Interventional pulmonology (IP)

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No conflict of interest to disclose

The Canada Lymph Node Score: National Validation of a Sonographic Score to Determine Mediastinal Lymph Node Malignancy

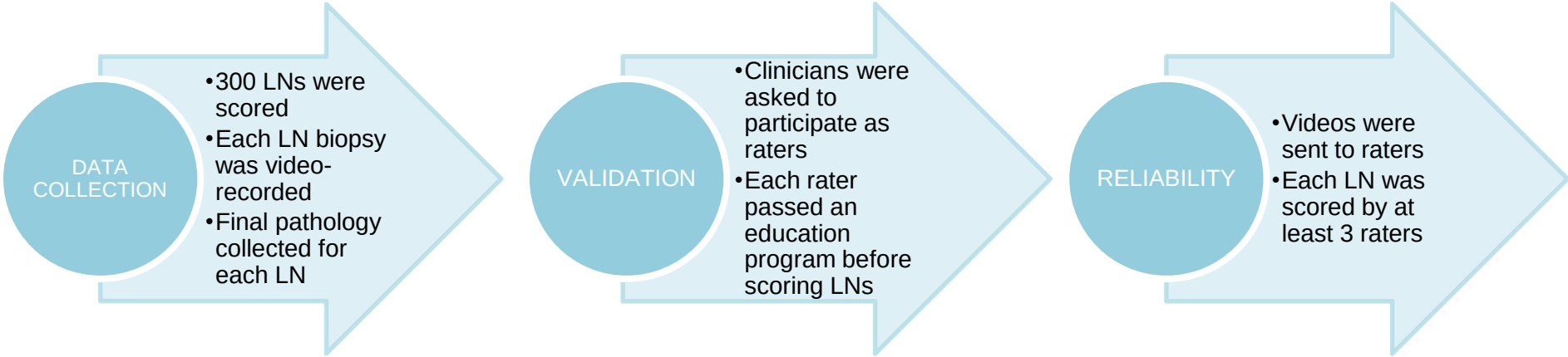
Danielle Hylton, Julie Huang, Simon Turner, Daniel French, Chuck Wen, James Masters, Biniam Kidane, Johnathan Spicer, Jenelle Taylor, Christian Finley, Yaron Shargall, Christine Fahim, Forough Farrokhyar, Kazuhiro Yasufuku, John Agzarian, Waël C. Hanna and the **Research Group of the Canadian Association of Thoracic Surgeons**

Background:

- During EBUS staging for NSCLC ultrasonographic features, for example CHS amongst others, can be used to predict LN malignancy
- This hasn't gained widespread use due to lack of research demonstrating its validity & reliability
- Hypothesis: At the time of EBUS staging, utilization of an ultrasonographic score can ***accurately*** and ***reliably*** predict malignancy

Methods:

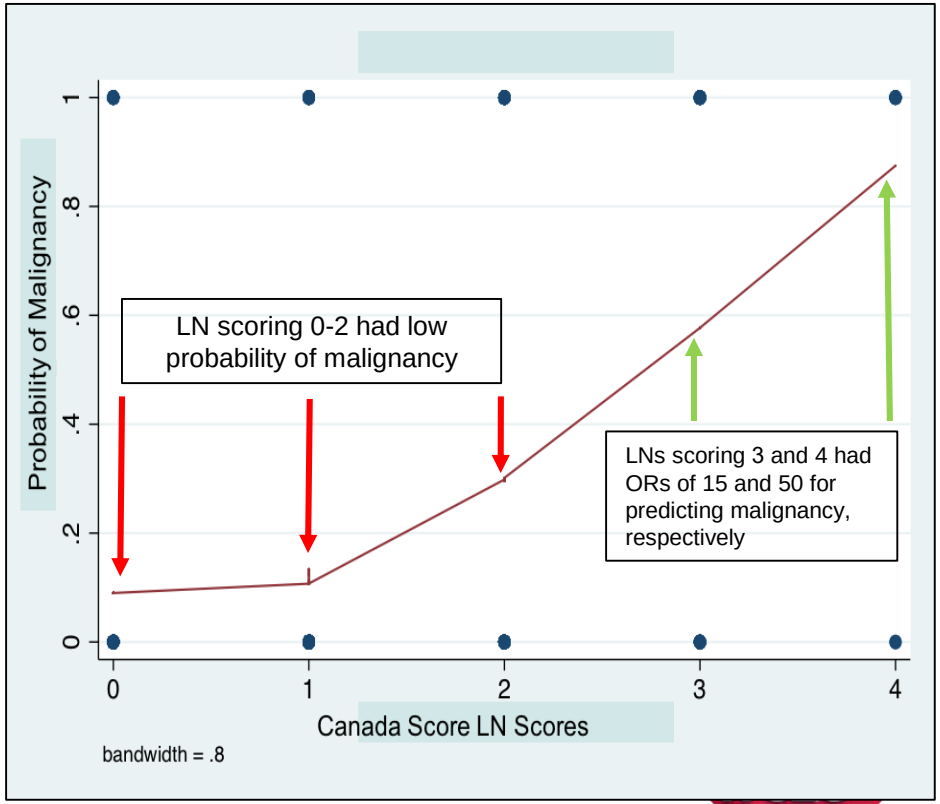
- A prospective cohort validation design was used to assess the reliability and validity of the ultrasonographic features



- Logistic regression, ROC curves, Hosmer-Lemeshow test, & Gwet's AC1 coefficient were used to test performance, discrimination, calibration, & IRR

Results:

- 300 LNs (18% malignant) from 140 patients were analyzed by 12 endoscopists across 7 Canadian centres
- Logistic regression, Hosmer-Lemeshow testing (X^2=11.86, p=0.16), & ROC curves (c-index= 0.72 ±0.042) identified 4 features predictive of malignancy
- IRR for a score ≥ 3 was 0.81 (95%CI: 0.77-0.85)



Conclusion:

- Ultimate result of this research was the development of a novel, reliable, and accurate predictive tool called: **The Canada Lymph Node Score**
- The Canada Lymph Node Score shows excellent performance in identifying malignant LNs
- A cutoff value of $\geq$ 3 has the potential to inform decision-making regarding biopsy or repeat biopsy/mediastinoscopy if initial results are inconclusive
- Further education is required to improve inter-rater reliability among clinicians

Lymph Node Sonographic score - EBUS: predictive of malignancy

- strengths: only one prior prospective study, heavily experienced endoscopists, ≥ 3 blinded raters

- weaknesses: final pathology not described (EBUS, surgery?), impact of benign disease (sarcoidosis? TB?), negative predictive value (NPV)?, inter-rater reliability to be improved, impact of real-time EBUS?

