Interstitial Lung Disease

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Case #1

Case #1

- **57 y.o. WM with a history of shortness of breath and cough that has been present for 1 year**
- **Initially worse with walking, moderate exertion. No resting symptoms.**
- **Now activity limiting**
- **Associated with a dry, nonproductive cough**
- **Negative cardiac evaluation**

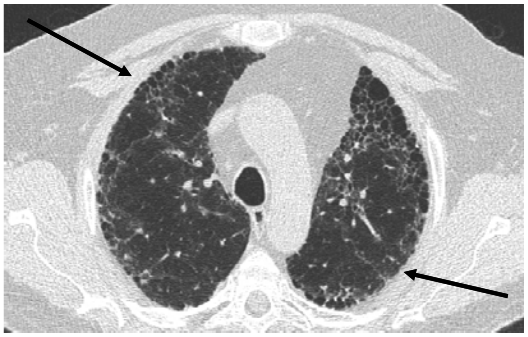
- **PMHx: HTN**
- **Meds: HCTZ**
- **SOCHx: 30 pack year smoking history, quit 10 years ago**

Case #1

- **PE: HR 78, BP 138/67, sats 96% on room air**
  - **Lungs with bibasilar dry crackles**
  - **Ext with clubbing**
- **PFTs:**
  - **FVC 69% predicted**
  - **FEV1 72%**
  - **TLC 62%**
  - **DLCO 53%**
  - **6 Minute walk: Walks 1100 feet with an initial sat of 96% dropping to 79% on room air**

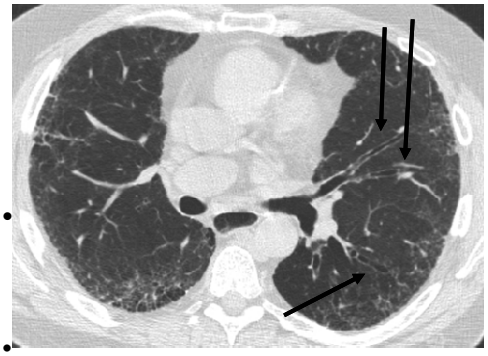
Case #1

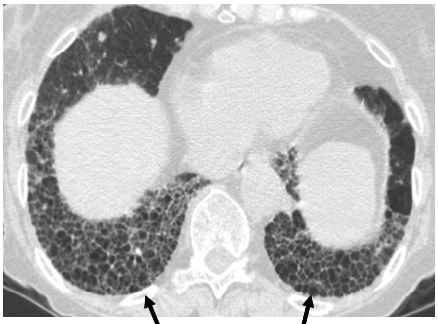
- **CT scan**
  - **Subpleural fibrosis**



Case #1

- CT scan
  - Traction bronchiectasis

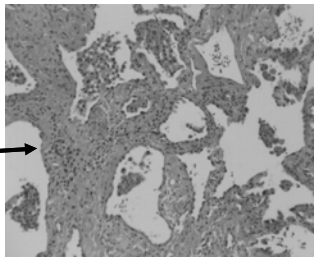


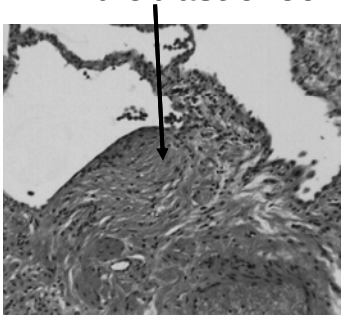


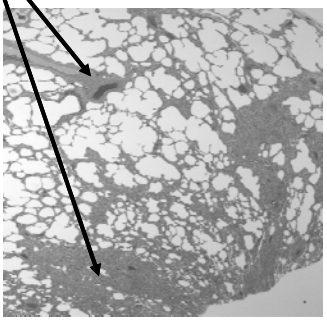
Honeycombing

Case #1

- Lung biopsy
  - Interstitial thickening
  - Temporal heterogeneity
  - Fibroblastic foci







Idiopathic Pulmonary Fibrosis

- Most common ILD of unknown etiology
- Mainly affects people > 50 yo, most are over the age of 60 yo
- Incidence is estimated at 7.4-10.7 cases per 100,000 per year
- Prevalence of IPF is estimated at 13-20/100,000
- Most are current or former smokers
- Potential risk factors for developing IPF include cigarette smoking, occupational/environmental exposures

Idiopathic Pulmonary Fibrosis

- History/Exam
  - Gradual onset and progressive dyspnea and/or a nonproductive cough
  - Bibasilar inspiratory crackles (Velcro crackles)
  - Clubbing also common
  - Later in the clinical course, signs of right heart failure and peripheral edema
- No characteristic lab findings
  - Positive autoimmune serologies
- PFTs show restriction, low diffusing capacity and desaturation with exertion

Idiopathic Pulmonary Fibrosis

- Diagnosis based on imaging, lung biopsy
- High resolution chest CT scan can be very specific for the diagnosis of IPF
    - Subpleural, basal predominance
    - Interstitial/reticular infiltrates
    - Honeycombing with or without traction bronchiectasis
- Biopsy findings: Usual interstitial pneumonitis (UIP) pathologic pattern
    - Temporal heterogeneity
        - » Alternating areas of normal lung, interstitial inflammation, fibrosis, and honeycombing
    - Most severe in the subpleural region of the lung
    - Fibroblastic foci

Idiopathic Pulmonary Fibrosis

- Prognosis
    - Progressive course, acute exacerbations
    - 80% mortality at 5 years
- Treatment
    - No evidence of benefit in patients with IPF treated with corticosteroids alone or a combination corticosteroid and immunosuppression
    - Participation in clinical trials encouraged
    - Supplemental oxygen
    - Pulmonary rehabilitation
    - Treatment of GERD
    - Lung transplant evaluation

Case #2

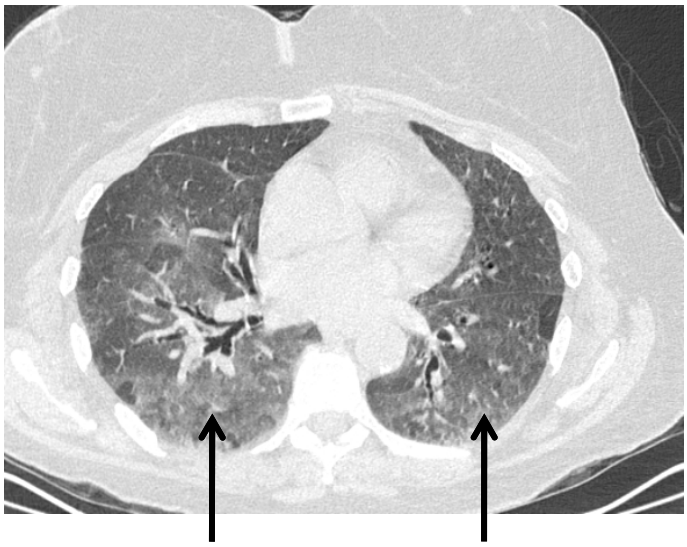
Case #2

- 64-year old woman with 1 year history of cough and dyspnea
- Started on home oxygen 6 weeks previously
- Past medical history: uterine CA 1998 (hysterectomy & XRT)
- Social history: non-smoker with feather pillow
- Exam: basilar crackles without digital clubbing

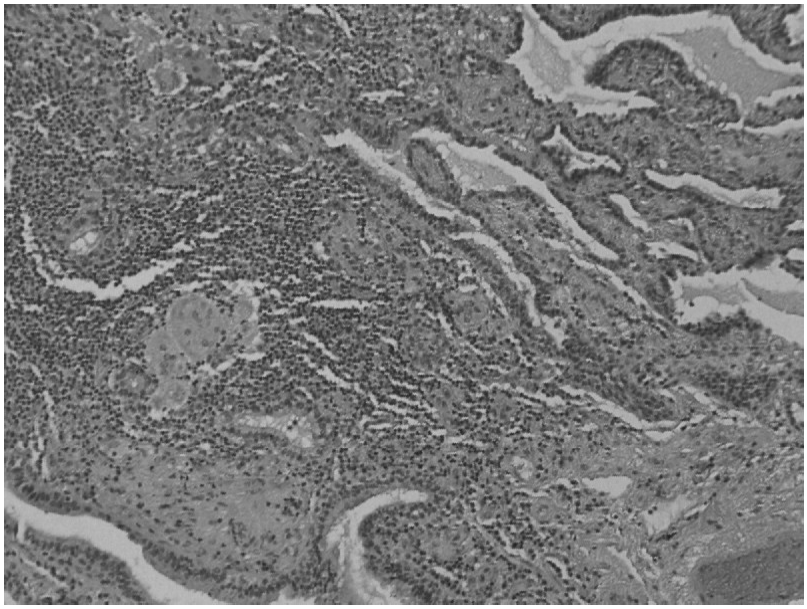
Pulmonary Function Tests

• FVC	1.88	50%
• FEV1	1.59	58%
• TLC	3.84	77%
• DLCO	13.1	66%

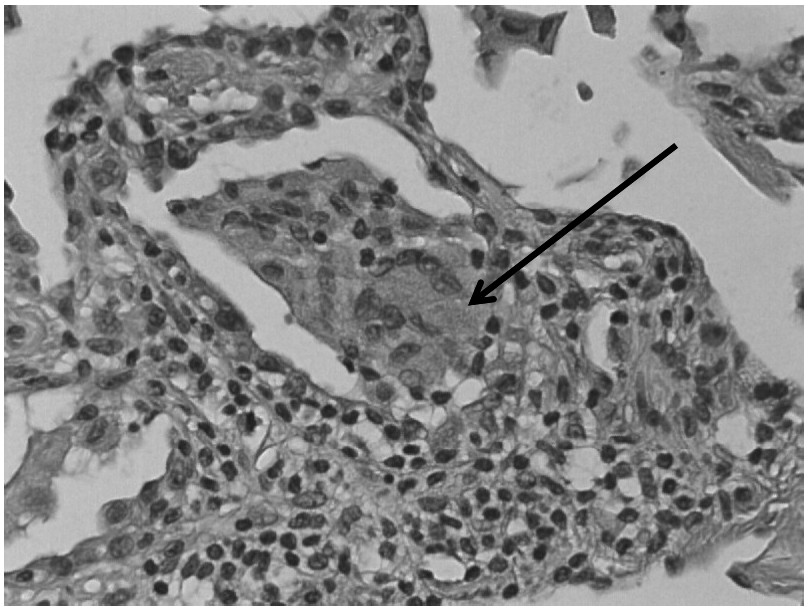
Restriction with a low diffusing capacity



