EBUS – Mediastinal Staging

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Mediastinal Staging

• Non-invasive staging (Imaging)
  • CT, PET-CT

• Invasive staging (Tissue diagnosis)
  • Surgical biopsy (Med, VATS)
  • Needle biopsy (TBNA, EBUS-TBNA, EUS-FNA, TTNA)
Endoscopic Staging - EBUS-TBNA

- Access to all LN stations accessible by Med as well as N1 nodes
- A minimally invasive modality
- Sensitivity 85-96%
- Real time procedure
- Doppler mode enables differentiation of LN from vessels
- Adopted in over 2500 centers

Convex Probe EBUS (Olympus)

Outer Diameter: 6.9 mm
Scanning Range: 50 degrees
Instrument Channel: 2.2 mm
Optics: 35 degrees forward oblique
Convex Probe EBUS (Olympus)
EBUS-TBNA – Equipment (Olympus)

EU-C60

EU-ME1

EU-ME2
EBUS - EB1970UK (Pentax Medical)

New Small Hitachi Linear Array Ultrasound Transducers

- 19 French
- 6.3mm Insertion Tube
- 2mm working channel
- Color CCD video images
  - 45° Forward Oblique
- Hitachi 5500 scanner
  - 75° Forward Oblique
  - 5, 6.5, 7.5, 9, 10 MHz options
EBUS scope – EB-530US (FUJIFILM)

Fujifilm Ultra Small Super CCD Chip installed

10° forward oblique view

Wide Field of View: 120°
NA-201SX-4022, 4021 (Olympus)

21G and 22G needles
SonoTip EBUS Pro Flex (Medi-Globe)

Dimensionally stable 22G Nitinol needle
Eliminates needle deformation
EchoTip ProCore EBUS Needles (Cook Medical)

Core trap design to obtain tissue

22G and 25G
Expect™ EBUS-TBNA Needles (Boston Scientific)

22G and 25G
Cell blocks often contain a “mini-core” of tumour.

Can be used for multiple immunohistochemical stains.

Can provide prognostic information (cell-cycle proteins, EGFR mutation).
EBUS-TBNA
Understanding the Mediastinum
Bronchoscopic Anatomy
Carina

SVC

Esophagus

Azygos vein

Lt Upper Lobe Br

Lt Lower Lobe Br

Descending Aorta

PA

Ascending Aorta

A1,3

Tr Intermedius

Rt Upper Lobe Br

A1+2 a,b

A1+2 c

A3

A6

#10

#4L

#4R

#6

#5

#10

#3p

#7

#10

#10

#4R

#3p
Rt Upper / Tr Intermedius
Rt Upper / Tr Intermedius

- A1
- A2
- A3
- V1,2
- V3
- V4,5

- SPV
- Rt Main stem PA
- Rt Upper Lobe Br
- Rt Lower Lobe Br

#10R
#11R
#12R

Rt Upper / Tr Intermedius
Rt Middle and Lower Lobe Br

Rt IPV

Rt Main PA

Basalis PA

V4,5

A4

A5

A6a

A6b,c

#10

#11R

#12R

#13
Aorta

Lt Main PA

#7

#10L

#4L

A3 + A1 + 2a,b

Lt Main Br
Understanding the Mediastinum

EBUS Anatomy
Stations 4R and 4L
Stations 4R and 10R

Azygos vein
Stations 4R, 2R and 2L
Stations 7 and 11R
EBUS-TBNA for Lung Ca Staging

- EBUS-TBNA Systematic Review and Meta-analysis
  - 22 studies
  - >2000 patients

- Sensitivity: 0.88-0.93 (95% CI 0.79-0.94)
- Specificity: 1 (95% CI 0.92-1)

- Equivalent to Mediastinoscopy sensitivity, NPV, diagnostic accuracy

Lung ca staging (EBUS vs Med)

