UIP on Axial CT

- Subpleural honeycombing
- Traction bronchiectasis
- Reticular opacities
- Focal ground glass opacities
- Enlarged mediastinal LN
- Large areas of relatively preserved lung

Non-contrast, axial chest CT, patient JB. Image source: BIDMC (PACS)
Our Pt JB: UIP on Axial CT

- Apico-basilar gradient is clearly demonstrated on inferior section
- Subpleural honeycombing
- Reticular opacities
- Ground glass opacities

Non-contrast, axial chest CT, patient JB.
Image source: BIDMC (PACS)
Companion Patient #2: Severe UIP on Axial CT

- Honeycombing
- Reticular opacities
- Extensive ground glass opacities
- Traction bronchiectasis

Non-contrast, axial chest CT, companion pt. #2
Image source: Lynch DA, et. al.
Companion Patient #3: UIP on Coronal CT

- Honeycombing
  - Reticular opacities
  - Ground glass opacities
  - Traction bronchiectasis
  - Obvious apico-basilar gradient

Non-contrast, coronal chest CT, companion pt. #3
Image source: Mueller-Mang C, et. al.
Mr. JB was enrolled in an investigational study and remained clinically stable for 8 months.

However, over a three week period, Mr. JB experienced a rapid decline in respiratory status:
- Oxygen saturation low 80s on 5L O2 NC
- Admitted to the BIDMC MICU
Our Patient JB: Acute Exacerbation of UIP on Axial CT

- More extensive honeycombing
- Increased reticular opacities and central involvement
- Substantial extension of diffuse ground glass opacity affecting all lobes of the lung

Contrast-enhanced, axial chest CT, patient JB
Image source: BIDMC (PACS)
Our Patient JB: Acute Exacerbation of UIP on Sagittal CT

- Sagittal reconstruction
- Similar findings to previous image
- Marked loss of lung volumes
Acute Exacerbation of IPF

- Abrupt (< 4 weeks) and unexpected worsening of underlying lung disease without obvious cause
  - Rule out infections, PE, PTX, or CHF
- Mortality during episode 67 - 100%
- May account for up to 50% of deaths attributable to IPF
- Chest CT findings: new, diffuse opacities
  - Pattern of diffuse alveolar damage on background of UIP
Summary (1)

- IPF is a chronic, fibrosing interstitial pneumonia of unknown cause
- Has a characteristic clinical and radiographic presentation
- CXR is the usual initial imaging modality
  - Non-specific findings
- HRCT
  - Specific and sensitive for UIP
Summary (2)

- Classic findings on HRCT:
  - Reticular opacities
  - Honeycombing
  - Traction bronchiectasis
  - Apico-basilar gradient
  - Heterogeneity

- These findings on HRCT are diagnostic for UIP when combined with appropriate clinical presentation
Summary (3)

- **Acute exacerbation of IPF:**
  - Rapid decline in pulmonary function
  - Findings on HRCT:
    - Diffuse, rapid worsening of reticular and alveolar opacities
    - Pattern of DAD on the background of IPF
  - Very high mortality rate
Acknowledgments

- Dr. Peter LaCamera of BIDMC Pulmonology for his help in case acquisition and radiographic interpretation
- Dr. David Roberts of BIDMC Pulmonology for his help in case acquisition
- Dr. Gillian Lieberman, BIDMC Radiology
- Maria Levantakis, BIDMC Radiology
- Larry Barbaras, Webmaster
References