

## **Pulmonary Objectives**

### **Introduction to Pulmonary Medicine, Laboratory, and Pulmonary Diagnostic Procedures**

1. Identify the anatomical structures of the pulmonary system.
2. Illustrate and explain the pulmonary circulation.
3. Describe the mechanisms of ventilation.
4. Relate pulmonary signs and symptoms to the underlying pathophysiology of common pulmonary diseases.
5. Identify risk factors for pulmonary disease and state why these factors put the patient at increased risk for developing specific pulmonary diseases and complications of disease.
6. List the common causes/differential diagnosis for cough, dyspnea, hypoxemia, sputum production, hemoptysis, and clubbing as it pertains to the pulmonary system.
7. Explain the following laboratory/diagnostic studies including indications for initial and follow-up assessment, interpretation of results, invasiveness, risks to patient, cost, and patient education regarding procedures.
  - Chest x-ray (covered in detail in the Intro to Radiology Laboratory)
  - Pulmonary Function Test/Peak Flow Testing (covered in more detail in PFT Lecture/Lab)
  - CT Scan, Spiral CT, Multi-row CT
  - V-Q Scan
  - D-dimer
  - Cardiopulmonary exercise stress testing
  - Sputum Culture
  - WBC and differential
  - Bronchoscopy
  - Oximetry
  - Pulmonary angiography
  - Arterial Blood Gases (ABG's)
    - Describe the method of obtaining ABG's.
    - Define acidosis in relationship to the pathological changes occurring in the body.
    - Define alkalosis in relationship to the pathological changes occurring in the body.
  - Identify expected ABG findings associated with:
    - metabolic acidosis
    - metabolic alkalosis
    - respiratory acidosis
    - respiratory alkalosis

### **Introduction to Radiology Laboratory**

1. Describe a systematic approach to the evaluation of a chest x-ray.
2. Discuss the benefits and limitations of a chest x-ray.
3. Develop the ability to interpret a chest x-ray using a systematic approach.
4. Define density, contrasts, absorption, radio-opaque/lucent, and 2 vs. 3 dimensional studies.
5. Describe the role of the x-ray technician, and radiologist with regard to x-ray interpretation in the clinical setting.

## **Pulmonary Function Tests and Therapeutic Interventions**

1. Define each of the following parameters of pulmonary function testing:
  - Tidal volume (TV)
  - Inspiratory Reserve Volume (IRV)
  - Inspiratory Capacity (IC) (Note:  $IC = TV + IRV$ )
  - Expiratory Reserve Volume (ERV)
  - Vital Capacity (VC) (Note:  $VC = TV + IRV + ERV$ ;  $VC = IC + ERV$ )
  - Residual Volume (RV)
  - Functional Residual Capacity (FRC) (Note:  $FRC = ERV + RV$ )
  - Total Lung Capacity (TLC) (Note:  $TLC = TV + IRV + ERV + RV$ ;  $TLC = VC + RV$ )
  - Peak Flow
  - Forced Expiratory Volume in 1 Second ( $FEV_1$ )
  - Forced Expiratory Flow (FEF)
2. Discuss the importance and use of the following formula for calculating alveolar/arterial oxygen gradient:  $AaO_2 = 150 - pCO_2 - pO_2$  ( $nl < 15$ )
3. Describe indications for conducting PFTs and the interpretation of findings.
4. Describe common therapeutic interventions (non-pharmacologic) for treatment of various pulmonary conditions/complications including use of oxygen, nebulizers, various inhalers, and chest PT.
5. Discuss patient education strategies regarding pulmonary function testing and therapeutic interventions.

## **Pertussis and Influenza**

1. Discuss the etiology, epidemiology, and pathophysiology of pertussis and influenza.
2. Describe current recommendations for the primary prevention of pertussis and influenza including availability and current recommendations for immunizations and their efficacy.
3. Describe the clinical presentation of pertussis and influenza, differential diagnosis, laboratory and other diagnostic evaluation, and the management of pertussis and influenza.
4. Discuss common complications of pertussis and influenza.

## **Asthma**

1. Discuss the epidemiology of asthma.
2. List precipitating environmental events and risk factors for a patient with asthma.
3. Explain the pathophysiology, history and physical exam findings, and diagnostic evaluation for a patient presenting with asthma.
4. Recognize expected findings on chest x-ray (CXR) and peak flow tests for patients with varying degrees of asthma.
5. Differentiate between mild intermittent, mild persistent, moderate persistent, and severe persistent asthma with regard to symptoms and lung function.
6. Formulate a treatment plan for acute and long-term management of the disease.
7. Identify the components of patient education including: preventing and managing an asthma attack, environmental triggers, importance of home monitoring, and follow-up.
8. Recognize risks and complications of disease associated with asthma.