IASLC
INTERNATIONAL ASSOCIATION FOR THE STUDY OF LUNG CANCER
IASLC 19th World Conference on Lung Cancer
September 23–26, 2018 Toronto, Canada
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#WCLC2018

Endosonography with Lymph Nodes Sampling for Restaging the Mediastinum in Lung Cancer: a systematic review and pooled-data analysis

Long Jiang[1], Jun Liu[1], Wenlong Shao[1], Kassem Harris[2], Lonny Yarmus[3], Weizhe Huang[1], Jianxing He[1*];

1Department of Thoracic Surgery and Oncology, The first affiliated hospital of Guangzhou Medical University, Guangzhou/China; 2Westchester Medical Center, New York Medical College, New York/United States of America; 3Johns Hopkins University, Baltimore/United States of America

Background

- Mediastinal restaging after induction treatment is still a difficult and controversial issue.

- Performing remediastinoscopy is recognized as technically difficult because of adhesions and fibrotic changes induced by the initial procedure and induction treatment.
- Other surgical approaches such as thoracoscopy is also invasive and costly.
- The accuracies of imaging techniques such as CT and PET/CT for restaging varies largely.

Minimally invasive procedures such as EBUS-TBNA and EUS-FNA are confirmed with reliably accurate results for the initial staging of lung cancer. We aimed to investigate the diagnostic accuracy for restaging the mediastinum after induction treatment in patients with lung cancer.

Mediasting restaging – EBUS and/or EUS

- systematic review and pooled analysis after induction treatment for lung cancer
- 9 studies (until July 2017), 542 patients, mediastinal LN metastases previously diagnosed pathologically (mostly N2)
- stable or partial response (CT or PET) after induction treatment (previous chemotherapy, radiotherapy or both)

The Diagnostic Accuracy of the Included Studies

Variables	No. of patients	Pooled sensitivity (95% CI)	Pooled specificity (95% CI)	Negative Likelihood Ratio	AUC
In all mediastinal stations					
Overall	543	0.70 (0.65-0.75)	1.00 (0.98-1.00)	0.30 (0.21-0.43)	0.93 (0.91-0.95)
EBUS-TBNA	424	0.66 (0.60-0.72)	1.00 (0.98-1.00)	0.38 (0.26-0.54)	0.84 (0.81-0.87)
EUS-FNA	226	0.73 (0.52-0.87)	0.99 (0.90-1.00)	0.27 (0.14-0.53)	0.99 (0.90-1.00)
Combine	106	0.67 (0.53–0.79)	0.96 (0.86–0.99)	N/A	0.81 (0.73–0.87)
Subgroup analysis					
Chemo alone	365	0.69 (0.63-0.75)	1.00 (0.97-1.00)	0.35 (0.26-0.48)	0.90 (0.88-0.94)
Chemo radiotherapy	130	0.65 (0.50-0.78)	1.00 (0.96-1.00)	0.25 (0.06-1.02)	0.97 (0.95-0.98)

TAKE HOME MESSAGE

- Endosonography with lymph node sampling is an accurate and safe technique in mediastinal restaging in lung cancer patients after induction treatment.

- For non-diagnostic results, a more invasive approach should be thoroughly considered.

Mediasting restaging – EBUS and/or EUS

- strengths: first systematic review, restaging verified by surgery, assessment of complications

- weaknesses: most are small, single-center retrospective studies, criteria to select the sampled nodes?, EBUS/EUS techniques not described (separate needle passes, needle size, ROSE), N2/N3 prevalence?

Mediasting restaging – EBUS and/or EUS

- sensitivity: lower (70%) than for initial EBUS (89%) or EUS or both; reasons? heterogeneity of the studies? fibrosis/necrosis, localized malignant cells…
- sensitivity of repeat mediastinoscopy is also lower than for primary mediastinoscopy (FN 20% vs 10%)

Diagnostic yield of N3 hilar staging by endobronchial ultrasonography (EBUS) in lung cancer.

J.Bordas[1]; J.L. Vercher [2]; G.Rodríguez[1]; C. Martín[1]; N. Cubero[1,3]; R.M. López-Lisbona[1]; M. Díez-Ferrer[1]; N. Baixeras[4]; J. Dorca[1,3,5]; A. Rosell[1,3,5]

1-Dept. Pulmonology, Bellvitge Universitary Hospital, IDIBELL, L'Hospitalet, Barcelona, Spain; 2-NM-PET/CT Unit, ICS-IDI, Barcelona University, L'Hospitalet, Barcelona, Spain; 3-CIBER of respiratory diseases (CIBERES), L'Hospitalet, Barcelona, Spain; 4-Dept. Anatomic Pathology, Bellvitge Hospital, Barcelona University, L'Hospitalet, Spain; 5- Barcelona University, L'Hospitalet, Barcelona, Spain

Introduction

- Systematic lung cancer staging with EBUS has proven to be equivalent to cervical mediastinoscopy[1,2].
- Nevertheless, in the daily practice it is not uncommon to explore and sample negative PET-CT hilar N3 lymph nodes (LN)[3,4].
- This study aims to explore if there is enough evidence to support this clinical practice.

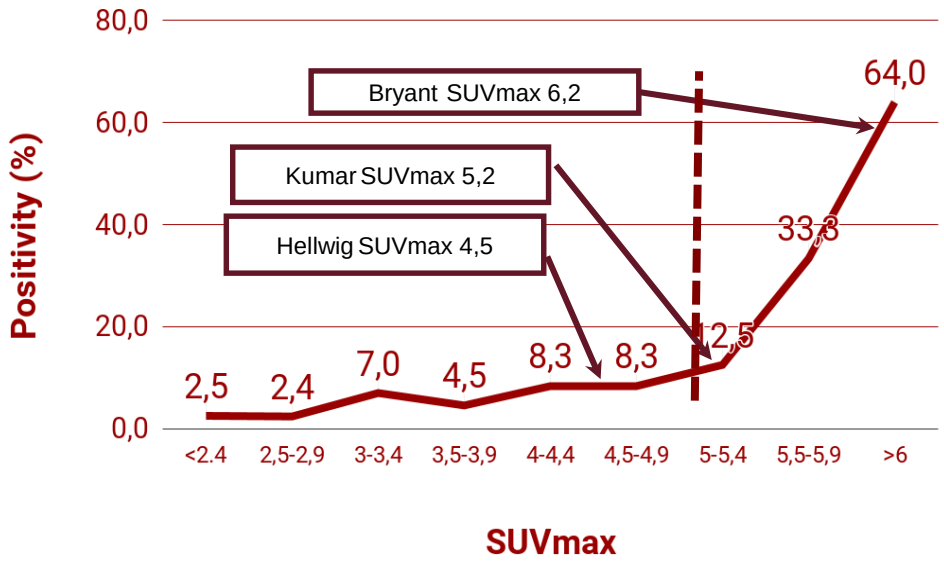
1.Chest 143(5 Suppl): e211S-e250S. ; 2. Lung 193(5): 757-766. 3. Chest 133(4): 887-891. ; 4. Chest 147(5): 1401-1412

