Pulmonary Medicine
Section 9

Classic Respiratory Symptoms
- Dyspnea
- Cough
- Hemoptysis
- Chest pain

Dyspnea
- Three forms
  - Intense need to breath heavily and rapidly
    - Anxiety attacks, low O2 in air, high CO2 in blood
    - Can occur after vigorous exercise
  - Increased efforts of breathing with increased airflow resistance
    - Asthma, croup, bronchitis
  - Chest tightness
    - Asthma, croup, pneumothorax, pleural effusion, pneumonia
- Specific manifestations of dyspnea
  - Tachypnea – rapid respiratory rate
  - Hyperventilation – greater respiratory effort
  - Apnea – no breathing
  - Orthopnea – SOB when recumbent
  - PND – paroxysmal nocturnal dyspnea
    - Awakening from sleep with orthopnea
- Treatment
  - Treatment determined of what condition is causing dyspnea
- Diagnosis of dyspnea
  - Airway problems
    - Foreign body, upper airway obstruction
  - Parenchymal lung disease – interstitial lung disease
    - ARDS, pneumonia, interstitial fibrosis
  - Pulmonary vascular disease
    - Pulmonary embolism, pulmonary hypertension
  - Pleural diseases
    - Pneumothorax, pleural effusion
  - Neuromuscular or chest wall diseases
    - Myasthenia gravis, severe scoliosis
  - Cardiovascular
  - Increased respiratory drive
    - Hyperthyroidism, pregnancy
  - Psychological reasons
    - Anxiety, panic attacks, psychosomatic disorders
Cough
• Differential diagnosis of cough
  o Airway irritants – smoke, dust, atmospheric irritants
  o Aspiration of foreign bodies – food, oral secretions, gastric secretions
  o Airway disease and URI – most common cause
    ▪ Tracheitis (croup), bronchitis, bronchiectasis, pneumonia
  o Interstitial disease within the lung tissue
    ▪ Pneumonia, lung abscess, pulmonary fibrosis
  o Congestive heart failure
• Productive cough
  o Produces clear, mucoid or grey phlegm
• Nonproductive cough
  o Viral pneumonia, bronchitis, chest cold, flu (dry cough)

Hemoptysis
• Coughing up blood
• Differential diagnosis
  o Airway diseases
    ▪ Bronchitis, bronchiectasis, bronchiogenic carcinoma
  o Interstitial diseases
    ▪ Tuberculosis, lung abscess after pneumonia
  o Vascular diseases
    ▪ Left ventricular failure, pulmonary embolism

Chest pain
• Chest pain does not start in the lungs, because there is not pain fibers in the lung tissue
• Differential diagnosis
  o Pleuritis
  o Pneumothorax
  o Pleural effusion
  o Pulmonary embolism extending to the lung surface
  o Abscess or hematoma under the diaphragm
    ▪ Ruptured appendicitis, ovarian cysts, gallbladder, tubal pregnancy
  o Lupus lung
  o Heart disease or mediastinal disease
Pulmonary Diagnostic Tools

- Physical exam
  - Inspection – chest size, shape, symmetry, strength, atrophy, ease of respiration, intercostal retraction
  - Palpation – depth of excursion, chest wall compliance
  - Percussion – top and bottom of chest bilateral
  - Auscultation – the main part of the examination

- Clubbing
  - Unknown cause, seen in pulmonary disease
  - Finger clubbing is characterized by enlarged fingertips and a loss of the normal angle at the nail bed

- Chest x-ray
- CT scans – good for interstitial diseases
- MRI scans – good for mediastinal and hilar diseases
- Lung scans
- Pulmonary angiograms
- Bronchoscopy
- Pulmonary function tests
  - Lung volumes – shows the size of various parts in the lung
  - Flow rates – if the flow in the airways is impeded or not
  - Diffusing capacity – how fast the gas transfers
  - Arterial blood gases
Asthma

