Chapter 26

Cancer of the Lung
Anatomic Alterations of the Lungs

- Inflammation, swelling, and destruction of the bronchial airways and alveoli
- Excessive mucus production
- Tracheobronchial mucus accumulation and plugging
- Airway obstruction
  - Blood
  - Mucous accumulation
  - Tumor projecting into a bronchus
- Atelectasis
- Alveolar consolidation
- Cavity formation
- Pleural effusion
Etiology

- Lung cancer is the leading cause of cancer deaths in the United States
- More than 214,000 new cases are reported in the United States annually
  - About 114,000 in males
  - About 100,000 in females
Types of Cancer

- Non–small-cell cancer (NSCLC)
  - Squamous cell carcinoma
  - Adenocarcinoma
  - Large-cell carcinoma (Undifferentiated)
- Small-cell lung cancer (SCLC)
  - Small-cell (or oat cell carcinoma)
### Table 26-1: Characteristics of Lung Cancers

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Growth Rate</th>
<th>Metastasis</th>
<th>Means of Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamous cell carcinoma</td>
<td>Slow</td>
<td>Late; mostly to hilar lymph nodes</td>
<td>Biopsy, sputum analysis, bronchoscopy, electron microscopy, immunohistochemistry</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>Moderate</td>
<td>Early</td>
<td>Radiography, fiberoptic bronchoscopy, electron microscopy</td>
</tr>
<tr>
<td>Large cell carcinoma</td>
<td>Rapid</td>
<td>Early and widespread</td>
<td>Sputum analysis, bronchoscopy, electron microscopy (by exclusion of other cell types)</td>
</tr>
<tr>
<td>Small cell (oat cell) cancer</td>
<td>Very rapid</td>
<td>Very early; to mediastinum or distally in lung</td>
<td>Radiography, sputum analysis, bronchoscopy, electron microscopy, immunohistochemistry, and clinical manifestations (cough, chest pain, dyspnea, hemoptyis, localized wheezing)</td>
</tr>
</tbody>
</table>


Table 26-1. Characteristics of Lung Cancers
Screening and Diagnosis

- Routine chest x-ray is the most common
- Computed tomography (CT) scan
- Positron emission tomography (PET) scan
- View a tissue sample (biopsy) under a microscope—used for a definitive diagnosis
Screening and Diagnosis (Cont’d)

- Procedures used to obtain a tissue biopsy
  - Bronchoscopy
  - Thoracoscopy
  - Mediastinoscopy
  - Transbronchial needle biopsy
  - Open-lung biopsy
  - Sputum cytology
  - Thoracentesis
  - Video thoracoscopy
Staging of Lung Cancer

- Staging is the process of classifying information about cancer
  - Cancer type
  - Size of the tumor
  - Level of lymph node involvement
  - The extent to which the cancer has spread

- The patient’s prognosis and treatment depend on the staging results
Staging of Lung Cancer (Cont’d)

System most often used for staging lung cancer

- **TNM classification**
  - \( T \) represents the extent of the primary tumor
  - \( N \) denotes the lymph node involvement
  - \( M \) indicates the extent of metastasis

- **Roman numerals are used to identify stages**
  - \( 0 \) being the least advanced
  - \( IV \) being the most advanced
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary tumor (T)</strong></td>
<td></td>
</tr>
<tr>
<td>T0</td>
<td>No evidence of tumor</td>
</tr>
<tr>
<td>Tx</td>
<td>Tumor that cannot be assessed</td>
</tr>
<tr>
<td><strong>Lymph nodes (N)</strong></td>
<td></td>
</tr>
<tr>
<td>Nx</td>
<td>Regional lymph nodes cannot be assessed</td>
</tr>
<tr>
<td>N0</td>
<td>Absence of regional lymph involvement</td>
</tr>
<tr>
<td><strong>Distant metastasis (M)</strong></td>
<td></td>
</tr>
<tr>
<td>Mx</td>
<td>Metastasis cannot be assessed</td>
</tr>
<tr>
<td>M0</td>
<td>Absence of distant metastasis</td>
</tr>
</tbody>
</table>

Figure 26-2. Staging of lung cancer by the TNM classification system. 

