

EBUS Workshop

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Disclosures

- Research support from Olympus

Objectives

- The demonstration of EBUS-TBNA for mediastinal staging
- Proper sampling technique to obtain both a diagnosis and molecular analysis with EBUS-TBNA
- The role of EBUS-TBNA in clinical cases

History

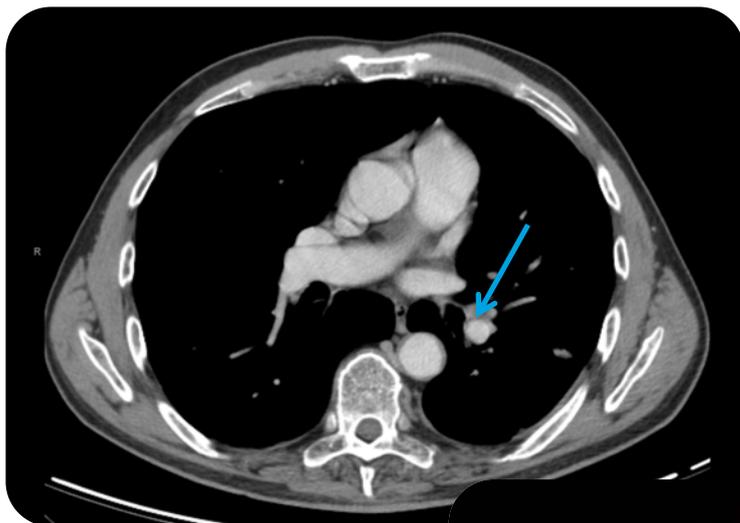
- 65 y/o male, heavy smoker (30 pack year)
- History of resected prostate CA had a rising PSA
- CT Chest/Abd/Pelvis was performed
- PFTs showed mild obstruction (FEV1 65% pred) and moderate reduction in DLCO (59% pred).
- Physical exam unremarkable

CT

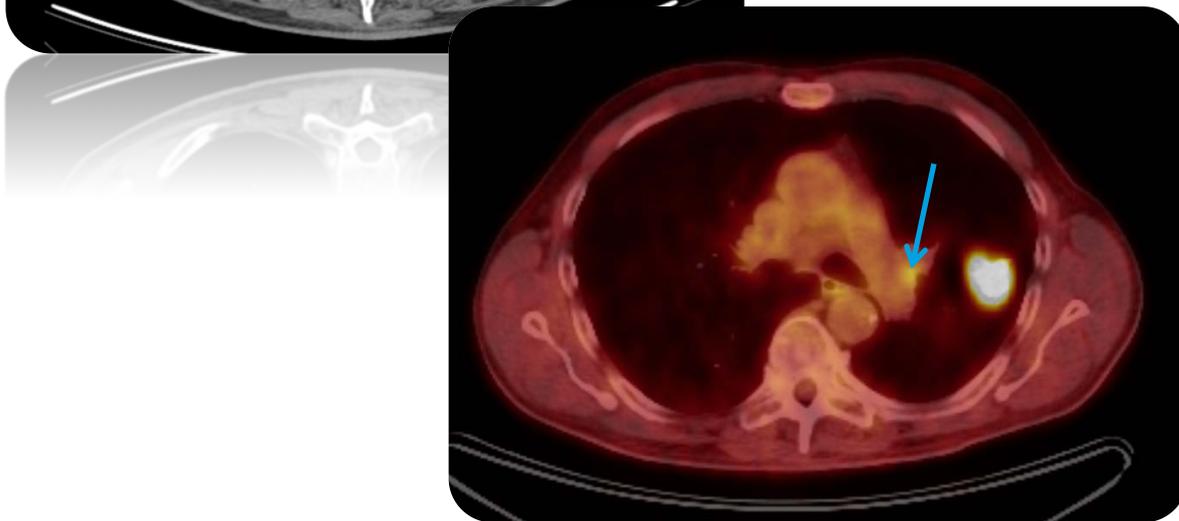


24 X 23 mm

FDG Avidity in the LUL nodule and 10L

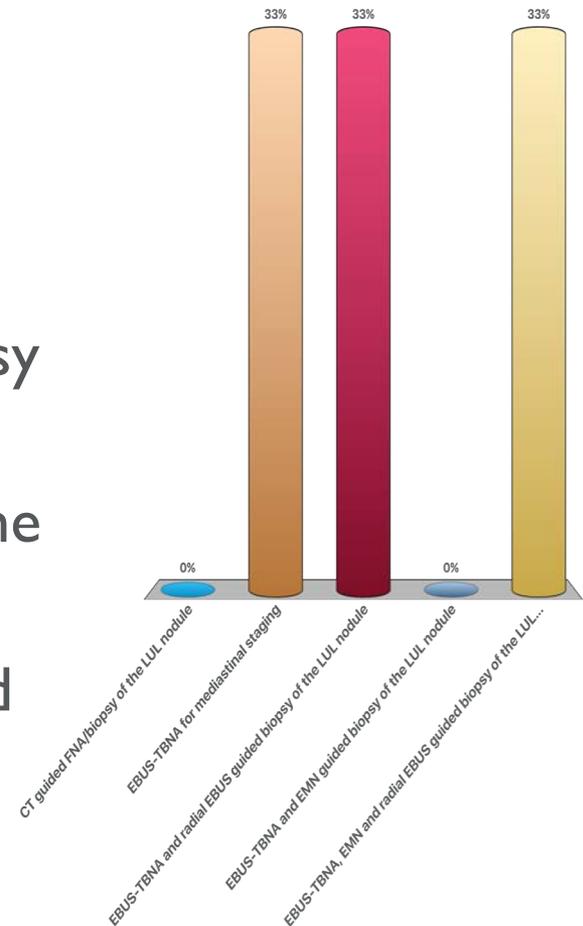


PET



Question 1: You highly suspect primary lung cancer. Which of the following would you do next?

- A. CT guided FNA/biopsy of the LUL nodule
- ✓ B. EBUS-TBNA for mediastinal staging
- C. EBUS-TBNA and radial EBUS guided biopsy of the LUL nodule
- D. EBUS-TBNA and EMN guided biopsy of the LUL nodule
- E. EBUS-TBNA, EMN and radial EBUS guided biopsy of the LUL nodule



In the presence of mediastinal/hilar LAD, a diagnosis and mediastinal staging can be obtained at the same time using EBUS-TBNA

- In patients with an intermediate suspicion for N2, 3 involvement, i.e. radiographically normal mediastinum (by CT and PET) and a central tumor or N1 lymph node enlargement (and no distant metastasis)
- A needle technique (EBUS-NA, EUS-NA or combined EBUS/EUS-NA) is suggested over surgical staging as a best first test (Grade 2B)

EBUS-TBNA for staging of NSCLC

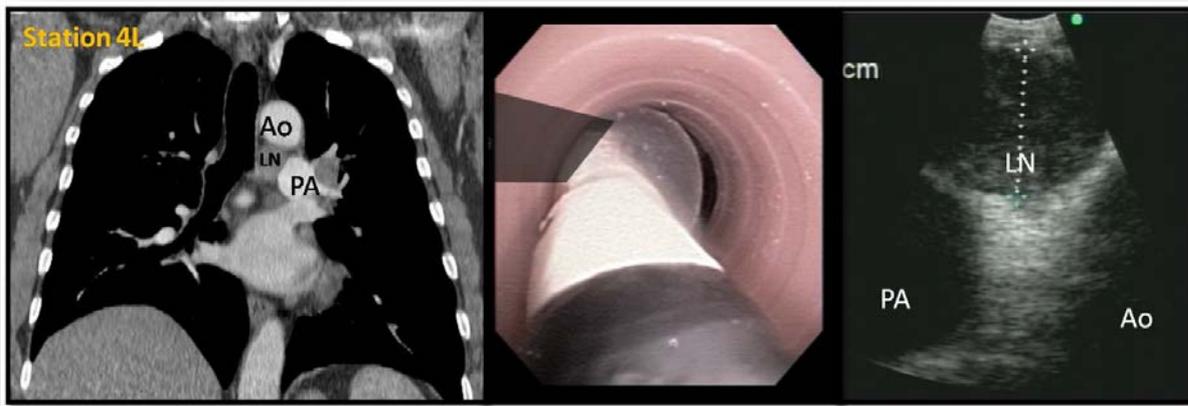


- EBUS-TBNA and mediastinoscopy achieve similar results for the mediastinal staging of lung cancer

J Thorac Cardiovasc Surg 2011;142(6):1393-400

- 28% of patients with a high clinical suspicion of nodal disease had nodal metastases confirmed by mediastinoscopy despite negative EBUS-TBNA

Ann Thorac Surg 2010; 90: 1753– 8

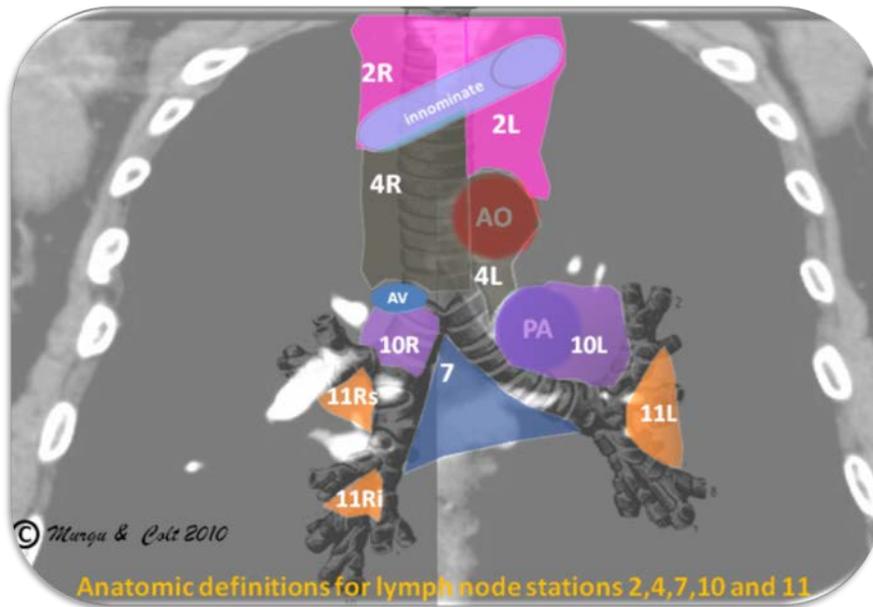


Evaluate and sample contralateral mediastinal lymph nodes, if present

- When performed for diagnosis and staging purposes, however, EBUS-TBNA should be performed first from N3 nodes, followed by N2 nodes and for diagnosis, when necessary N1 nodes.
- If N3 nodes were found to be positive for malignancy on rapid on-site cytological evaluation, the procedure could be terminated.
- In this case N3 nodes are the contralateral (left) sided mediastinal nodes.

Case continues...a systematic EBUS exploration (i.e. visualization) of the mediastinum is performed starting with N3=>N2=>N1

- For this patient, that means looking for LN in the following stations



- ✓ 4R
- ✓ 7
- ✓ 4L
- ✓ 10L
- ✓ 11L

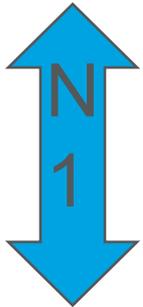
Question 2: Based on the IASLC staging system, the presence of malignant cells in station 10L in this patient represents

- A. N0 disease
- B. N1 disease
- C. N2 disease
- D. N3 disease

Answer Q2: B: N1 disease

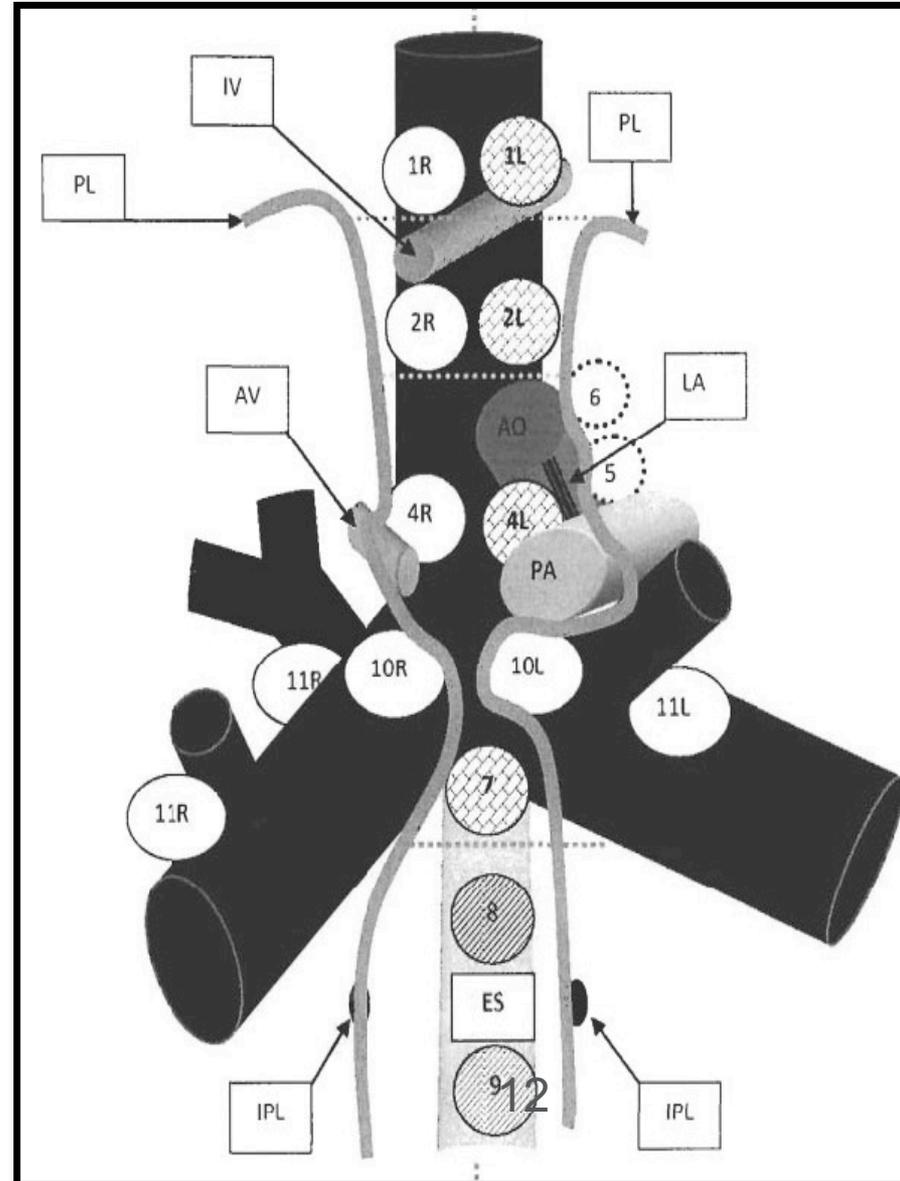


1. Highest mediastinal
2. Upper paratracheal
3. Prevascular and retrotracheal
4. Lower paratracheal
5. Subaortic (AP window)
6. Paraaortic(ascending aorta/phrenic)
7. Subcarinal
8. Paraesophageal
9. Pulmonary ligament

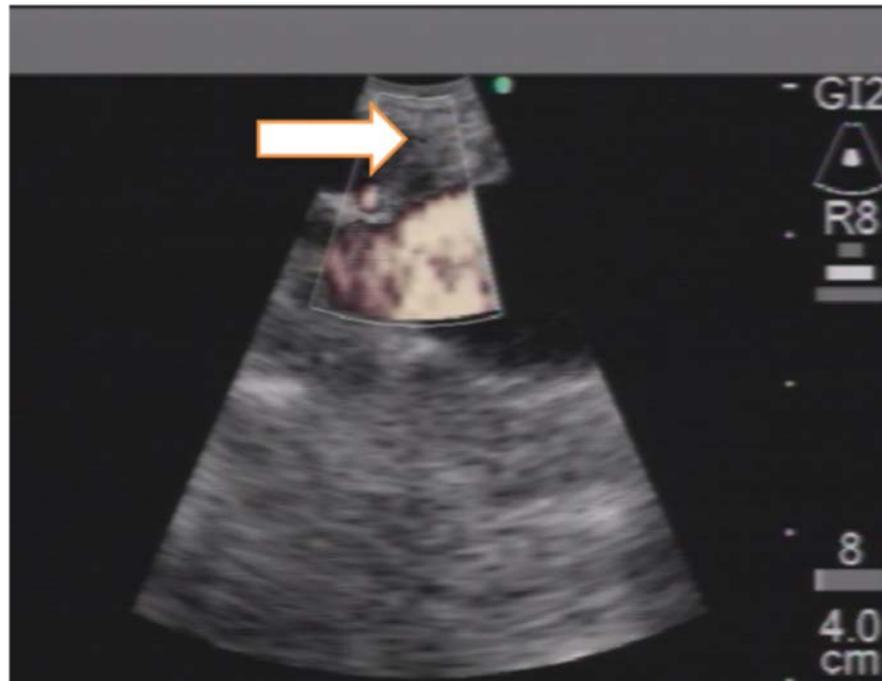


10. Hilar
11. Interlobar
12. Lobar
13. Segmental
14. Subsegmental

Double digit ipsilateral: N1
Single digit nodes: N2
Any contralateral node: N3



Question 3: With the EBUS scope in the proximal bronchus intermedius and with the transducer oriented towards the right lateral wall, the following image is displayed on the monitor.