- Incidence
  - In the last decade the incidence of asthma has increased by 1/3
    - 20 million people in the US
    - 6 million children and 14 million adults
- Children under 16 and adults over 65 are more prone
- Asthma is a process that affects the airways with excessive mucus production, bronchial muscle contraction, and swelling causing obstruction.
  - During an asthma attack, spasms in the muscles and bronchi constrict, impeding the outward passage of stale air. Sufferers can get starved for air with coughing, wheezing and chest tightness.
  - The basic cause is hyper-responsiveness of the airways to perceived noxious substances inhaled
  - Recently, asthma has been found to be a chronic inflammatory process with the prior symptoms.
  - Most of the research has been aimed at determining what might trigger asthma responses and what to avoid.
- Risk Factors and Triggers
  - It is thought that asthma starts in childhood and may be due to interaction of several factors
  - Asthma symptoms can be triggered by several factors
    - Allergies, viral or sinus infections, exercise, medications, foods, anxiety, heredity
  - Reflux disease
    - stomach acid flowing back up the esophagus
  - Air pollutants
    - tobacco, wood smoke, chemicals, and ozone
Asthma - continued
- Asthma Risk Factors and Triggers - continued
  - Occupational exposure
    - allergens, vapors, dust, gas, fumes
  - Strong odors or sprays
    - Other air borne particles
      - dust, chalk dust, talcum powder
- Signs and symptoms
  - Usually seen in childhood and teenage years - Rare in adults
  - Classic four symptoms
    - Cough
    - Dyspnea
    - Wheezing
    - Chest tightness
- Range of severity
  - Normal is 1 to 2 per week
  - Some have daily attacks
  - Persistent asthma symptoms – status asthmaticus
- Treatment
  - Allergen avoidance
    - Reduce exposure to dust mites, which are microscopic insects that live off dead skins cell flakes, and are everywhere.
    - The mites and their waste products are allergic to asthmatics.
    - To limit exposure to dust mites you should:
      - Enclose pillows & mattress with airtight plastic covers
      - Remove carpeting and curtains
      - Wash sheets and stuffed toys weekly in hot water
      - Clean bedrooms often with HEPA filter vacuum
      - Cockroaches and their feces is also a huge trigger, so cleanliness is essential
  - Desensitization allergy shots – not very effective
- Medications
  - Bronchodilators
    - Sympathomimetics
    - Epinephrine injections, inhalers
    - Xanthines – orally or injected
    - Anticolinergics
  - Anti-inflammatory drugs
    - Prednisone, Medrol, Qvar, Aristocort
  - Mast cell stabilizers
    - Crolon oral, Tilade inhaler
  - Anti-leukotriene drugs
    - Singulair, Accolate
  - Low humidified oxygen
    - Swimming has long been used for asthma because moist air is better than cold dry air. Very effective with older patients.
COPD

- Includes chronic bronchitis and emphysema
- Bronchitis – chronic cough, sputum production and thickening of bronchial passages
- Emphysema destroys the lung and enlarges the alveoli air spaces
- Incidence
  - 16 million Americans, 110,000 death per year
- Etiology
  - Smoking
  - Genetic predisposition
  - Multiple lung infections in children
  - Heavy exposure to environmental and industrial pollution
  - Cystic fibrosis
- How COPD develops
  - Smoking causes increased mucus production and bronchial inflammation
  - Nicotine paralyzes the mucociliary escalator
    - Mucociliary escalator traps mucus, bacteria, irritants
  - Nicotine blocks protein inhibitors which will eventually dissolve the alveoli
COPD - continued

- Pathophysiology
  - Involves all four parts of the respiratory tract
    - Bronchi
    - Bronchioles
    - Alveoli
    - Parenchyma

- Specific Pathophysiology
  - Increased resistance to airflow
  - Loss of elastic recoil
  - Decreased expiratory flow rate
  - Alveolar walls frequently break because of the increased resistance of airflows
  - The hyper inflated lungs flatten the curvature of the diaphragm and enlarge the rib cage
  - The altered configuration of the chest cavity places the respiratory muscles, including the diaphragm, at a mechanical disadvantage and impairs their force-generating capacity
  - Consequently, the metabolic work of breathing increases, and dyspnea increases

Two types of COPD

- Type A – Pink Puffers
  - Have mostly emphysema
  - Need to breathe rapidly to exchange O2 and CO2
  - Have prominent dyspnea, the fast puffing keeps them from becoming cyanotic
  - Most of the lung is perfused with blood exchange is not efficient because of fewer alveoli
COPD - continued

- Type B – Blue Bloaters
  - Have mostly chronic bronchitis with bronchiolar obstruction and non-ventilated alveoli
  - Results in shunting of cyanotic blood away from the area where there is no air in the lungs
  - Results in pulmonary hypertension which leads to heart failure with peripheral swelling
  - Severe dyspnea with any exertion

- Diagnosis of COPD
- Smoker with hacking cough, sputum and dyspnea
- Type A – thin, dorsal kyphosis, clubbing, pigeon breast (pectus carinatum) or funnel chest (pectus excavatum)
- Type B – obese, swollen appearance, cyanotic
- X-ray findings
  - Large lung volumes hyperlucent, flat diaphragm, increased AP diameter
- Pulmonary function tests
  - Airway obstruction and decrease, air trapping
- Blood gases
  - Type A – normal blood gases
  - Type B – marked hypoxemia and CO2 retention
- Treatment of COPD
  - Bronchodilators
  - Antibiotics
  - Corticosteroids
  - Supplemental oxygen therapy
  - Chest physiotherapy to lose secretions
  - Surgery to remove diseased lung tissue
  - Lung transplantation
**Bronchiectasis**