A, B, Stage I disease includes tumors classified as T1, with or without metastasis to the lymph nodes in the ipsilateral hilar region. C, Also included in stage I are tumors classified as T2 but having no nodal or distant metastases. D, Stage II disease includes those tumors classified as T2, with metastasis only to the ipsilateral hilar lymph nodes. E, Stage III includes all tumors more extensive than T2 or any tumor with metastasis to the lymph nodes in the mediastinum or with distant metastasis.
Non–Small-Cell Cancer Staging

The stages for non–small-cell lung cancer include these subcategories:

- Stage 0
- Stage I
- Stage II
- Stage III A
- Stage III B
- Stage IV
Small-Cell Cancer Staging

Small-cell cancer is staged differently than non–small-cell cancer. Usually classified as:

- **Limited**: cancer confined to only one lung and to its neighboring lymph nodes
- **Extensive**: cancer has spread beyond one lung and nearby lymph nodes. It may have invaded both lungs, more remote lymph nodes, or other organs
Overview of the Cardiopulmonary Clinical Manifestations Associated with Cancer of the Lung

The following clinical manifestations result from the pathophysiologic mechanisms caused (or activated) by:

- Atelectasis
- Alveolar Consolidation
- Excessive Bronchial Secretions
Fig. 9-8. Atelectasis clinical scenario.
Fig. 9-9. Alveolar consolidation clinical scenario. *Or increased when a fever is present.
Fig. 9-12. Excessive bronchial secretions clinical scenario.
Clinical Data Obtained at the Patient’s Bedside
## The Physical Examination

### Vital Signs

- **Increased**
  - **Respiratory rate** *(tachypnea)*
  - **Heart rate** *(pulse)*
  - **Blood pressure**
<table>
<thead>
<tr>
<th>The Physical Examination (Cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Cyanosis</td>
</tr>
<tr>
<td>● Cough, sputum production, and hemoptysis</td>
</tr>
<tr>
<td>● Chest Assessment Findings</td>
</tr>
<tr>
<td>➢ Crackles, rhonchi, wheezing</td>
</tr>
</tbody>
</table>
Clinical Data Obtained from Laboratory Tests and Special Procedures
**Pulmonary Function Test Findings**

- Relative to where the malignancy originates, the PFT values may show either obstructive or restrictive values. For example, when the malignancy obstructs major airways, the PFTs may show obstructive pathology—especially when there is COPD present.

- However, when large amounts of pulmonary tissue, and/or diaphragm is involved (extensive bronchioalveolar carcinoma), then the pathology may show restrictive PFT values.
### Arterial Blood Gases

**Localized (e.g., lobar) Lung Cancer**

#### Acute Alveolar Hyperventilation with Hypoxemia
*(Acute Respiratory Alkalosis)*

<table>
<thead>
<tr>
<th>pH</th>
<th>PaCO₂</th>
<th>HCO₃</th>
<th>PaO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(slightly)</td>
<td></td>
</tr>
</tbody>
</table>
**PaO$_2$ and PaCO$_2$ trends during acute alveolar hyperventilation.**
### Arterial Blood Gases

**Extensive or Widespread Lung Cancer**

**Acute Ventilatory Failure with Hypoxemia**

**(Acute Respiratory Acidosis)**

<table>
<thead>
<tr>
<th>pH</th>
<th>PaCO₂</th>
<th>HCO₃⁻</th>
<th>PaO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>↑</td>
<td>↑ (Slightly)</td>
<td>↓</td>
</tr>
</tbody>
</table>


**PaO₂ and PaCO₂ trends during acute or chronic ventilatory failure.**

Fig. 4-6. PaO₂ and PaCO₂ trends during acute or chronic ventilatory failure.
# Oxygenation Indices

<table>
<thead>
<tr>
<th>(Q_S/Q_T)</th>
<th>(DO_2)</th>
<th>(VO_2)</th>
<th>(C(a-v)O_2)</th>
<th>(O_2ER)</th>
<th>(SvO_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>↓</td>
<td>N</td>
<td>N</td>
<td>↑</td>
<td>↓</td>
</tr>
</tbody>
</table>
### Hemodynamic Indices

