EBUS and ENB
- Diagnostic Modalities for Assessment of Lung Nodules

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• Consultant
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  • Johnson and Johnson
  • Auris Surgical Robotics
  • Concordia Healthcare

• Research Collaboration
  • Siemens
  • Novadaq Corp
  • Veran Medical Technologies
82F

• R lower lobe nodule
• Non-smoker
• Asymptomatic

**Methods of Bx?**

• Transbronchial biopsy
• CT guided biopsy
• VATS
64M

- L lower lobe mass
- 40 pk yr smoker
- Asymptomatic

**Methods of Bx?**
- Transbronchial biopsy
- CT guided biopsy
- VATS
72M

- R upper lobe nodule
- 40 pk yr smoker
- Asymptomatic

**Methods of Bx?**
- Transbronchial biopsy
- CT guided biopsy
- VATS
78F

- Growing LUL nodule
- Severe COPD on home O2
- Current smoker

**Methods of Bx?**
- Transbronchial biopsy
- CT guided biopsy
Diagnostic Modality for SPN

- Surgical Biopsy
- Transthoracic Needle Biopsy
- Bronchoscopic Biopsy
Transthoracic Needle Lung Biopsy (CT)

• Overall sensitivity 90%

• Cannot be used in all cases due to co-morbidities and location

• Complications
  • Pneumothorax: 15% (6.6% of any PTX requiring chest tube)
  • Hemoptysis
  • Hemorrhage: 1% (18% required blood transfusion)

*Manhire A et al, Thorax 2003; 58; 920-936*
Guided Bronchoscopy

• Radial Probe EBUS/guide sheath
• Electromagnetic Navigation bronchoscopy
  • Super Dimension, Veran Medical
• Virtual bronchoscopy guided
  • Lung Point, BF Navigation
• CT guided bronchoscopy
• Ultrathin bronchoscopy
Guided Bronchoscopy

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Improving the Yield: Radial probe EBUS

UM-3R (O.D. = 2.5mm)

UM-S20-20R (O.D. = 1.7mm)
84F

LUL lung nodule
Radial probe EBUS - results

• Meta-analysis of 7 studies using radial probe EBUS for peripheral lesions
  • Pooled sensitivity for lesions < 25 mm was 71%

• One randomized prospective trial has compared radial EBUS with CT guided biopsy
  • Similar diagnostic accuracy
  • Complication rates 3% vs. 27%

Eur Respir J. 2011; 37: 902-10
Respir Med. 2011; 105: 1704-11
Guided Bronchoscopy

• Peripheral radial EBUS/guide sheath

• Electromagnetic Navigation bronchoscopy
  • Super Dimension, Veran Medical

• Virtual bronchoscopy guided
  • Lung Point, BF Navigation

• CT guided bronchoscopy
• Ultrathin bronchoscopy
Electromagnetic Navigation (EMN)

- inReach system, (SuperDimension, Medtronic)
Real-time Location Information

Miniaturized sensor

Real-time delivery of information 166/sec

Electromagnetic Location Board

Generation of electromagnetic waves
EMN: Procedural steps

CT scan ➔ DICOM CD

Planning ➔ File export

Navigation ➔ Biopsy
EMN: Procedure
Electromagnetic Navigation (EMN)

- SPiN™ System, (Veran)

Multiple Pathway Views
- CT Views: Enables physicians to visualize the instrument location in multiple views
- Virtual Bronchoscopic Fly-Through: Provides a high quality interior lumen view and the target lesion
- 3D Bronchial Airway: Automatic pathway planning and global visualization of instrument location

Patient 4D Tracker
Respiratory gating for optimal accuracy

EM Field Generator

Always-On Working Channel – Tip-tracked Steerable 3mm instrument w/ 2mm working channel that is navigated to the lesion
vPADS – Automatic Registration

vPads enable automatic registration and dynamic referencing throughout the procedure.

vPads communicate with system 20x per second to update respiratory movement.

System *Automatically* recalibrates if patient moves during the procedure.
Always On Tip Tracked Tools

ALWAYS-ON TIP TRACKED® INSTRUMENTS
Always-On Tip Tracked® Instruments feature electromagnetic sensors that enable clear visualization—even during biopsy.

SPIN EWC®
This Expanded Working Channel enables you to reach peripheral targets using a therapeutic scope.

SPIN FLEX™ NEEDLE
The 22ga laser-etched NiTi needle enables tight turns.