- **Pathophysiology**
  - Irreversible dilation of part of the bronchial tree
  - Caused by chronic infection of bronchi & bronchioles
  - Chronic bronchial infection causes a dilatation of the air passages which are trapped with muco-purulent material
  - Caused by slow-growing bacteria and fungi

- **S & S**
  - Chronic deep hacking cough
  - Copious amounts of foul-spelling pus sputum
  - Frequent attacks of pneumonia

- **Diagnosis**
  - Localized rales and coarse ronchi
  - Appears similar to COPD with clubbing
  - Normal blood gases
  - History of chronic infection
  - CT scan confirms the diagnosis

- **Treatment**
  - Antibiotics – ciprofloxacin
  - Bronchopulmonary drainage
    - Bending over, almost standing on head, to get the mucus up and out
  - Bronchodilators

**Cystic Fibrosis**

- Inherited disease that causes thick, sticky mucus to build up in the lungs and digestive tract
- The most common type of chronic lung disease in children and young adults
  - 1 in every 3,300 – most children and teenagers
  - May result in early death

- **S & S**
  - Pneumonitis, bronchiectasis, lung abscesses, pancreatic insufficiency

- **Diagnosis**
  - Established by the sweat electrolyte test

- **Treatment**
Pulmonary fibrosis

- Referred to as interstitial lung diseases
- Causes inflammation and fibrosis of the connective tissue between the alveoli
- Most common causes
  - Environmental causes – inhaled dusts, asbestosis, silicosis, glass makers, construction workers
  - Antigens – hypersensitivity pneumonitis
  - Drugs – Methotrexate
  - Radiation injury
  - Other diseases – sarcoidosis, RA
  - Mimicking disorders similar presentation but vastly different
    - CHF, pneumocystis or viral pneumonia, carcinomatosis
- Pathology of interstitial lung disease
  - Inflammation of the alveolar wall and inter-alveolar spaces
  - Fibrous scarring
  - Granuloma formation
  - End stage leads to a mass of scar tissue with contraction and the formation of cystic areas
Pulmonary fibrosis - continued

- Impairment of pulmonary function
  - Decreased lung volume
  - Decreased compliance (stiff lungs)
  - Impairment of diffusion
  - Decreased gas exchange
  - Shunting and spasm of pulmonary arteries
  - Heart failure resulting from pulmonary hypertension

- S & S of pulmonary fibrosis
  - Obvious dyspnea
  - Chronic nonproductive cough
  - Clubbing
  - Mild cyanosis

- Diagnosis of pulmonary fibrosis
  - CT scan is confirmatory

- Specific diseases that can cause pulmonary fibrosis
  - Silicosis – disease of glass makers, sand blasters, rock miners and stone cutters
    - Takes 20 years to develop
  - Pneumoconiosis – coal miner’s disease
    - Severe lung fibrosis with hypoxia
  - Asbestosis – leads to 3 distinct diseases
    - Bronchiogenic carcinoma
    - Mesothelioma of lung (cancer of lung pleura)
    - Interstitial fibrosis – takes 20 years to develop
  - Drug-induced pulmonary fibrosis – chemotherapy

- Treatment of pulmonary fibrosis
  - Very little effective care
  - Oxygen 24 / 7
  - Corticosteroids
Pulmonary Embolism

- Occurs when a blood clot is from the deep venous system travels to the lungs
  - Usually involves veins of legs, arms and pelvis (pregnancy)
- Three conditions are put you at risk
  - Increased coagulation of blood
    - Stress, surgery, injury, heart attack, severe illness
  - Stasis or stagnation of blood flow
    - Seen in conditions of immobility such as prolonged bed rest long car rides of plane flights in cramped position
  - Damage to vessel wall or venous valves
    - Stasis-induced phlebitis, soft-tissue injury, bad ankle sprain
- Pathophysiology
  - Pulmonary infarction of distal tissues occurs in a small number of cases
  - Hemorrhage and edema of tissues distal to the clot is more common
  - Vasoconstriction of pulmonary blood vessels occurs
    - This causes a release of serotonin an vasoconstrictive amines which cause more constriction
  - Low blood pH causes even more constriction
  - Right sided heart failure followed by left sided blood flow followed by syncope and sudden death
- S & S
  - Sudden dyspnea
  - Pleuritic chest pain with hemoptysis
  - Can have syncope followed by death
- Diagnosis
  - Normal chest x-ray
  - Perfusion lung scan shows absence of perfusion to involved arteries
  - Pulmonary arteriography – “gold standard”
  - Contrast CT
  - Decreased blood gases and increased pH
- Treatment
  - tPA – tissue plasminogen activator if potentially life threatening embolism
  - Complete bed rest
  - Anticoagulation with heparin in ICU
  - Coumadin anticoagulation for six months
  - Vena caval filter surgery
- PE prophylaxis
  - Most common secondary cause of hospital deaths
  - Lower extremity anti-embolism device with compression during surgery are after heart attack or sever illness
  - Low dose heparin during surgery
  - Graduated compression support hose for patients with deep venous insufficiency
Pleural effusion
- Caused by inflammation of pleura
- S & S
  - Dyspnea
  - Pleuritic chest pain
- Physical findings
  - Decreased breath sounds
  - Pleural friction rub
- Differential diagnosis
  - Pleural effusion with have exudate or transudate
  - Hemothorax from trauma will have blood
  - Empyema becomes a giant abscess of pus
- Diagnosis
  - Chest x-rays
  - Ultrasound
  - Thoracentesis – needle aspiration
- Treatment
  - Treat the cause
  - Drain off fluid
  - May need pleurodesis – surgical breakup of adhesions