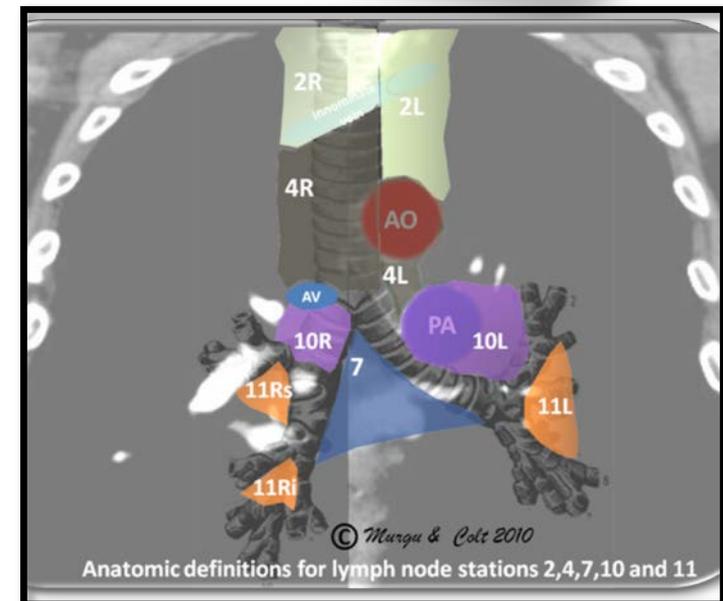
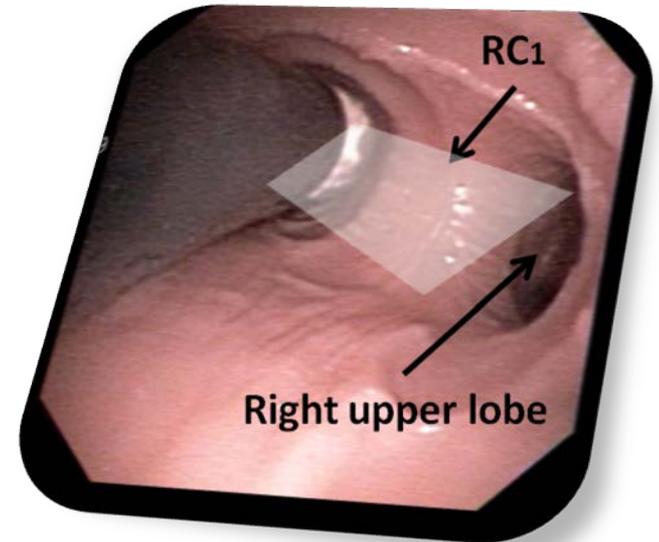
Question 3. The marked structure (arrow) represents:



- A. Lymph node station 10R
- ✓ B. Lymph node station 11R superior
- C. Lymph node station 11R inferior
- D. Interlobar artery

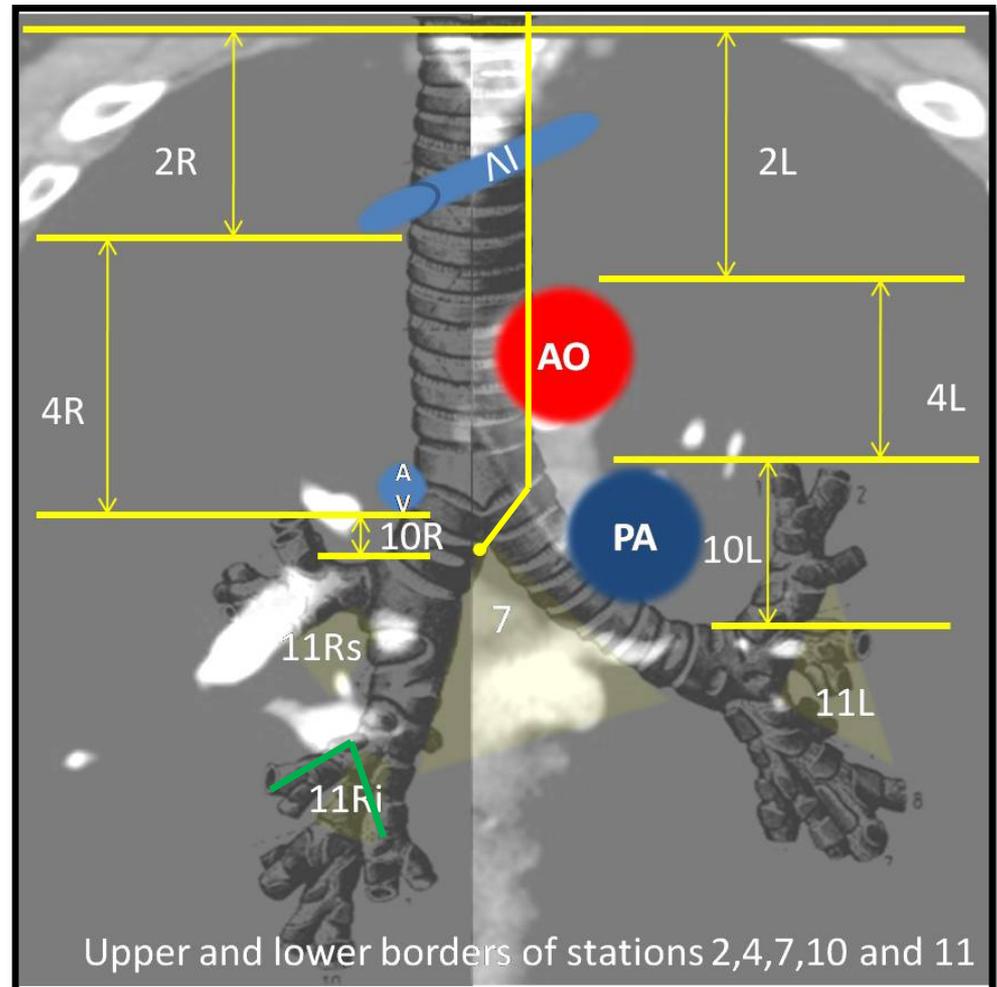
Answer Q3: B: Lymph node station 11R superior

- With the scope at that location and orientation (Figure), the visualized lymph node pointed in the image is the right superior interlobar node (station 11R s).
- **Station 11R superior** is comprised of the nodes between the right upper lobe bronchus and bronchus intermedius.
- **Station 11R inferior** is between the middle and the right lower lobe bronchi and is visualized with the scope positioned in the proximal right lower lobe and the transducer oriented towards the right lateral wall.
- **Station 10 R** includes nodes immediately adjacent to the right mainstem bronchus and hilar vessels including the proximal portions of the pulmonary veins and main pulmonary artery.
- **The interlobar artery** is the anechoic Doppler positive structure adjacent to the node.

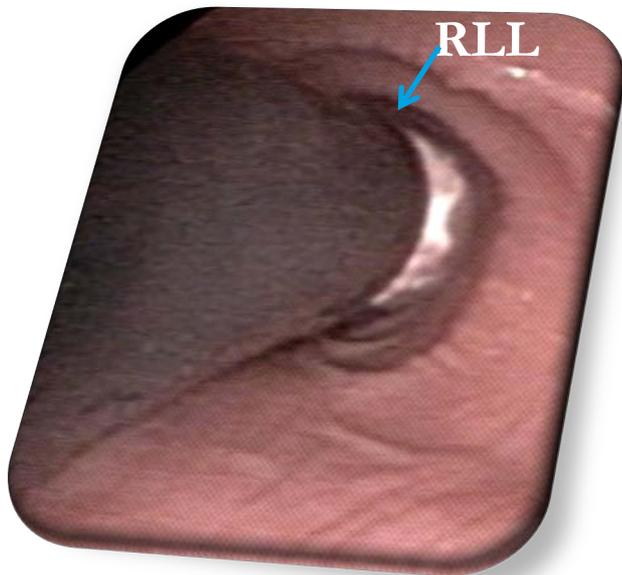


Station 11 Ri (right inferior interlobar)

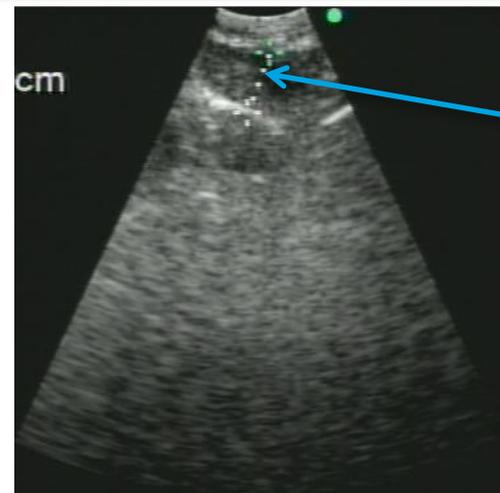
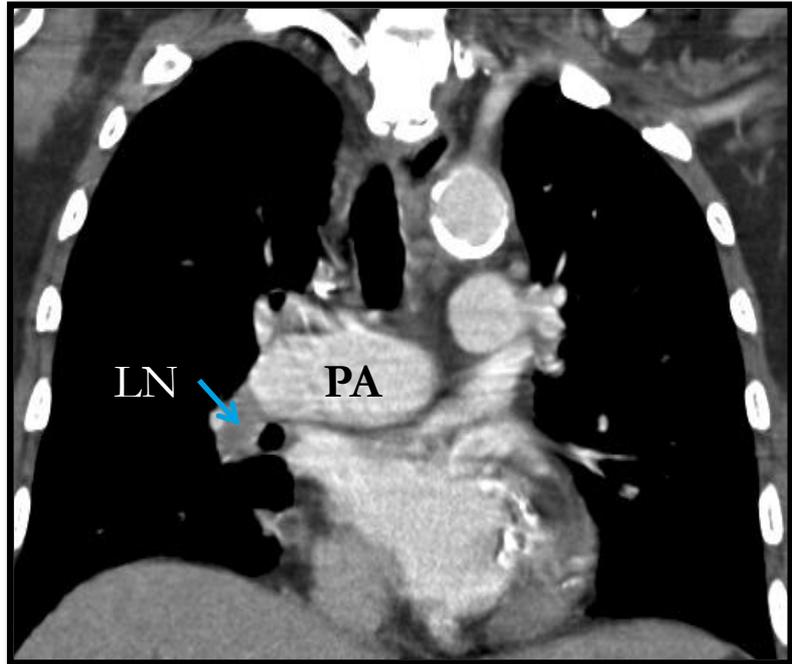
- 11Ri: between the middle and lower lobe bronchi on the right



Station 11 Ri (right inferior interlobar)



EBUS scope in the proximal RLL
with the probe oriented
anteriorly



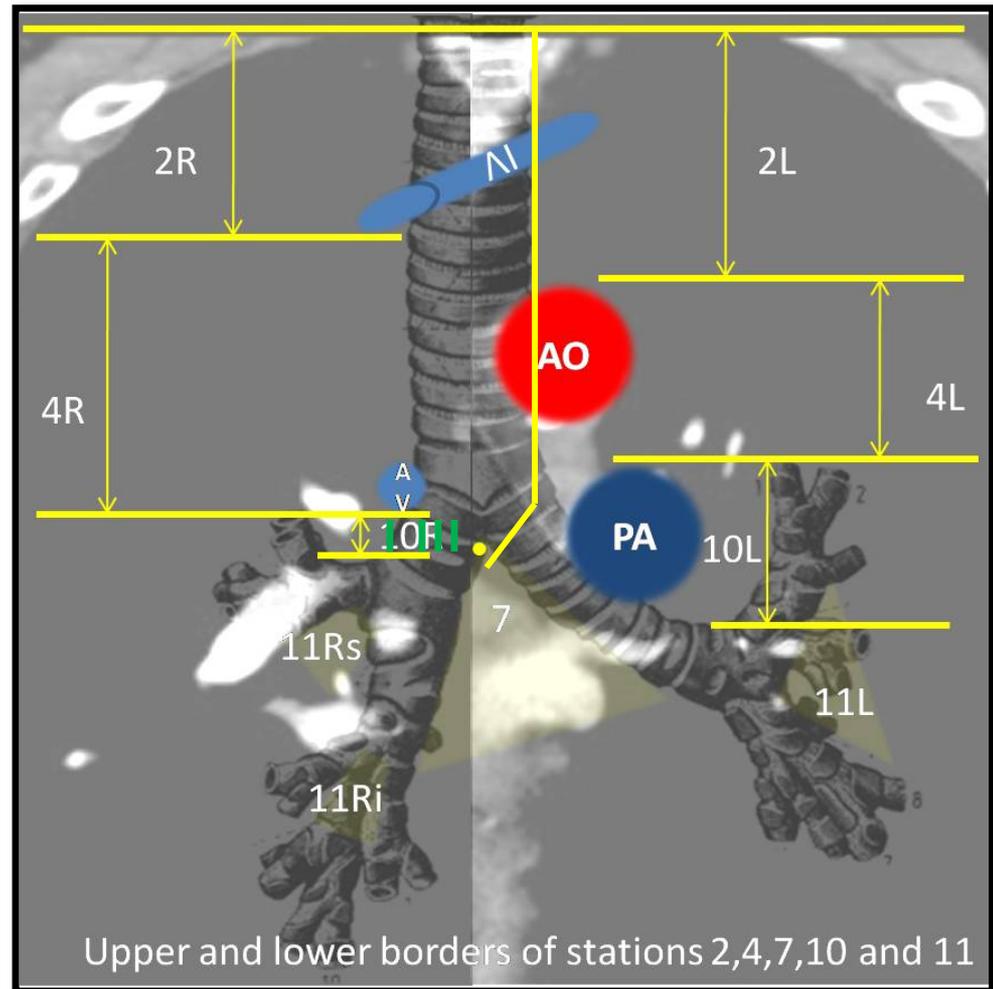
11R I
Isoechoic LLN

Case continues...

