Diseases of the Lung and Respiratory Tract, Part I

William Bligh-Glover M.D.
Department of Anatomy, CWRU
Educational objectives:

- Distinguish the types of atelectasis and their etiologies
- Distinguish the types of obstructive lung disease,
  - Etiology, epidemiology, pathogenesis, pathophysiology, and consequences
- Distinguish the types of restrictive pulmonary disease
  - Etiology, epidemiology, pathogenesis, pathophysiology, and consequences
Normal Lung

• Function
  – Exchange gases between inspired air and blood
  – O2 in CO2 out.

• Progressively smaller air passages
  – Lining pseudostratified, tall columnar ciliated epithelial cells
  – Alveoli type I, type II pneumocytes and capillaries
Normal Lung Gross
Atelectasis

• “Collapsed lung”
  – Collapse of previously inflated lung
• Aneectasis never inflated lung.
Atelectasis Gross
Types of Atelectasis

• Obstruction (resorption)
• Compression
• Contraction
Resorption Atelectasis

• Complete obstruction of an airway
  – Resorption of trapped oxygen
  – Unimpaired blood flow
• Excessive secretions
  – Mucous plugging
• Asthma, bronchitis, bronchiectasis, aspiration
Atelectasis

Figure 31-5 Atelectasis caused by airway obstruction and absorption of air from the involved lung area on the left and by compression of lung tissue on the right.
Compression Atelectasis

- Pleural cavity filled with fluid
  - Hemothorax (blood)
  - Pneumothorax (air)
  - Pleural effusion
  - Tumor

- Most often occurs in the setting of heart failure with pleural effusions or malignant pleural effusions
Compression Atelectasis
Contraction Atelectasis

• Fibrosis of pulmonary parenchyma prevents full expansion
• Pneumoconioses
Contraction Atelectasis
Honeycomb lung
Mediastinal Shifts

• Resorption Atelectasis
  – Towards Affected Side
• Compression Atelectasis
  – Away from Affected Side
• Contraction Atelectasis
  – No Shift
Mediastinal shift
Obstructive vs. Restrictive

- Airway diseases
- Increased resistance to airflow
- Decreased FEV1 forced expiratory volume 1 sec

- Parenchymal diseases
- Reduced expansion, decreased total lung capacity
- Normal airflow
Obstructive vs. Restrictive

• Obstructive Lung Diseases
  – Asthma
  – Bronchiectasis
  – Chronic Bronchitis
  – Emphysema
  – Tumor

• Restrictive Lung Disease
  – Chest wall abnormalities
  – ARDS
  – Pneumoconioses
Asthma

- Reactive airways
- Production of excessive mucus
- Allergies
- Eosinophils
Asthma
Mucus plug with eosinophils
Asthma Mucus
Bronchiectasis

- Sequelae of chronic infections
- Lung tissue destroyed by necrotizing infections
- Compounded by stasis of secretions
  - CF
Bronchiectasis Gross
Bronchiectasis
Large bronchi close to pleura
Bronchiectasis Micro
Bronchiectasis
Chronic Bronchitis

- Productive cough
- Lasting for three months
- Two or more years running
- Associated with smoking
  - Impairment of muco-ciliary elevator
Emphysema

- Destruction of pulmonary parenchyma
- Dilated air spaces
- “Septae in space”
- Destruction of lung by neutrophil enzymes
  - Alpha-1-antitrypsinase deficiency
  - Smoking
Emphysema - Physical
Emphysema Gross
Emphysema Micro
Tumors

• Squamous cell carcinomas
  – Most common
  – Hilar origin
  – Associated with smoking

• Adenocarcinomas
  – Less common
  – Not associated with smoking
  – Peripheral location

• Neuroendocrine
  – Treatment amenable
Tumors
ARDS

• Initial damage to pulmonary capillaries
• Leakage of fluid, production of hyaline membranes
• Tremendous disruption of gas exchange
ARDS
Occupational Lung Disease

• Coal Worker’s Pneumoconiosis
• Silicosis
• Farmer’s Lung
• Silo Filler’s Lung
Coal Worker’s Pneumoconiosis

- Shaft miners > pit miners
- Reaction to silica in coal matrix
- Gradually worsening lung disease
  - Coal macules
  - Black lung
  - Progressive Massive Fibrosis
Coal Macule
Coal Macule

- Anthracotic pigment in interstitial macrophages
- Prominent nodules of black in grey background
- Deeply pigmented, irregular nodules.
  - micronodular (< 7 mm in diameter)
  - macronodular (> 7 mm) forms
Progressive Massive Fibrosis

• Multiple, retracted scars of lung
PMF