Diffuse Ground Glass Infiltrates



Lymphocytic & granulomatous infiltrates



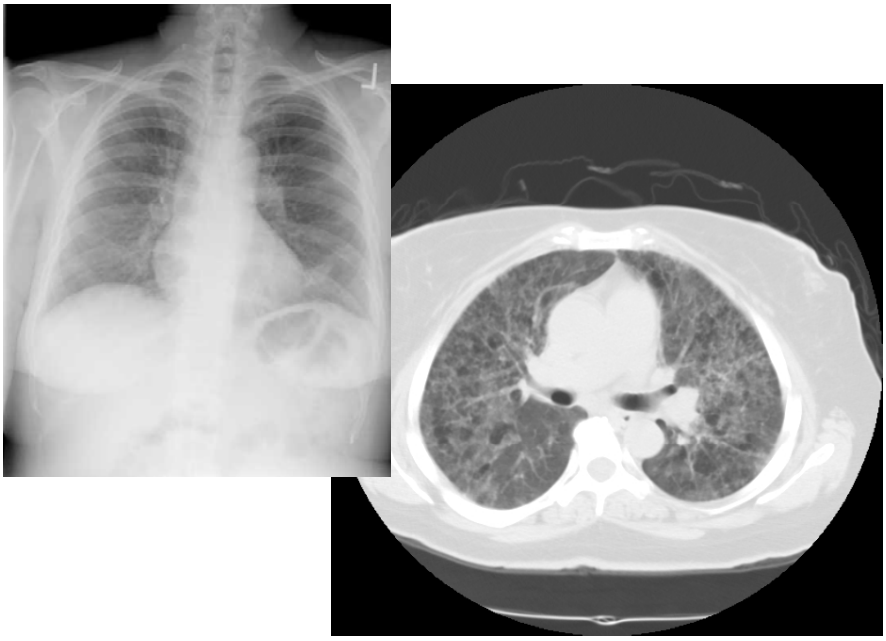
Poorly-formed granulomas

Hypersensitivity Pneumonitis

- Etiology often hard to identify
  - Birds, feathers, down
  - Hot tubs
  - Occupation
  - Drugs
- Pathology:
  - T-suppressor cell alveolitis
  - Poorly formed granulomas
- Laboratory:
  - Serology can aid in clinical assessment
- Treatment:
  - Remove offending antigen
  - Prednisone
- Outcome:
  - Complete resolution
  - Chronic fibrosis

Photo: Kathrin Gaisser

Photo: David Shankbone



Case #3

Case #3

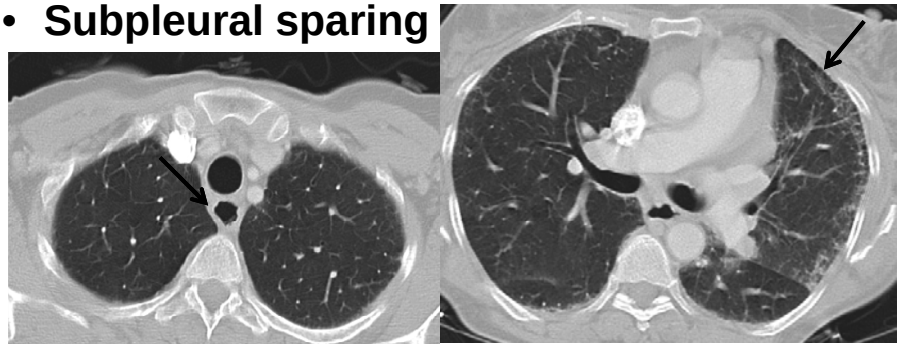
- 49yo AAF with a several month history of progressive cough, SOB/DOE especially climbing stairs
- Rash involving face, neck
- GERD and dysphagia

- PMHx: (-)
- SOCHx: non-smoker, no exposures

- Exam: basilar dry crackles, no clubbing, rash, synovitis
- PFTs: restriction, no desat with exertion
- Autoimmune evaluation: (+) ANA, (+) CK

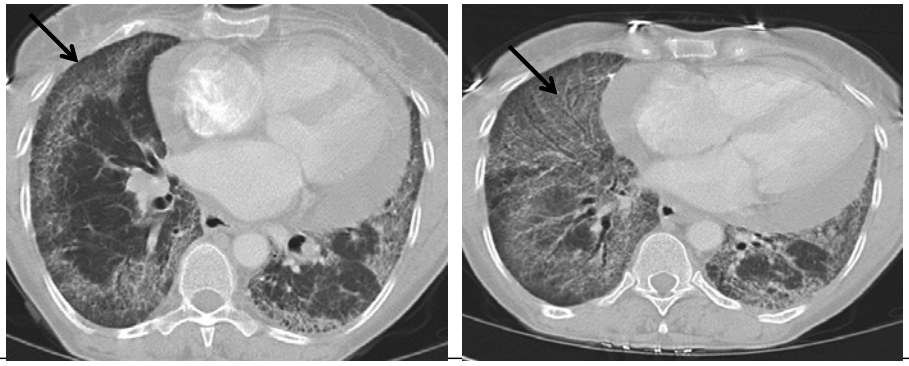
Case #3

- Interstitial infiltrates
- Subpleural sparing



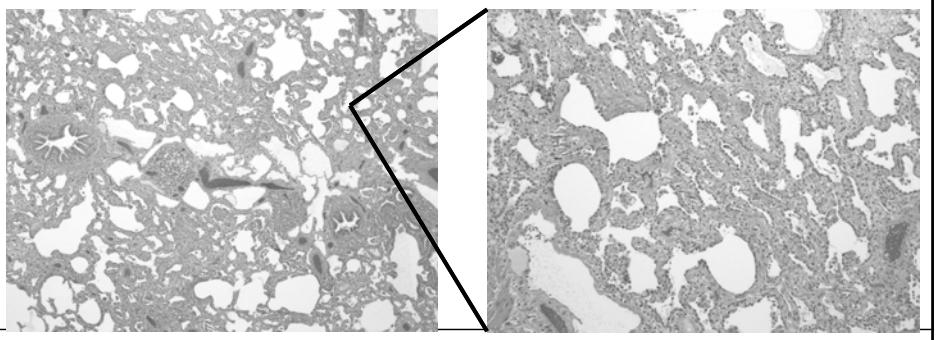
Case #3

- Ground glass infiltrates
- Subpleural sparing of infiltrate and fibrosis
- No honeycombing



Case #3

- Interstitial fibrosis
- Temporal homogeneity



Non-Specific Interstitial Pneumonitis

- Second most common idiopathic interstitial pneumonia
- Affects men and women equally with an average age about 10 years younger than IPF
- Shortness of breath and dry cough
- Physical findings include inspiratory crackles, clubbing

- Often associated with autoimmune disease
    - Patients with connective tissue disease, especially systemic sclerosis and polymyositis/dermatomyositis
    - Lung disease can precede signs of systemic autoimmune disease

Non-Specific Interstitial Pneumonitis

- High-resolution CT
    - Nonspecific combination of ground glass opacities, consolidation, and irregular lines
    - Peripheral subpleural distribution, lower lung
    - Subpleural sparing
- Pathology
    - Temporally uniform interstitial inflammation with varying degrees of fibrosis
    - Cellular NSIP
        - » Prominent inflammation without significant fibrosis
    - Fibrotic NSIP
        - » Significant fibrosis with little or no inflammation

Non-Specific Interstitial Pneumonitis

- **Important to differentiate from UIP/IPF**
  - **NSIP 5 year mortality <10%**
  - **Survival > 6-10 years**
- **Treatment**
  - **Corticosteroid therapy, generally with corticosteroid and immunosuppressant combination therapy**
  - **Evalaution for underlying autoimmune disease**

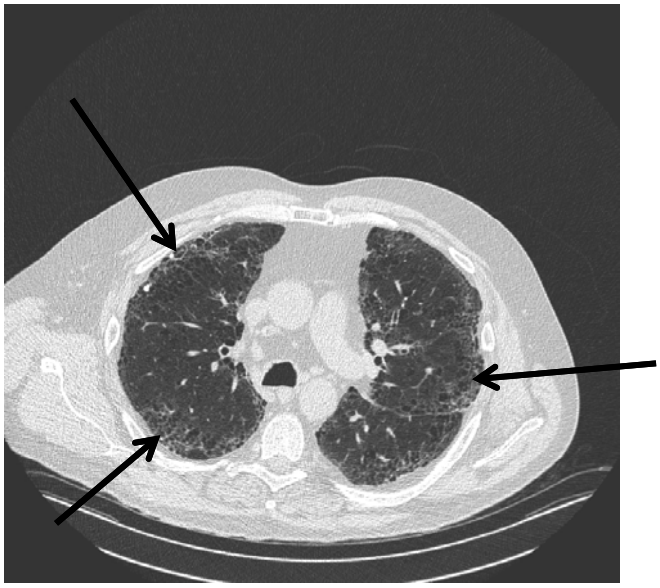
Case #4

Case #4

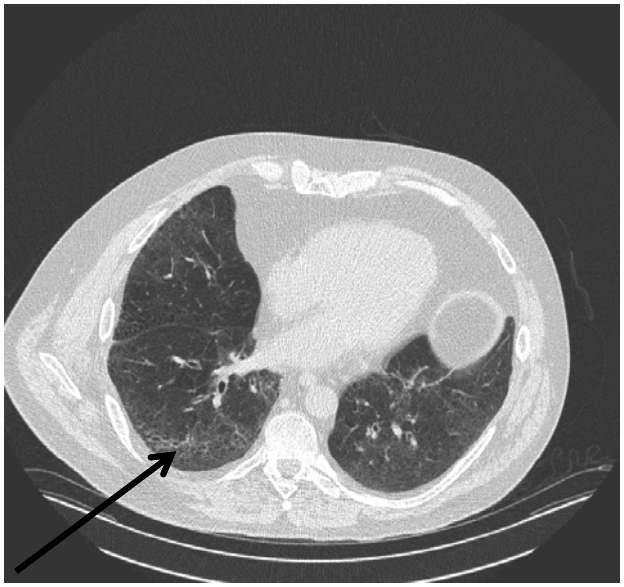
- 57 year-old man
- Dyspnea for 4 years, now worsening
- Started on home oxygen; prednisone course helped but he gained 60 pounds
- SH: 42 pack-year smoker; trucker; lives on a farm with a barn and cows
- Exam: basilar dry crackles, no clubbing

Laboratory Testing

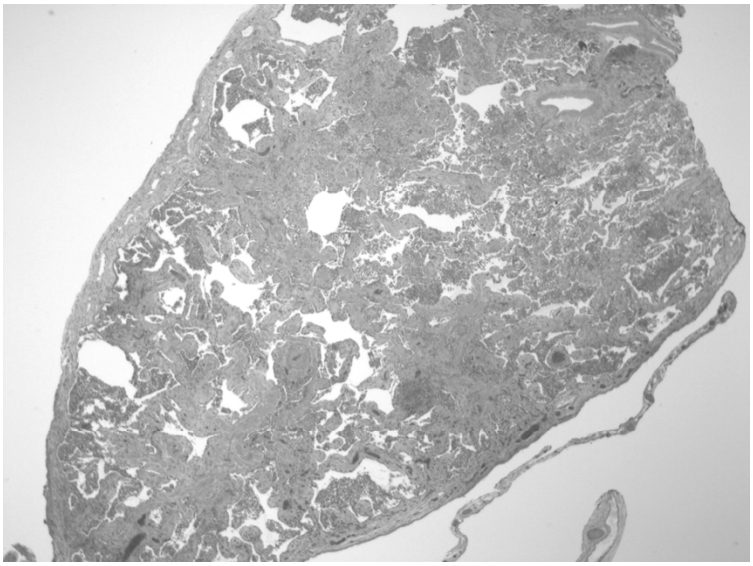
- Multiplex ANA positive
  - Anti-dsDNA positive
  - All other autoimmune antibodies negative
- Hypersensitivity pneumonitis panel negative
- CBC normal
- Pulmonary function tests:
  - Restriction
  - Low diffusing capacity