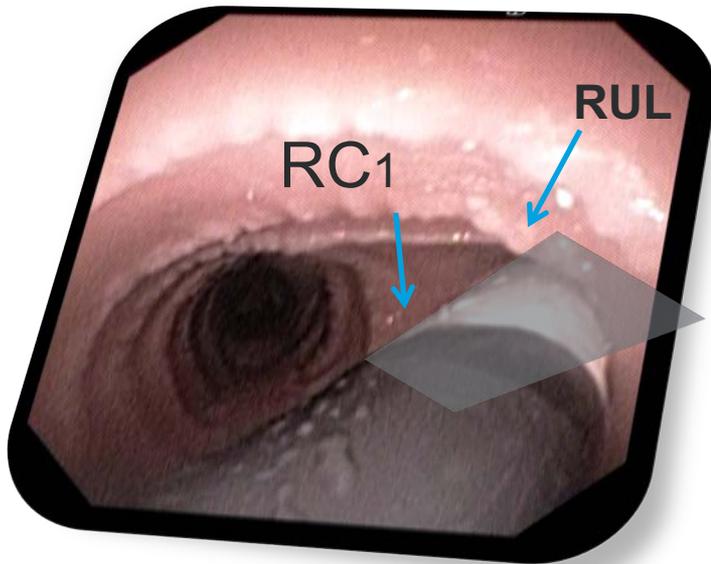
Stations 10R

(right hilar node) is inspected

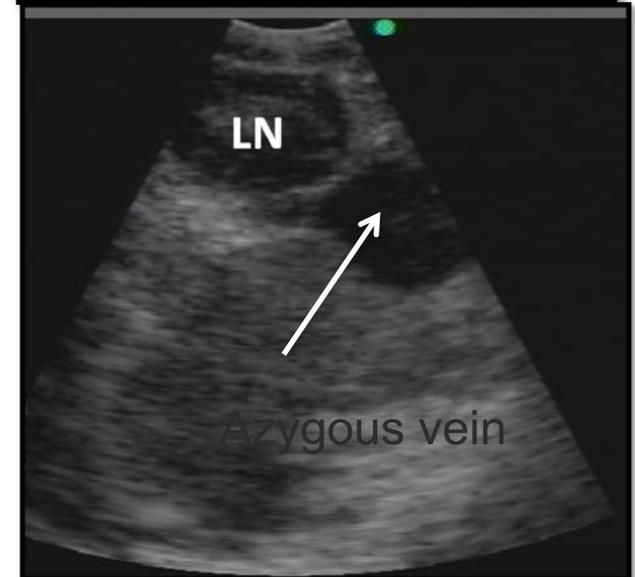
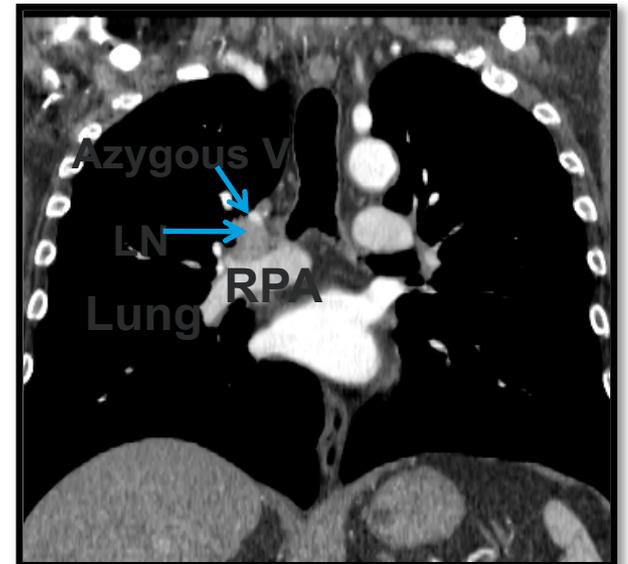
- Includes nodes immediately adjacent to the mainstem bronchus and hilar vessels including the proximal portions of the pulmonary veins and main pulmonary artery
- Upper border: the lower rim of the azygos vein on the right;
- Lower border: interlobar region (RUL and BI)



Stations 10R (right hilar node)



EBUS scope in the proximal RUL with the probe oriented towards the anterior and right lateral walls



Question 4: Case continues...While performing EBUS at this station (10R), however, you notice the following image on the display monitor.



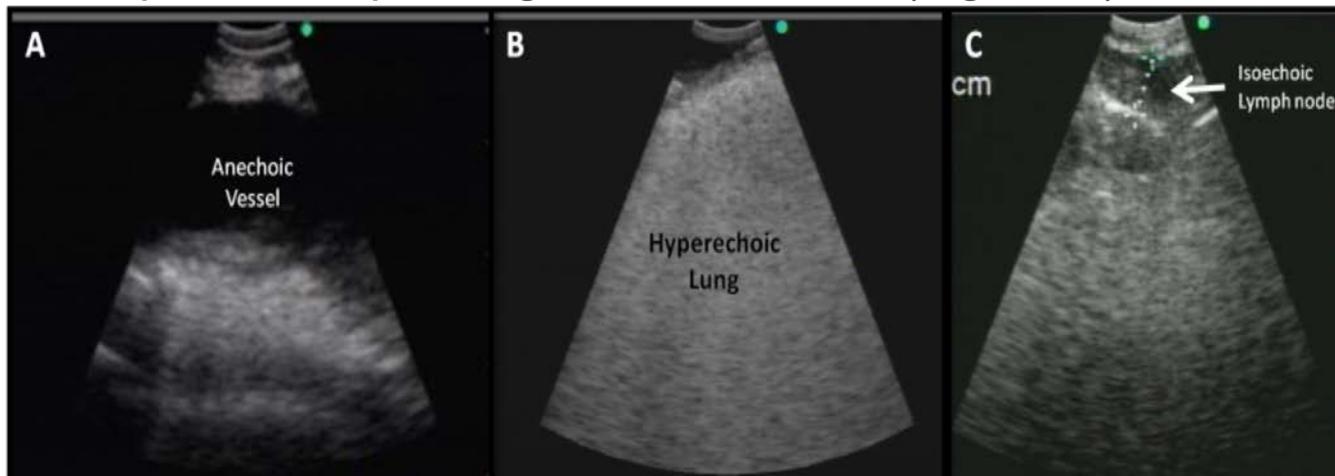
Question 4. What has happened?



- A. You rotated your wrist and now you are imaging a blood vessel
- B. The lymph node is not in the scanning plane and you are imaging the normal lung
- ✓ C. The balloon is not in intimate contact with the airway wall.
- D. Nothing has happened; this is the normal pattern of a lymph node

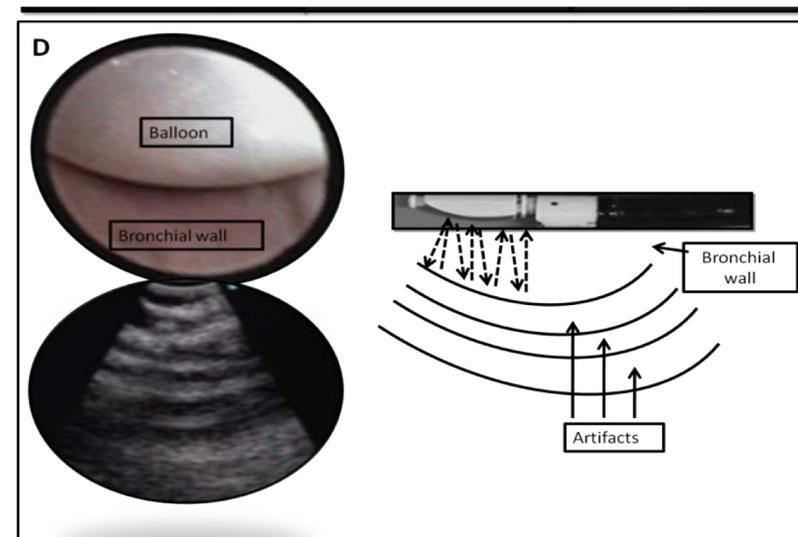
Answer Q4:C: The balloon is not in intimate contact with the airway wall.

- Fluid (blood) transmits the ultrasound completely so that blood vessels have the least echogenicity during EBUS and they often appear black (anechoic) (Figure A).
- The normal lung being filled with air, on the other hand, is hyperechogenic and appears white (Figure B).
- The lymph nodes are usually well defined structures with isoechoic (comparable with the surrounding tissue) or mixed hypoechoic, isoechoic, or hyperechoic pattern, depending on their content (Figure C).



Answer Q4 :C: The balloon is not in intimate contact with the airway wall.

- The displayed image is characterized by multiple equally spaced strong false hyperechoic lines on the ultrasound image, due to acoustic waves being repeatedly reflected between the airway wall and the transducer.
- This is called reverberation artifact and occurs when the water filled balloon of the EBUS scope is not in contact with the airway wall (Figure D).



Question 5: Case continues...with the EBUS scope placed just proximal to the main carina and turned towards the 3-o'clock position, the following EBUS image is displayed.



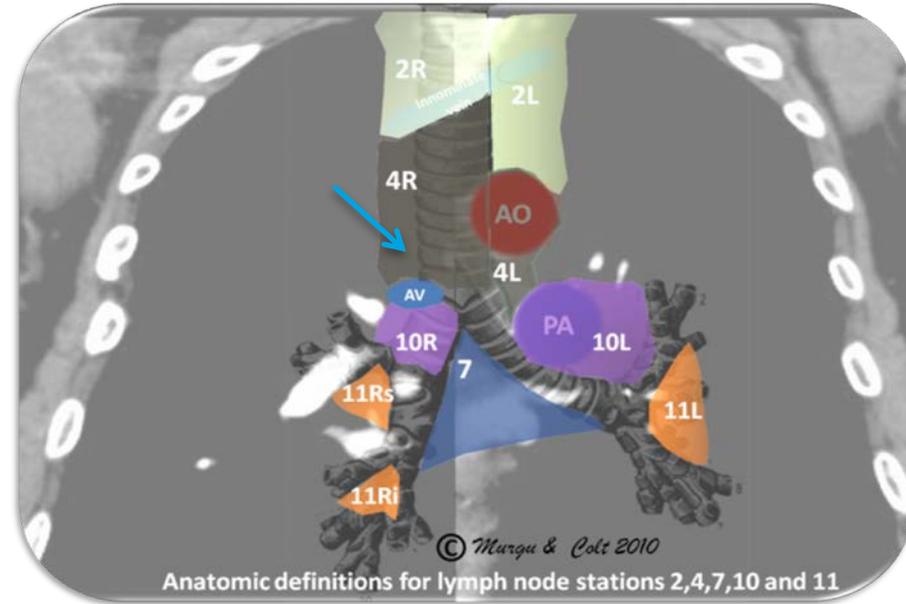
Question 5. The visualized lymph node represents:



- ✓ A. Station 4R
- B. Station 10R
- C. Station 2R
- D. Station 7

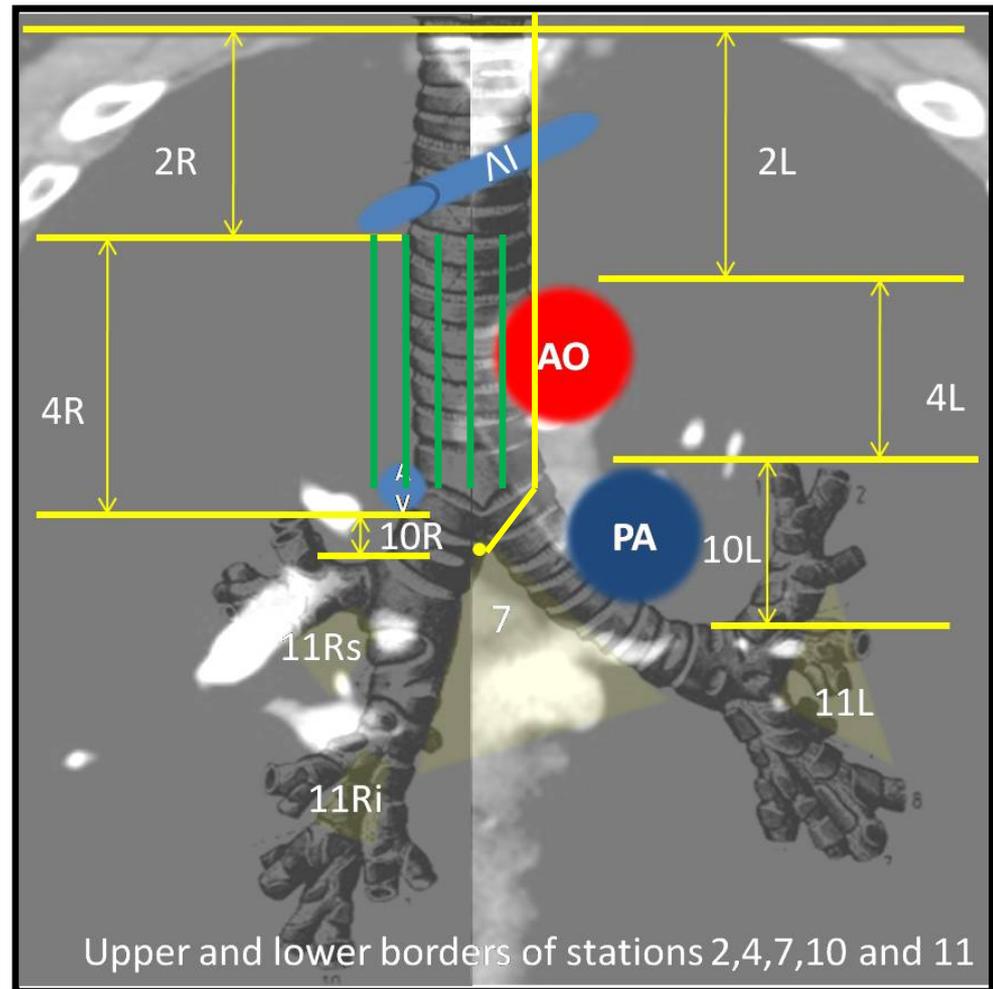
Answer Q5:A: Station 4R

- The anechoic round structure at 11 o'clock position on the EBUS image represents the azygous vein.
- [The isoechoic structure](#) seen above it at 1 o'clock position represents the right lower paratracheal lymph node (4R).
- Station 4R includes right lower paratracheal nodes, and pretracheal nodes extending to the left lateral border of trachea.
- The upper border is the intersection of caudal margin of innominate vein with the trachea while the lower border is the lower border of azygos vein.



Station 4R (right lower paratracheal)

- includes right paratracheal nodes, **and** pretracheal nodes extending to the left lateral border of trachea
- Upper border: intersection of caudal margin of innominate vein with the trachea
- Lower border: lower border of azygos vein



Question 6: Case continues...While performing EBUS examination of the SVC, you obtain the following image (after the assistant inadvertently touch a processor button). To increase the brightness of the entire image you tell your assistant to:



Question 6. To increase the brightness of the entire image, you tell your assistant to...



- ✓ A. Increase the gain
- B. Increase the depth
- C. Switch to Doppler mode
- D. There is nothing you can do

Answer Q6:A: Increase the gain

- **Gain** represents the function for adjusting the brightness of the image in its entirety.
- Changing gain makes the image brighter or darker but differences in brightness between light and dark areas are unchanged (Figure).
- **Contrast**, on the other hand, adjusts the brightness difference between light and dark areas of the image by varying signal strength and is particularly useful for echo-poor structures.
- **Doppler mode** is useful for distinguishing vessels from other structures, but switching to Doppler mode does not improve the image quality.