Methods

- Retrospective study from our database including 1,013 explorations over the last 5 years.
- Including criteria were patients with lung cancer staged by PET-CT and EBUS-TBNA.
- Mediastinal and hilar N3 LN with a short axis ≥ 5 mm were sampled assessed by rapid on site evaluation.
- A single nuclear medicine expert reviewed blindly all PET-CT scans and determined the SUVmax of every LN.
- Those that were ≥ 5 SUVmax[5,6,7] by PET-CT and/or ≥ 10mm in short axis by EBUS were considered abnormal

5. Nucl Med 48(11): 1761-1766. ;6. Ann Thorac Med 6(1): 11-16. ; 7. Ann Thorac Surg 82(2): 417-422; discussion 422-413.

Efficiency percentage in base on SUVmax



Results

Table 2: N3 lymph nodes characteristics

N3 Mediastinal		N3 Hilar		N3h + SUVmax ≥ 5	N3h + SUVmax ≥ 2,5
EBUS	PET	EBUS	PET		
-	-	-	-	0/61 (0%)	0/31 (0%)

Conclusions

In absence of abnormal N3 hilar LN (PET: SUVmax<5; EBUS<10mm in short axis) **it seems there is not enough evidence to sample them,** regardless of N3 mediastinal status.

N3 hilar staging

- strengths: paucity of data on N3 hilar staging, database of 1013 explorations, PET-CT review blinded

- weaknesses: small number of patients, retrospective study, SUVmax ≥ 5 (literature: ≥ 2.5 or higher uptake than surrounding mediastinal structure, risk of malignancy increased if > 4), SUVmax not routinely in the reports?

Conclusion

- lymph node sonographic score: very promising

- mediastinal restaging: EBUS for restaging, mediastinoscopy if negative

- N3 hilar staging: to sample or not to sample? impact on radiation treatment; skipping metastasis

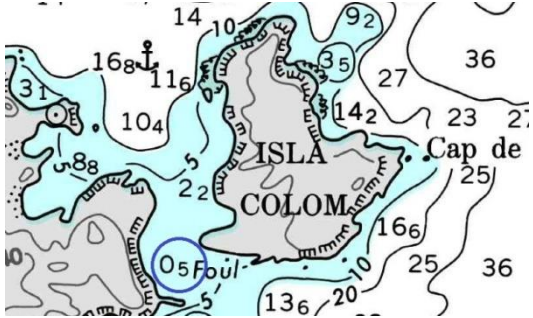
MA13 - Interventional Pulmonology

10:30 - 12:00
9/25/2018
Location: Room 206 AC
Type: Mini Oral Abstract Session
Track: Interventional Diagnostics/Pulmonology
Moderators:Jason S Agulnik, Kwun M Fong

MA13.12 - Discussion - MA 13.09, MA 13.10, MA 13.11

Dr. Antoni Rosell
Head of Interventional Pulmonology Unit
Respiratory Medicine Department
Hospital Universitari de Bellvitge (Barcelona)
Email: arosell@bellvitgehospital.cat

Guided bronchoscopy



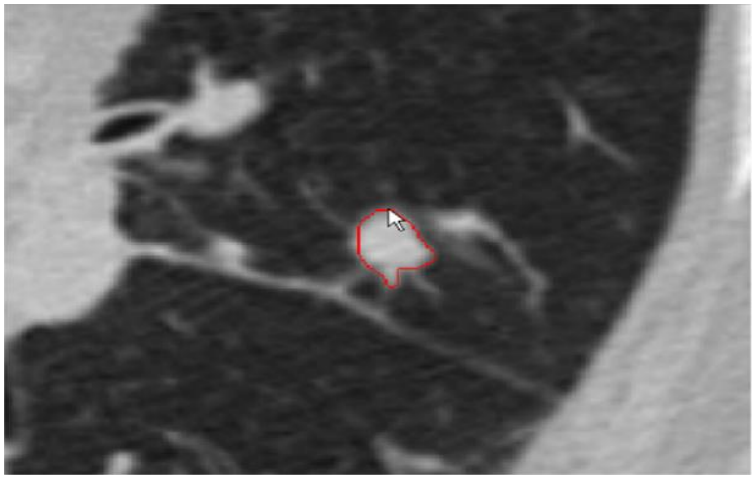
(1) ROI Definition & Selection

(2) Airway-Tree Segmentation

(3) Route Planning

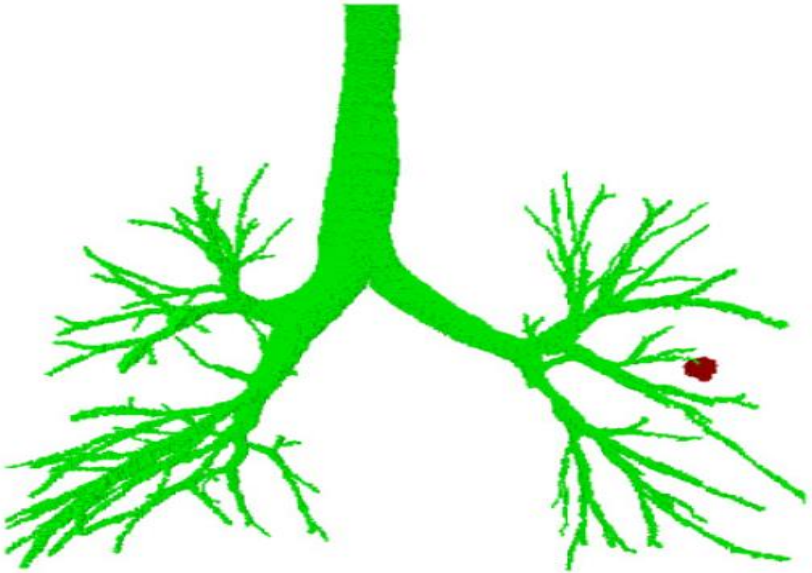
(4) Tracking

(1) ROI Definition & Selection



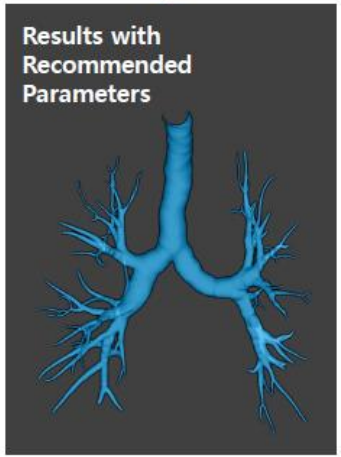
- CT and system dependant
- Operator dependant