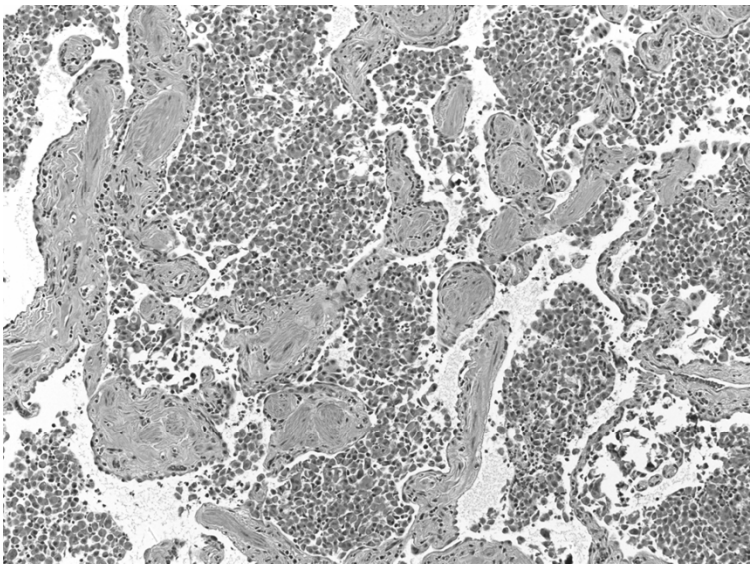
Peripheral reticular infiltrates



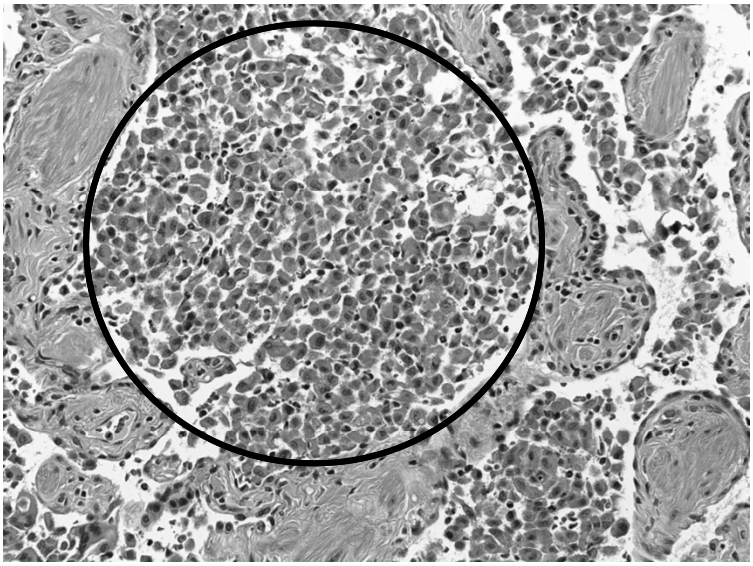
Basilar Ground Glass Infiltrates



Right Middle Lobe: Low Power



Right Middle Lobe: Medium Power



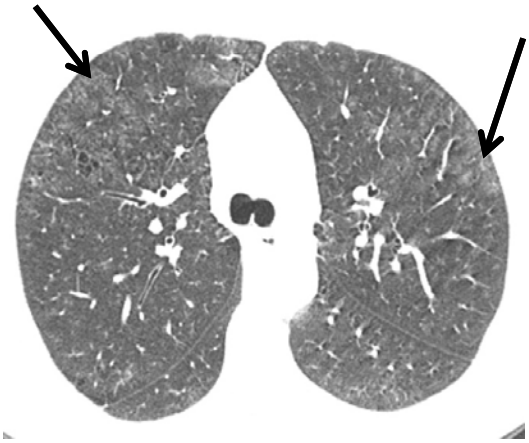
Right Middle Lobe: High Power

Desquamative Interstitial Pneumonitis

- **> 90% are smokers**
  - **Rarely associated with collagen vascular disease**
- **Typical age = 30-50**
- **Chest CT:**
  - **Ground glass infiltrates**
  - **CXR may be normal**
- **Pathology:**
  - **Abundant smoker's macrophages**
  - **Little alveolar wall inflammation**
- **Frequently overlaps with respiratory bronchiolitis interstitial lung disease**

Desquamative Interstitial Pneumonitis Treatment

- Smoking cessation
- Corticosteroids
- Azathioprine
- Cyclophosphamide
- Mycophenolate?



Prognosis is generally good

Case #5

Case #5

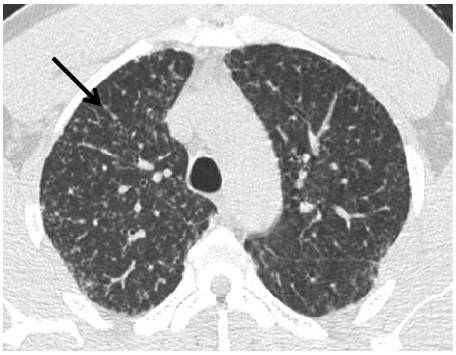
- 42 yo AAM with a past medical history significant for an episode of pericarditis over 10 years prior
- Recently developed symptoms of SOB/DOE and a nonproductive cough
- Some chest discomfort with his shortness of breath but no pleuritic pain, orthopnea or lower extremity edema
- No fevers, chills, night sweats or recent weight changes

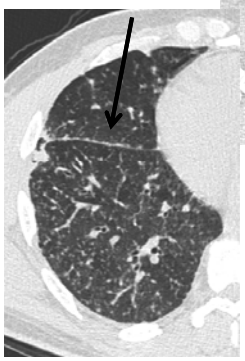
- PMHx: Pericarditis, OSA
- PHSx: wrist surgery
- Meds: MVI
- FamHx: unremarkable
- SocHx: Works at a printing warehouse, computer work. No alcohol, tobacco or drug use

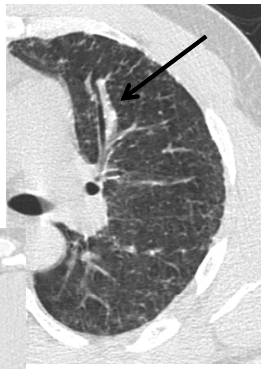
- PFTs: Mild restriction and mild reduced DLCO

Case #5

- Diffuse nodules
- Peribronchial

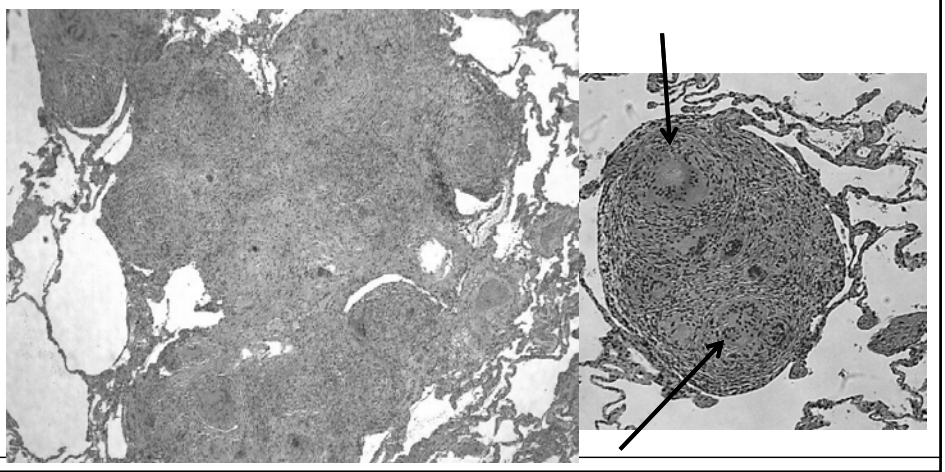






Case #5

- Non-caseating granulomas



Sarcoidosis

- Multisystem disease
- Characterized by granulomatous inflammation
- Dyspnea, cough, chest pain are common presenting symptoms
- Radiographically:
    - Hilar, mediastinal lymphadenopathy
    - Interstitial fibrosis or ground glass infiltrates
    - peribronchial infiltrates/thickening
    - Beaded or irregular thickening of the bronchovascular bundles, nodules along bronchi, vessels, and subpleural regions, bronchial wall thickening
- PFTs can show restriction or obstruction

Sarcoidosis

- Diagnosis based on finding granulomatous inflammation in a patient with a compatible clinical history
- Rule out other cause of granulomas
    - Infections such as mycobacterial and fungal infections
    - Beryllium and other metals exposure
    - Granulomas have been identified in reaction to cancer or lymphoma
- Differentiate from granulomas related to hypersensitivity pneumonitis

Sarcoidosis

- Treatment of sarcoidosis usually is based on symptoms and pulmonary function testing
- Absolute indications for therapy include cardiac and neurologic involvement, hypercalcemia, ocular disease
- Therapies include
    - Corticosteroids
    - Hydroxychloroquine
    - Methotrexate
    - Infliximab

Sarcoidosis

- **Monitoring for other organ involvement**
  - **Ocular**
  - **Cardiac**

  - **Echo: EF 15-20%**
  - **Cardiac MRI:**
    - » **Severely dilated LV with severe global hypokinesis. Estimated EF 20%.**
    - » **Evidence of increased signal intensity suggestive of postinflammatory changes.**
    - » **Delayed contrast images demonstrate diffuse hyperenhancment suggestive of fibrous replacement scarring.**

Case #6

Case #6

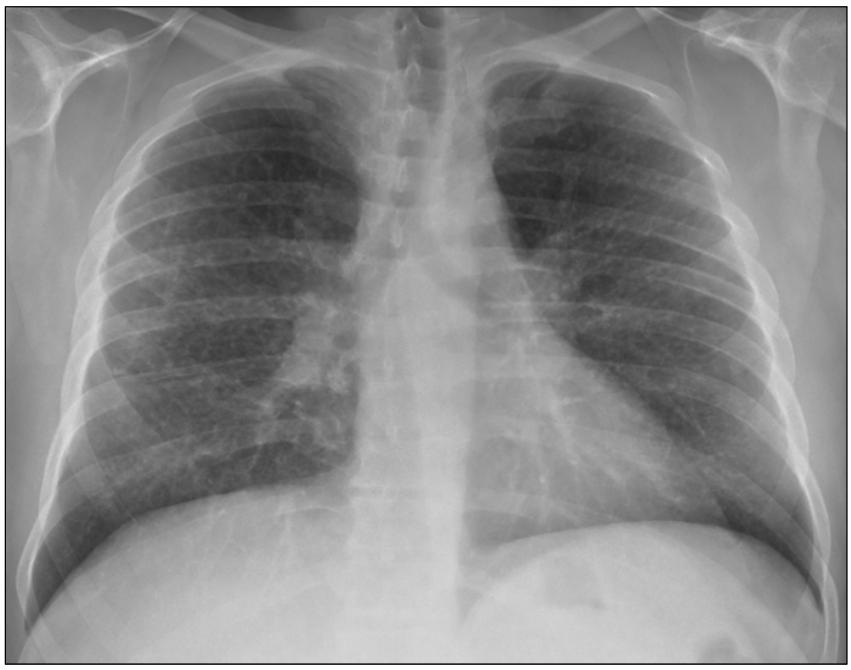
- 48-year old man with 2-year history of dyspnea
- Past medical history: hypertension, gout
- Meds: lisinopril, hydrochlorothiazide, allopurinol
- Family history: negative

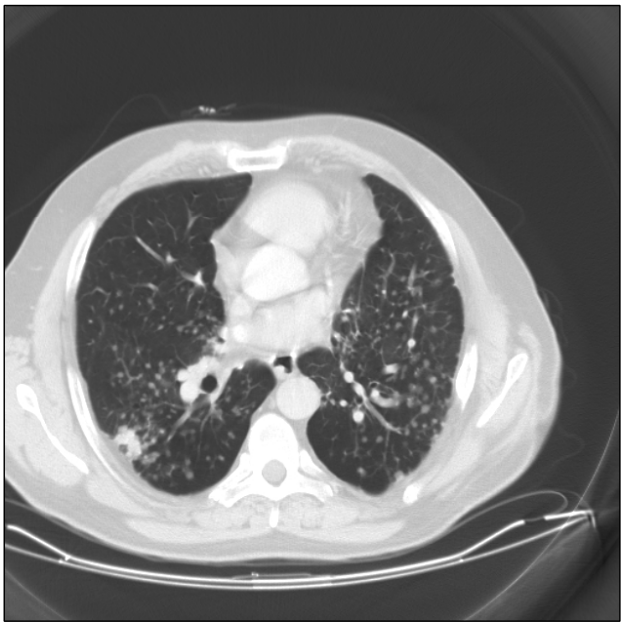
- Social history: worked 30 years in a foundry in cleaning room where he was responsible for chipping and grinding sand off of metal castings. Wore mask occasionally
- 20 pack year smoker
- Exam: lungs clear, no clubbing
- PPD skin test: negative