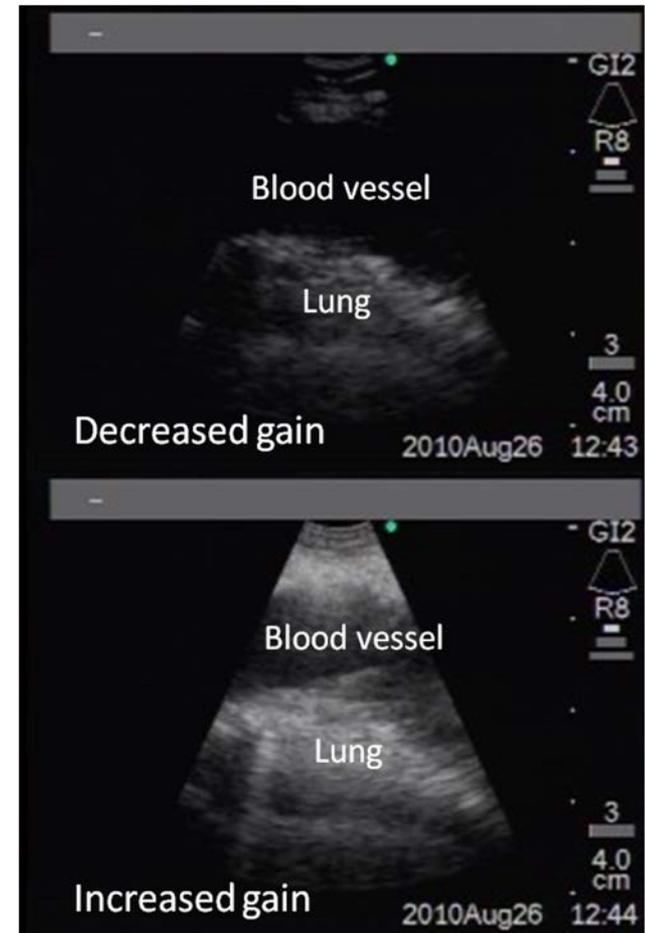
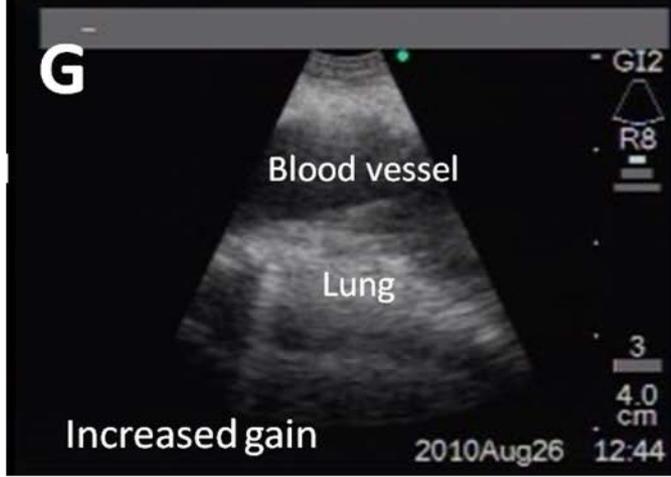
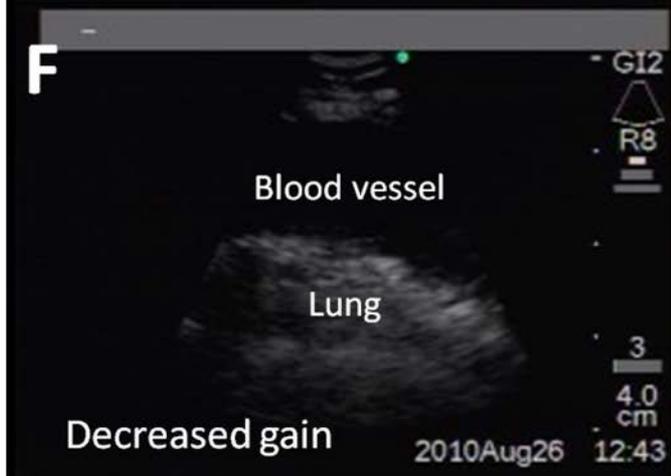
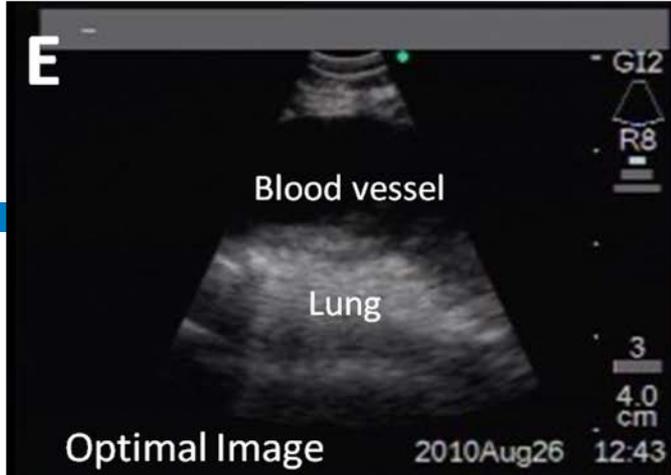


Image quality adjustment

- Gain
- Contrast
- Doppler

Understanding these functions helps us:

1. Improve image quality
2. Distinguish nodes from vessels and other mediastinal structures
3. Potentially improve safety of the procedure



Question 7: Case Continues. This patient is on clopidogrel for a drug eluting coronary stent that was placed 2 months ago.

Which of the following statements is the best plan?

- A. The procedure should be delayed and the patient off clopidogrel for 5-7 days while on alternated anticoagulations such as LMWH
-  B. You can proceed with EBUS TBNA informing the patient that the risk may be higher for bleeding

EBUS-TBNA Complications

- Overall very safe technique with no reported complications
- A few reports of infectious complications have emerged:
 - Infectious pericarditis/pericardial effusion after EBUS-TBNA of subcarinal mass
 - Tumor bed infection after EBUS-TBNA of right lung mass posterior to the bronchus intermedius
 - One case of mediastinal abscesses
 - Once case of ascending mediastinitis
- Possible explanation:
 - Deposition of oral contaminants into the lymph node or tumor mass caused the infection

Hass, AR. Eur Respir J 2009;33:935-38

Moffatt-Bruce, SD. J Cardiothoracic Surg. 2010;5:33

Parker KL. Ann Thoracic Surg 2010;89:1271-2

EBUS-TBNA Complications

- Incidence of bacteremia following EBUS-TBNA
 - 43 patients undergoing EBUS-TBNA had blood cultures within 60 seconds of the puncture
 - Incidence of bacteremia: 7%
 - Similar to bacteremia reported following routine flexible bronchoscopy
 - No clinical features suggestive of infections

Bleeding Complications

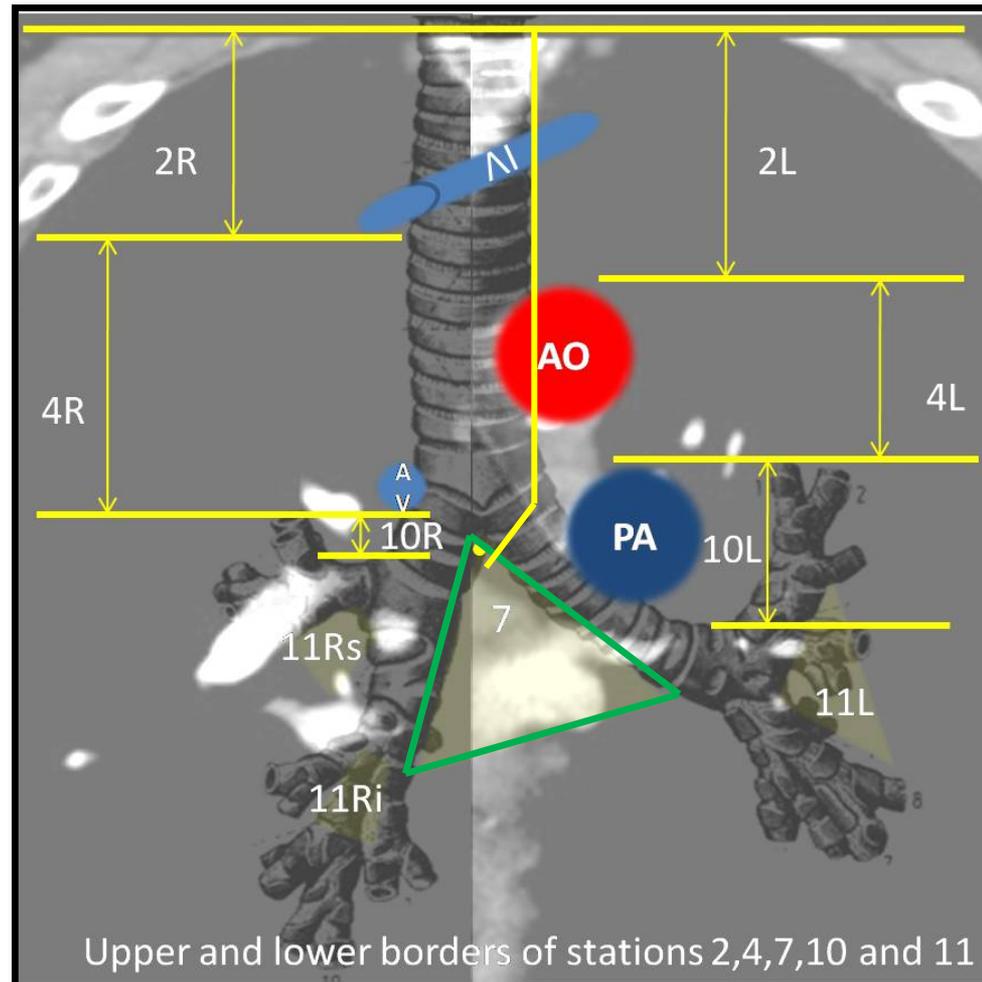
- Is EBUS-TBNA safe on clopidogrel (Plavix)?
 - Retrospective study of 12 cases of EBUS-TBNA
 - Performed by experienced operators
 - Patients with short-term high risk of thrombosis if Clopidogrel held
 - No bleeding complications, but still should hold if able
 - Proceed with EBUS in select cases with caution and careful informed consent including potential increased risk of bleeding
- A case of fatal hemorrhage after EBUS-TBNA!
 - Patient with mild thrombocytopenia, renal failure, bone marrow infiltration, and prolonged PT/PTT
 - The patient was not aggressively resuscitated due to the family's wishes
 - Caution is warranted

Stather, D.R. Respiration 2012;83(4):330-4

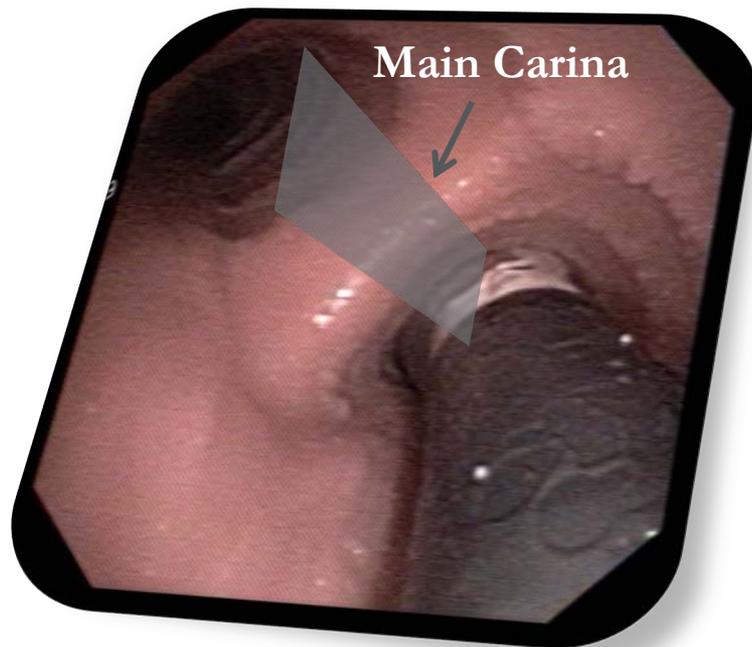
Miller, D. QJM 2013, 106(3):295-6

Case continues...Subcarina (Station 7) is then examined

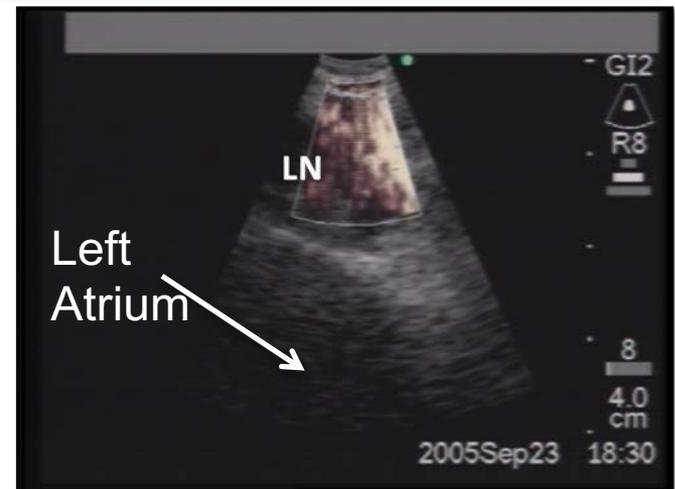
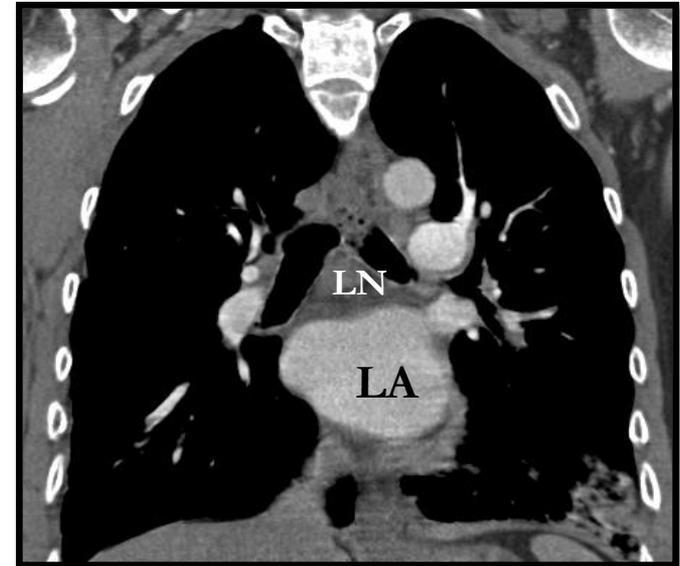
- Upper border:
 - the carina of the trachea
- Lower border:
 - the upper border of the lower lobe bronchus on the left;
 - the lower border of the bronchus intermedius on the right



Station 7 (subcarina)



EBUS scope in the RMB with the probe facing medially



EBUS image with the scope in the RMB

Question 8: Case continues...In this patient, imaging of the subcarina revealed an isoechoic LN. The arrow points to a necrotic intra-nodal region



A. True

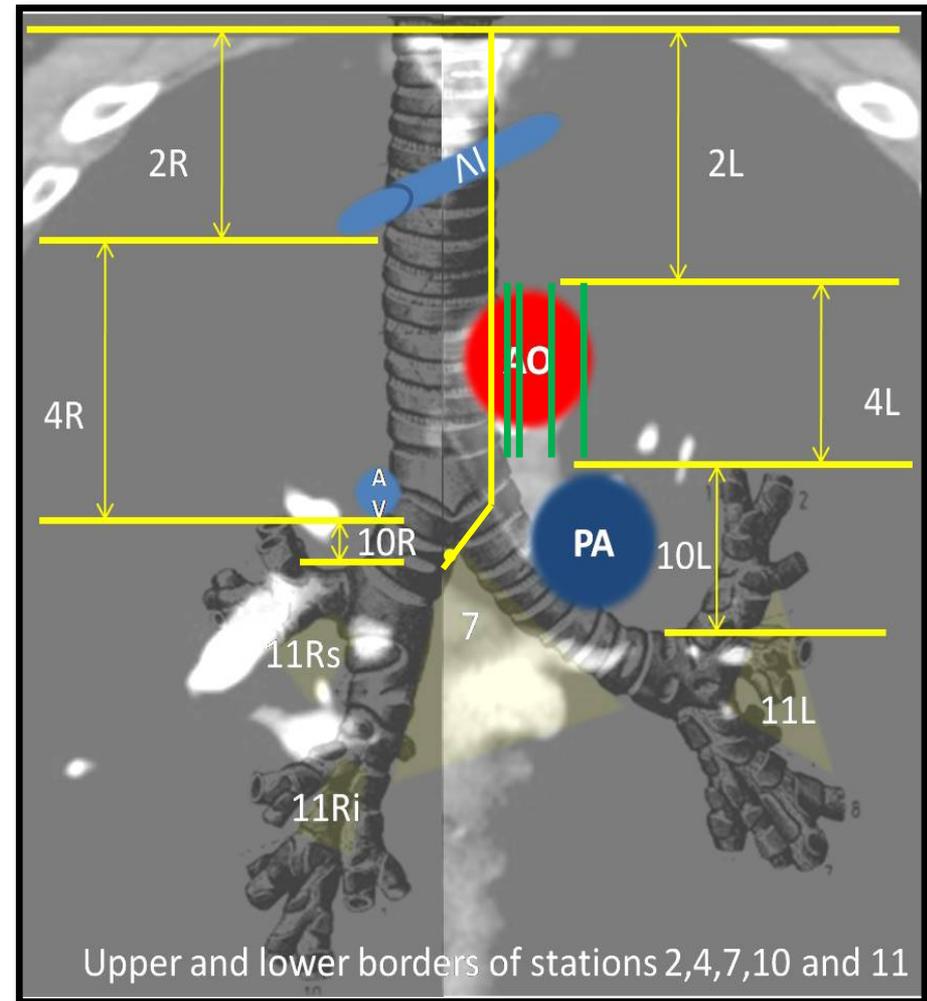
B. False

Answer Q8: B: False: The structure represents an intranodal vessel as demonstrated by Doppler signal