(2) Airway-Tree Segmentation

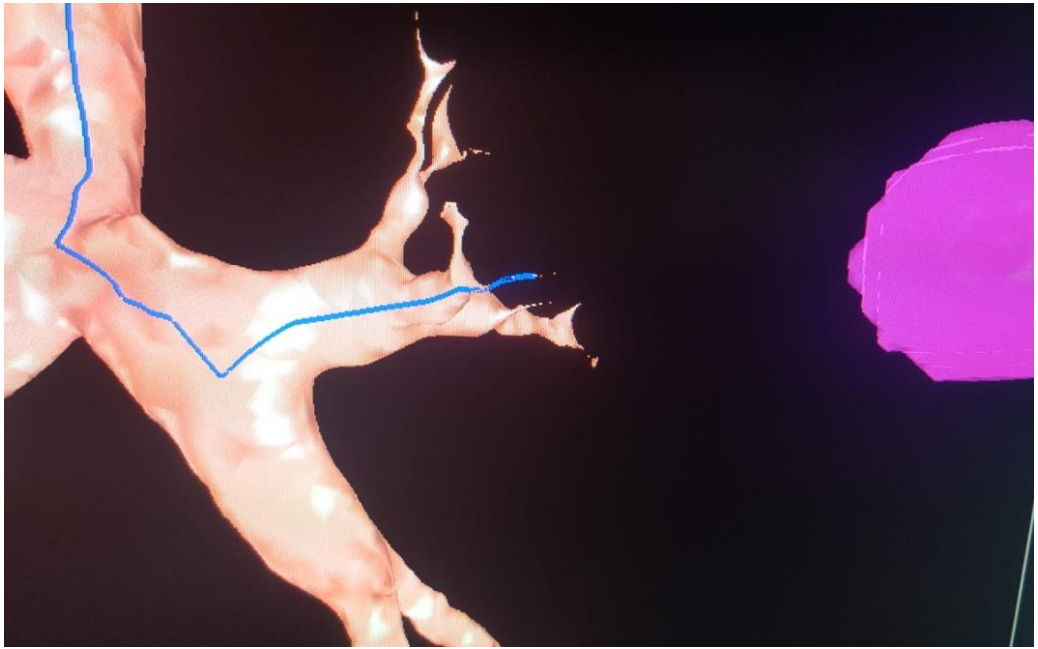


- CT and system dependant (accurcy for distal airways)
- Patient dependant (COPD)
- Static acquisicion (inspiration- TLC)

Parameters:	This CT
Thickness:	1.25 mm
Interval:	1
Image Gaps:	No
Overlap:	20 %
Kernel:	STANDARD
Images:	312



Parameters:	This CT
Thickness:	3.75 mm
Interval:	3.27
Image Gaps:	No
Overlap:	13 %
Kernel:	SOFT
Images:	267

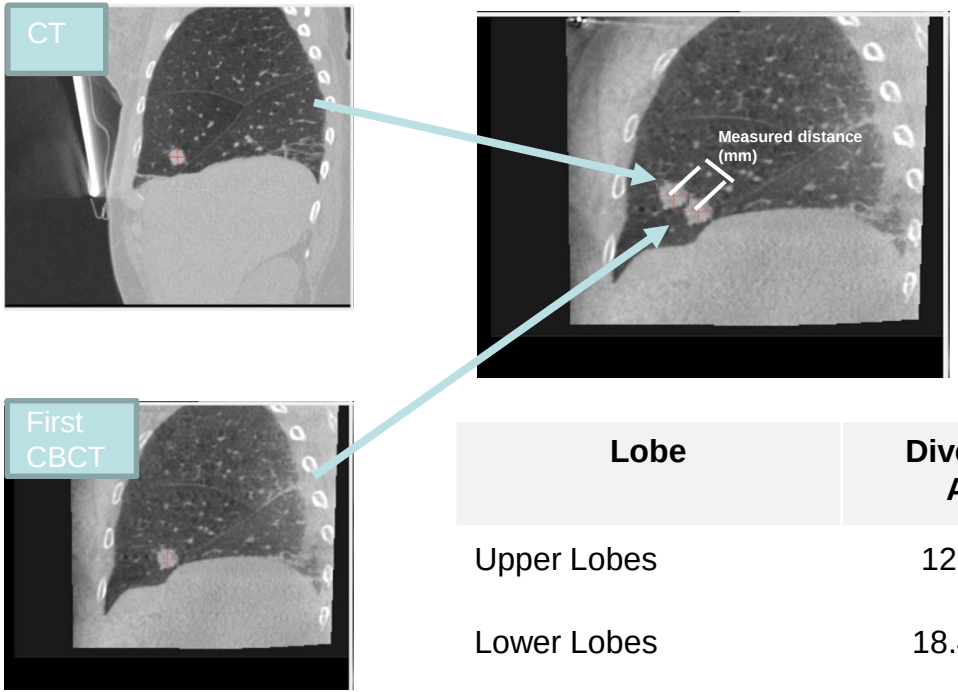


Severe emphysema

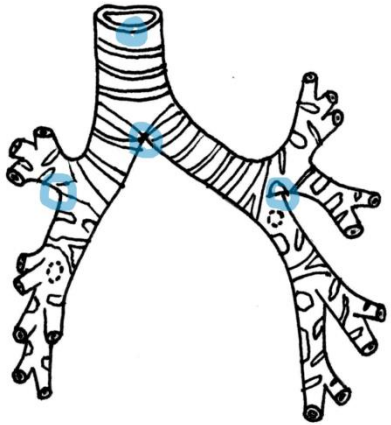
BRONCHOSCOPY PERFORMED IN TIDAL VOLUME!!

