Types of Bronchiectasis

- Cylindrical bronchiectasis  
  - Tubular
- Varicose bronchiectasis  
  - Fusiform
- Cystic bronchiectasis  
  - Saccular

Anatomic Alterations

- Chronic dilation and distortion of bronchial airways
- Excessive production of often foul-smelling sputum
- Bronchospasm
- Hyperinflation of alveoli (air-trapping)
- Atelectasis, and parenchymal fibrosis
- Hemorrhage secondary to bronchial arterial erosion

Etiology

- Acquired bronchiectasis  
  - Recurrent pulmonary infection
  - Bronchial obstruction
  - Inhalation and aspiration
- Congenital bronchiectasis  
  - Kartagener's syndrome
  - Systemic disorders

Overview of the Cardiopulmonary Clinical Manifestations Associated with Bronchiectasis

The following clinical manifestations result from the pathophysiologic mechanisms caused by
- Excessive Bronchial Secretions
- Bronchospasm
- Increased Alveolar-Capillary Membrane Thickness
Clinical Data Obtained at the Bedside

- Bronchiectasis can be obstructive restrictive or both
  - Depends on
    - the amount of bronchial secretions
    - the degree of bronchial destruction and fibrosis
  - If the disease is limited to a relatively small portion of the lungs—as it often is—the patient may not have any of the following clinical manifestations
The Physical Exam

- Vital signs
  - Increased
    - Respiratory rate
    - Pulse
    - Blood pressure
- Accessory muscle use (inspiratory/expiratory)
- Pursed-lip breathing

The Physical Exam

- Increased A-P diameter
- Cyanosis
- Digital clubbing
- Peripheral edema and venous distension
  - Distended neck veins
  - Pitting edema
  - Enlarged, tender liver

The Physical Exam

- Cough, sputum production, hemoptysis
  - Chronic cough producing large amounts of foul-smelling sputum
- Chest assessment findings
  - When obstructive
    - Decreased tactile and vocal fremitus
    - Hyperresonant percussion note
    - Wheezing
    - Rhonchi

The Physical Exam

- Chest assessment findings
  - When restrictive
    - Increased tactile and vocal fremitus
    - Bronchial breath sounds
    - Crackles
    - Whispered pectoriloquy
    - Dull percussion note

Clinical Data from Lab Tests and Special Procedures

<table>
<thead>
<tr>
<th>Pulmonary Function Test Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Primarily Obstructive in Nature (Moderate to Severe Bronchiectasis)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forced Expiratory Flow Rate Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>FEF&lt;sub&gt;50%&lt;/sub&gt;</td>
</tr>
<tr>
<td>↓</td>
</tr>
</tbody>
</table>
RSPT 2310
Bronchiectasis

**Pulmonary Function Test Findings**

When Primarily Obstructive in Nature
(Moderate to Severe Bronchiectasis)

<table>
<thead>
<tr>
<th>Lung Volume &amp; Capacity Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT</td>
</tr>
<tr>
<td>N or ↑</td>
</tr>
<tr>
<td>IC</td>
</tr>
<tr>
<td>N or ↓</td>
</tr>
</tbody>
</table>

**Pulmonary Function Test Findings**

When Primarily Restrictive in Nature
(Moderate to Severe Bronchiectasis)

<table>
<thead>
<tr>
<th>Forced Expiratory Flow Rate Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>FEF₂₀₀₂₀₀</td>
</tr>
<tr>
<td>N or ↓</td>
</tr>
</tbody>
</table>

**Arterial Blood Gases**

Bronchiectasis

**Mild to Moderate Stages**
Acute Alveolar Hyperventilation with Hypoxemia
(Acute Respiratory Alkalosis)

<table>
<thead>
<tr>
<th>pH</th>
<th>PaCO₂</th>
<th>HCO₃</th>
<th>PaO₂</th>
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</thead>
<tbody>
<tr>
<td>↑</td>
<td>↓</td>
<td>(slightly)</td>
<td>↓</td>
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**Arterial Blood Gases**

Bronchiectasis

**Severe Stage**
Chronic Ventilatory Failure with Hypoxemia
(Compensated Respiratory Acidosis)

<table>
<thead>
<tr>
<th>pH</th>
<th>PaCO₂</th>
<th>HCO₃</th>
<th>PaO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>↑</td>
<td>↑ (Significantly)</td>
<td>↓</td>
</tr>
</tbody>
</table>
Arterial Blood Gases
Bronchiectasis

Acute Ventilatory Changes Superimposed On Chronic Ventilatory Failure

- Because acute ventilatory changes are frequently seen in patients with chronic ventilatory failure be alert for:
  - Acute alveolar hyperventilation superimposed on chronic ventilatory failure
  - Acute ventilatory failure (acute hypoventilation) superimposed on chronic ventilatory failure.