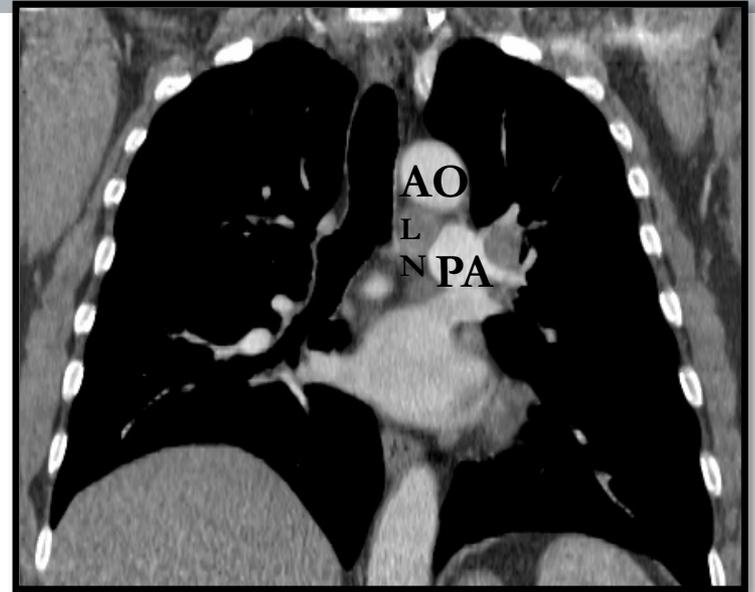


Case continues...then Station 4L (left lower paratracheal)

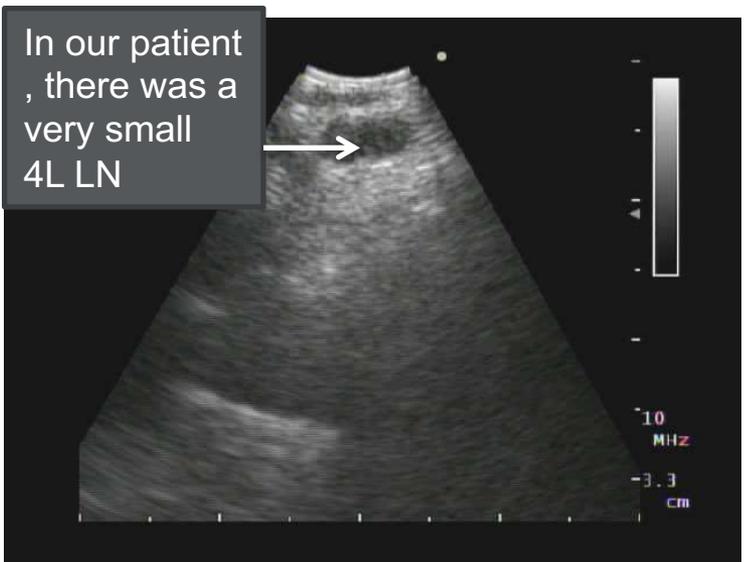
- Includes nodes to the left of the left lateral border of the trachea, medial to the ligamentum arteriosum
- Upper border: upper margin of the aortic arch
- Lower border: upper rim of the left main pulmonary artery



Station 4L (left lower paratracheal)



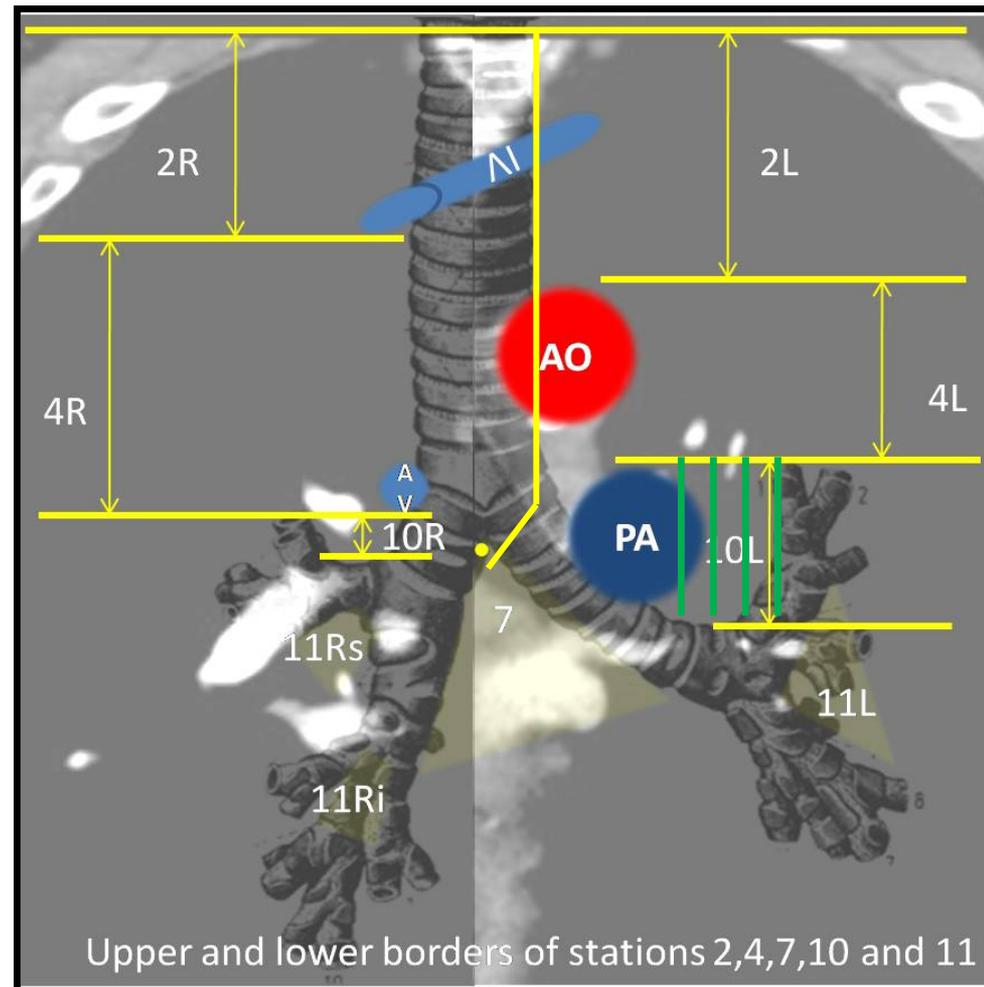
[Video 4L](#)



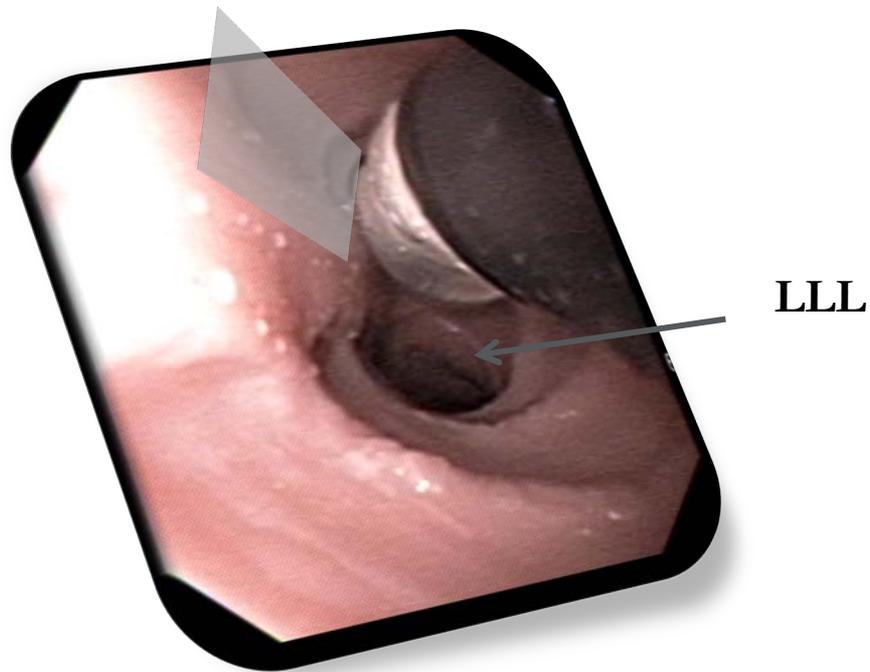
EBUS scope in the proximal LMB
at the level of main carina with
the probe oriented to the left

Case continues...Station 10 L (left hilar)

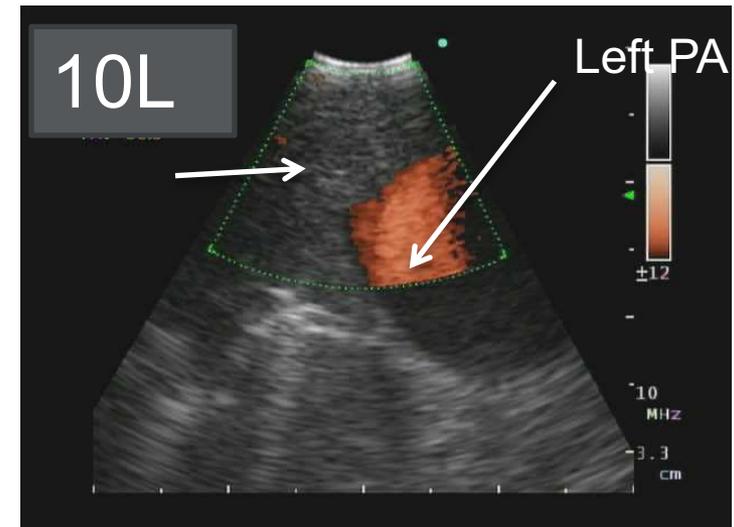
- Includes nodes immediately adjacent to the mainstem bronchus and hilar vessels including the proximal portions of the pulmonary veins and main pulmonary artery
- Upper border: upper rim of the pulmonary artery on the left
- Lower border: interlobar region (LUL and LLL)



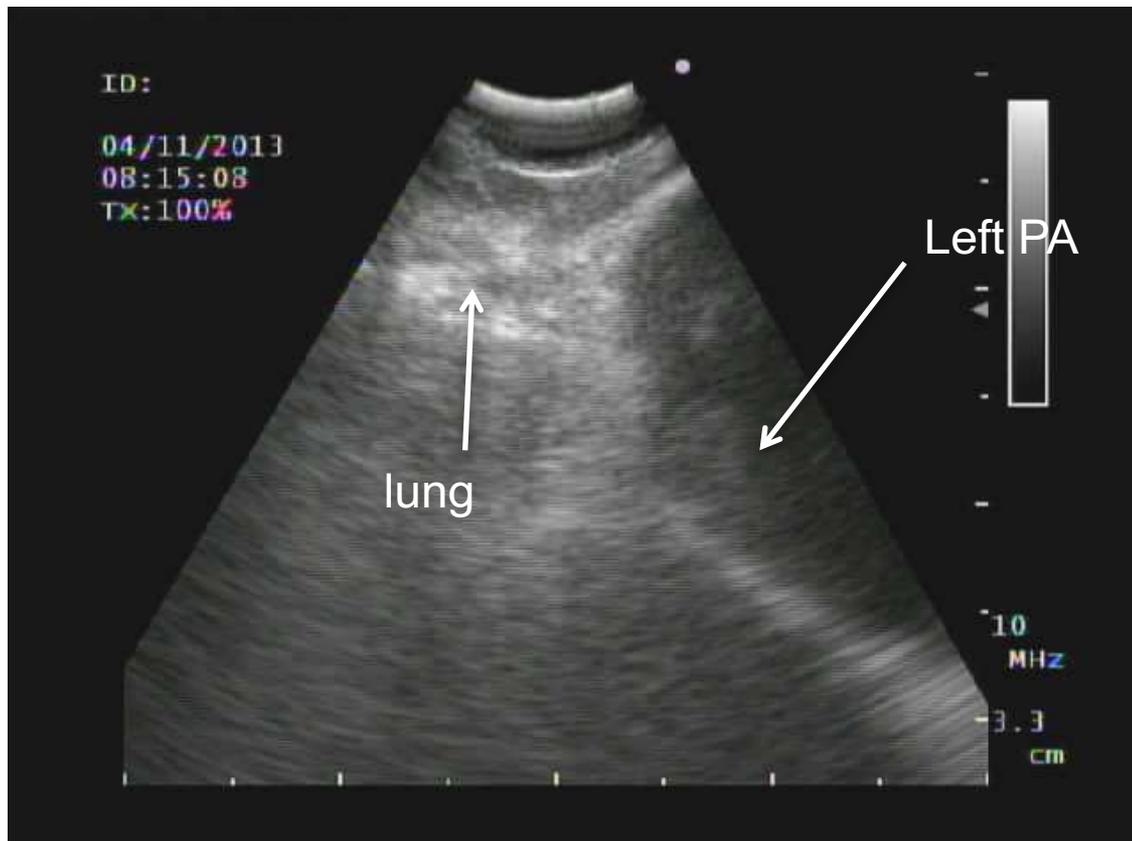
Station 10 L (left hilar)



EBUS scope in the proximal LUL at the level of main carina with the probe oriented to wards 11 o' clock position