Presenting Author: Michael A. Pritchett

Nodule Movement Measurements

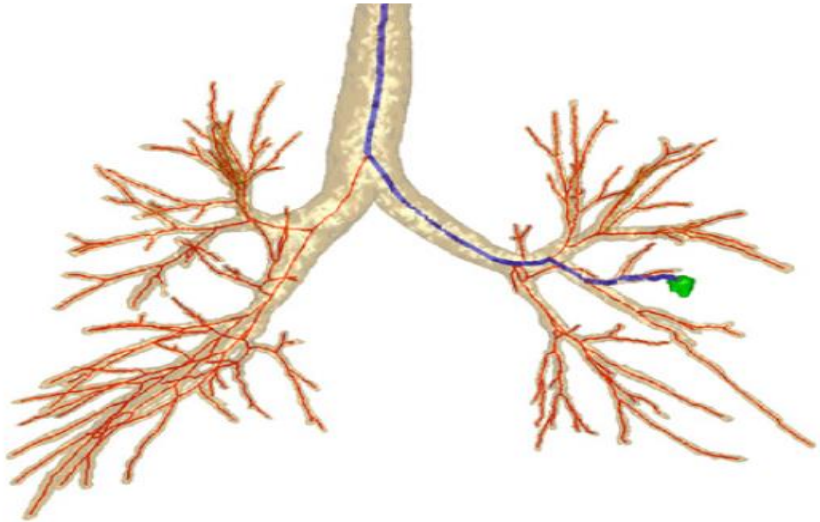


- CT to CT comparison in 3-dimensions
- Registration based central airway

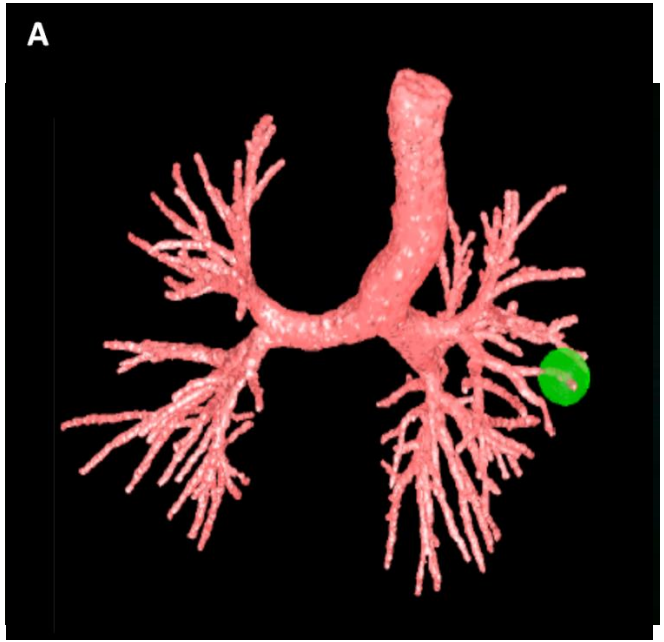


Lobe	Divergence (mm) Avg (range)
Upper Lobes	12.6 (2.64-35.9)
Lower Lobes	18.4 (9.56-28.89)

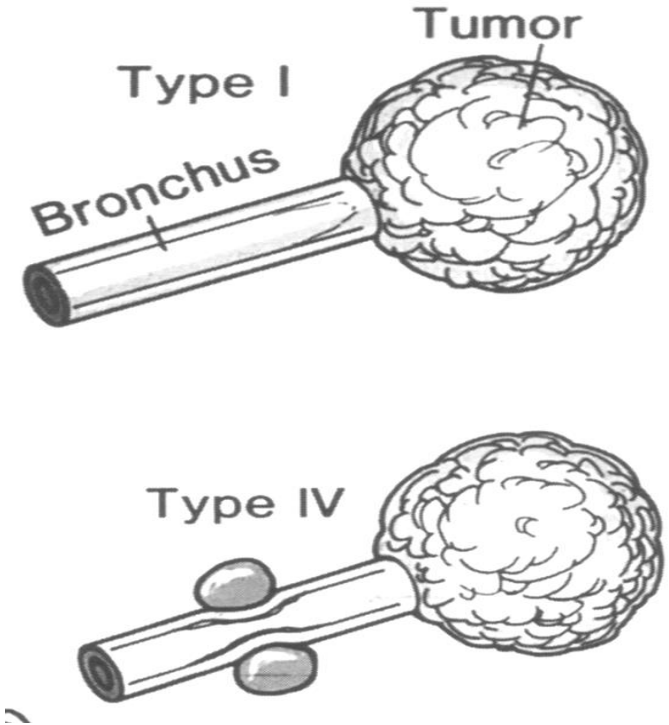
(3) Route Planning



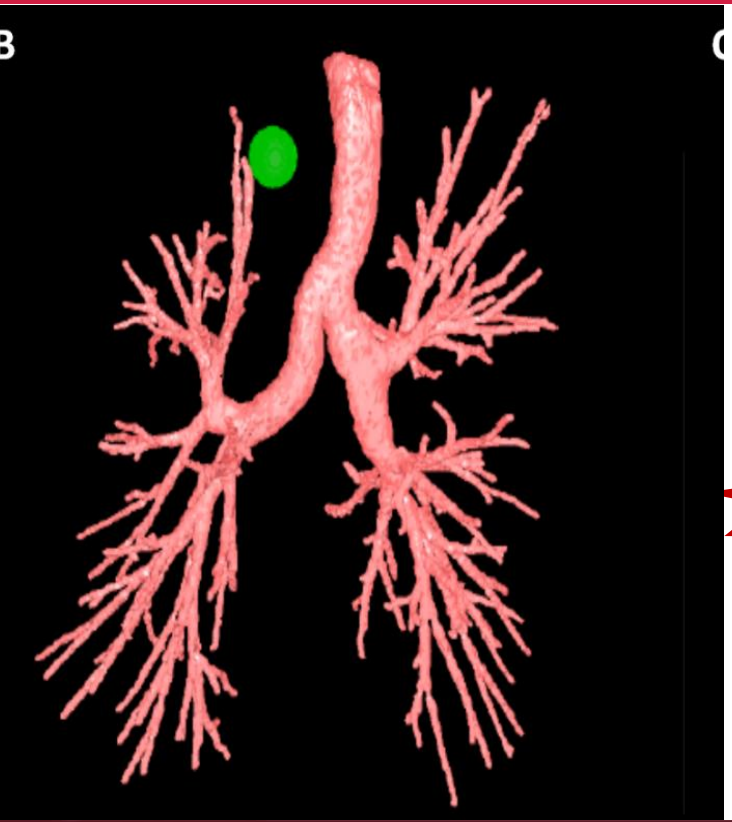
- System dependant, and it should provide:
- pathways according to the diameter and the flexibility of the bronchoscope
- Lesion location: Intra/peri/extrabronchial

