

# Various Biopsy Techniques for Pathologic Confirmation

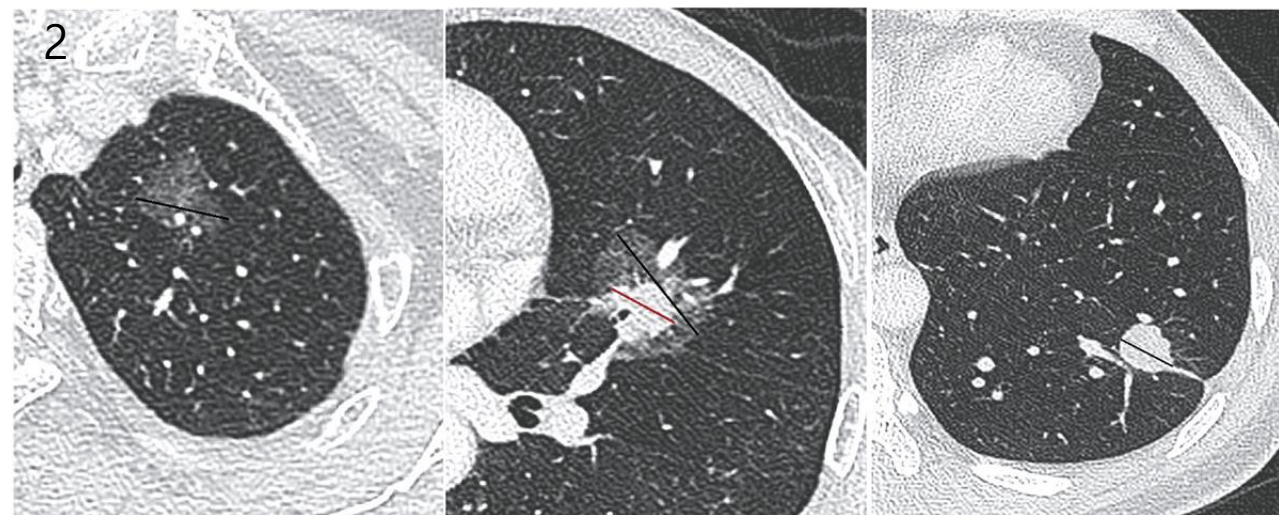
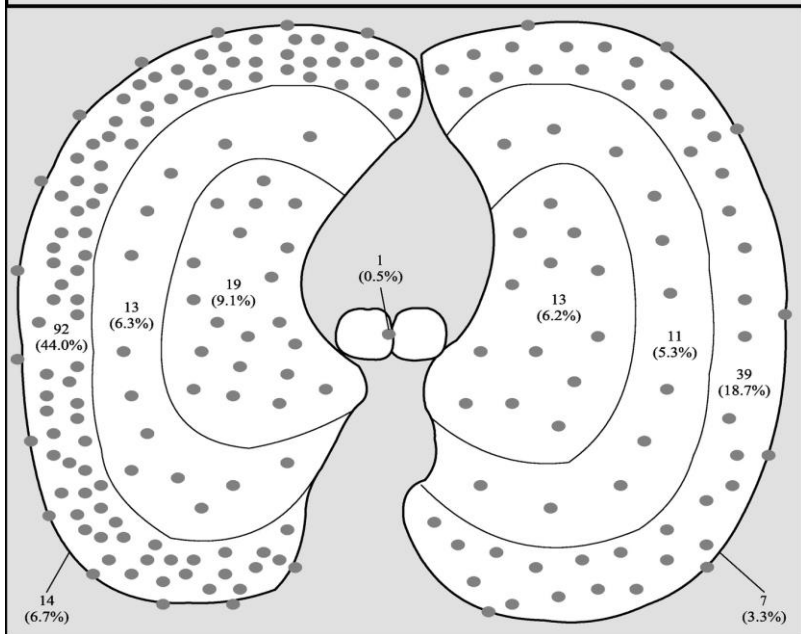
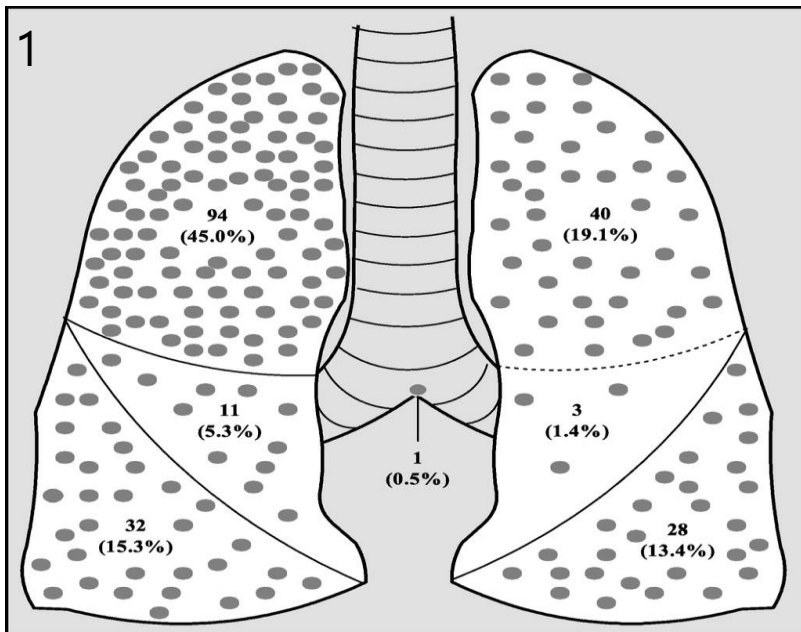
2025.04.11 (금)