Pulmonary Function Tests

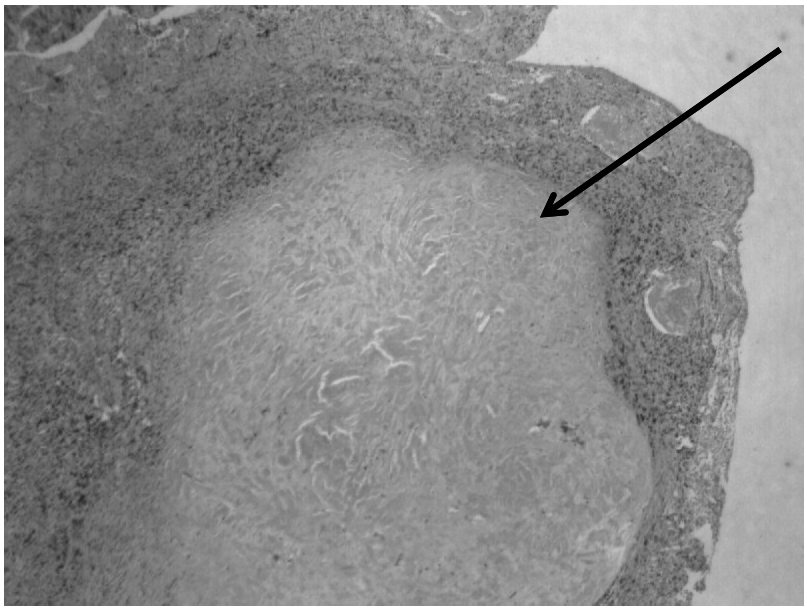
• FVC	4.07 L	91%
• FEV1	3.04 L	87%
• FEV1/FVC		74%
• TLC	5.58 L	91%
• DLCO	21.0	71%

- Low diffusing capacity with normal spirometry and lung volumes

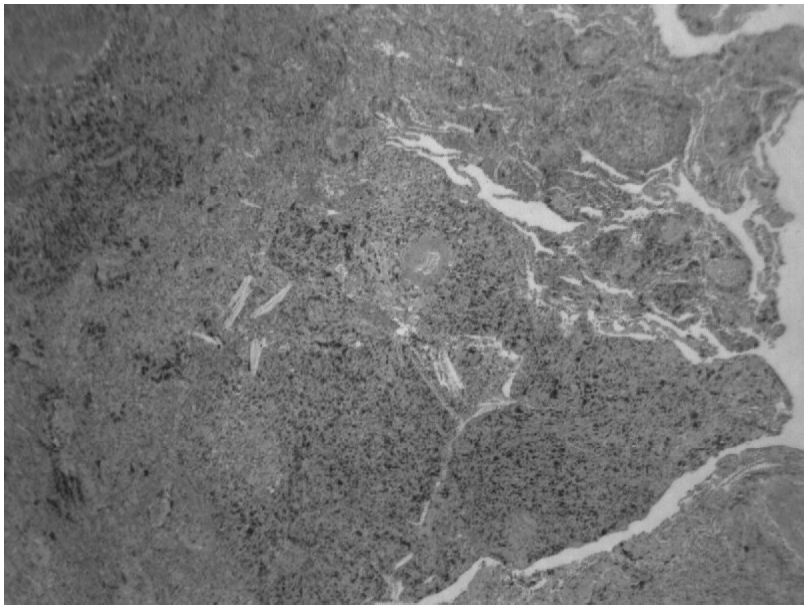




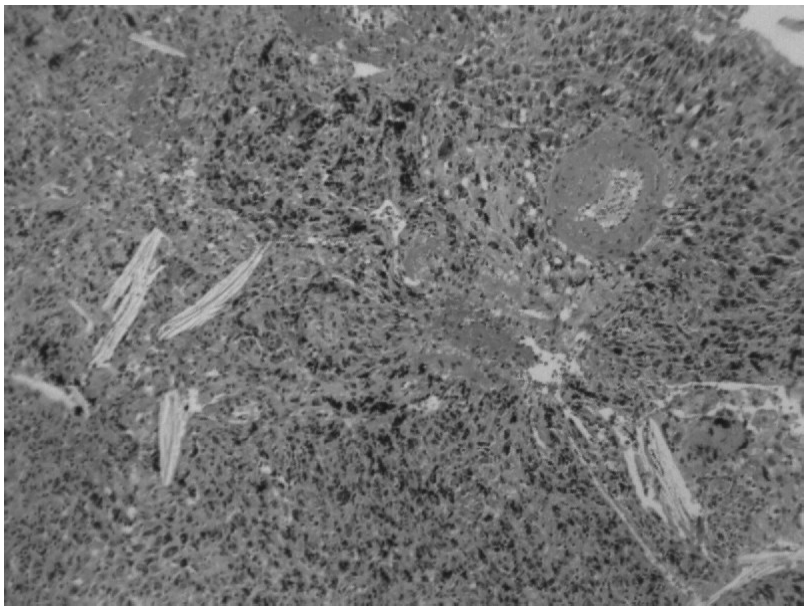
Hundreds of tiny nodules



Silicotic Nodule



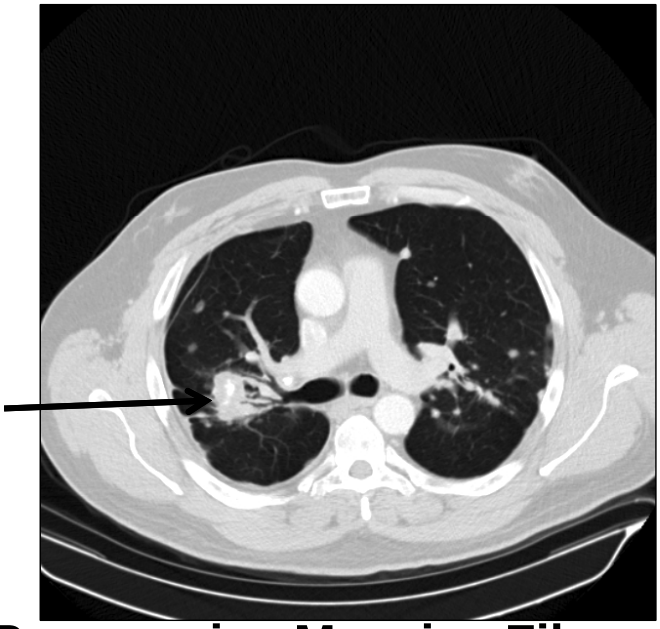
Granulomatous Infiltrates



Pigmented Dust and Silica Crystals

Silicosis

- Most common element on surface of the earth
- High risk occupations: miners, quarry workers, sandblasters, foundry workers, many others
- X-ray: upper lobe nodules, lymph node calcification, progressive massive fibrosis
- High risk for TB
- No effective treatment; remove from environment



Progressive Massive Fibrosis

Case #7

Case #7

- 59yo WM with a several month history of SOB and nonproductive cough
- Initially treated with antibiotics, felt better but symptoms recurred. No improvement after second round of antibiotics and inhaler
- CXR with bilateral infiltrates
- Follow up CXR showed some improvement but new infiltrates in other areas

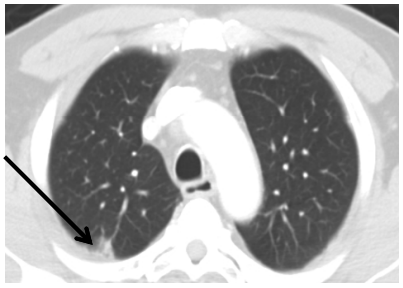
Case #7

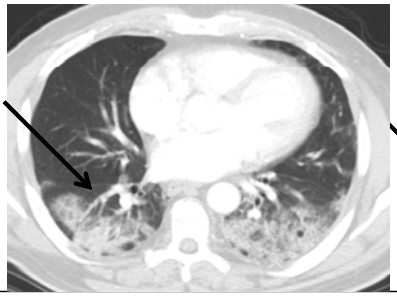
- **PMHx: pernicious anemia**
- **Meds: Vitamin B12**
- **SOCHx: nonsmoker, no exposures**

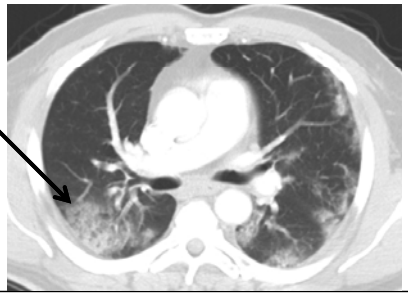
- **Exam with crackles and squeaks in the bases**

Case #7

- **Chest CT:**
  - **Ground glass infiltrates**
  - **Nodular lesions**

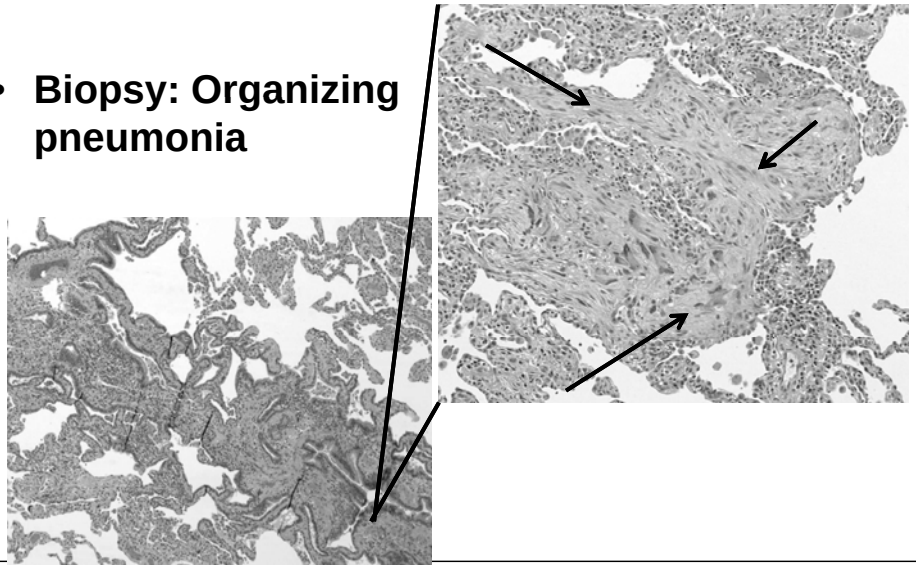






Case #7

- **Biopsy: Organizing pneumonia**



Organizing pneumonia

- **Organizing pneumonia is a histologic pattern**
- **A corresponding clinical-radiologic- pathologic diagnosis**

- **Organizing pneumonia may result from:**
  - **Infection by bacteria, viruses, parasites, and fungi**
  - **Drugs**
  - **Radiation therapy**
  - **Clinical conditions**
    - » **Connective tissue disorders (dermatomyositis, rheumatoid arthritis, Sjogren's syndrome)**
    - » **Autoimmune processes**
    - » **Ulcerative colitis, Crohn's**
    - » **Transplantation: lung, bone marrow**
    - » **Hematologic malignancies**
- **If no identifiable cause, cryptogenic organizing pneumonia (COP)**
- **Bronchiolitis obliterans organizing pneumonia (BOOP)**