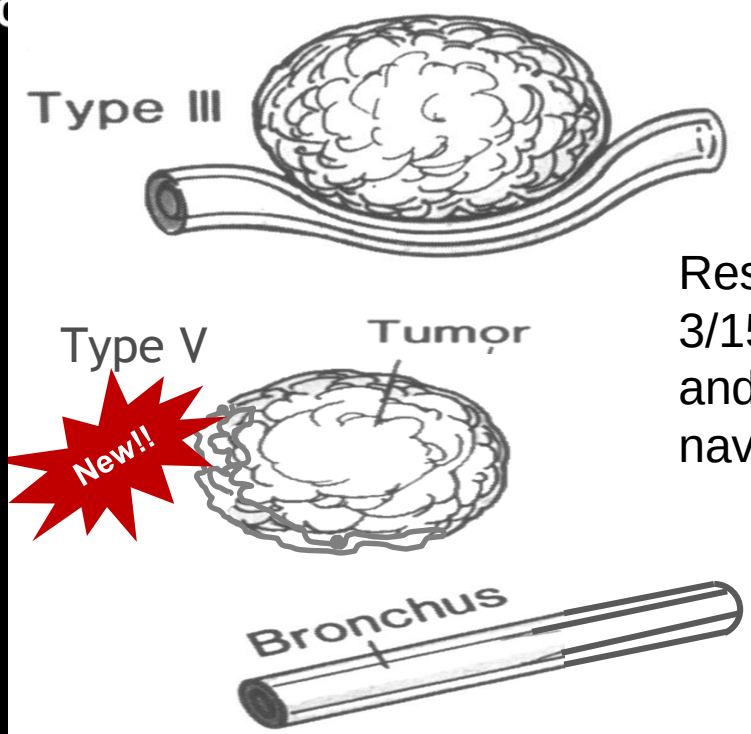


Intra-bronchial

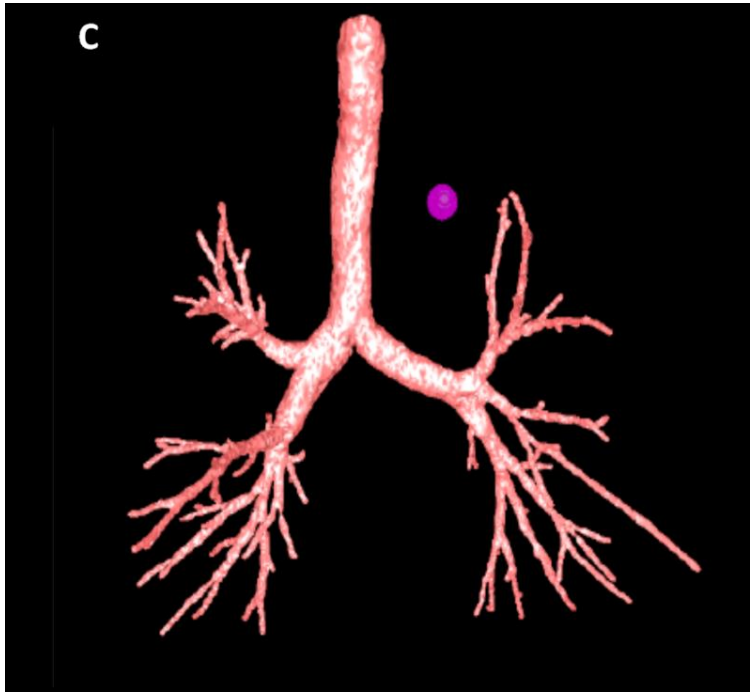


Respiration (pending)
17/20= **85%** with UTH and LungPoint navigation



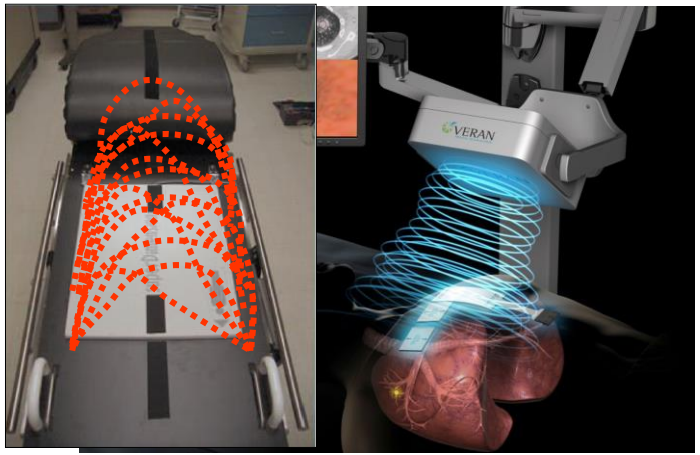


Respiration (pending)
3/15= **20%** with UTH and LungPoint navigation



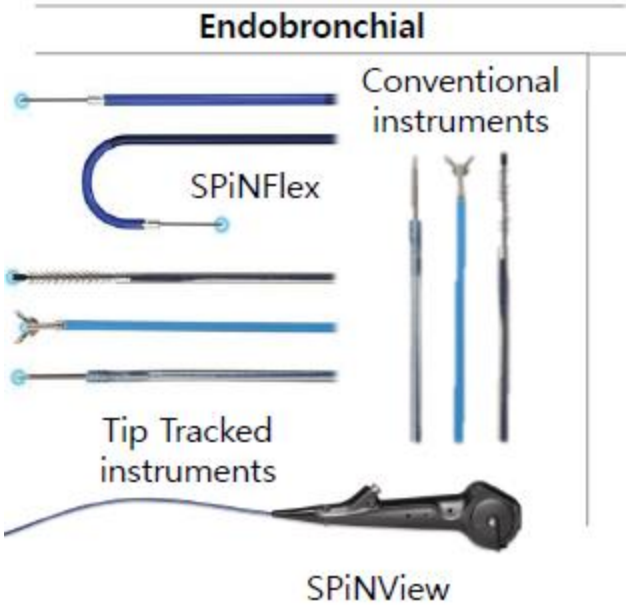
Respiration (pending)
6/20= **30%** with UTH and LungPoint navigation

(4) Tracking



Electromagnetic
(SD, Veran)

Ancillary instrument (single use)



Veran

Edge™ navigation catheter

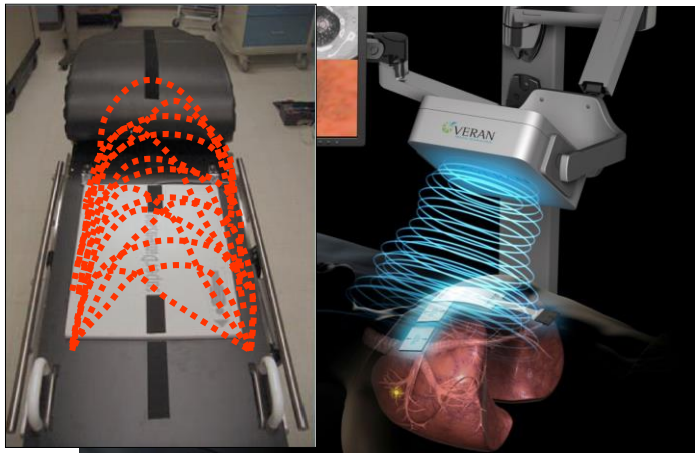
Edge™ Locatable Guide

Edge™ Extended Working Channel

Edge™ Bronchoscope Adapter

Super-Dimension

(4) Tracking



Electromagnetic
(SD, Veran)

