Introduction to Interventional Pulmonology

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Objectives

- What is Interventional Pulmonology
- Introduction to selected procedures
- Describe relationship with Respiratory Therapy
Beginnings
Foreign Body Aspiration

• 1897 Gustav Killian uses a rigid esophagoscope, long forceps and a head mirror to remove a bone from the right mainstem bronchus
Rigid Core Out
Rigid vs. Flexible Bronchoscopes

- Airway control when working on central lesions
- Better and faster for larger airway obstructions
  - Rigid “core-out”
- Able to deploy metal and silicone stents

- Accepts majority of modes of tumor destruction
- Able to examine beyond subsegmental level
- Conscious sedation
- Able to deploy metal stents
Modes of Tissue Destruction

- Manual debulking
- Argon plasma coagulation
- Nd:YAG laser
- Cryotherapy
- Electrosurgery
- Brachytherapy
- Balloon dilation
Airway Stent for Intrinsic Airway Obstruction

• Stent used to physically displace endobronchial disease
What Is An Interventionalist?

- Defined by rigid bronchoscopy?
- What procedures are being performed by pulmonologists?
  - Bronchoalveolar lavage
  - Transbronchial biopsy
  - Transbronchial needle aspiration
What Are Pulmonologists Doing?

• 2003 ACCP review of practicing pulmonologists revealed
  – Inadequate training in advanced bronchoscopy
• Guidelines set to establish competency regarding chest procedures

Ernst et al. *Chest*, 2003
Birth of Interventional Pulmonologists?

- So called “proceduralists”
- “Interventional” pulmonologists continue training in rigid bronchoscopy and pleuroscopy
- Shift from therapeutic to diagnostic tools

Endobronchial Ultrasound (EBUS)
Central Lesions
What Would You Do?
Diagnosing the Mediastinum

- Mediastinoscopy
- Bronchoscopy with conventional transbronchial needle aspiration (TBNA)
- Curvilinear array endobronchial ultrasound (EBUS) assisted transbronchial needle aspiration
Transbronchial Needle Aspiration
“Blind” TBNA

- 2003 meta-analysis found an overall sensitivity of 55% for diagnosing NSCLC\textsuperscript{1}
- 2007 review by ACCP found an overall sensitivity of 78% (range 14-100%)\textsuperscript{2}
- False negative rate approximately 28%

\textsuperscript{1}Holty et al. Thorax 2005;60:949-955
\textsuperscript{2}Detterbeck et al. Chest 2007;132:202S-220S
EBUS-TBNA
## EBUS-TBNA for Mediastinal Nodes

<table>
<thead>
<tr>
<th>Study</th>
<th>Number (N)</th>
<th>Lymph Tissue Present (%)</th>
<th>Diagnostic Yield (%)</th>
<th>PPV For Malignancy (%)</th>
<th>NPV For Malignancy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herth et al Chest 2003</td>
<td>242</td>
<td>86%</td>
<td>71%</td>
<td>100%</td>
<td>22%</td>
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<tr>
<td>Herth et al Chest 2004</td>
<td>50</td>
<td>84%</td>
<td>74%</td>
<td>NR</td>
<td>NR</td>
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<tr>
<td>Herth et al Thorax 2006¹</td>
<td>572</td>
<td>94.5%</td>
<td>93.5%</td>
<td>100%</td>
<td>11%</td>
</tr>
</tbody>
</table>

NR=not reported

¹=Linear array endobronchial ultrasound used
Advantages of Convex Probe EBUS

• Allows diagnosis and staging of cancer with one procedure
• Direct visualization of aspiration of lymph nodes/masses
• Fewer passes required
• Avoid blood vessels
• Sensitivity, specificity, negative predictive value at least as good as mediastinoscopy

1Ernst et al. J Thorac Onc 2008;3:577-582
Pulmonary Nodules
What Would You Do?

- Surgical biopsy
- Transthoracic needle biopsy
- Bronchoscopic biopsy
  - Conventional TBBx
  - Electromagnetic Navigation
  - Radial Endobronchial Ultrasound
CT Guided Needle Aspiration

- Diagnostic yield 80-90%
- Rate of pneumothorax 8-64%  
  - Chest tube  
  - Hospitalizations  
  - Prolonged air leak
Electromagnetic Navigation

- “GPS” system for the lungs
- Virtual airway reconstruction
  - Based on thin slice CT
- EM sensor tracked during procedure
Procedure Display
EBUS for Peripheral Pulmonary Lesions

- Utilizes radial ultrasound probe
- 1.7mm probe inserted through the working channel of a therapeutic bronchoscope
Convex Probe vs Radial Probe

Convex Probe EBUS

Radial Probe EBUS
Radial EBUS
Interventional Pulmonology: Current Status

• Continued efforts towards improving minimally invasive diagnostic and staging techniques
• Increasing emphasis on bronchoscopic treatments for chronic medical illness
Emphysema
Emphysema

- Medication
- Pulmonary rehabilitation
- Lung transplantation
- Lung volume reduction surgery
Lung Volume Reduction

- NETT demonstrated palliation and survival benefit for subsets of patients with emphysema undergoing LVRS
- Significant associated morbidity, mortality and cost
- Minimally invasive techniques to achieve similar effects to LVRS desirable

Herth FJ et al. Respiration 2011
Bronchoscopic Lung Volume Reduction

• One way valves designed to induce lobar atelectasis
• Heterogeneous emphysema
• Homogeneous emphysema
Bronchoscopic View

Exhalation  Inspiration

Strange et al. BMC Pulmonary Medicine 2007
Other Devices for BLVR

- Foam
- Steam
- Coils
- Airway Bypass

Slebos DJ, et al. CHEST 2011
Bronchopleural Fistula
Bronchopleural Fistula
Bronchopleural Fistula
Valve Deployment
Asthma
Asthma

- Disorder of airway inflammation
- Majority of airway resistance occurs in the larger airways
- Airway smooth muscle may be hypertrophied in asthmatics
- May contribute to bronchoconstriction during asthma attack
Bronchial Thermoplasty

- Delivery of controlled thermal energy to the airway wall
- Decreases ASM
- Attenuating bronchoconstriction
Health Care Utilization for Respiratory Symptoms During Post-Treatment Period

- 6 weeks after the last bronchoscopy procedure to 12 month follow-up

* Posterior Probability of Superiority = 95.6%
** Posterior Probability of Superiority = 99.9%

- Severe Exacerbations (Steroid): 32% decrease over Sham
- Unscheduled Physician Office Visits: 22% decrease over Sham
- Emergency Room Visits: 84% decrease over Sham
- Hospitalizations: 73% decrease over Sham

BT = Bronchial Thermoplasty

Interventional Pulmonary and Respiratory Therapy

• Dedicated assistance with pulmonary procedures
• Background in respiratory mechanics
• Pre and post-procedure care of patients undergoing pulmonary procedures
• Assistance with improving current methods and developing new technology