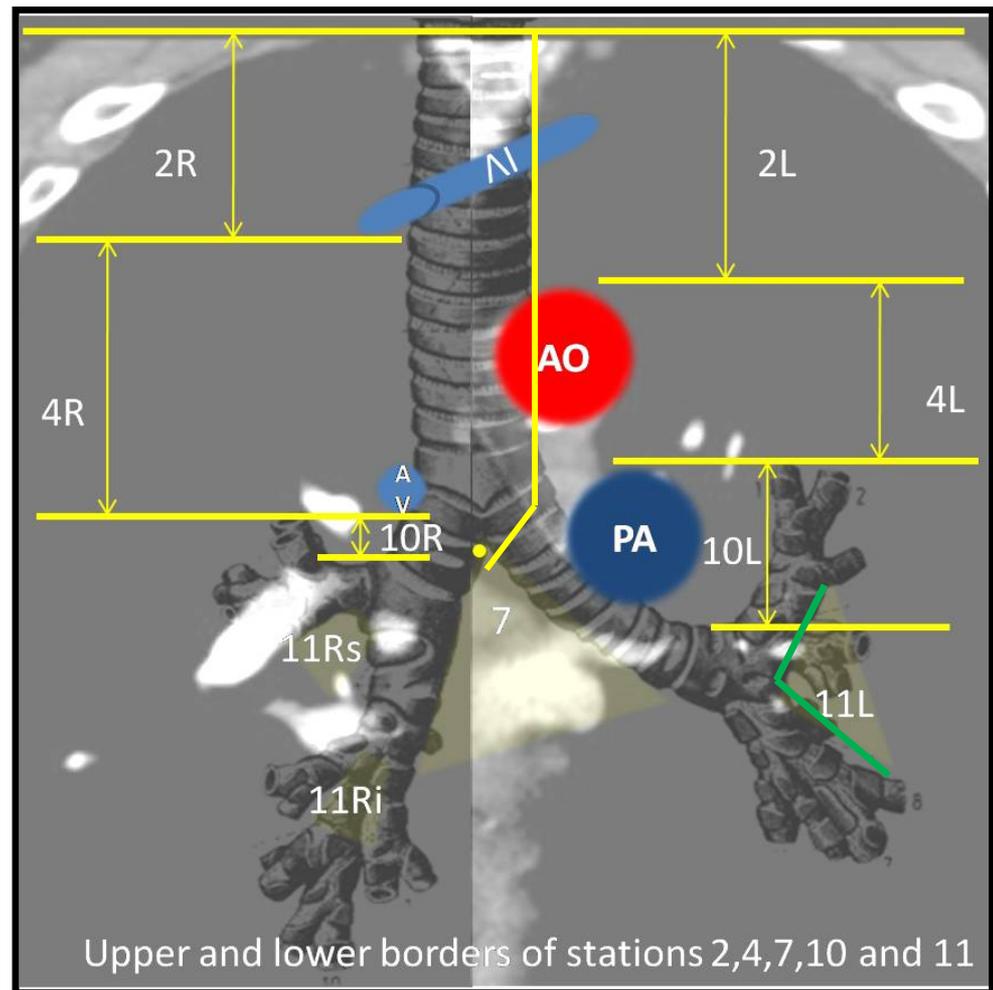


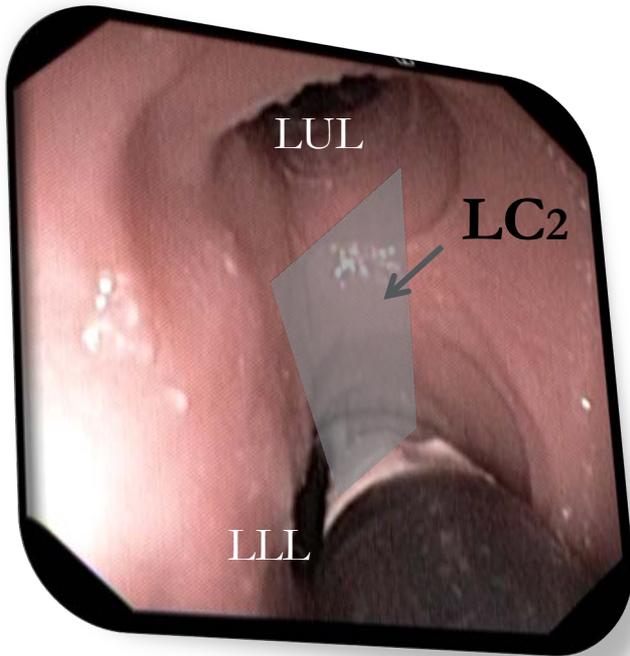
In our patient, there was no adenopathy identified in station 10L (despite slight PET Avidity)



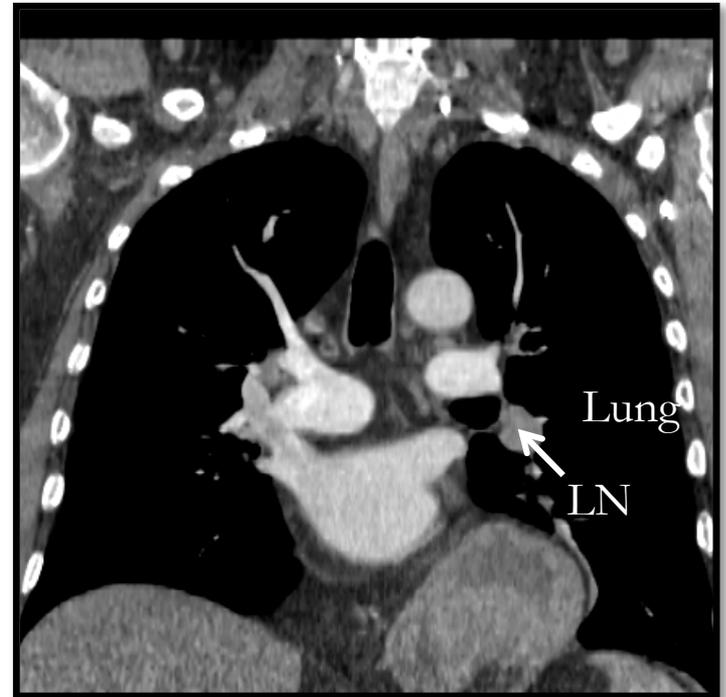
Then station Station 11 L (left interlobar) is imaged

- Between the origin of the left upper and lower lobar bronchi

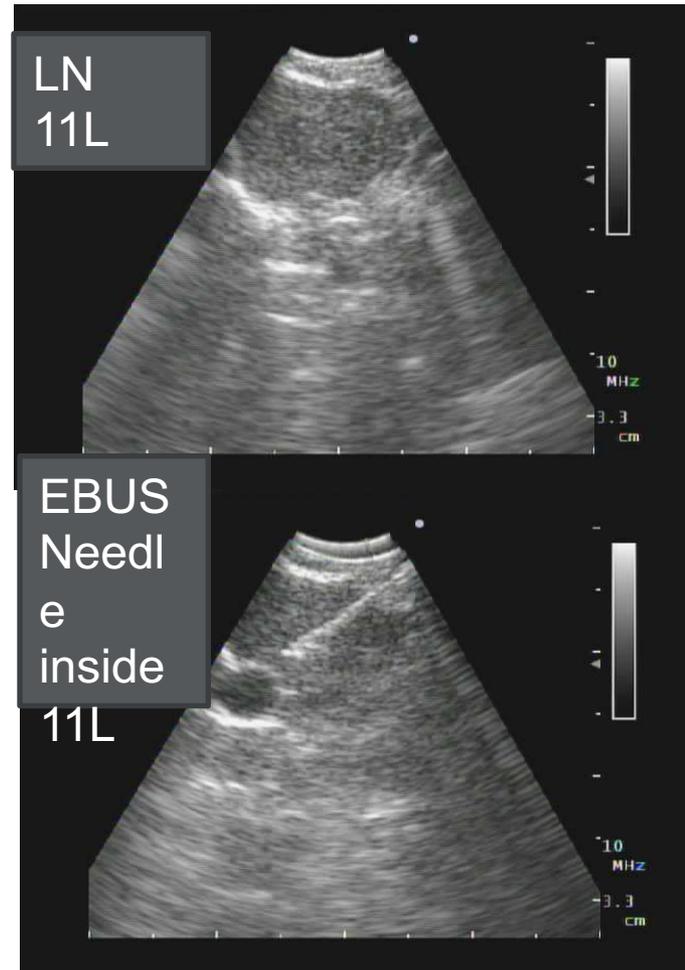
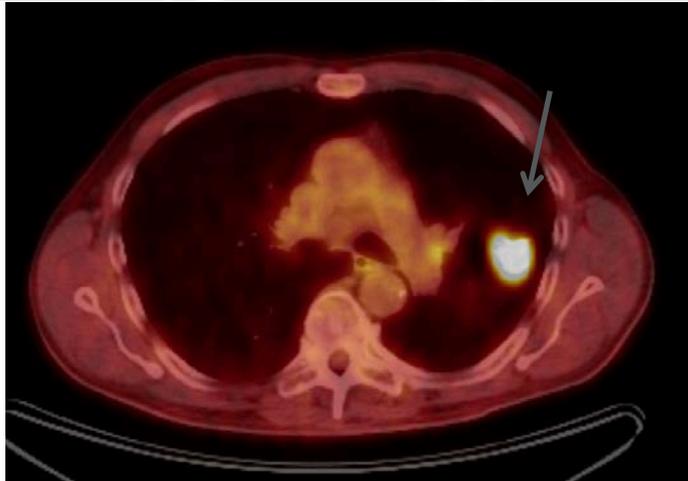
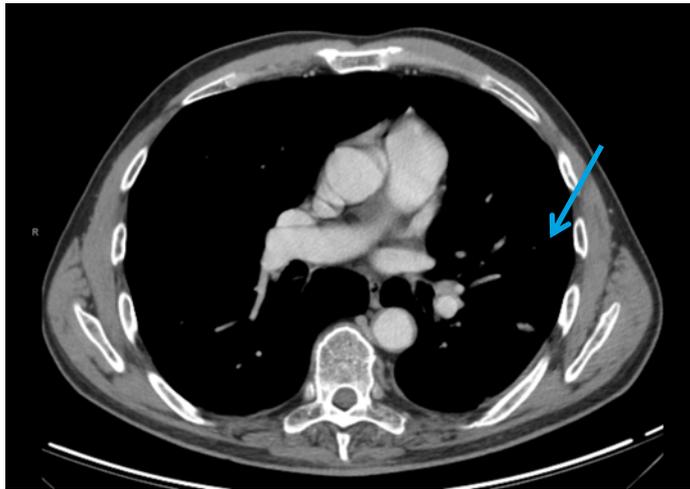




EBUS scope in the proximal LLL
at the level of main carina with
the probe oriented laterally



Case continues...back to 11L (N1 node)



Question 9: Case continues. Which of the following statements is true?

- A. The use of ROSE (Rapid Onsite Evaluation) increases diagnostic yield
- B. The use of ROSE increases the time of a procedure
-  C. The use of ROSE may be helpful in assessing adequacy for molecular markers

Role of Rapid-On Site Evaluation in EBUS

- ROSE is not needed to confirm that your needle is in the right place
- However, ROSE can:
 - Decrease time of procedure and number of aspirations needed
 - Sampling is stopped if a higher stage lymph node (N3) is positive or an alternative diagnosis is reached (small cell lung cancer, sarcoidosis, etc...)
 - Assess adequacy of Specimens for genetic molecular testing

ROSE in EBUS-TBNA

- A retrospective study of 294 EBUS-TBNA specimens in a 6-month period (ROSE for 48% of specimens)
 - No incremental diagnostic benefit with ROSE in association with EBUS-TBNA
 - Griffin AC. Cytojournal 2011;8:20. Epub 2011 Nov 21
- BUT in a randomized trial of EBUS for mutation analysis
 - ROSE may prevent the need for repeat invasive diagnostic procedure aimed at mutation analysis in 1 of 10 patients
 - Trisolini R. Chest 2015;148(6): 1430-1437

Question 10: Which of the following statements is true?

- A. A larger gauge needle increase diagnostic yield
- ✓ B. The addition of suction has no effect on yield

Needle Size: 22 Gauge vs. 21 Gauge

- Retrospective study of EBUS-TBNA of the utility of 21G vs. 22G needles in 45 lesions (lymph nodes and lung masses) in 33 patients
- The number of adequate cells within individual slides was significantly greater in 21G needles than 22G needles
- More blood contamination in samples obtained with the 21G needle
- There were no differences in the diagnostic yield between the 21G and 22G needles during EBUS-TBNA
- Nonnecrotizing granulomatous inflammation suggestive of sarcoidosis tended to be more preserved in the 22G needles compared with the 21G

Suction vs. No-suction

- Should you use suction with EBUS-TBNA?
- Suction can potentially:
 - Improve the quality of specimen by increasing the number of retrieved cells
 - Worsen the quality of specimen by increasing the amount of blood

Suction vs. No-suction

- A single-blinded prospective randomized trial comparing EBUS-TBNA with and without suction
- A total of 115 patients and 192 LNs included
- No differences in adequacy, diagnosis, and quality were found between samples
 - Regardless of node size (<1 cm vs. >1 cm)
- There is no evidence of benefit of the practice of applying suction to EBUS-guided biopsies

Case resolution

- Mediastinal and hilar LN EBUS aspirates were adequate and negative for malignancy
- Patient underwent thoracotomy with LULobectomy

If EBUS TBNA is being done for mutational analysis, what is the optimal number of passes/station for mutational analysis?

- A. 1-2
- B. 2-3
- C. 3-4
- D. >5

Number of passes/station

- Many variables thus difficult to conclude
- Seems to be 3-4 adequate samples for diagnosis
- And, 3-4 samples dedicated for mutation analysis if indicated

Transl Lung Cancer Res 2012; 1:111-121

Chest 2008; 134:368-374

J Thorac Oncol 2011; 6:203-206

Annals ATS 2013; 10(6): 636-643

Mutation Analysis & Minimally Invasive Tissue Samples

- Retrospective analysis of 209 cytology specimens from patients with lung cancer MD Anderson
 - 99 EBUS samples
 - 67 TTNA samples
 - 27 body fluid
 - 10 US-guided FNA superficial sites
- DNA sequencing for EGFR and KRAS performed all specimens

EBUS for Mutational Analysis

- Overall specimen insufficiency rate was low: 6.2%
 - Body fluid: 3.7%
 - EBUS: 4%
 - TTNA: 7.5%
 - US-guided superficial FNA: 10%

Billah S, et al. Cancer Cytopathol. 2011; 119(2):111-117

- EBUS FNA reliable tissue source without ROSE

Nakajima T, et al. J Thorac Oncol 2011; 6:203-206
Nakajima T, et al. Chest 2011

NCCN Guidelines for Molecular Testing

Adenocarcinoma, Large Cell & NSCLC NOS

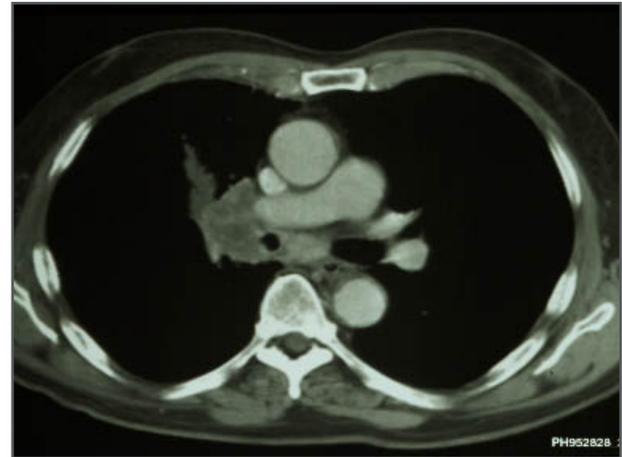
- EGFR
- ALK
- ROS 1
- BRAF
- PD-L1

Squamous Cell Carcinoma

- T/C EGFR and ALK in never smokers or small specimens or mixed histology
- T/C ROS1
- T/C BRAF
- PD-L1

63 year female previous smoker of 30 years presents with cough and following CT scan. Which of the following is the best next step?

- A. PET CT to see if this abnormality is PET positive.
- ✓ • B. Perform EBUS-TBNA
- C. Start definitive chemoradiotherapy
- D. Neoadjuvant chemotherapy



Importance of tissue acquisition

- Majority of patients presenting with lung cancer are unresectable
- No longer dealing with lung cancer as a single entity
 - NSCLC vs. SCLC to guide therapeutic decisions no longer adequate
- Targeted therapies have changed the landscape

- Should be performed on all NSCLC specimens that cannot be classified with conventional morphology (**use a limited panel to conserve material**)
- **Markers of squamous differentiation**
 - **Cytokeratins 5/6 (CK5/6)**
 - HMWCK
 - **P63/P40**
 - Desmocollin-3(>99%specific)
 - Glypican-3
- **Markers of glandular (adenocarcinoma) differentiation**
 - **Thyroid transcription factor-1 (TTF-1)**
 - Napsin A
 - PD-L1

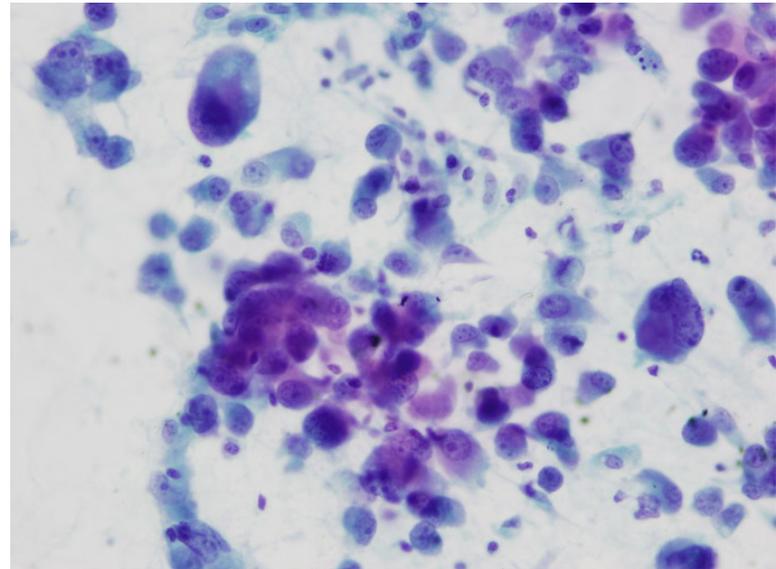
- Tsuta K, et al J Thorac Oncol 2011; 6(7):190-1199
- Sakakibara et al. Clinical Lung Cancer. 2017; 18(5): 527 – 34

Which of the following provide adequate tissue for IHC analysis?