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# Diagnostic Approach

- Target approach (어떻게 접근하여)
  - ✓ Percutaneous approach; CT guided, PET CT guided
  - ✓ Transbronchial approach; EBUS(linear), EBUS(radial) ± Guide sheath, ENB
  - ✓ Cone beam CT-assisted
  - ✓ Robotic approach
  - ✓ Thoracoscopic approach
- Tissue obtain (어떻게 확보하는가)
  - ✓ Needle biopsy
  - ✓ Forceps biopsy (Alligator forceps, Standard forceps, GS-small forceps)
  - ✓ CRYO biopsy

# 폐 병변의 위치 형태 특성 (Nodule and Lymph node)

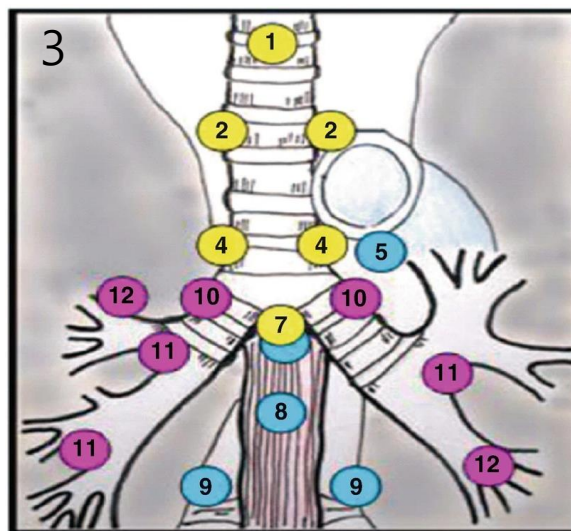


Pure GGN  
CTR=0

Part-solid nodule  
 $0 < \text{CTR} < 1$

Pure solid nodule  
CTR = 1

**Figure 1.** Definition of pure ground glass nodules (GGNs), part-solid nodules and pure solid nodules and description of radiological measurements for consolidation-to-tumor ratio (CTR), the solid component size (red line), and tumor size (black line).

