

SESSION V: MECHANISMS OF HUMAN DISEASE: LABORATORY SESSIONS
PULMONARY PATHOLOGY II

December 10, 2008
9:30 am – 11:00am

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GOAL: Describe the basic morphologic and pathophysiologic changes in various conditions of the respiratory system. Define (describe) and correlate symptoms and signs of diseases with the structural changes of diseased organs.

OBJECTIVES:

1. Review the normal gross and histologic anatomy of the lung.
2. Describe the morphologic characteristics of pneumonias.
3. Describe the morphologic characteristics of common tumors of the lung.

CLINICAL CASE:

1. **Case 1**

A 62 year-old woman develops cough productive of green sputum, dyspnea, fever, chills, and pleuritic chest pain. She had a “cold” (stuffy nose, sneezing, sore throat) for the past week. Her past history is negative for any hospitalization or surgery.

On exam her temperature is 101⁰F. Oxygen saturation on room air is 89%.

On percussion there is dullness over the right upper lung field. On auscultation there are bronchial breath sounds in the right upper lung field.

Sputum gram stain shows few squamous cells, many neutrophils, and Gram positive diplococci.

- a. Identify organ: **Lung**
- b. Describe the characteristic pathologic changes in the specimen. **Section of the lung shows acute inflammation. Alveoli are filled with fibrin and inflammatory cells, predominantly neutrophils. Interstitial capillaries are congested. Bronchioles are filled with inflammatory cells. The pleura is edematous and contain some inflammatory cells.**
- c. Correlate the clinical findings with the pathology.
Fever and chills – acute inflammation (cytokines)
Cough and purulent sputum – bronchiolitis
Chest pain – pleuritis
Recent (likely viral) upper respiratory tract infection–impaired mucociliary apparatus/pulmonary defense mechanism
- d. Diagnosis: **Community acquired pneumonia (Acute Bacterial Pneumonia)**
Most likely *Streptococcus pneumoniae* based on sputum Gram stain
Most common cause of CAP
Accounts for >90% of cases of “lobar” pneumonia

2. **Case 2**

57-year-old man develops hemoptysis. He has been smoking two packs of cigarettes per day for 30 years. He has had a chronic cough worse in the morning for 10 years. He has had mild dyspnea on exertion in the past 5 years

- a. Identify organ: **Lung**
- b. Describe the characteristic pathologic changes in the specimen. **Lung tissue is replaced by an infiltrating well differentiated, squamous cell carcinoma with keratin pearl formation.**
- c. Diagnosis: **Squamous Cell Carcinoma of the Lung.**

3. **Case 3**

69-year-old woman presents to the emergency room with chest pain. She has no chronic medical problems. She smoked 1 pack of cigarettes during her first two years of college, none since.

On physical exam heart, lung, abdominal exams are normal.

On chest X-ray there is a “coin lesion” in the periphery of the right lung.

- a. Identify organ: **Lung**
- b. Describe the characteristic pathologic changes in the specimen. **Lung tissue is replaced by an infiltrating adenocarcinoma which forms glands.**
- c. Diagnosis: **Adenocarcinoma of the lung.**

4. **Case 4**

51-year-old-woman complains of cough for several weeks. The cough is productive of gray-white mucous material. She has never smoked.

On physical exam there are decreased breath sounds in the lower right lung field.

Chest X-ray shows a diffuse infiltrate in periphery of the right lower lobe.

- a. Identify organ: **Lung**
- b. Describe the characteristic pathologic changes in the specimen:
Section of the lung shows a diffusely infiltrating bronchioloalveolar carcinoma. Alveoli are lined by large neoplastic cells with abundant cytoplasm and prominent vesicular nuclei. The neoplastic cells form small papillary growths in many alveoli. The alveolar spaces

contain desquamated neoplastic cells, some inflammatory cells and mucin. The interstitial spaces contain a combination of mononuclear and polymorphonuclear leukocytes.

c. Diagnosis: **Bronchioloalveolar carcinoma.**

5. **Case 5**

A-71 year-old man develops progressive chest pain, dyspnea and back pain. He has had a 20 pound unintentional weight loss over 3 months. He smokes and has a 50 pack year smoking history.

On physical exam there is hepatomegaly.

Chest X-ray shows enlarged hilar and mediastinal lymph nodes.

CT scan shows bilaterally enlarged adrenal glands and multiple masses in the liver.

a. Identify organ: **Lung/Liver**

b. Describe the characteristic pathologic changes in the specimens. **Section of the lung reveals an infiltrating small cell carcinoma composed of nests of small round cells with scant cytoplasm. The neoplasm penetrates the bronchial wall, lying adjacent to strips of hyaline cartilage. Tumor also forms nests scattered in fibrotic lung tissue.**

Section of the liver shows a nodular metastasis from the lung. There may be areas of necrosis within the primary tumor and the metastases. (You need not discuss any secondary changes to the liver other than compression and destruction of hepatic lobules.)

c. Diagnosis: **Small Carcinoma of the Lung**

6. What are the most common genetic mutations found in lung neoplasms?

Lung cancer cells have a number of acquired genetic mutations. In some cancer cells there are greater than 10 mutations.

Below are some of the more common mutations:

a. **Dominant oncogene abnormalities:**

c-myc overexpression (prevalent in small cell lung cancer)

K-ras mutations (prevalent in adenocarcinomas)

b. **Recessive oncogene (tumor suppressor gene) abnormalities**

P53 mutations

Retinoblastoma gene mutations

3p deletions