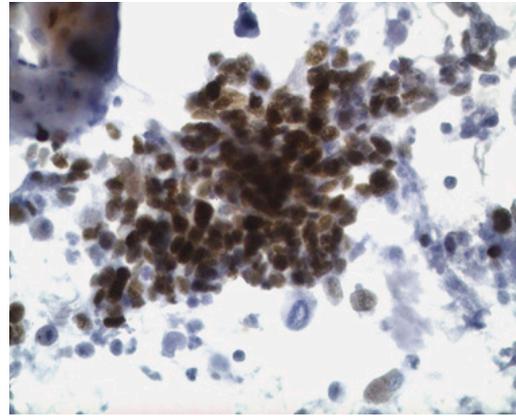
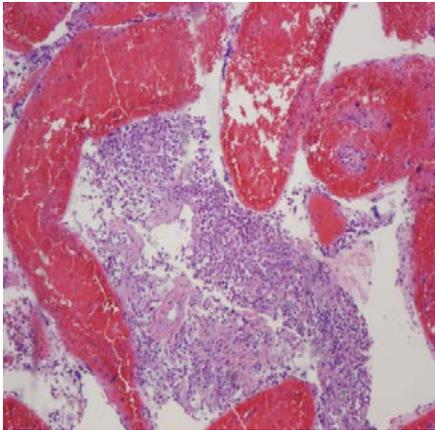
- A. EBUS FNA
- B. CT guided TBNA
- C. Bronchoscopy forceps biopsy
-  D. All of the above

- Cytology Specimens
 - H&E or PAP on slides
 - Cell block
- Surgical path specimens
 - Core samples
 - Material from forceps biopsy (BLBx)
 - Surgical biopsy

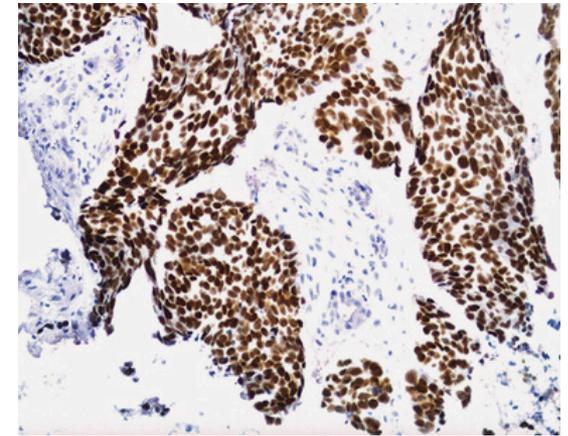
- Bronchoscopic
 - Wash
 - Brush
 - Lavage
- FNA
 - Transbronchial
 - Transthoracic
 - EBUS
 - EUS



- Morphology
- Immunohistochemistry
- Mutational analysis



TTF1



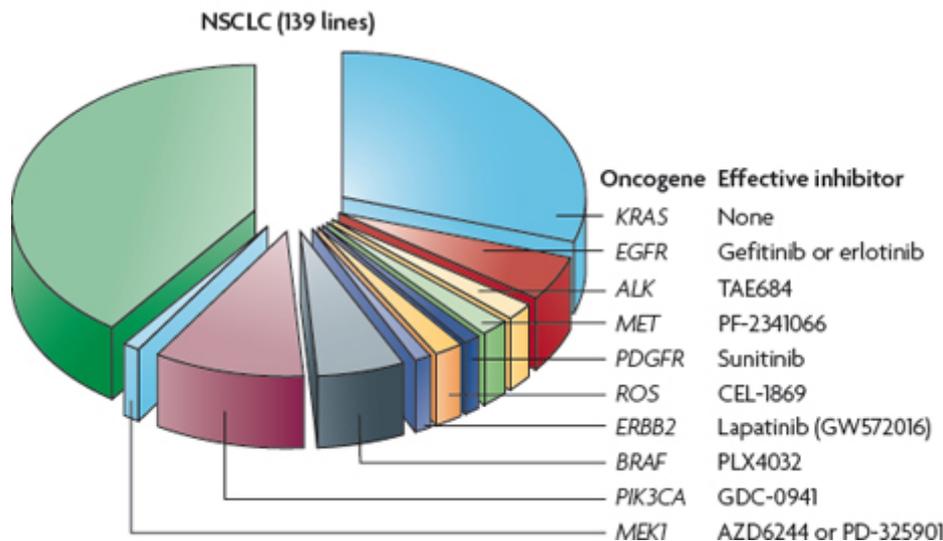
TTF1

57 year old male, what next?

Current smoker: smoked since 16, 1 pack per day
Hemoptysis in July 2010, CT chest showed left lung mass and confluent adenopathy, PET scan showed skeletal metastases

- A. Palliative care
- ✓ B. EBUS sampling for histologic and mutation analysis
- C. Standard Chemotherapy

Potential Candidates for Targeted Therapy in Lung Cancer



Gene	Oncogenic activation	Frequency		Refs
		Patients	Cell lines	
EGFR	Deletion (Δ E746-A750), point mutation (L858R) and amplification	10–40%	5%	43,48
ALK	Translocation (EML4–ALK)	3–7%	2%	49,148
MET	Amplification	11%	2%	48,149
PDGFR	Amplification	13%	1%	52,53
ROS	Translocation (CD74–ROS)	1%	2%	53
ERBB2	Insertion	2–4%	1%	150,151
BRAF	Point mutation (exon 11)	3%	6%	152,153
PIK3CA	Point mutation	2%	10%	154
MEK1	Point mutation	0.50%	1%	155

EGFR, epidermal growth factor receptor; PDGFR, platelet-derived growth factor.

Which of the following mutations does not have targeted therapy?

A. EGFR

 B. KRAS

C. EML4-ALK

D. BRAF

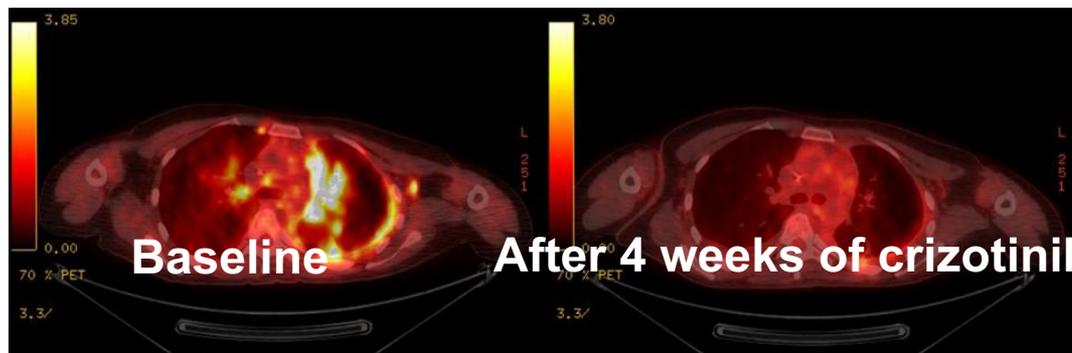
Methods for Detecting EML4-ALK Rearrangement (3% NSCLC)

- FFPE (biopsy, cell block, resection)
- Break apart FISH; gold standard
- IHC; promising, not commercially available
- RT-PCR; does not detect all EML4-ALK variants

Which of the following is a true statement?

- A. c-MET has good prognosis in NSCLC
- B. c-MET associated with good response to EGFR kinase inhibitors
- C. ROS1 rearrangement not responsive to TKIs
- ✓ D. ROS1 present in 2% NSCLC

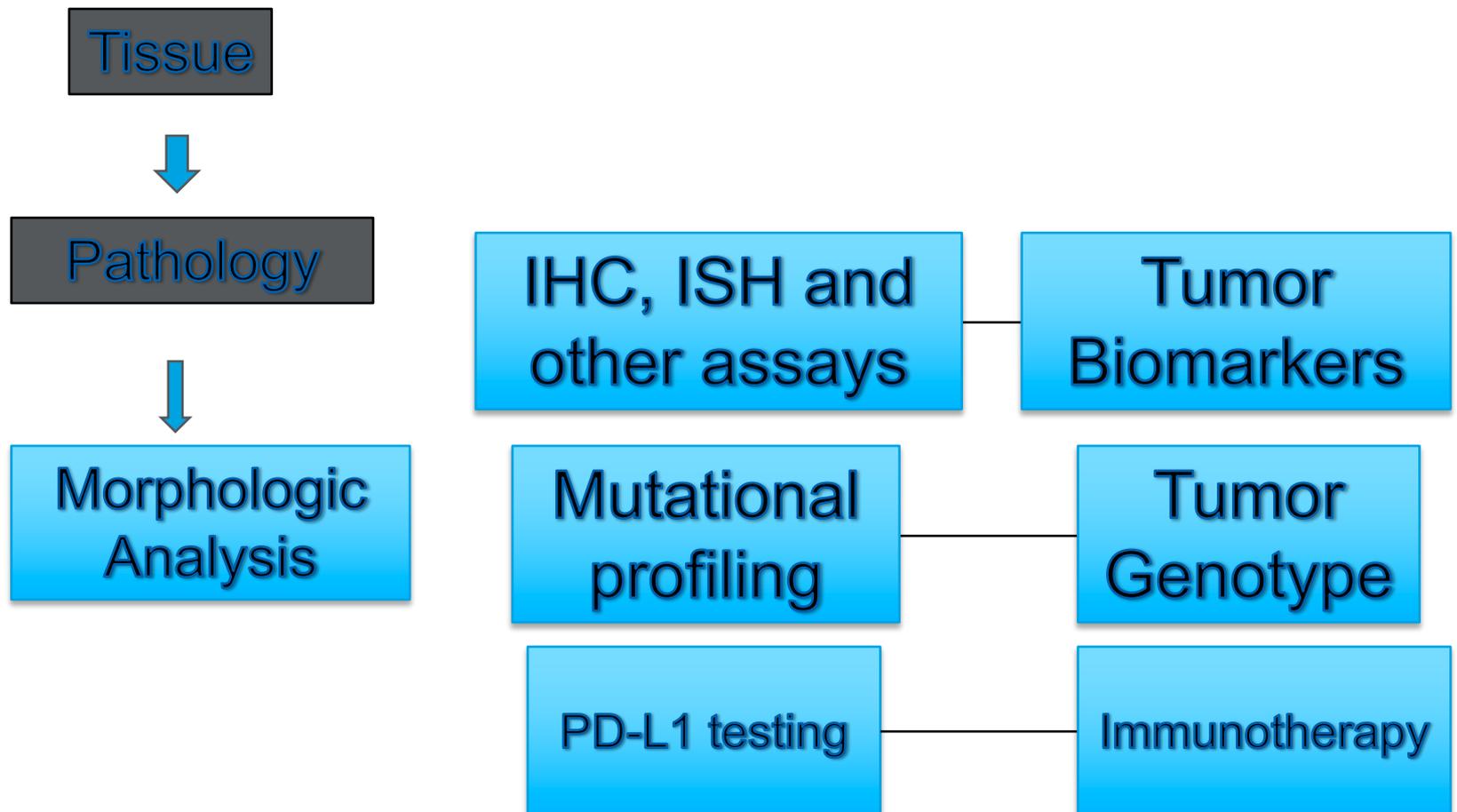
- ROS1 is a receptor tyrosine kinase of the insulin receptor family.
- Seen in glioblastoma (ROS1 – FIG)
- ~ 2% of lung adenocarcinomas (1% NSCLC)
- Sensitive to TKIs, ie, crizotinib (why we may biopsy patients who progress on erlotinib)

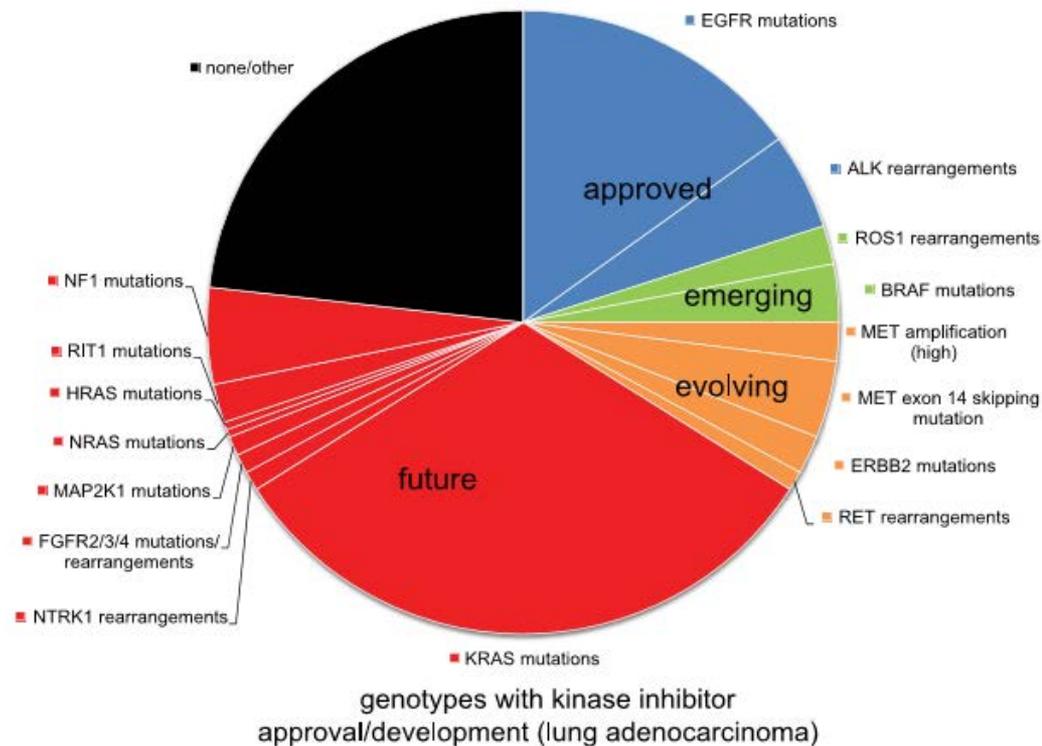


Implications of Mutation Analysis to the Bronchoscopist

- Develop streamlined and standardized approach to specimen acquisition and processing
- Appropriate tests ordered
- Samples of sufficient quality and quantity
 - Refine traditional technique
 - Future – techniques for more tissue

Evolving Paradigm in NSCLC Analysis





Requires less DNA for multiple gene testing (estimated 5% tumor content)

Next Generation Sequencing (NGS)

Validation study

- 61 previously profiled clinical tumor specimens
- Concordance of 1005 between NGS and conventional platforms
- Analysis of tumor cell lines indicated reliable mutation detection in samples with up 5% tumor content

Mutation Type	Gene	Platforms	Expected	Detected	% Concordance
SNV	<i>EGFR</i>	ARMS-PCR	22	22	100%
SNV	<i>KRAS</i>	ARMS-PCR	16	16	100%
SNV	<i>PIK3CA</i>	ARMS-PCR	2	2	100%
Deletion	<i>EGFR</i>	ARMS-PCR	16	16	100%
Insertion	<i>EGFR</i>	ARMS-PCR	1	1	100%
Gene Fusion	<i>ROS1</i>	FISH	2	2	100%
Gene Fusion	<i>ALK</i>	FISH	1	1	100%
Gene Fusion	<i>RET</i>	FISH	1	1	100%
Total	-	-	61	61	100%

Table 3. Concordance of targeted NGS with conventional platforms.