### **Lower Respiratory Infections: Bronchitis, Pneumonia, and Lung Abscess**

1. List the most common etiologic agents for the development of bronchitis or pneumonia including:
  - Bacterial
  - Viral
  - Fungal
2. Recognize common underlying disorders that predispose individuals to pneumonia and identify populations at risk for developing the following pneumonias:
  - Pneumococcal
  - Klebsiella
  - Mycoplasma
  - Hemophilus influenza
  - Legionella
  - PCP
  - Aspiration
3. Compare and contrast the clinical presentation and signs and symptoms in a patient presenting with bronchitis versus pneumonia.
4. Identify the indications and usefulness of each of the following with regard to the differential diagnosis of lower respiratory track infections.
  - Laboratory, CBC with differential
  - CXR
  - Nasal swab
  - Gram stain
  - Sputum culture
  - Blood culture
  - PFT's
  - ABG's
5. Discuss the management of patients with bronchitis and pneumonia including patient education, and follow-up. (Pharmacological management will be covered in Pharmacotherapy I.)
6. Discuss additional treatment considerations for at risk patients such as those with history of underlying pulmonary disease or immuno-compromise/suppression.
7. Discuss the current recommendations regarding pneumococcal vaccines

### **Chronic Obstructive Pulmonary Disease (COPD), Chronic Obstructive Lung Disease (COLD)**

1. Define COPD, chronic bronchitis, and emphysema.
2. Describe the pathophysiology of COPD/COLD.
3. Recognize precipitating environmental events and risk factors for the development of obstructive and restrictive lung disease.
4. Discuss the natural course of COPD/COLD and its prognosis.
5. Discuss the clinical features and common history and physical exam findings, for a patient with COPD/COLD.
6. Compare and contrast chronic bronchitis with emphysema in regard to signs and symptoms.
7. Discuss the chest x-ray (CXR) findings, changes in lung volume and air exchange in relation to pulmonary function tests, and peak flow findings expected for varying stages of COPD/COLD.

8. Discuss the non-pharmacological management of COPD/COLD and patient education regarding treatment, progression, and prognosis based on stage of disease.

### **Tuberculosis (TB)**

1. Discuss the pathology of TB and describe the nature of the mycobacterium with respect to its:
  - general classification as a bacterium
  - staining characteristics
2. Discuss the epidemiology, etiology, routes of transmission and identify those populations most at risk for contracting and developing TB.
3. Explain the natural course of each of the following:
  - primary TB
    - asymptomatic
    - symptomatic
  - secondary or reactivation
    - pulmonary TB
    - extrapulmonary TB
4. Identify the expected history and physical exam findings in a patient with active, symptomatic TB.
5. Describe the diagnostic approach for a patient with suspected exposure or active TB and including current recommendations of pharmacologic and non-pharmacologic intervention.
6. Explain the screening process for TB with regard to:
  - a. who should be screened
  - b. method of screening
  - c. tests used for evaluation of a patient with possible exposure
  - d. tests used for evaluation of a patient with a known history of TB or positive skin test
  - e. tests used for evaluation of a patient with suspected active TB
  - f. discuss methods and interpretation of CXR and Tuberculin Skin Tests
7. Discuss the public health issues surrounding TB.
8. Outline the important education information to be communicated to the patient and his/her family.
9. Formulate a treatment plan for a patient with a positive mantoux test and active pulmonary TB.
10. Describe an approach to the management of a patient with active TB, including pharmacological treatment, patient education, prevention of spread of disease, and follow-up.

### **Interstitial Lung Disease**

1. Define interstitial lung disease and describe the pathophysiology and characteristics of the disease.
2. Discuss the various etiologies and differential diagnoses for interstitial lung disease with regards to each of the following:
  - Drug-related causes
  - Environmental and occupational inhalation exposure (e.g., pneumoconiosis)
  - Hypersensitivity
  - Radiation
  - Infections
  - Primary pulmonary disorders
  - Idiopathic pulmonary fibrosis
  - Systemic disorders (e.g., collagen vascular diseases, sarcoidosis)

3. Discuss the clinical presentation, physical findings, diagnostic evaluation, and first line treatment of interstitial lung disease.