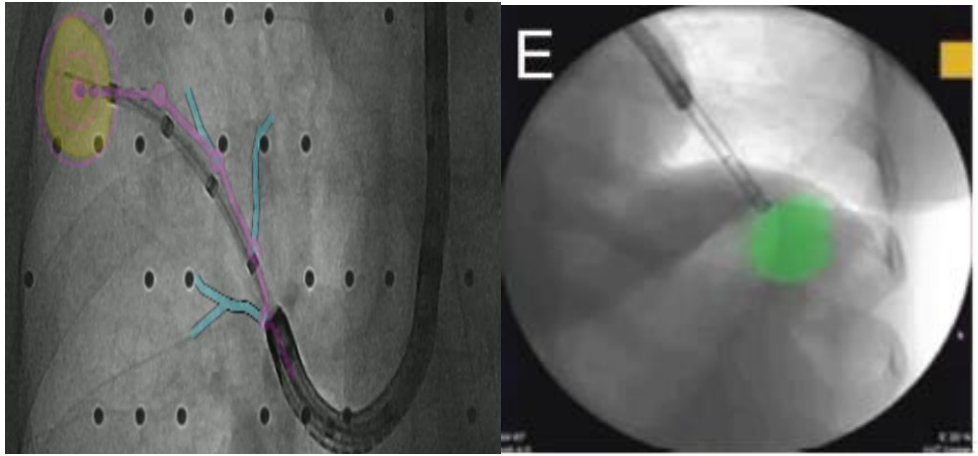
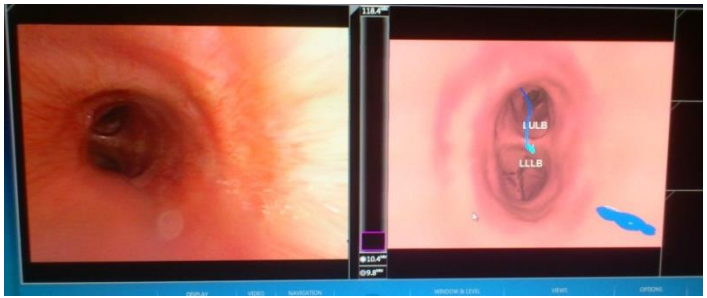


Image based
(Bf-NAVI, LungPoint, Archimides, Lung Vision)

Registration

Image-to-image: matching different radiology images (MRI/CT/PET) with each other

Image-to-patient: Virtual model from the CT alignement with the airways of the patients



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ELECTROMAGNETIC NAVIGATION BRONCHOSCOPY AS AN INTEGRATED APPROACH TO AID IN THE DIAGNOSIS AND TREATMENT OF PULMONARY LESIONS

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Inova Health System, Falls Church, VA

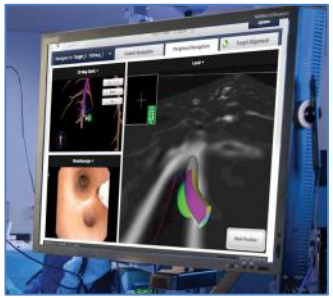
Septimiu D. Murgu MD, D. Kyle Hogarth MD, William S. Krimsky MD, Javier Flandes MD, Otis B. Rickman DO, Momen M. Wahidi MD MBA, Eric Sztejman MD, Philip A. Linden MD, Sadia Benzaquen MD, Sandeep Bansal MD, Erik E. Folch MD MSc

On Behalf of the NAVIGATE Study Investigators

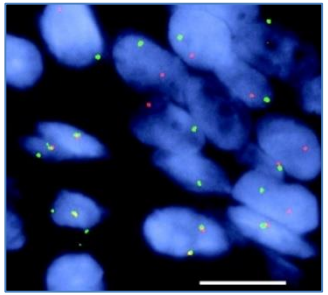
NAVIGATE

- An Integrated and Efficient Approach to Aid in...

Diagnosis of Peripheral Lesions



Tissue Collection for Molecular Testing



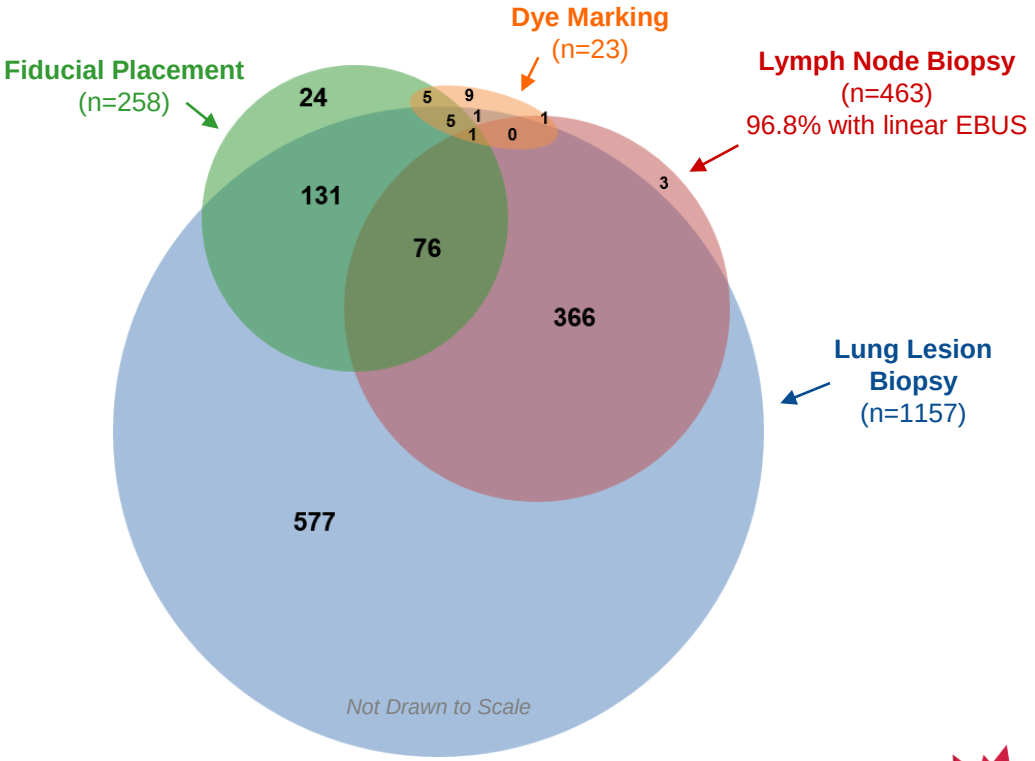
Staging in the Same Procedure

Localization for Minimally Invasive Treatment

Current Objective: Evaluate the multidimensional utility of ENB in a large, prospective, multicenter study

The NAVIGATE Study

- Prospective, multicenter, global, cohort study
- ENB using the superDimension™ navigation system
- United States Cohort: 1,215 consecutive subjects at 29 sites from April 2015 to August 2016
- 12-Month Interim Analysis



Not shown in graph:
- Fiducial placement + lymph node biopsy (n=15)
- Fiducial placement + lymph node biopsy + dye marking (n=1)

Full Study Design: Folch et al. BMC Pulm Med. 2016;16:60
www.clinicaltrials.gov, NCT02410837

NAVIGATE

Diagnostic Outcomes

NAVIGATE United States Cohort
(N=1215)

↓

ENB-guided Lung Lesion Biopsy Attempted
95.2% (1157/1215)

↓

Navigation Completed and Tissue Obtained
94.4% (1092/1157)

