Bronchiectasis Diagnosis and Management and in Clinical Practice
Big Sky Pulmonary Conference
March 22, 2012
Gwen Huitt, M.D., M.S.
Professor of Medicine
Division of Mycobacterial and Respiratory Infections
National Jewish Health
Associate Professor, University of Colorado
Denver, Colorado

Conflicts of Interest
• Scientific Advisory Board Member

Learning Objectives
• Learn possible etiologies of bronchiectasis
• Learn treatment management options for bronchiectasis
• To understand the different airway hygiene options that are commonly used in clinical practice for bronchiectasis
Bronchiectasis is Alive and Unwell

- If you are prescribing antibiotics for respiratory exacerbations more than twice a year, you should consider underlying bronchiectasis as a possible etiology
- Multiple courses of antibiotics most certainly contributes to drug resistance
- A HRCT (non-contrasted) is standard of care for making the diagnosis of bronchiectasis
Definition of Bronchiectasis

Bronchiectasis: (bronchus + Gr. *ektasis* dilatation)

- Chronic dilatation of the bronchi marked by fetid breath and paroxysmal coughing, with the expectoration of mucopurulent matter
Bronchiectasis

- Wet
  - Purulent material (mucus, WBC's, debris)
- Dry

Pathophysiology of Bronchiectasis

- External insult (infectious or toxic)
- Bronchial wall inflammation and destruction
- Ciliary dyskinesia or altered bronchial dynamics
- Ineffective mucus clearance
- Genetic predisposition

Bronchiectasis Picture Source: http://medlib.med.utah.edu/WebPath/LUNGHTML/LUNG054.html
Causes of Bronchiectasis

- Infectious
  - Is this the chicken or the egg?
  - Tends to be purulent
- Cystic fibrosis
  - Adult and pediatric
- Young’s syndrome
- ABPA
- Alpha-1-antitrypsin deficiency

<table>
<thead>
<tr>
<th>Bronchiectasis</th>
<th>Normal</th>
</tr>
</thead>
</table>

Cystic Fibrosis

MS/R347H/ΔF508
Young's Syndrome

A-1-A Deficiency
ZZ

Common Variable Immunodeficiency and Alpha-1-Antitrypsin Deficiency (SZ)
## Other Causes of Bronchiectasis

- **Interstitial Lung Diseases**
  - Connective tissue diseases
    - Rheumatoid arthritis
    - Sjogren’s syndrome
    - Scleroderma
    - Mixed connective tissue disease
  - Vasculitis
    - Bronchiolitis (Diffuse panbronchiolitis, Follicular bronchiolitis)
- **Post-infectious**

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Rheumatoid Arthritis

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Pulmonary Fibrosis
**Diffuse Panbronchiolitis**

**Other Causes of Bronchiectasis**

- GERD
  - Reflux from the stomach
  - Increased gastric pressures secondary to chronic cough
  - Low LES tone
  - ? Aging
  - Diet, obesity, OSA
  - Increased incidence of CAP with PPI’s
  - Chronic aspiration

*BOTH MAY BE AND OFTEN ARE SILENT!*

**GERD**
GERD
Paraesophageal Hernia

Reflux associated aspiration is like adding fuel to the flame!

Guidelines for Preventing Health-Care–Associated Pneumonia, 2003
Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee
The Centers for Disease Control and Prevention recommends use of backrest elevations of 30° to 45° to prevent ventilator-associated pneumonia.
### Causes of Bronchiectasis

<table>
<thead>
<tr>
<th>Cause</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>80 (53)</td>
</tr>
<tr>
<td>Postinfectious complication</td>
<td>44 (29)</td>
</tr>
<tr>
<td>Immune defect</td>
<td>12 (8)</td>
</tr>
<tr>
<td>Total humoral</td>
<td>11 (7)</td>
</tr>
<tr>
<td>Total neutrophil function</td>
<td>1 (&lt; 1)</td>
</tr>
<tr>
<td>ABPA</td>
<td>11 (7)</td>
</tr>
<tr>
<td>Aspiration/GERD</td>
<td>6 (4)</td>
</tr>
<tr>
<td>Young's syndrome</td>
<td>5 (3)</td>
</tr>
<tr>
<td>CF</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Ciliary dysfunction</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Ulcerative colitis</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Panbronchiolitis</td>
<td>1 (&lt; 1)</td>
</tr>
<tr>
<td>Congenital defect</td>
<td>1 (&lt; 1)</td>
</tr>
</tbody>
</table>