### **Pleural Disease: Pneumothorax, Hemothorax, Pleuritis, and Pleural Effusion**

1. Pneumothorax
  - Define pneumothorax.
  - Discuss the etiology, pathophysiology, and risk factors associated with each of the following:
    - Simple pneumothorax
    - Spontaneous pneumothorax
      - Primary
      - Secondary
    - Traumatic
    - Tension pneumothorax
    - Hemopneumothorax
    - Flail chest
    - Iatrogenic (hemo) pneumothorax
  - Recognize the clinical presentation, common complaints, and physical exam findings that are consistent with a diagnosis of pneumothorax.
  - Discuss the expected CXR findings in a patient with a pneumothorax and state how the degree of pneumothorax is estimated.
  - Describe the expected ABG findings for O<sub>2</sub> saturation for a patient with a pneumothorax
  - Discuss the indications and rationale for the decision to treat a pneumothorax with:
    - observation
    - chest tube
    - one-way flutter valve or angiocath
    - thoracotomy
2. Pleuritis
  - Explain the etiology and pathophysiology of pleuritis.
  - Recognize the clinical presentation, differential diagnosis, and diagnostic evaluation that leads to a diagnosis of pleuritis.
  - Formulate a treatment plan for a patient with pleuritis which addresses the pain and inflammation.
3. Pleural Effusion
  - Define pleural effusion and describe the etiology and pathophysiology of this condition.
  - Identify and describe the five major types of pleural effusion and give an example of a clinical condition which would fall into each of these categories.
  - Describe the clinical presentation, diagnostic evaluation, and management of a patient with a pleural effusion.

### **Pulmonary Circulation**

#### **Pulmonary Embolism, Pulmonary Hypertension, Pulmonary Edema, and ARDS**

1. Pulmonary Embolism
  - Identify the mechanism contributing to venous thromboembolism.
  - Explain how the following risk factors contribute to the development of a PE:
    - DVT
    - BCP
    - Pregnancy
    - Immobilization

- Occult malignancy
  - Local trauma
  - Smoking
  - Chronic disease states
- Identify signs, symptoms, and physical exam findings that might alert the examiner the presence of a pulmonary embolus (PE) and describe their specificity in regard to the differential diagnosis.
  - Identify the ABG findings that occur with respect to changes in O<sub>2</sub> levels, CO<sub>2</sub> levels, and O<sub>2</sub> saturation.
  - Define dead space and the significance when a PE is present.
  - Describe the various diagnostic tools used evaluate the patient with suspect PE. Comment on their accuracy, specificity, sensitivity, cost, and complications or contraindications.
  - Define V/Q (ventilation perfusion quotient) in terms of the parameters that it is measuring. Compare and contrast its use and efficacy with d-dimer and CT Scan.
  - List the pulmonary vascular and cardiac complications of PE.
  - Recognize the first line treatment of a patient with a PE.
3. Pulmonary Hypertension
- Define primary (idiopathic) pulmonary hypertension.
  - Describe the 4 etiological/pathological mechanisms that result in secondary pulmonary hypertension.
  - Give an example of a clinical condition which falls under each of the above mechanisms. (*Example: Mitral stenosis is a clinical condition that may lead to increased pulmonary venous pressure and therefore pulmonary hypertension.*)
  - Describe the expected clinical presentation of pulmonary hypertension.
  - Briefly describe the evaluation of a patient with secondary pulmonary hypertension.
3. Pulmonary Edema
- Explain the various etiologies and pathophysiology of pulmonary edema.
  - Recognize the clinical presentation and evaluation of pulmonary edema.
  - Recognize the first line treatment for pulmonary edema.
4. Acute Respiratory Distress Syndrome (ARDS)
- Explain the various etiologies and pathophysiology of ARDS.
  - Recognize the presentation of Acute Respiratory Distress Syndrome (ARDS) and emergent situation requiring admission and referral.

## Principles of Oncology

1. Define each of the following and describe differential features of each:
  - Cancer
  - Tumor
  - Neoplasm
  - Malignancy
  - Benign
2. Differentiate the characteristics of normal vs malignant cells.
3. List the seven warning signs of cancer.
4. Describe the body's response to cancer including:
  - Local effects (the area right around the cancer)
  - Systemic effects
  - Metastatic effects
5. Discuss the advantages and disadvantages of the following treatment modalities:

- Surgery
- Chemotherapy
- Radiation Therapy
- Immunotherapy

### **Lung Cancer**

1. Discuss the epidemiology and risk factors for lung cancer.
2. Differentiate between benign and malignant lesions.
3. Discuss the characteristics of:
  - Bronchogenic carcinoma
  - Carcinoid tumors
  - Metastatic tumors
  - Pulmonary nodules
4. Describe/differentiate the major cell types of carcinoma of the lungs and including area of the lung affected, clinical presentation, and pattern of metastasis.
  - Non Small Cell Cancer
    - Adenocarcinoma
    - Squamous cell carcinoma
    - Large cell (anaplastic) carcinoma
  - Small Cell Cancer
5. Describe the diagnostic evaluation of lung cancer including laboratory and other diagnostic procedures.
6. Discuss the benefits and limitations of chest x-ray to screen for lung cancer
7. Discuss staging of lung cancer, the basis of treatment options for lung cancer, and prognosis.