(When hypoxemia and acidosis are present, or when a tumor invades the mediastinum and compresses the superior vena cava)

<table>
<thead>
<tr>
<th>Variable</th>
<th>CVP</th>
<th>RAP</th>
<th>PA</th>
<th>PCWP</th>
<th>CO</th>
<th>SV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
<td>↓ or N</td>
<td>↓ or N</td>
<td>↓ or N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>SVI</th>
<th>CI</th>
<th>RVSWI</th>
<th>LVSWI</th>
<th>PVR</th>
<th>SVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td>↓ or N</td>
<td>↓ or N</td>
<td>↑</td>
<td>↓ or N</td>
<td>↑</td>
<td>N</td>
</tr>
</tbody>
</table>
Radiologic Findings

- **Chest Radiograph**
  - Small oval or coin lesion
  - Large irregular mass
  - Alveolar consolidation
  - Atelectasis
  - Pleural effusion
  - Involvement of the mediastinum or diaphragm
Figure 26-3. Right lung squamous cell carcinoma of the bronchus illustrating the huge size these tumors may attain before discovery.
Figure 26-4 Chest radiograph identifying two suspicious findings: in the right upper lobe (A) and in the left lower lobe (B), just behind the heart (*white arrows*).
Figure 26-5. Same chest radiograph as shown in Figure 26-4. Note the CT scan also identifies the suspicious nodules and their precise location.
Figure 26-6. PET scan: coronal views. The last three views show a “hot spot” in left lower lung lobe.
Figure 26-7. PET scan: sagittal views. The encircled images show a “hot spot” in the lower left lobe.
Figure 26-8. PET scan: axial view. A “hot spot” is further confirmed in left lower lung lobe.
Figure 26-9. PET scan: axial view. This image confirms that the small nodule identified in the upper right lobe in the chest radiograph and CT scan is benign (i.e., no “hot spot” is evident).
Figure 26-10. CT/PET scan (center). CT scan, CT/PET fusion, and PET scan, all showing the same malignant nodule in right upper lobe (white arrow). Note: The CT/PET fusion is normally presented in color (e.g., red, blue, yellow).
Figure 26-11. A, Bronchoscopic view of a tumor protruding into the right mainstem bronchus. B, A wire stent is in place to help hold the airway open (black arrow).
<table>
<thead>
<tr>
<th>Common Nonrespiratory Clinical Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Hoarseness</td>
</tr>
<tr>
<td>● Difficulty in swallowing</td>
</tr>
<tr>
<td>● Superior vena cava syndrome</td>
</tr>
<tr>
<td>● Weakness</td>
</tr>
<tr>
<td>➢ Distention of the neck veins</td>
</tr>
<tr>
<td>➢ Neck and facial edema</td>
</tr>
<tr>
<td>● Electrolyte abnormalities</td>
</tr>
</tbody>
</table>
General Management of Cancer of the Lung

- Surgery
- Chemotherapy
- Radiation therapy
Surgery

- Wedge resection (partial removal of a lung lobe)
- Segmentectomy (removal of a lung segment or segments of the lung)
- Lobectomy (removal of one lung lobe)
- Bilobectomy (removal of two lung lobes)
- Pneumonectomy (removal of whole right or left lung)
Chemotherapy

Chemotherapy is the general term for any treatment involving the use of chemical agents or drugs that are selectively destructive to malignant cancer cells.
Radiation Therapy

- **Radiation therapy** (external radiation) is often given with chemotherapy. It may be used with curative intent in patients with non-small cell lung carcinoma who are not eligible for surgery.
Comfort (Supportive Care)

- Radiation therapy and chemotherapy may not be tolerated when the patient has extensive small-cell lung cancer and is in poor health.
- The patient may choose to receive only comfort or palliative care, which means treating the symptoms of the cancer rather than the cancer itself.
Respiratory Care Treatment Protocols

- Oxygen Therapy Protocol
- Bronchopulmonary Hygiene Therapy Protocol
- Lung Expansion Therapy Protocol
- Aerosolized Medication