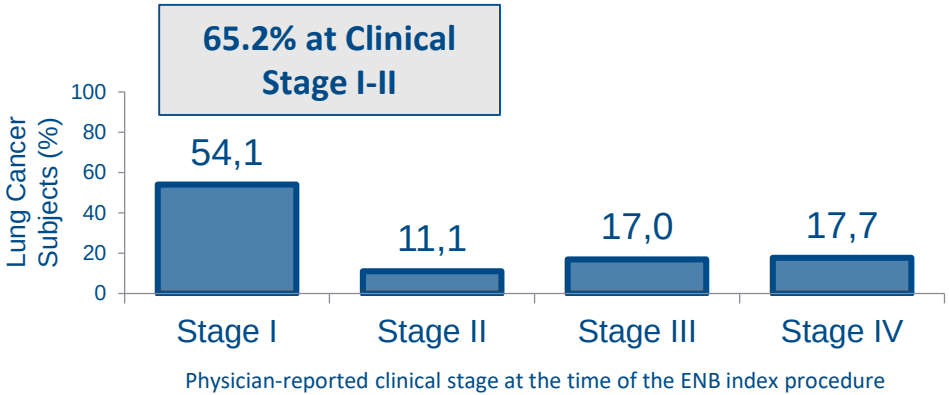
↓

Negative for Malignancy
on the ENB index procedure
55.7% (608/1092)

Positive for Malignancy
on the ENB index procedure
44.3% (484/1092)

12-Month Diagnostic Yield
72.9% (768/1053)

(True positives plus true negatives as of 1-year follow-up)



Physician-reported clinical stage at the time of the ENB index procedure

Molecular testing in adenocarcinoma or NSCLC-NOS:*

- **86.2% -** Tissue adequacy in 87 lesions with testing attempted

EGFR: 14.7% (11/75)	ROS1: 1.3% (1/75)
KRAS: 9.3% (7/75)	BRAF: 1.3% (1/75)
ALK: 4.0% (3/75)	

- **57.9% -** Stage IIIB/IV subjects with testing attempted

*Only actionable mutations at study enrollment (April 2015 to August 2016) were evaluated.

NAVIGATE

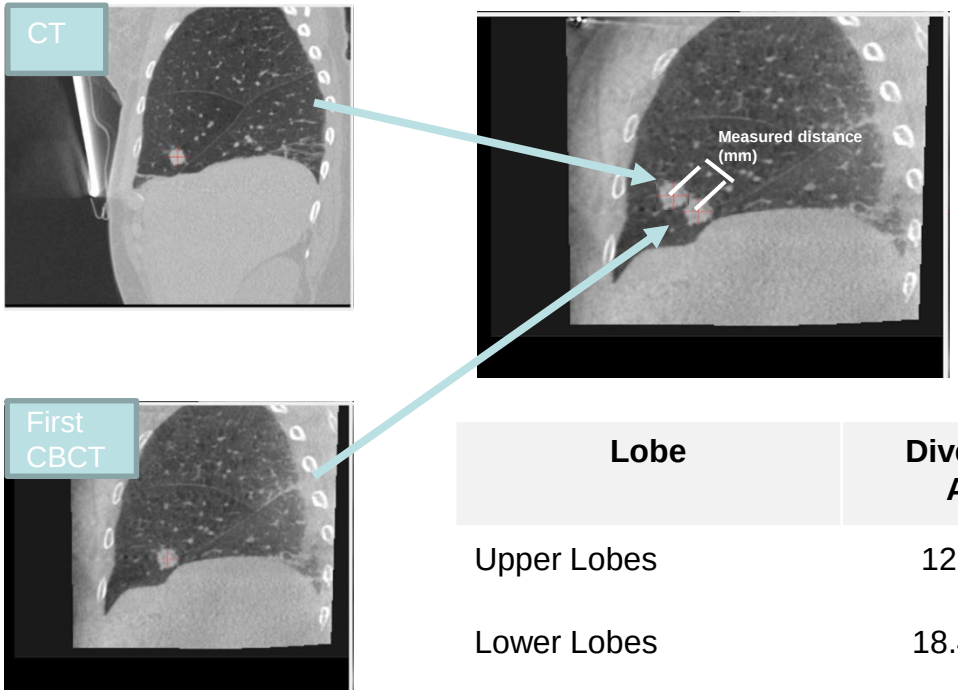
Take-Home Messages

- Generalizable: Largest prospective, multicenter ENB study to date
- Multidimensional approach to aid in lung biopsy and mediastinal/hilar staging:
  - 463 subjects with lymph node staging during the ENB procedure (same anesthetic event)
  - 22% with fiducial or dye marking to prepare for minimally invasive surgery
- Very low complication rates
  - 4.3% pneumothorax rate (compared to 19-25% for transthoracic biopsy)[1,2]
- Tissue adequate for molecular testing in 86%
- 73% diagnostic yield based on rigorous 12-month follow-up
  - Two-year follow-up is ongoing

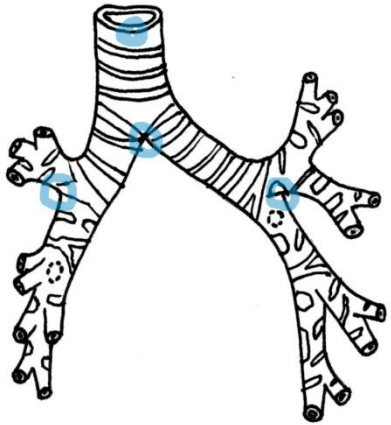
1. DiBardino et al. J Thorac Dis. 2015;7:S304-16
2. Heerink et al. Eur Radiol. 2017;27:138-48.

Presenting Author: Michael A. Pritchett

Nodule Movement Measurements



- CT to CT comparison in 3-dimensions
- Registration based central airway



Lobe	Divergence (mm) Avg (range)
Upper Lobes	12.6 (2.64-35.9)
Lower Lobes	18.4 (9.56-28.89)

	MA13.09 Super-Dimension	**MA13.10** Lung Vision
N. Patients	1215	21
Metodolgy	Prospective, multicenter	Prospective, one center
Comparative	No	Cone beam CT (accuracy**: 5.9 ± 3.2 mm)**
Follow-up	1 year	Not reported
Innovative technology	No	Yes
Selection criteria	Not reported	Not reported
Nodule ≤ 20 mm	Not reported	15 (65%)
Complications	4.3%	Not reported
Diagnostic yield	73%	86% (80% for nodules ≤ 20 mm)
ROSE	No	Yes
Ancillary equipment	Yes	No
Registration	Image-to-patient	Image-to-image

TAKE HOME MESSAGE 1 (DIAGNOSIS)

1. Guided bronchoscopy is a must for the study of pulmonary lesions that need a pathological result
2. There are not comparative randomized clinical trials to recommend one system to another
3. SuperDimension is a EMN system that requires ancillary instruments and that reaches 73% of diagnoses in a large multicentre prospective study after more than a decade in clinical use
4. Lung Vision is new image-based navigation on augmented fluoroscopy with not need of ancillary instruments that in a pilot study obtains 87% of diagnoses with ROSE
5. None of both systems allow navigation outside the airways

Thank you !