Organizing pneumonia

- Histologic pattern
  - Nonspecific reaction from alveolar damage with intra-alveolar leakage of plasma proteins
  - Presence of buds of granulation tissue consisting of fibroblasts and myofibroblasts embedded in a connective tissue matrix
  - Present in the lumen of the distal airspaces (the alveoli, alveolar ducts, and bronchioles)
  - Bronchoscopic biopsy or surgical lung biopsy

Cryptogenic Organizing Pneumonia

- Effects men and women equally
- Usually 50-60s yo, not related to smoking
- Initially present with a subacute flu-like syndrome that lasts for a few weeks
- Often accompanied by mild fever, anorexia, weight loss, sweats, nonproductive cough, and mild dyspnea
- Initially thought to be infectious in etiology, no/partial response to antibiotics
- May also have a more severe presentation with features of acute respiratory distress syndrome (ARDS)
- Physical examination, laboratory testing is nonspecific

Cryptogenic Organizing Pneumonia

- Chest imaging shows patchy alveolar opacities, usually bilateral, often migratory
- Can be ground glass, or dense mass-like lesions
- May also present as cavitary lesions, nodules,

- Bronchoscopy shows a ‘‘mixed pattern,’’ with an increase in lymphocytes, neutrophils and eosinophils
- Tissue biopsy required to confirm diagnosis

Cryptogenic Organizing Pneumonia

- Corticosteroids are the standard treatment of COP
- Rapid clinical and imaging response to corticosteroids
- Clinical symptoms improve within days, radiographs show resolution within a few weeks

- Significant number may relapse rates
- In most reports, relapses were not associated with increased mortality or increased long-term functional morbidity
- Did not seem to relate to steroid dose or tapering

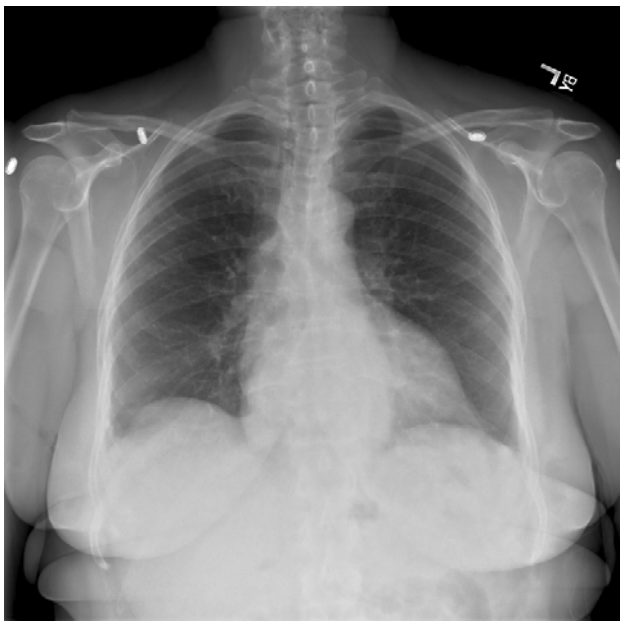
Case #8

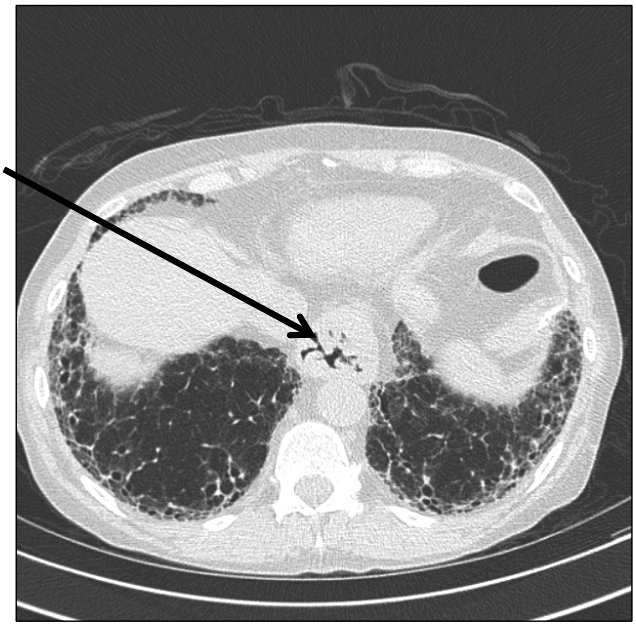
Case #8

- **73 year old woman with dyspnea for 6 years**
- **Past Medical History: hypertension, hyperlipidemia, hiatal hernia**
- **Social history: retired accountant; rare smoking**
- **Environmental history: no exposures**

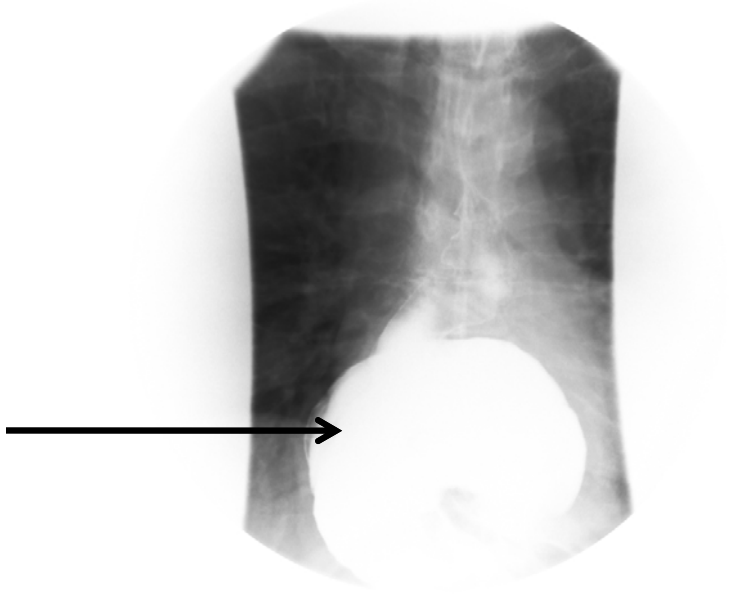
Case #8

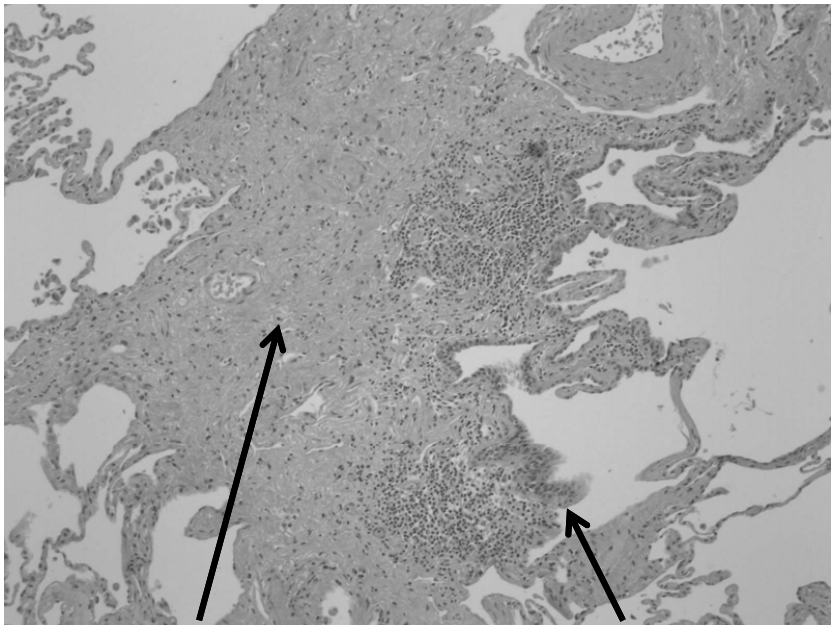
- **Exam: basilar crackles; no clubbing**
- **Labs: all autoimmune serology negative**
- **Pulmonary function tests: mild restriction with mild reduction in the diffusing capacity**



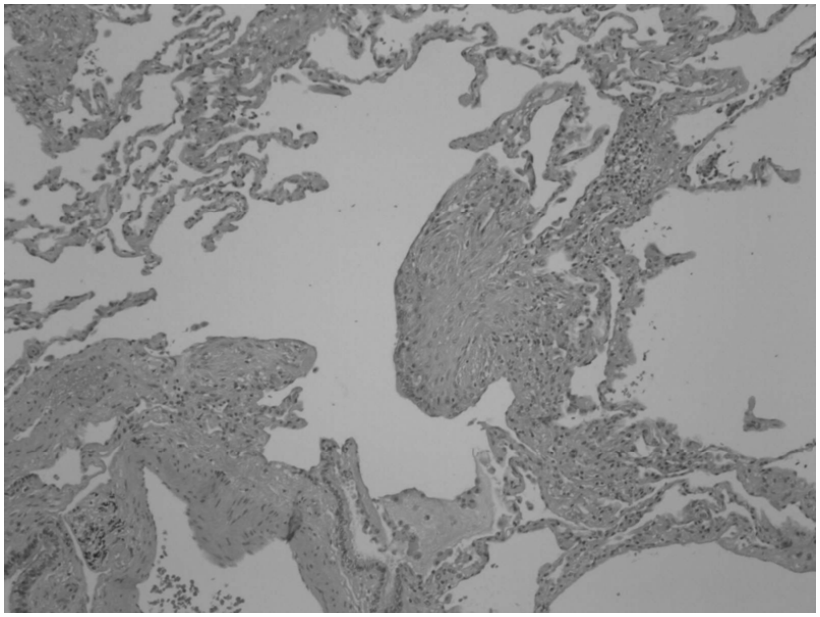


Large Hiatal Hernia





Pulmonary fibrosis **Epithelial injury**



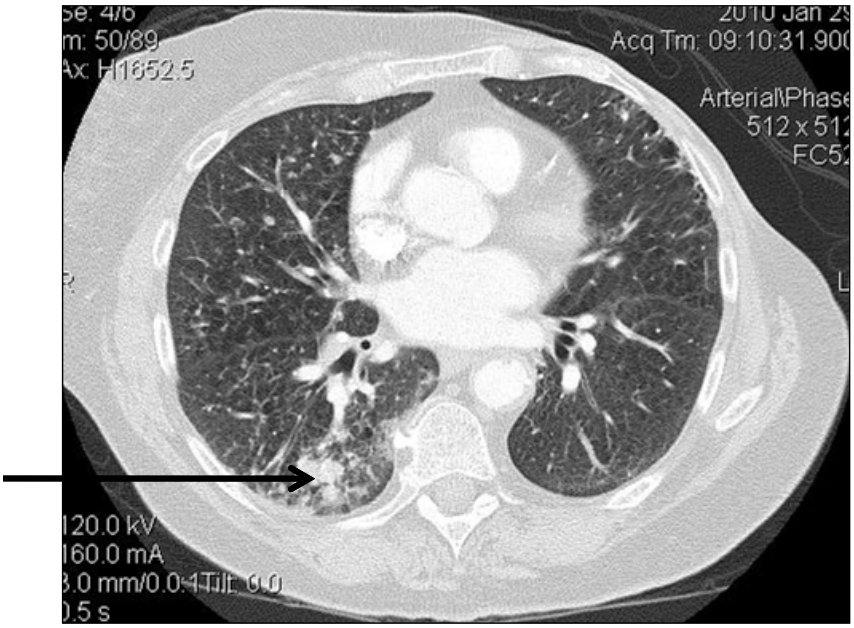
Epithelial injury

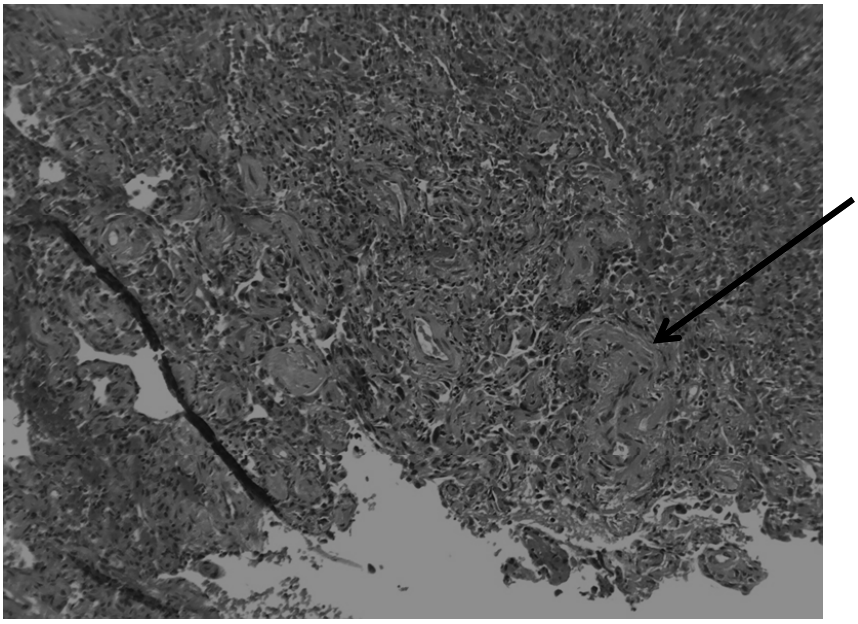
Paraesophageal hernias and interstitial lung disease