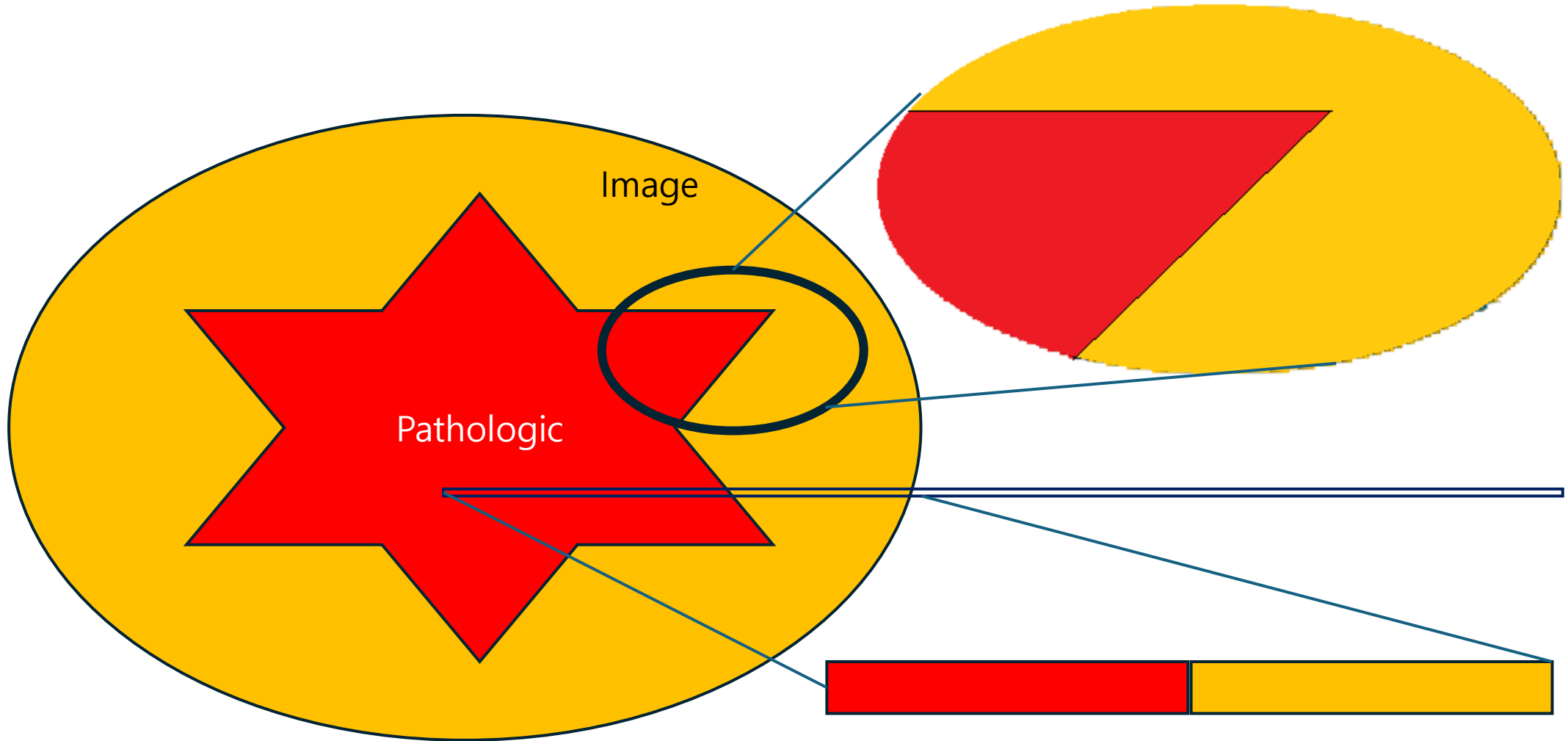


1 Am J Respir Crit Care Med Vol 187, Iss. 8, pp 848–854, Apr 15, 2013

2 Translational Oncology Volume 14, Issue 4p617-627 April 2019

3 Papanikolaou, N.I., et al. (eds) Imaging in Clinical Oncology. Springer, Cham. [https://doi.org/10.1007/978-3-319-68873-2\\_32](https://doi.org/10.1007/978-3-319-68873-2_32)