Pneumothorax
- Air in the pleural space that collapses all or part of the lung
  - The pressure of the air against the lung causes it to give way, often leading to mild to severe chest pain and shortness of breath
  - Lung collapses in proportion to the amount of air that leaks into your chest cavity
  - Although the entire lung can collapse, a partial collapse is much more common
- Causes
  - Trauma
  - Growing tumor blocking a major airway
  - An infection
  - Inhaled foreign object.
- S & S
  - If a small amount of air enters the pleural space, there may be a few signs or symptoms
  - Even a minimally collapsed lung is likely to cause some chest pain
  - When the lung has collapsed 25 percent or more:
    - Sudden, sharp chest pain on the same side as the affected lung
    - Dyspnea
    - Chest tightness
    - Tachycardia
- Physical exam
  - Asymmetrical breath sounds
  - Decreased sounds over pneumothorax
Pneumothorax - continued

- Diagnosis
  - Chest x-ray is pathognomonic

- Complications of pneumothorax
  - Hypoxemia
  - Respiratory failure
  - Cardiac arrest
  - Shock

- Treatment
  - Bedrest and observation if collapse is less than 25%
  - Chest tube if collapse over 25%
    - Suction continued for up to 3 days
  - Thoracotomy needed if lung does not re-inflate

Mediastinal Diseases

- Mediastinal masses
  - Thyoma, germ cell tumor, lymphoma, thyroid enlargement, carcinoma, pericardial cysts, neurogenic tumors

- S & S
  - Half of masses have no symptoms and the growth is found incidental on another examination
  - The other half of the patients have chest pain, dyspnea, nonproductive cough and facial edema

- Diagnosis
  - Lateral chest x-ray
  - CT scan
  - Mediastinoscopy
Disorders of Ventilatory Control
- Hyperventilation – rapid breathing
  - Occurs with neurological diseases of the cortex such as meningitis, encephalitis, strokes
  - Can also occur with panic attacks
- Hypoventilation
  - Occurs with neurological diseases of the medulla such as encephalitis
- Cheyne-Stokes breathing
  - Cyclic pattern of increasing and decreasing respiration leading to apnea
  - Seen in neurological disorders and CHF
- Sleep apnea syndrome
  - During REM sleep there is a collapse of soft tissues with periods of apnea

ARDS - Acute Respiratory Distress Syndrome
- Life threatening process with breakdown of alveolar cell membranes leading to pulmonary edema
- Causes
  - Aspiration of gastric contents or water (near drowning)
  - Toxic gas inhalation
  - Severe diffuse pneumonia
  - Sepsis, shock, severe trauma, head trauma
  - Intravascular coagulation
  - Fat embolism
  - Multiple transfusions
  - Pancreatitis
  - Drug reactions
    - Called heroin pulmonary edema
- ARDS pathology
  - Damage to alveolar epithelial cells leads to a buildup of interstitial and alveolar fluid leading to alveolar collapse
  - This leads to increased vascular resistance, decreased lung compliance and buildup of hyaline membranes
  - The thickening of the membranes leads to pulmonary fibrosis
- S & S
  - Dyspnea, tachypnea, tachycardia, rales, hypoxia
- Treatment
  - Aggressive treatment of the cause (sepsis, shock, etc.)
  - Corticosteroids
  - Support of impaired gas exchange
- Prognosis
  - Mortality 50 %
**Pulmonary Red Flags**
- Severe asthma attacks
- New onset of dyspnea or worsening dyspnea
- All cases of chest pain
- Upper airway disease
- Pulmonary embolism
- Pneumothorax
- Pleural effusion with dyspnea
- Pneumonitis
- Cheyne-Stokes breathing
- Acute onset of any breathing problems
- Acute respiratory distress

**Pulmonary sub-acute red flags**
- New onset of asthma
- New cough lasting for more than one week
- Hemoptysis
- COPD if not currently under care
- Bronchiectasis
- Cystic fibrosis
- Pulmonary fibrosis
- Pulmonary effusion
- History or S & S of mediastinal disease
- Sleep apnea