Lymph Node Staging Presentation

Stage IIIB

Stage IA
Lymph Node Staging Presentation

![Graph showing lymph node staging presentation](Mountain CF, Chest 1997;111:1710)
Lymph Node Staging Survival

% Alive

Stage IA IB IIA IIB IIIA IIIB IV

Mountain CF. Chest 1997; 111:1710-17
Lung Cancer
Lymph Node Evaluation
## Lymph Node Staging

### Non-invasive staging

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Chest</td>
<td>51.9</td>
<td>80.3</td>
</tr>
<tr>
<td>PET Scan</td>
<td>74</td>
<td>85</td>
</tr>
</tbody>
</table>

Integrated PET-CT: improved staging and anatomic accuracy; sensitivity: ~ 90%, specificity: ~ 94%

<table>
<thead>
<tr>
<th>Tumor Size</th>
<th>LN Involvement (%)</th>
<th>5 yr Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1.0 cm</td>
<td>0 - 7</td>
<td>80 - 100</td>
</tr>
<tr>
<td>1.1 - 2.0 cm</td>
<td>17 - 19</td>
<td>74 - 86</td>
</tr>
<tr>
<td>2.1 – 3.0 cm</td>
<td>23 - 37</td>
<td>51 - 68</td>
</tr>
</tbody>
</table>
Lymph Node Staging
Invasive Staging

- Mediastinoscopy
- Mediastinotomy (Chamberlain procedure)
- Video-assisted Thoracic Surgery (VATS)
- Thoracotomy
- Transthoracic needle aspiration (CT)
- Endobronchial Ultrasound (EBUS)
- Endoscopy Ultrasound (EUS)
- Navigational Bronchoscopy (SD)
Lymph Node Staging

Mediastinoscopy
Lymph Node Staging

Mediastinotomy
In 2001, patient care survey of 729 hospitals

- 40,090 NSCLC pts; 11,668 pts (29%) had surgery
- Surgery only – 74%; Stage I – 60%; Lobe - 75%
- Mediastinoscopy (27%); LN biopsied 47%
- N2 LN removed (58%); N1 with specimen (42%)
- Positive surgical margin 8%; Frozen section 65%
- Mortality – wedge (5%), Lobe (5%), Pneumo (9%)
- Current surgical treatment of lung cancer is poor
- There is no standard of care
Lung Cancer

Society Thoracic Surgeons Database

- 49,029 operations; 9033 pulmonary resections
- Resection: Wedge – 18%, Segment – 4%, Lobe – 67%, Bilobe – 4%, and Pneumo – 7%
- Mediastinal LN evaluate 65%; Mediastinoscopy – 21%
- LN Dissection - 41%, Sampling – 21%, Biopsy – 8%
- Operative mortality 2.5%
- Postoperative complications 32%
Lymph Node Staging

EBUS
Lymph Node Staging
Radial Endobronchial Ultrasound

- Developed by Becker (Thorax Clinic, Germany)
- Water filled balloon surrounds the crystal
  » Ensures “coupling”
  » 20-MHz probe
  » Requires a 2.8 mm working channel
Lymph Node Staging

Mediastinal Anatomy
Lymph Node Staging

EBUS
Lymph Node Staging

EBUS
Lymph Node Staging
Radial EBUS

- 100 patients
  - Cytology needles
- Group A: subcarinal LNs
  - Sensitivity 86% vs. 74%
- Group B: paratracheal LNs
  - Sensitivity 84% vs. 58%

Group A, Group B
Lymph Node Staging

Clinical staging differ from pathologic staging

24% clinically over staged
20% clinically under staged

ATS/ERS: Obtain pathologic evaluation in all patients thought to be surgical candidates prior to VATS or thoracotomy
Lymph Node Staging
Linear Ultrasound or “The Puncture Scope”

7.5 MHz probe

Balloon
Lymph Node Staging
Linear Ultrasound or “The Puncture Scope”

Operator end of scope
502 patients with any size LN

Linear EBUS TBNA

Specificity 100%

Sensitivity 96%

Accuracy 97%
Lymph Node Staging

EBUS

- 100 patients with NSCLC and CT with no mediastinal LN > 10mm → EBUS-TBNA of all identifiable nodes → surgical staging with mediastinoscopy (15) or thoracotomy (85)
  - Mean LN diameter: 8.1mm
  - 2 aspirates / node
  - Cancer seen in 19 LN, missed in 2 LN
  - Sensitivity 92.3%, Specificity 100%, NPV 96.3%
  - Could avoid surgery in 17% of patients with no CT evidence of disease