- **Chronic aspiration and/or GERD can result in interstitial lung disease**
- **Consider when patients have aspiration symptoms or hiatal hernia**
- **Prominent epithelial hyperplasia in the setting of few fibroblastic foci are a clue**
- **Treatment is to fix the hernia/GERD**

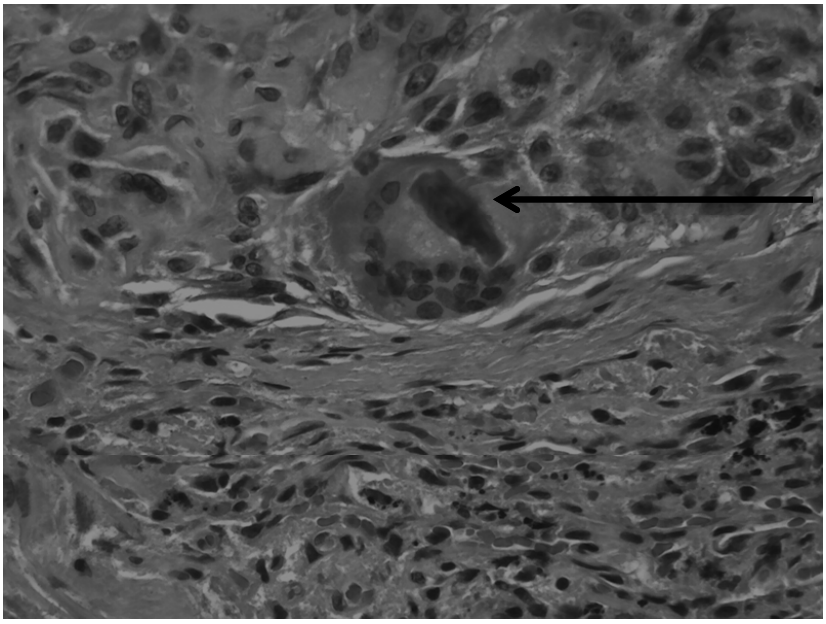
Regurgitation Causing Interstitial Lung Disease

- 69-year old woman with episodic dyspnea x 1 year
- Dyspnea episodes accompanied by fever to 102
- On-going GERD symptoms with regurgitation of food every 3 days
- Exam: bibasilar crackles





Granulomatous inflammation



Foreign body in multi-nucleated giant cell

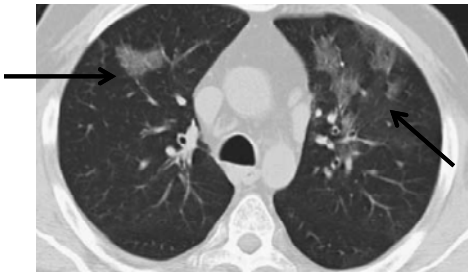
Case #9

Case #9

- 24yo WF without significant past medical history
- One month prior, developed symptoms of anterior chest discomfort and nonproductive cough
- Symptoms persisted for several weeks, treated with decongestant and cough medication without improvement
- Received an initial round of antibiotics but did not have significant improvement
- CXR showed hazy bilateral infiltrates and she was treated with a second course of antibiotics but remained symptomatic
- No hemoptysis, fevers or chills but some night sweats and weight loss. Increasing SOB/DOE, difficulty climbing stairs.

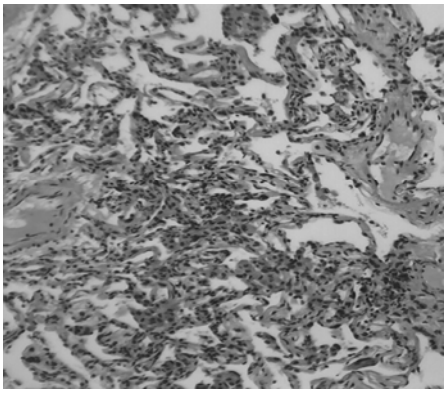
Case #9

- **PMHx (-)**
- **Meds: recent albuterol inhaler, minocycline for acne, OCP**
- **SOC: (-) tob, drugs, exposures, travels**
- **Chest CT:**



Case #9

- **Biopsy: interstitial inflammation and eosinophilia, organizing pneumonia, focal accumulation of foamy macrophages within alveolar lumens**
- **Minocycline started about 6 weeks prior to symptoms**



Drug-induced lung disease

- Patterns of drug-induced lung injury
  - Interstitial lung disease
    - » All histopathologic subtypes of interstitial lung disease can be observed as the result of treatments with drugs
  - Alveolar changes
    - » Pulmonary edema, hemorrhage, diffuse alveolar damage, exogenous lipoid pneumonia, alveolar proteinosis
  - Vasculitis

Drug-induced lung disease

- Difficult to predict
- No reliable clinical, imaging, bronchoalveolar lavage (BAL), or histopathologic feature that is specific of, or diagnostic for drug-induced ILD
- Establish a definite temporal relationship between exposure to the agent and the onset of the lung disease
- Differentiate from cardiac etiology, concomitant ILD, opportunistic infection
- Stop the drug, corticosteroids

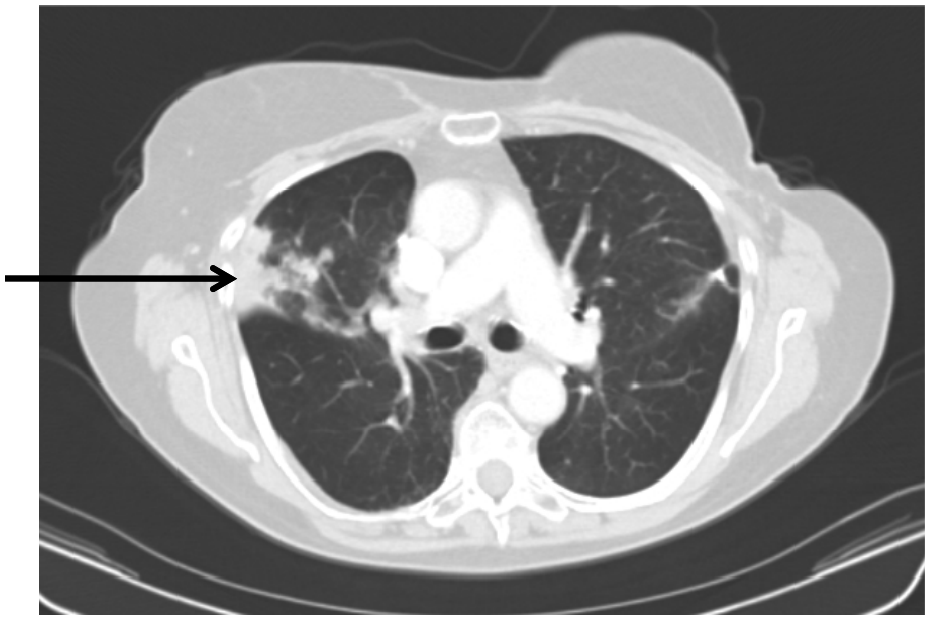
Drug-induced lung disease

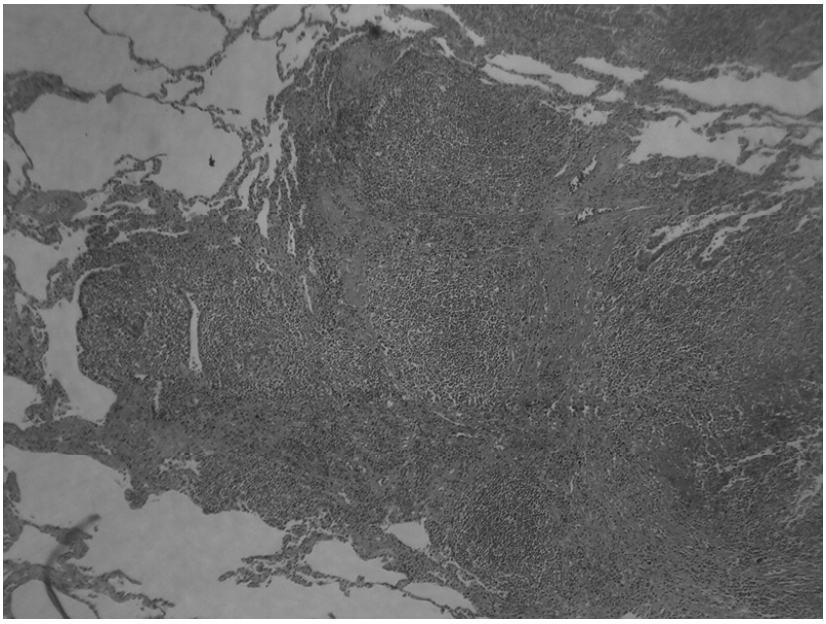
- Common drugs
  - Minocycline
  - Nitorfurantoin
  - Amiodarone
  - Methotrexate
- Pneumotox, www.pneumotox.com

Case #10

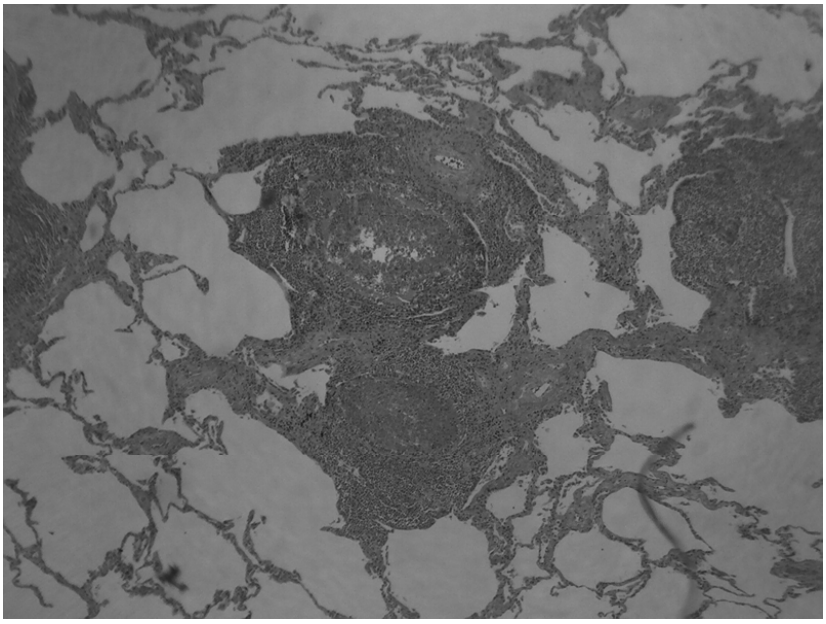
Case #10

- 58-year old woman
- Cough, fever, and dyspnea for 2 months
- Used hot tub daily because of arthritis
- Admitted and diagnosed with pneumonia
- Improved with empiric antibiotics
- Symptoms recurred after returning home from the hospital