### Sputum Microbiology in Bronchiectasis

<table>
<thead>
<tr>
<th>Organism</th>
<th>Isolated n (%)</th>
<th>Colonizing n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. aeruginosa</em></td>
<td>46 (31)</td>
<td>36 (24)</td>
</tr>
<tr>
<td><em>H. influenzae</em></td>
<td>30 (20)</td>
<td>26 (17)</td>
</tr>
<tr>
<td><em>M. catarrhalis</em></td>
<td>21 (14)</td>
<td>11 (7)</td>
</tr>
<tr>
<td><em>S. aureus</em></td>
<td>52 (35)</td>
<td>11 (7)</td>
</tr>
<tr>
<td><em>S. pneumoniae</em></td>
<td>20 (13)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>Coliforms</td>
<td>17 (11)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>A. fumigatus</td>
<td>3 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>No organism isolated</td>
<td>7 (5)</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34 (23)</strong></td>
<td><strong>—</strong></td>
</tr>
</tbody>
</table>

Other Important Pathogens

- Pseudomonas species
  - PSA (mucoid vs. nonmucoid)
  - P. fluorescens
  - P. putida
- Achromobacter xylosoxidans
- Enterobacter aerogenes
- Stenotrophomonas
- NTM

Prince, NEJM, 2002, 347, 1111
The Trouble With Biofilms

- Planktonic Killing Dose \( (1) \) MIC=1
- Biofilm Killing Dose is 1,000x ↑↑↑
- Biofilms paralyze phagocytosis
- 65-80% of infections are biofilm related
- Antibiotic resistance is prominent during biofilm growth which promotes genetic diversity

Single-celled (planktonic) lifestyle as a transition phase… between existing as multicellular adherent communities (biofilms).

Neutrophil enhancement of \( P. \text{aeruginosa} \) biofilm development

<table>
<thead>
<tr>
<th>48 hrs</th>
<th>3-D Recom.</th>
<th>Confocal</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P. \text{aeruginosa} )</td>
<td>( P. \text{aeruginosa} ) + neutrophils</td>
<td>( P. \text{aeruginosa} )</td>
</tr>
</tbody>
</table>

Courtesy of Jerry Nick, M.D.
### Bronchiectasis: Treatment Goals

- Reduce or eliminate underlying host deficiency
- Improve clearance of secretions
- Control acute infections
- Treat airway obstruction
- Reduce colonizing load of organisms
- Reduce inflammation

### Inhaled Antibiotics

- Inhaled tobramycin, Tobi™, amikacin, colistin
- New studies in non-CF bronchiectasis
  - Aztreonam
  - Ciprofloxacin
  - Mannitol
  - Liposomal amikacin

### Bronchiectasis: Management

- Management of primary cause, if identified
- Prevention
  - Avoidance of further lung damage (no smoking)
  - Immunization; early treatment of infection
- Treatment of acute exacerbations (cough, sputum)
  - Do sputum cultures in this population!
- Bronchial hygiene
- Acute antiinflammatory therapy (Inhaled corticosteroids)
- Azithromycin (Only if NO NTM on culture!)
- Long acting bronchodilators
Anti-inflammatory Agents:
Inhaled Corticosteroids

- Double-blind, randomized, placebo-controlled 52-week trial
- 86 patients with bronchiectasis; 13 withdrawals
- Fluticasone (35 patients; 500 μg bid via inhaler) versus placebo (38 patients.)
  - 24-hour sputum volume, especially in patients with 24-hour sputum volume <30 ml, sputum purulence score >5, and exacerbation frequency <2/year
  - No change in exacerbation frequency, FEV1, FVC, or sputum purulence score
  - Decrement in sputum volume more significant in patients with P aeruginosa infection; less frequent exacerbations also seen


Secretion Modification

- Hypertonic saline nebs (3%, 7%, 10%)
- Normal Saline nebs
- Mucomyst
- Guaifenesin
- Pulmozyme?

Hypertonic saline

May serve to restore volume to the airway surface fluid layer, allowing for improved mucus transport

Pulmonary Hygiene

Airway clearance mechanisms
Get your RT’s involved!
• Acapella valve, Quake, Pep, Flutter
• Vest systems (Full vest vs. wraps)
• Postural drainage and clapping techniques
Surgical Options for Bronchiectasis

- Surgery should always be considered as an adjunctive treatment option in focal / localized bronchiectasis
- Not all surgeons are created equal
- Be sure that the patient is on adequate antibiotics pre and post op
- With a skilled surgeon, most disease for bronchiectasis can be accomplished via VATS approach
  - Minimizes post op pain
  - Shorter hospital stay (2-3d vs. 5-10d)
John Mitchell, M.D.

VATS lung resection

Great Sand Dunes National Park
Thank You!