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Number</th>
<th>Prevalence of N2/N3</th>
<th>Sensitivity</th>
<th>NPV</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td>EBUS</td>
<td>Med</td>
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<tr>
<td>Ernst et al</td>
<td>2008</td>
<td>66</td>
<td>89</td>
<td>87</td>
<td>68</td>
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<td>Yasufuku et al</td>
<td>2011</td>
<td>153</td>
<td>32</td>
<td>81</td>
<td>79</td>
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<tr>
<td>Um et al</td>
<td>2015</td>
<td>127</td>
<td>59</td>
<td>88</td>
<td>81</td>
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</tbody>
</table>

- Prospective cross-over trial (Ernst et al)
  - Disagreement in the yield for #7 (24%; p=0.011)

- Prospective controlled study (Yasufuku et al)
  - No difference between EBUS and Med

- Prospective controlled study (Um et al)
  - EBUS superior to Med in sensitivity, accuracy and NPV (p<0.005)

Um SW et al. J Thorac Oncol. 2015; 10(2): 331-7
Lung ca staging (EBUS vs VAM) – meta-analysis

• Quantitative meta-analysis of EBUS-TBNA (n=10) and VAM (n=7)
• Meta-regression applied after adjusting quality score, study design and LN station number

• Sensitivity
  • EBUS 0.84 (95% CI 0.79-0.88) vs VAM 0.85 (95% CI 0.82-0.88)

• More procedural complications and fewer false negatives with VAM than EBUS

• EBUS-TBNA should be performed first, followed by VAM in the case of a negative needle result

*Ge Xet al. Lung. 2015; [Epub ahead of print]*
Cost Effectiveness

- A decision-tree analysis to compare downstream costs of EBUS-TBNA, conventional TBNA and mediastinoscopy.
  - EBUS-TBNA (-ve results surgically confirmed) most cost-beneficial approach (AU$2961)
  - EBUS-TBNA (-ve results not surgically confirmed) ($3344)
  - Conventional TBNA ($3754)
  - Mediastinoscopy ($8859)

Changes of ACCP Guidelines – Mediastinal Staging

• 2007 ACCP Guidelines
  - Mediastinoscopy is generally preferable because of the higher FN rates of needle techniques in the setting of normal-sized lymph nodes
  - A non-malignant result from a needle technique (e.g., EUS-NA, TBNA, EBUS-NA, or TTNA) should be further confirmed by mediastinoscopy

• 2013 ACCP Guidelines
  - In patients with high suspicion of N2,3 involvement, a needle technique (EBUS-NA, EUS-NA or combined EBUS/EUS-NA) is recommended over surgical staging as a best first test (Grade 1B)
  - Remark: In cases where the clinical suspicion of mediastinal node involvement remains high after a negative result using a needle technique, surgical staging (e.g., mediastinoscopy, VATS, etc) should be performed
Advantages of EBUS over Med

- Outpatient setting under local anesthesia
- Absence of neck scar
- Access to N1 nodes
- Less risk of morbidity
- Less healthcare costs
- Potential to streamline thoracic surgical capacity
- Avoids unnecessary surgery in pts with infiltrating mediastinal disease

Hanna W, Yasufuku K. Curr Respir Care Rep 2013
Revised ESTS guidelines for mediastinal staging

(a): In tumours > 3 cm (mainly in adenocarcinoma with high FDG uptake) invasive staging should be considered
(b): Depending on local expertise to adhere to minimal requirements for staging
(c): Endoscopic techniques are minimally invasive and are the first choice if local expertise with EBUS/EUS needle aspiration is available
(d): Due to its higher NPV, in case of PET positive or CT enlarged mediastinal LN's, videoassisted mediastinoscopy (VAM) with nodal dissection or biopsy remain indicated when endoscopic staging is negative. Nodal dissection has an increased accuracy over biopsy

Summary

• Accurate staging of the mediastinum remains essential for management of patients with NSCLC

• The value of EBUS-TBNA as a diagnostic tool for LN staging of NSCLC has been established

• Understanding the anatomy of the mediastinum and the hilum is essential for performing a successful EBUS-TBNA

• EBUS-TBNA may be considered the first line procedure for pts with NSCLC with radiologic evidence of mediastinal adenopathy
Thank you