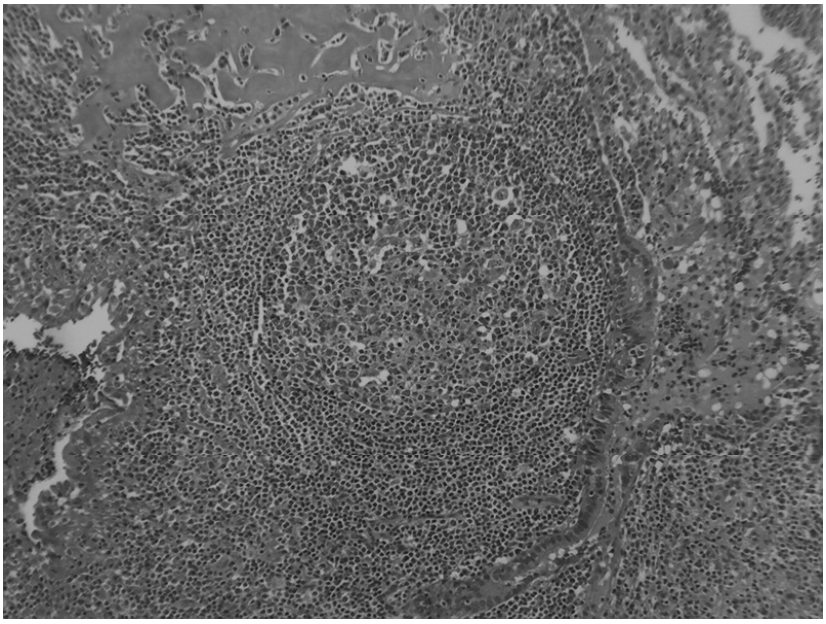




Lymphocytic infiltration



Lymphocytic infiltration around airways



Necrotizing granulomas

Culture = Mycobacterium avium complex

Hot Tub Lung

- **Causes:**
  - **Mycobacterium avium complex**
  - **Hypersensitivity pneumonitis**
- **Treatment:**
  - **Avoidance**
  - **Steroids for severe cases**
  - **Occasionally antibiotics:**
    - **Clarithromycin**
    - **Rifampin**
    - **Ethambutol**

Case #11

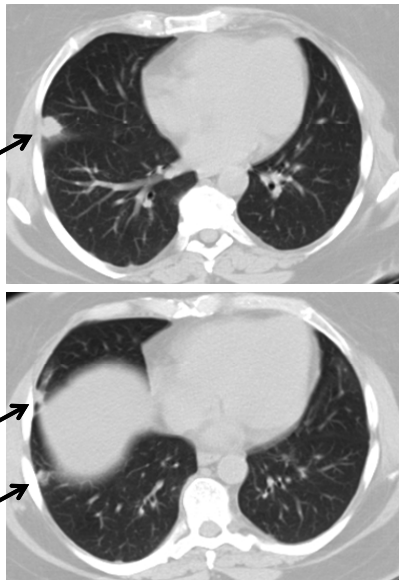
Case #11

- **54 yo WM with a history of shortness of breath and cough that has been present for 6 months and a CXR showing a lung mass.**
- **Originally presented to his PCP with recurrent sinus infections, epistaxis and was treated with a number of antibiotics. A CXR and CT showed pulmonary nodules.**
- **He notes SOB/DOE, fatigue, sinus congestion and drainage with a dry cough.**
- **PMHx: chronic sinusitis; Hypertension**
- **Meds: MVI, guaifenesin, amlodipine, atenolol, lisinopril-hydrochlorothiazide, Nexium, meloxicam, nasonex, and clindamycin**
- **SOCHx: Former smoker, 25PY, drinks alcohol, no illicit drugs**
- **Occupation: Construction worker with exposure to pesticides, asbestos, dust and mold**

Case #11

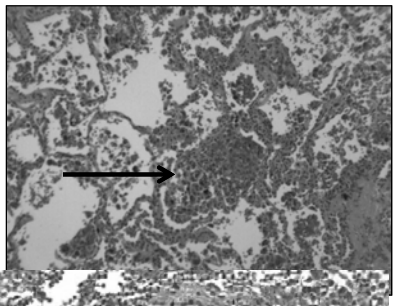
- Normal chemistries, CBC
- Normal urinalysis
- (+) ANCA, (+) PR3 antibody
  (-) ANA, RF

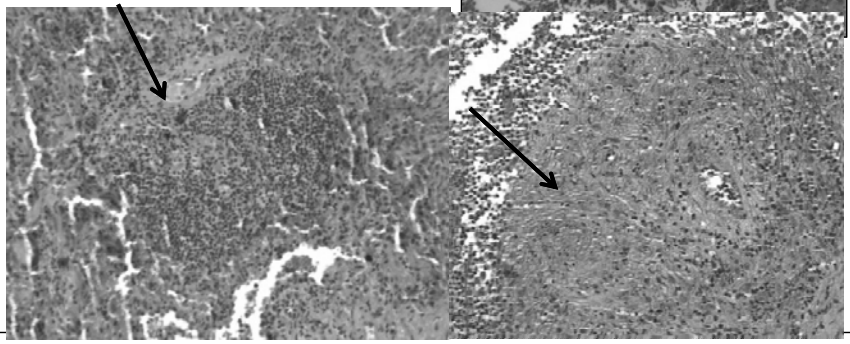
- Chest CT: multiple pulmonary nodules



Wegener's Granulomatosis

- Biopsy: Wegener's granulomatosis
  - Alveolar hemorrhage
  - Granulomatous inflammation
  - Vasculitis





Wegener's Granulomatosis

- WG is the most common of the small-vessel vasculitis, associated with antineutrophil cytoplasmic antibody (ANCA)
- Characterized by
  - Upper and lower respiratory tract involvement
    - » Most common manifestations of WG, especially at the time of onset of the disease
  - Upper airway disease can include:
    - » Epistaxis, rhinitis, sinusitis, deforming or ulcerating upper airway lesions, otitis, otalgia, tinnitus, hearing loss, laryngeal disease, subglottic stenosis, and/or tracheal stenosis
  - Lower respiratory disease includes: cough, chest pain, shortness of breath, hemoptysis

Wegener's Granulomatosis

- Subglottic, tracheal, and endobronchial disease usually not present at the time of diagnosis, but often develops after a delay of months or years
- Renal involvement is present in 40% of patients at the time of initial presentation but develops in 70% to 80% of patients over the course of the disease
- Other target organs can include:
  - Skin
  - Eyes
  - Peripheral nervous system
  - Musculoskeletal system
  - Heart

Wegener's Granulomatosis

- Present with target organ specific symptoms
- Constitutional symptoms are common, most patients have fatigue malaise, anorexia, fever, or weight loss
- Chest imaging shows interstitial, alveolar or mixed infiltrates, nodules, or cavities
- Pathologically, characterized by a necrotizing, small- and medium-vessel vasculitis, granulomatous inflammation

Wegener's Granulomatosis

- Diagnosis confirmed by tissue biopsy at a site of active disease
    - Skin biopsy of the skin shows leukocytoclastic vasculitis with little or no complement and immunoglobulin on immunofluorescence
    - Renal biopsies in patients with signs of renal disease and active urine sediment
    - Lung biopsy usually requires a surgical biopsy showing pulmonary capillaritis, granulomatous inflammation may be seen, exclude infections

Wegener's Granulomatosis

- Treatement
  - Initial induction of remission with immunosuppression
    - » Consists of cyclophopshamide and glucocorticoids
    - » Rituximab can be used if cannot use cyclophosphamide
  - Maintenance immunosuppressive therapy to prevent relapse
    - » Less toxic regiment with azathioprine or methotrexate
    - » Concurrent glucocorticoids