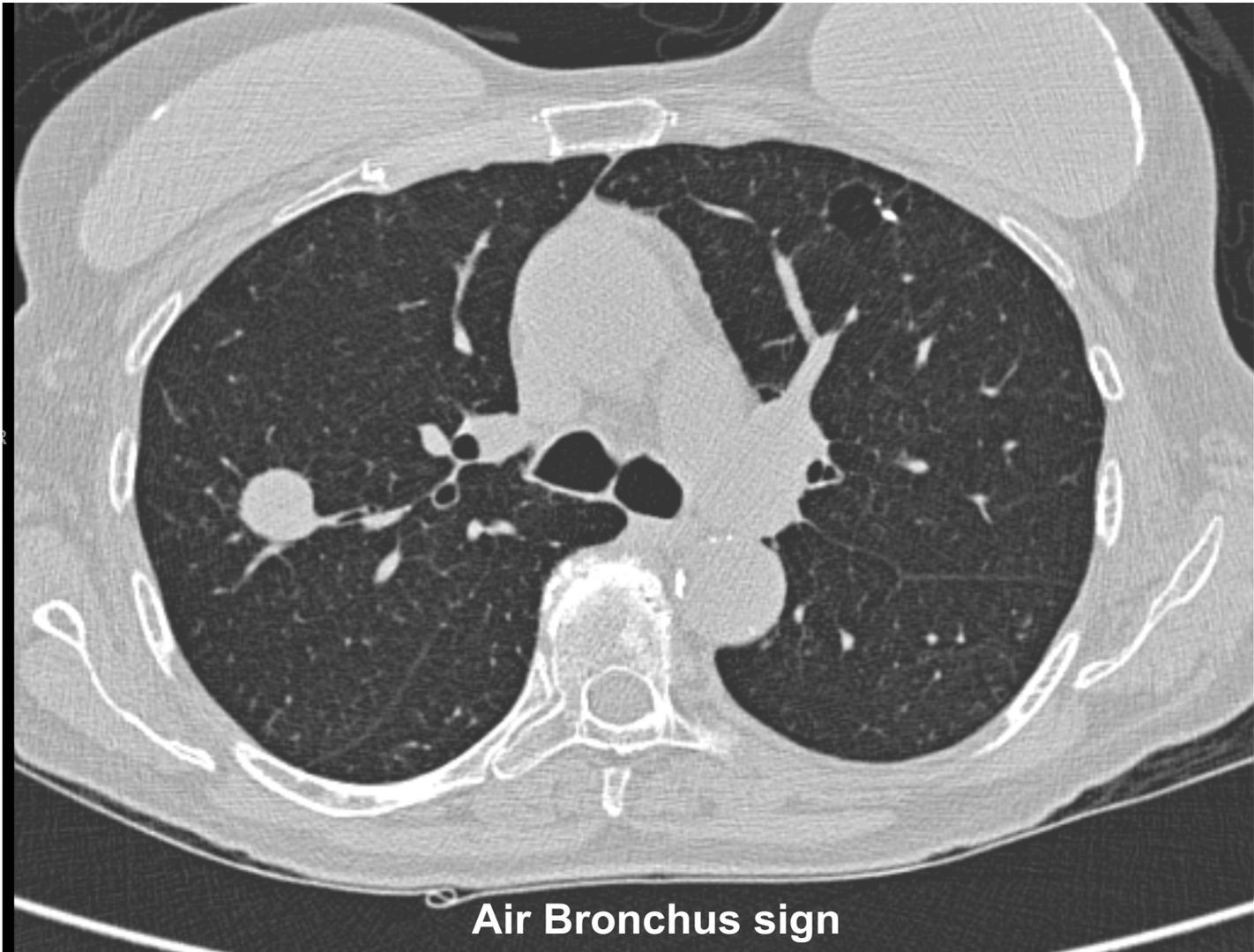
EBUS – TBNA Specimens for Programmed Death Ligand 1 (PD-L1)

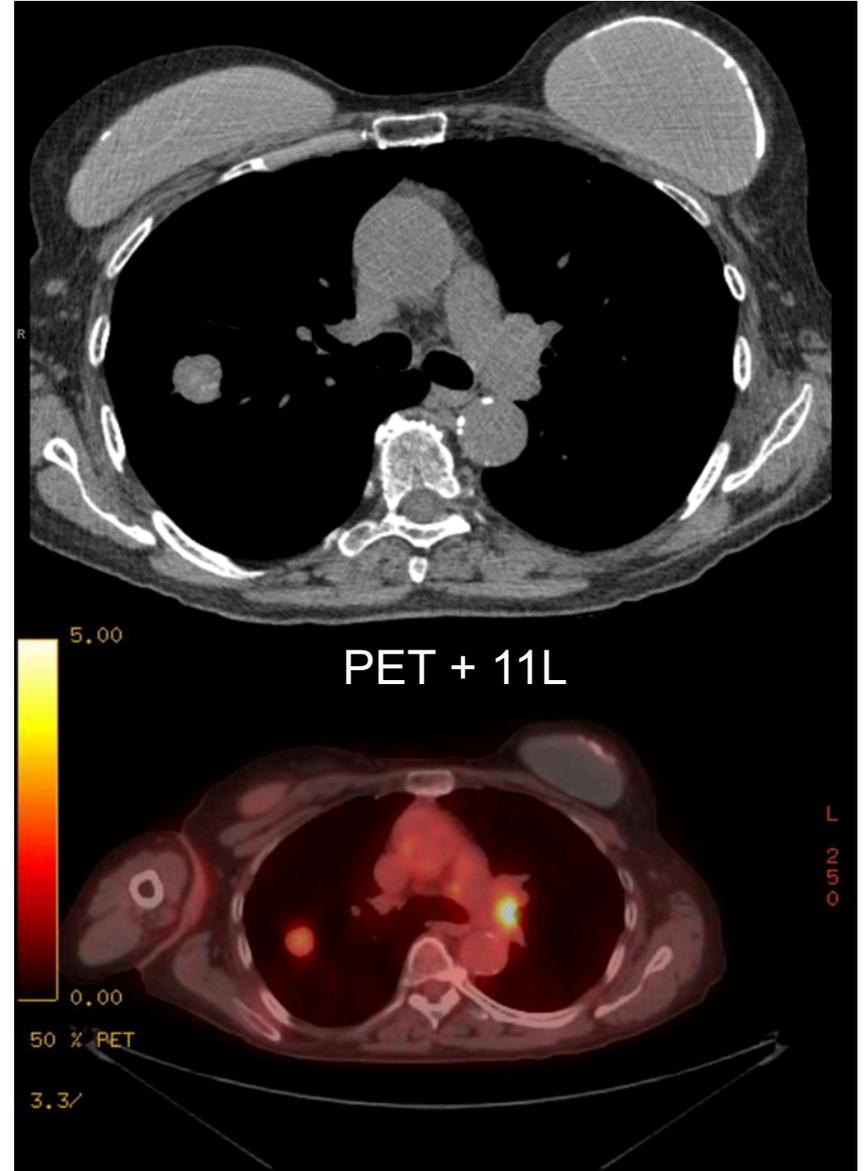
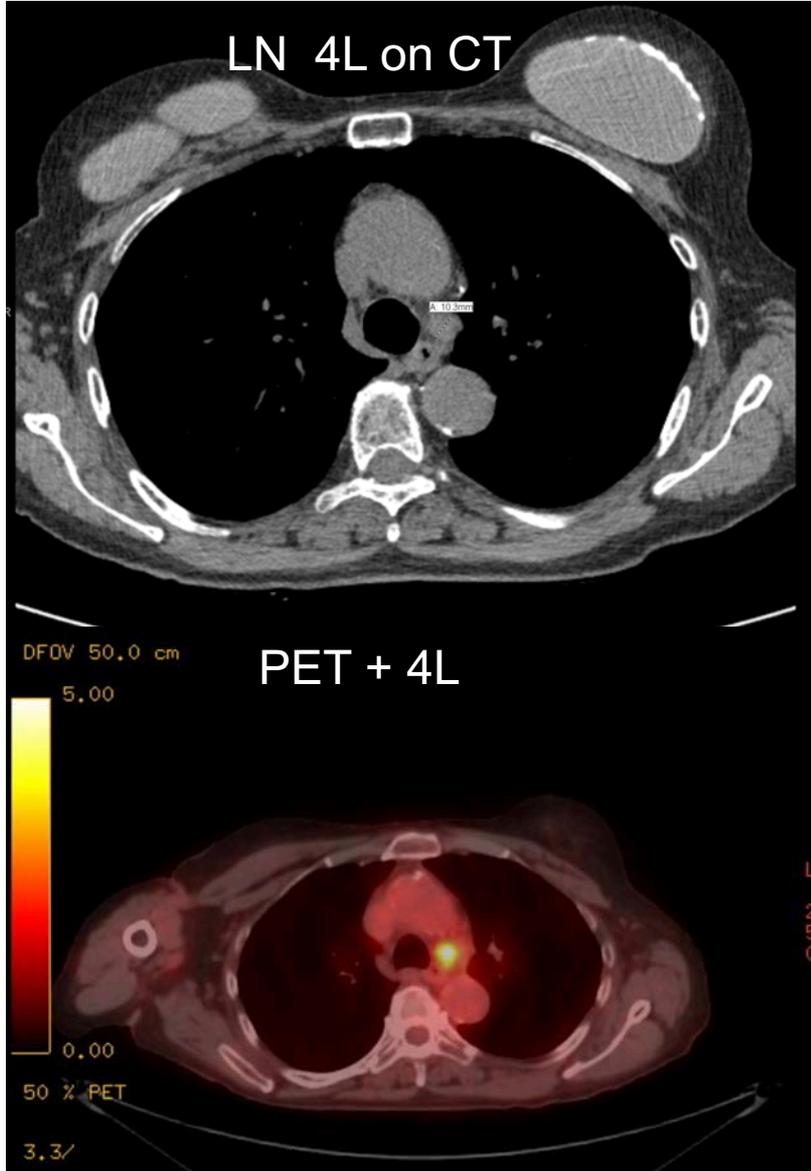
- PD – L1 expression determined by IHC
- Traditionally required histologic specimens
- Data favorable for EBUS
- Comparisons of EBUS-TBNA specimens to transbronchial biopsies, excisional LN biopsies and primary lung tumor for PD-L1 expression
- Authors found good concordance between excised lymph nodes and EBUS-TBNA samples ($r= 0.93$)

Another case description

- 65 year old woman with a 30 pack year smoking history had a fall and the CXR showed a new RUL nodule
- PFTs showed mild obstructive ventilatory impairment (FEV1 70 % pred) with a mild decrease in DLCO (65% pred)
- Comorbidities: resected colon cancer 3 years prior; HTN, DM with CKD and OSA

Case continues...





Question: In your conversation with the patient, you inform her that from all the differential diagnoses pertinent to her case, the success of EBUS-TBNA is the least for:

- A. Primary lung cancer
- B. Recurrent colon cancer
- C. Sarcoidosis
- ✓ D. Lymphoma

- Meta-analysis shows that for lung cancer, EBUS-TBNA has an overall pooled sensitivity of 93% and specificity of 100% with the highest pooled sensitivity of 97% was seen in studies that included on-site cytology ¹.
- The sensitivity and specificity of EBUS-TBNA for diagnosis of mediastinal and hilar lymph node metastasis from non-pulmonary tumors have been reported to be as high as 92.0% and 100%, respectively.
 - The tumors encountered included colorectal, head and neck, ovarian, ovarian, breast, esophageal, hepatocellular, prostate, renal, and germ cell cancers and malignant melanoma
- For sarcoidosis, EBUS-TBNA has a sensitivity and specificity of 83.3% and 100% respectively. In a high pre-test probability population, the sensitivity may be even higher than 90%

- Large prospective study showed that the sensitivity and specificity of EBUS-TBNA for definitive diagnosis of lymphoma were 57% and 100%, respectively.
- But, EBUS-TBNA diagnosis compared with final diagnosis in 100 cases of denovo or suspected relapsed lymphoma in another study
 - Correct diagnosis in 88% of de novo mediastinal lymphomas and in 100% of relapsed lymphoma
 - But, special cytopath evaluations (i.e., t-cell gene rearrangement, IHC with controls) not universally available

You highly suspect primary lung cancer. Which of the following would you do next?

- A. CT guided FNA/biopsy of the RUL nodule
- ✓ B. EBUS-TBNA for diagnosis and mediastinal staging
- C. EMN and radial EBUS guided biopsy of the RUL nodule

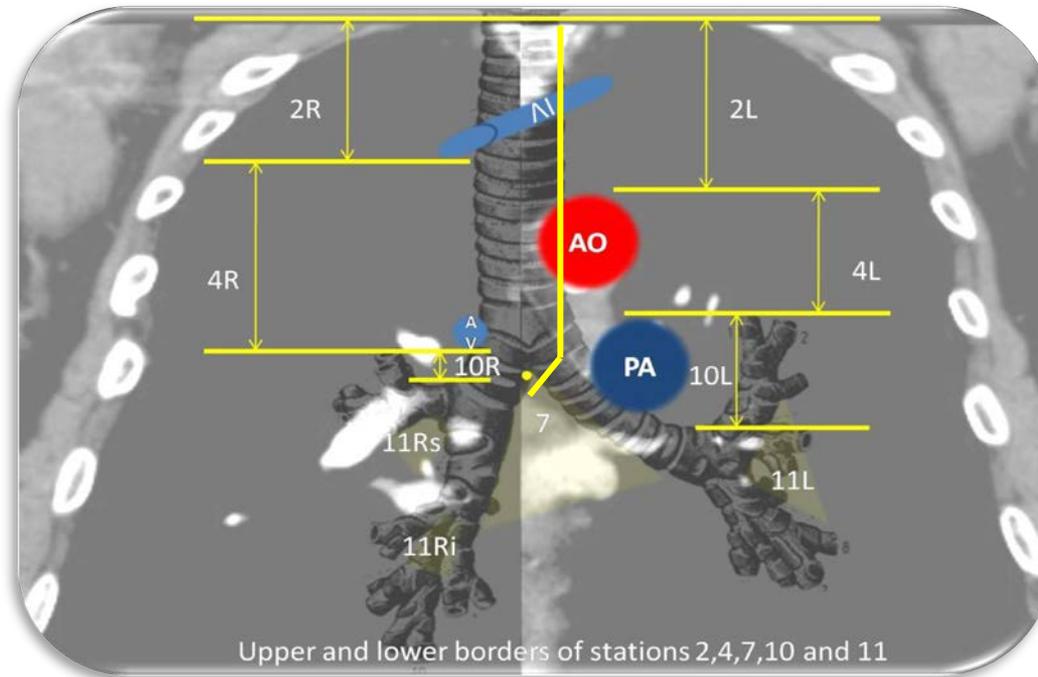
AnswerB: ...but may depend on local expertise and equipment availability

- A. CT guided FNA/biopsy of the RUL nodule
 - 1. No staging information;
 - 2. Higher risk of PTX than with bronchoscopic techniques
- B. EBUS-TBNA for diagnosis and mediastinal staging;
limited by
 - 1. Patient has likely stage III B lung cancer, thus adequate tissue for molecular analysis needed
 - 2. Possibility of two separate processes vs skip metastasis

Answer B: but may depend on local expertise and availability of techniques

- C. EBUS-TBNA and radial EBUS guided biopsy of the RUL nodule
 1. EBUS TBNA is accurate for diagnosis and staging
 2. Radial EBUS has a diagnostic yield of ~70%
- D. EBUS-TBNA and EMN guided biopsy of the RUL nodule
 1. EMN diagnostic yield for pulmonary nodules is 70%
 2. The “bronchus sign” increases the yield

Case continues...after complete airway examination was performed using the regular WLB, we inserted the EBUS-TBNA bronchoscope and imaged the mediastinal and hilar LN stations



Key points

- Mediastinal staging is essential for treatment strategies and prognosis and can be performed accurately by EBUS
- IASLC provides a common language for defining mediastinal and hilar LN stations; the anatomical borders are relevant to accurate EBUS staging
- Dedicated practice and training are needed for accurate EBUS image acquisition and interpretation
- Obtaining adequate tissue for mutational analysis and PDL-1 is standard of care.

Thank You

- Prepared by Chest faculty with the assistance of colleagues participating in Bronchoscopy International