Oxygenation Indices
Moderate to Severe Stages

<table>
<thead>
<tr>
<th>$Q_s/O_{2,t}$</th>
<th>$DO_2$</th>
<th>$VO_2$</th>
<th>C(a-v)O$_2$</th>
<th>$O_2$ER</th>
<th>SvO$_2$</th>
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</thead>
<tbody>
<tr>
<td>↑</td>
<td>↓</td>
<td>N</td>
<td>N</td>
<td>↑</td>
<td>↓</td>
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</table>

Hemodynamic Indices
Moderate to Severe Stages

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

<table>
<thead>
<tr>
<th>SVI</th>
<th>CI</th>
<th>RVSWI</th>
<th>LVSWI</th>
<th>PVR</th>
<th>SVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
<td>↑</td>
<td>N</td>
<td>↑</td>
<td>N</td>
</tr>
</tbody>
</table>

Abnormal Laboratory Tests and Procedures

- Increased hematocrit and hemoglobin
- Elevated white blood count if acutely infected
- Sputum examination
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae*
  - *Pseudomonas aeruginosa*
  - Anaerobic organisms

Radiologic Findings

- Chest Radiograph
  - When the bronchiectasis is primarily obstructive in nature
    - Translucent (dark) lung fields
    - Depressed or flattened diaphragms
    - Long and narrow heart (pulled down by diaphragms)
    - Areas of consolidation and/or atelectasis may or may not be seen
Gross cystic bronchiectasis.

Posteroanterior chest radiograph showing overinflated lungs.

There are multiple ring opacities, most obvious at the lung bases, ranging from 3 to 15 mm in diameter.

Left lower lobe bronchiectasis.

The marked volume loss of left lower lobe is indicated by an impressed hila, vertical left mainstem bronchus, mediastinal shift, and left-sided transradiancy.

Ciliary dyskinesia syndrome—Kartagener’s syndrome.

This 62-year-old woman gave a 40-year history consistent with bronchiectasis.

The aortic arch, descending aorta, heart, and gastric air bubble are all on the right. There is diffuse complex pulmonary stranding with crazy road opacities.

Broad-branching band shadows can just be seen through the heart and represent dilated fluid-filled airways.

Cylindrical bronchiectasis.

Left posterior oblique projection of left bronchogram showing cylindrical bronchiectasis affecting the whole of the lower lobe except for the superior segment. Few side branches fill.

Basal airways are crowded together, indicating volume loss of the lower lobe, a common finding in bronchiectasis.

Cystic (saccular) bronchiectasis.

Right lateral bronchogram showing cystic bronchiectasis affecting mainly the lower lobe and posterior segment of the upper lobe.

Varicose bronchiectasis.

Left posterior oblique projection of left bronchogram in a patient with the ciliary dyskinesia syndrome.

All basal branches are affected by varicose bronchiectasis.
Radiologic Findings

- Computed Tomography (CT Scan)
  - The bronchial walls may appear as follows:
    - Thick
    - Dilated
    - Characterized by ring lines or clusters
    - Signet ring-shaped
    - Flamed-shaped

Gross pathologic lung specimen from a patient with bronchiectasis.

Varicose bronchiectasis. Patient with allergic bronchopulmonary aspergillosis and cystic fibrosis. The bronchiectatic airways have a corrugated, or beaded, appearance.

Advanced cystic bronchiectasis in the upper lobes.
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Bronchiectasis

General Management

- Treatment includes
  - Controlling pulmonary infections
  - Controlling airway secretions
  - Preventing complications
- Commonly prescribed medications
  - Expectorants
  - Antibiotics

General Management

- Respiratory care treatment protocols
  - Oxygen Therapy
  - Bronchopulmonary Hygiene Therapy
  - Lung Expansion Therapy
  - Aerosolized Medication Therapy
  - Mechanical ventilation