Respiratory Pathology
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Normal lung: alveolar spaces

Respiratory Pathology Outline

- Acute respiratory distress syndrome
- Obstructive lung diseases
- Restrictive lung diseases
- Vascular diseases
- Infections
- Carcinoma
Acute respiratory distress syndrome

- Symptoms: rapid onset respiratory insufficiency that doesn’t respond to oxygen
- Associated with pneumonia, aspiration of gastric contents, sepsis, severe trauma
- Pathogenesis: Damage to alveolar capillary membrane; neutrophils play a big role
- Morphology: “diffuse alveolar damage” with hyaline membranes

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Emphysema

- Destruction/enlargement of airspaces
- Centriacinar emphysema
  - Destruction of proximal acinus
  - Worse in upper lobes of lung
  - Smoking
- Panacinar emphysema
  - Destruction of entire acinus
  - Worse in lower lobes of lung
  - Alpha-1-antitrypsin deficiency
Emphysema: dilated air spaces

Chronic Bronchitis

- Definition: persistent, productive cough for ≥ 3 months in ≥ 2 consecutive years
- Pathogenesis: hypersecretion of mucous
- Cause: smoking (mostly) and pollution

Pathogenesis of emphysema

Chronic bronchitis: mucous gland hyperplasia
Asthma

- Chronic inflammatory disease of airways leading to bronchial constriction
- Symptoms: wheezing, breathlessness
- Hallmarks: intermittent, reversible airway obstruction, chronic inflammation, increased mucus.
- Atopic (allergic) vs. non-atopic
- Triggers: allergens, infection, smoke, cold, exercise

How is asthma triggered?

Then what happens?

Bronchiectasis

- Permanent dilation of bronchi and bronchioles due to chronic inflammation
- Secondary to:
  - obstruction (tumor)
  - congenital conditions (cystic fibrosis)
  - bad pneumonia

Bronchiectasis
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Idiopathic pulmonary fibrosis

- Patchy, progressive lung fibrosis
- Symptoms: gradual onset cough, dyspnea. Respiratory failure and cor pulmonale within about 3 years
- Radiologic and histologic term: “usual interstitial pneumonia”

Pneumoconioses

- Disorders caused by inhalation of mineral dusts
- Size matters (1-5 μm particles are worst)
- Three main dust particles:
  - Carbon (coal workers)
  - Silica (sandblasting, mining, ceramics)
  - Asbestos (mining, insulation removal)
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Pulmonary embolism

- Most arise from leg veins
- Small emboli may be asymptomatic, cause infarction, or cause hemoptysis
- Medium-sized emboli (less common) cause shortness of breath and infarction
- Large emboli (even less common) can cause sudden death

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Pneumonia

- 1/6 of all deaths in the US!
- Can be acute or chronic
- Causes: bacteria, viruses
- Different anatomic patterns
- Different clinical settings
Typical bugs in different clinical settings

Community-acquired
- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Mycoplasma pneumoniae*
- *viruses*

Nosocomial
- gram-negative rods
- *Staphylococcus aureus*

Aspiration
- Anaerobic bacteria

Immunocompromised
- *Cytomegalovirus*
- *Pneumocystis jiroveci*
- *Aspergillus*

Chronic
- *Mycobacterium tuberculosis*
- *Histoplasma capsulatum*

Most community-acquired pneumonias are one of these:

Alveolar
- *Streptococcus pneumoniae* *
- *Staphylococcus aureus*
- *Haemophilus influenzae*

Interstitial
- *viruses*
- *Mycoplasma pneumoniae*

* Most common

Viral pneumonia  Bacterial pneumonia

Lung abscess

- Localized collection of pus
- Bugs: *Staph, Strep*, gram-negative bugs, anaerobes, or mixture
- Pathogenesis: aspiration of infected material (from teeth, sinuses), aspiration of gastric contents, as complication of nasty bacterial pneumonia

Lung abscess

- Cause: *Mycobacterium tuberculosis*
- Chronic, granulomatous disease that can involve any organ but often involves lungs
- Spread by respiratory droplet
- Primary (initial) TB: Ghon complex.
- Secondary (reactivation) TB: Cavitating granulomas.
Caseating granuloma

- Regular (non-caseating) granuloma
  - Just macrophages (no necrotic debris)
  - Lymphocytes
  - Necrotic debris
  - Macrophages

- Caseating granuloma
  - Regular macrophages
  - Necrotic debris
  - Foreign-body giant cells

TB organisms (acid-fast stain)

Ghon complex: lung lesion + involved nodes

Secondary TB: tons of caseating, cavitating necrosis

Spleen: miliary TB
Opportunistic pneumonias

- Affect immunosuppressed patients (patients with AIDS, cancer, post-transplant)
- Unusual organisms:
  - *Pneumocystis jiroveci*
  - *Aspergillus*
  - *Cytomegalovirus*

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Types of lung cancer

- Adenocarcinoma
- Squamous cell carcinoma
- Large cell carcinoma
- Small cell carcinoma

Presenting symptoms

- Potentially curable
  - asymptomatic
  - cough
  - hemoptysis
- Usually incurable
  - dyspnea
  - chest pain
  - anorexia & weight loss
  - hoarseness
  - bone pain

Survival statistics...bad.

- At diagnosis, >50% have metastases
- Overall (all stages) 5ys = 16%
- Localized disease 5ys = 45%

Adenocarcinoma

- Most common type, especially in women and non-smokers
- Usually peripheral
Adenocarcinoma

- Was called bronchioalveolar carcinoma
- A rare type of adenocarcinoma
- 5 year survival better (40%)
- Grows along existing architecture

Adenocarcinoma in situ

Squamous cell carcinoma

- Malignant tumor of squamous cells
- Usually centrally located
- Usually preceded by distinct lesions

Squamous cell carcinoma precursor lesions

- squamous metaplasia
- dysplasia
- carcinoma in situ
Squamous cell carcinoma

- Composed of large cells
- Kind of a “wastebasket” term
- Many are probably just anaplastic squamous cell carcinomas or adenocarcinomas

Large cell carcinoma

- VERY high mortality
- Small cells, minimal cytoplasm, “molding”
- Paraneoplastic syndromes
- High growth fraction yet treatment ineffective
- Median survival (with treatment) = 1 year

Small cell carcinoma
Mesothelioma

- Malignant tumor of mesothelial cells
- Most patients have had asbestos exposure
- Not related to smoking
- Highly malignant; short survival.