VIEW PERIPHERAL CATHETER™
Use this tip-tracked, steerable catheter with Radial EBUS for real-time confirmation.

The world's most compact digital camera, the View Optical Probe.
## Navigate

**Jane Doe**

de_identified

### Navigate to the Target

- Previous Control
- First Control
- Change Screen

### Select Plan

- Plane RLL
- 48 Mode
- Fly/Thr u GH
- 3D Mode
- A - C - D
- Iso
- 2X
- PW/View
- Off
- 3D Extension
- 0

### TargetLock

### Drop Preset

| Set to Net | Set to P
<table>
<thead>
<tr>
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<tbody>
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</tr>
</tbody>
</table>

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**Distance to Nodule:** 18.2mm

**Respiration Out of Sync:**

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**Technical Details:**

- Load Data
- Navigate
- SPN/PerC
- Active

---

**Back** | **Next**
EMN results

• Diagnostic yield
  • SPN<30mm: 54-75%

• Limitation
  • registration error (3-8mm)
  • not real-time sampling
  • expensive

Schwartz et al., Chest 2006; 129: 988
Gildea et al, Am J Respir Crit Care Med 2006; 174: 982
Eberhardt et al, CHEST 2007; 131:1800
Eberhardt et al, AJRCCM 2007; 176: 36
Eberhardt et al, AJRCCM 2007; 176: 36
EMN + EBUS-GS

- The combination of radial probe EBUS with electromagnetic navigation had a higher dx yield than either method alone
  - 69% radial probe EBUS
  - 59% electromagnetic navigation
  - 88% combined

*Am J Respir Crit Care Med 2007; 176: 36-41*
Guided Bronchoscopy

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- CT guided bronchoscopy
- Ultrathin bronchoscopy
LungPoint - Broncus

William E et al. Computerized Medical Imaging and Graphics, 2008; 32, 732
Yield 80%

*Eberhardt et al. JTO. 2010; 5(10):1559-1563*
Virtual Bronchoscopy/RP-EBUS guided Transbronchial Biopsy
Virtual Bronchoscopy Navigation (VBN)

• Olympus BF Navigation
Olympus BF Navigation

Courtesy Dr. Fumio Asano
VBN+EBUS-GS vs EBUS-GS (V-NINJYA Study)

- Multicentre, randomized control study
  - Small peripheral nodules (< 3cm)
  - Dx yield higher in VBN group: 80.4% vs 67.0% (p=0.032)
  - Shorter time in VBN group: 24.0min vs 26.2min (p=0.016)

Asano et al, Thorax 2011; 66: 1072
Guided bronchoscopy – Meta-analysis

Table 2—Inverse Weighted Diagnostic Yield Overall and by Modality

<table>
<thead>
<tr>
<th>Technology</th>
<th>Studies, No.</th>
<th>Weighted Proportion, %</th>
<th>95% CI</th>
<th>Q Statistic</th>
<th>Q P Value</th>
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<tbody>
<tr>
<td>VB</td>
<td>10</td>
<td>72.0</td>
<td>(65.7-78.4)</td>
<td>21.0</td>
<td>.01</td>
</tr>
<tr>
<td>ENB</td>
<td>11</td>
<td>67.0</td>
<td>(62.6-71.4)</td>
<td>13.3</td>
<td>.21</td>
</tr>
<tr>
<td>GS</td>
<td>10</td>
<td>73.2</td>
<td>(64.4-81.9)</td>
<td>63.8</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>U</td>
<td>11</td>
<td>70.0</td>
<td>(65.0-75.1)</td>
<td>15.2</td>
<td>.12</td>
</tr>
<tr>
<td>R-EBUS</td>
<td>20</td>
<td>71.1</td>
<td>(66.5-75.7)</td>
<td>84.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>All</td>
<td>39</td>
<td>70.0</td>
<td>(67.1-72.9)</td>
<td>119.4</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Wang et al, Chest 2012; 142
Summary

• New techniques in guided bronchoscopy improve the diagnostic yield for peripheral lesions

• Radial probe EBUS provides real-time feedback of location relative to peripheral nodules

• Combining techniques may offer a benefit over single methods

• Guided bronchoscopy is now an option for patients with peripheral lung nodules
82F

- CT guided biopsy
- Adenocarcinoma
64M

- Transbronchial biopsy
- Adenocarcinoma
72M

- Transbronchial biopsy
- Adenocarcinoma
- Transbronchial biopsy
- Squamous cell ca
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Thank you