Herth et al, Eur Respir J 2006; 28: 910
Lymph Node Staging

EBUS Upstaged

- 97 patients with known/suspected NSCLC and negative PET-CT in the mediastinum

- EBUS-TBNA followed by surgical staging
  - Mean diameter 7.9 mm
  - Cancer found in 8 patients: N3 in 1, N2 in 5, N1 in 2
  - 1 additional patient found with N1 disease on surgical staging
  - 5% upstage

Herth et al, Chest 2008; 133:887
# Lymph Node Staging

Invasive staging of the mediastinum

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical Mediastinoscopy (stations 1-2-4-7)</td>
<td>78</td>
<td>100</td>
</tr>
<tr>
<td>Anterior Mediastinoscopy (stations 5-6)</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>VATS (only ipsilateral)</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>


Yasufuku et al. Respirology 2007;12:173-183
66 patients with known cancer in a cross-over study

**Linear EBUS-TBNA**
- Sensitivity: 87%
- Specificity: 100%
- NPV: 78%

**Mediastinoscopy**
- Sensitivity: 68%
- Specificity: 100%
- NPV: 59%
Lymph Node Staging

EUS
Lymph Node Staging

EUS
Lymph Node Staging
EUS
Lymph Node Staging

EUS

- Superior to CT in the detection of mediastinal lymph nodes in patients with NSCLC

- EUS-Guided FNA reported for mediastinal masses and lymph nodes
  - Sensitivity 83-90%
  - Specificity 92-97%

Micames et al. CHEST 2007
Lymph Node Staging
EBUS and EUS

138 patients (surgically proven)

Linear EBUS-TBNA
Sensitivity 90%

Linear EUS-TBNA
Sensitivity 89%

Linear EBUS/EUS
Sensitivity 93%

Linear EBUS/EUS
NPV 97%

Wallace et al. JAMA, 2008
Lymph Node Staging
Combination of EBUS and EUS

150 patients with 619 LN (surgically proven)

- Linear EBUS-TBNA: Sensitivity 92%
- Linear EUS-TBNA: Sensitivity 89%
- Linear EBUS/EUS: Sensitivity 96%
- Linear EBUS/EUS: NPV 95%

Herth et al, CHEST 2010; 138(4). 790-794
Lymph Node Staging

EUS

- Only modality #8 LN
- Can stage adrenal
  L seen in 97%
  R seen in 20%
Lymph Node Staging

Is Ultrasound-guided TBNA replacing Surgery?

- Learning process to master anatomy and interpretation
- 50 supervised procedure, and 10/yr (25 in Europe) to maintain competency !!
- No technical reimbursement
- Easy scope damage

- Standard of care
- Already taught in residency
- Requires general anesthesia
- Costly
- Results not impressive in non-adequate hands
Lymph Node Staging

Ultrathin Bronchoscopy

Standard bronchoscope with an external diameter of 6.1 mm and a working channel of 2.0 mm; \textit{right}: an ultrathin bronchoscope with an external diameter of 2.8 mm and a working channel of 1.2 mm (BF-XP40; Olympus)
Lymph Node Staging
Ultrathin Bronchoscopy
Lymph Node Staging
Ultrathin Bronchoscopy
Lymph Node Staging
EBUS-TBBX - Fluoroscopically-invisible

N=54 (Lesions seen on CT, not Fluoro)

Peripheral radial EBUS

Lesions identified in 89%

70% diagnosis

Prevented surgery in 17%

Herth et al. Chest 2006;129:147-150
Lymph Node Staging
Navigational Bronchoscopy
Lymph Node Staging
Navigational Bronchoscopy
Sensors on patient account for inspiration, expiration & patient movement
Lymph Node Staging
Navigational Bronchoscopy
Lymph Node Staging
Navigational Bronchoscopy

N=60 (LN and peripheral lesions)

75% yield from peripheral lesions

100% yield from lymph node

Final diagnosis obtained in 80% of cases (75% cancer)

No Rhythm issues or Fluoro required
Lymph Node Staging

Conclusions

- Lymph node metastasis can occur in any size NSCLC tumor

- Accurate clinical staging is essential to provide the best treatment for patients with NSCLC

- Endoscopic staging (EBUS, EUS, SD) methods are proving to be reliable for staging of the mediastinum
Lung Cancer
Smoking Cessation