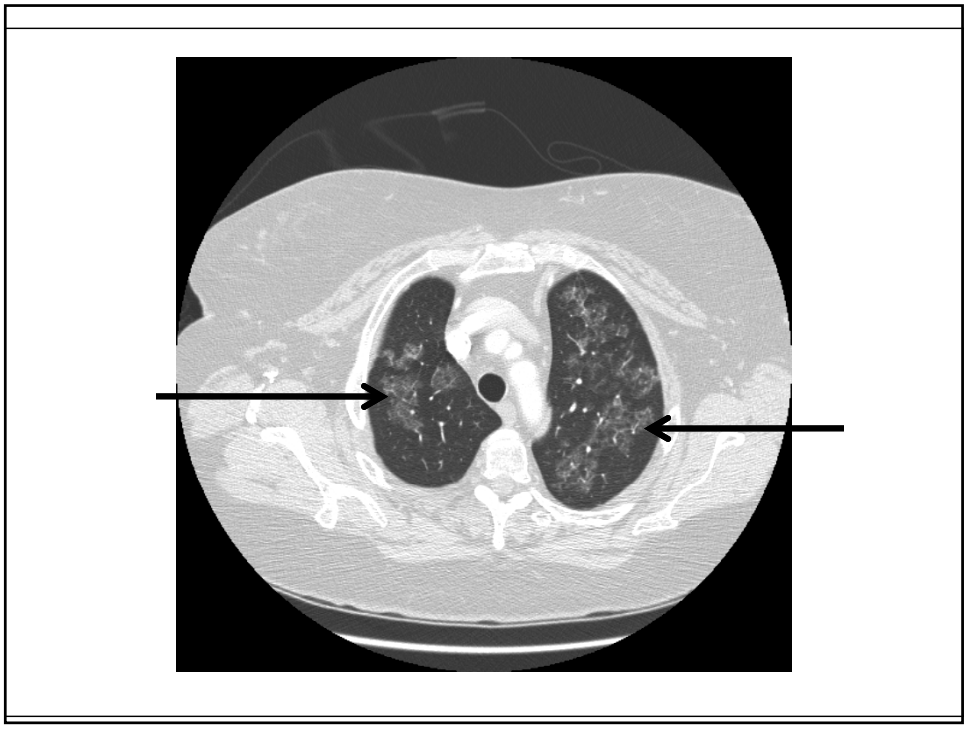
Case #12

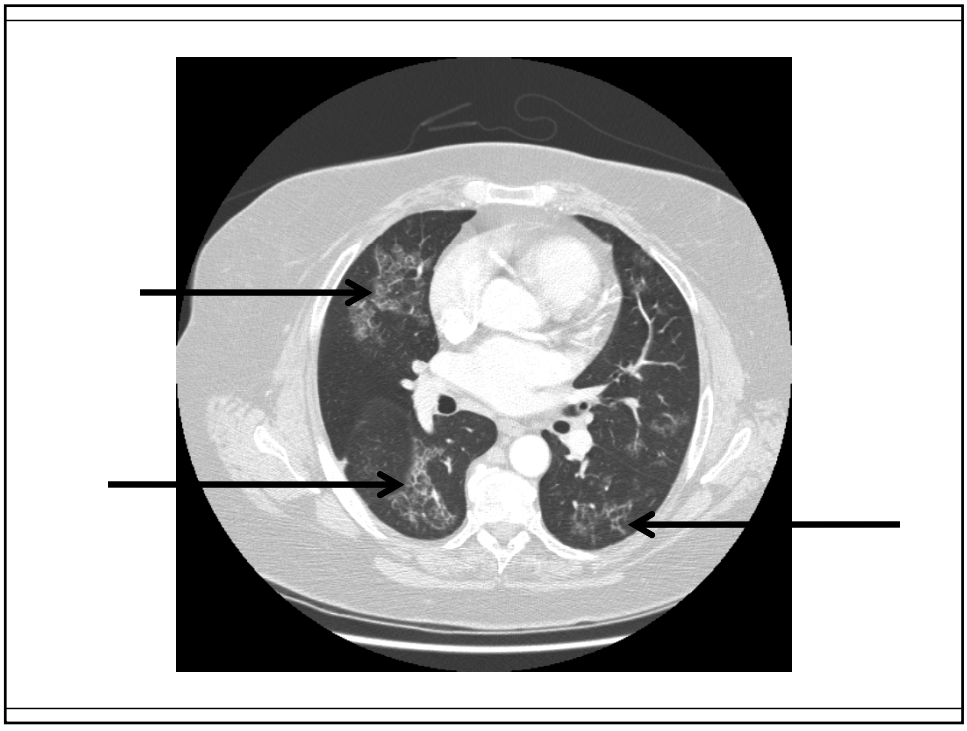
Case #12

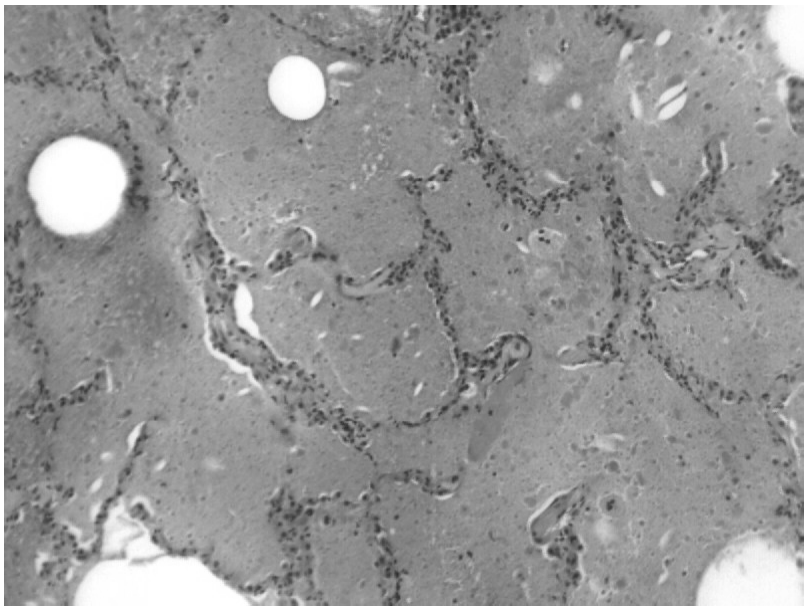
- 58-year old woman with 6 month history of dyspnea
- CXR showed pulmonary infiltrates but there was no improvement after empiric antibiotics
- PMH: hypothyroidism
- FHX: negative
- Exam: lung clear; no clubbing

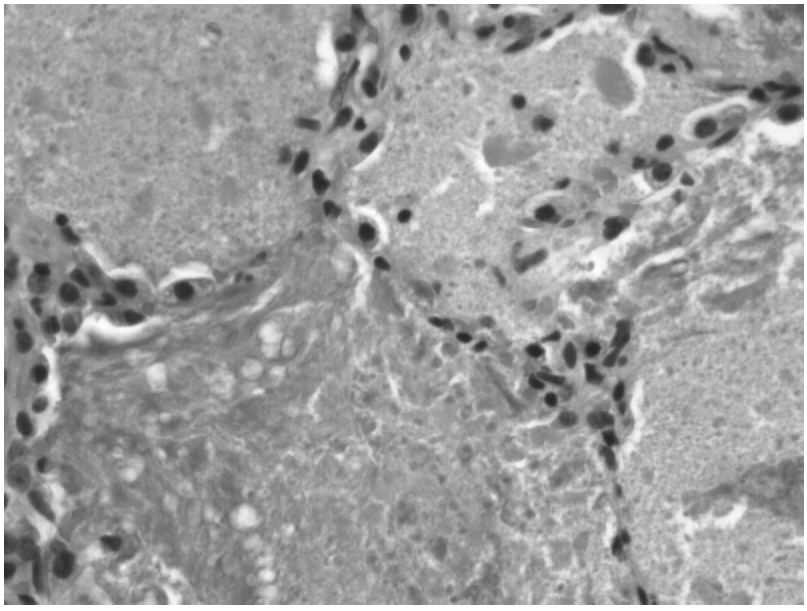
Pulmonary Function Tests

• FVC	2.94	109%
• FEV1	2.31	104%
• FEV1/FVC	77%	
• TLC	4.20	91%
• DLCO	14.9	72%

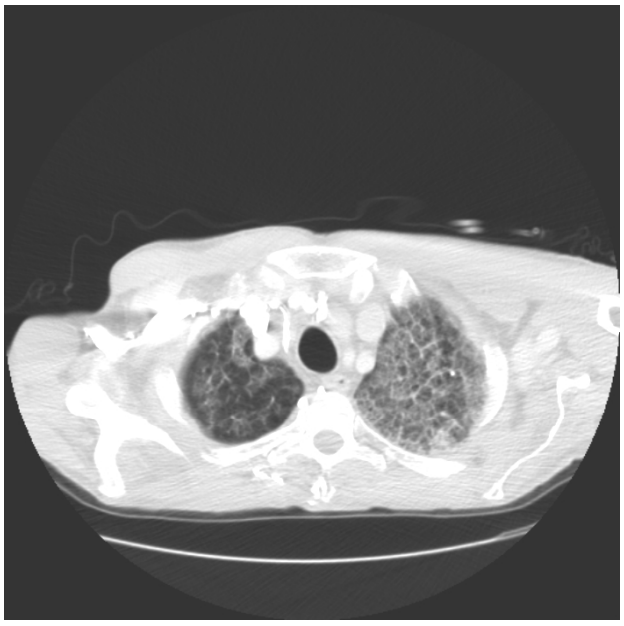


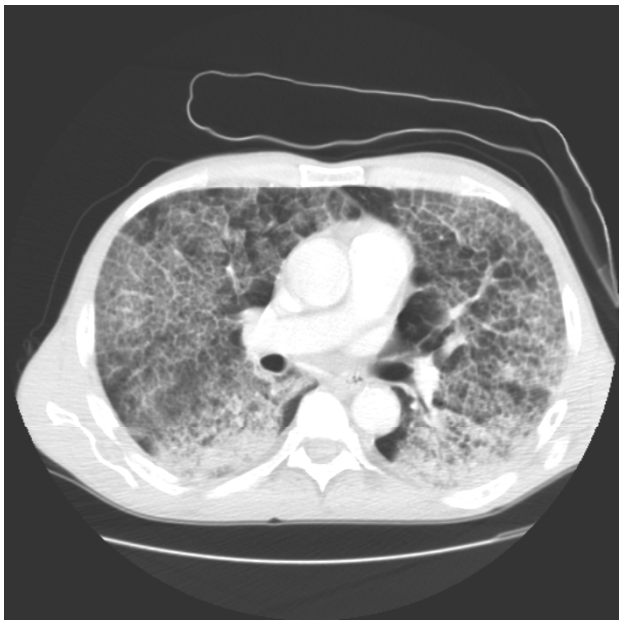


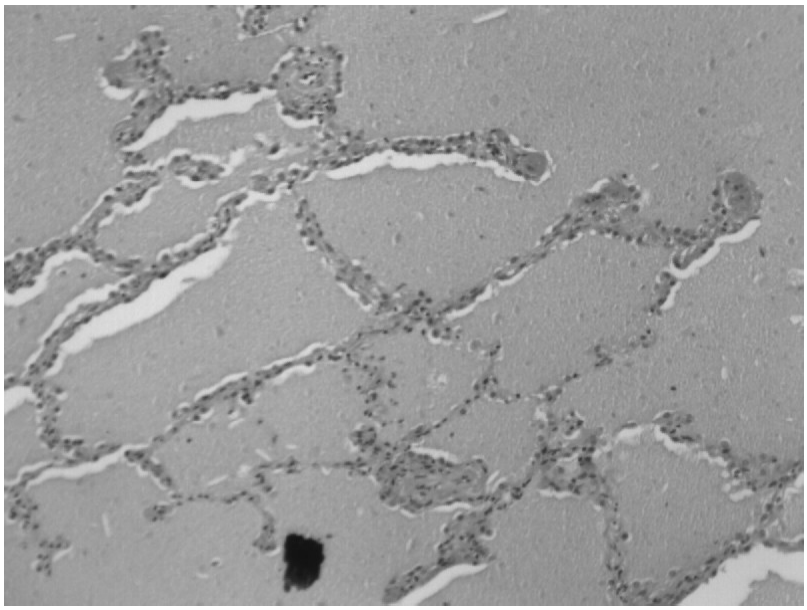


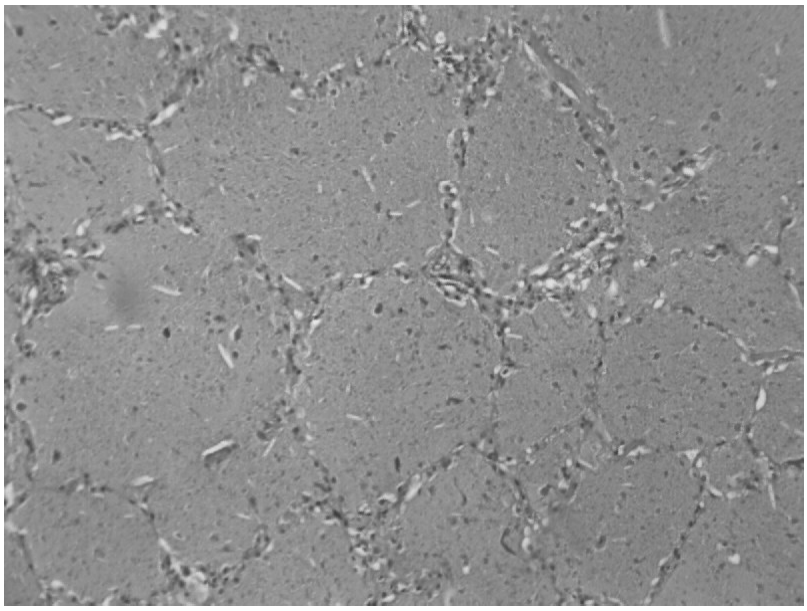


- **63-year old man with progressive dyspnea and hypoxemia over 3 months**
- **Underwent stem cell transplant for lymphoma 8 months earlier**









Pulmonary Alveolar Proteinosis

- **Accumulation of surfactant lipid and protein in alveolar spaces**
- **Causes:**
  - **Congenital: abnormal surfactant or GM-CSF receptors**
  - **Acquired: GM-CSF antibodies**
  - **Secondary: following massive dust inhalation, bone marrow transplant, or with leukemia/lymphoma**

Pulmonary Alveolar Proteinosis

- **Diagnosis:**
  - **Brownish fluid on bronchoalveolar lavage**
  - **Biopsy = PAS positive material in alveoli**
- **Treatment:**
  - **Observation**
  - **Whole lung lavage**
  - **GM-CSF?**