# 조직검사 (Forceps or Needle); 진단률 100%의 검사가 있을까?



# 폐 조직검사의 조합

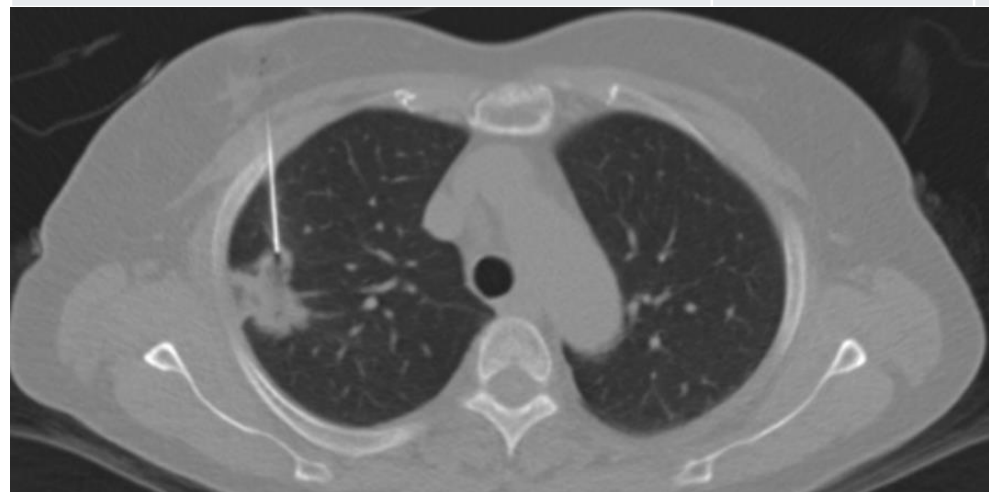
		Needle	Forceps	CRYO probe
<b>Lung nodule</b>				
• CT guided Percutaneous		CT-guided lung biopsy		
• Bronchoscopic	ENB	ENB-Needle	ENB-Forcep	
	Radial probe EBUS With or without GS	RP-EBUS Needle (TBNA)	RP-EBUS Forcep	RP-EBUS CRYO
• Cone beam CT-assisted				
• Robotic				
• Endobronchial lesion			Bronchoscopic biopsy	Bronchoscopic biopsy Deburking
<b>Lymph node</b>				
• Linear EBUS		EBUS TBNA (22G vs 19G)	EBUS Forcep	EBUS CRYO
• Convex probe bronchoscopy				

# Percutaneous approach

1. CT guided lung biopsy
2. PET guided percutaneous biopsy

# 1. Percutaneous approach; CT guided

Study	Accuracy	Study	Outcomes	Pneumothorax
Amalia Constantinescu, et al. <sup>1</sup>	85–95%	Single arm		12 to 45%
Meta-analysis; Ho ATN, et al. <sup>2</sup>	83.45%	Vs. r-EBUS TBB	Percutaneous; 83.45% Transbronchial; 68.82%	Percutaneous; 21.43% Transbronchial; 2.87%
Sam Yun, et al. <sup>3</sup>	87.6%	Solid vs. part solid	Solid; 87.0% (261/300) Part-solid; 90.7% (49/54)	26%
Lillian Dominguez-Konicki et al. <sup>4</sup>	71%	Small nodule (<10mm)	Sup segment; 84.2% Lower basal segment; 64.7%	
Yue Lin, et al. <sup>5</sup>	79.3%	PET fusion vs. CT	PET fusion; 82.9% Routine; 75.4%	26.9%
Konstantinos Stefanidis, et al. <sup>6</sup>	83.9%	PET fusion vs. CT	PET fusion; 88.8% Routine; 78.9%	4.49% 10.92%



1 J. Clin. Med. 2024, 13(23), 7330;

2 Lung. 2023 Feb;201(1):85-93.

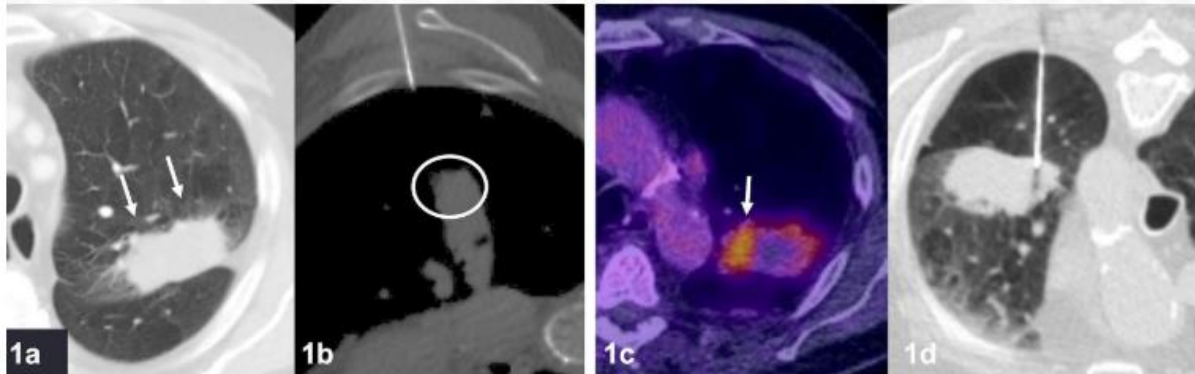
3 British Journal of Radiology, Volume 91, Issue 1088, 1 August 2018, 20170946

4 Clinical Imaging, 2020-10-01, Volume 66, Pages 7-9

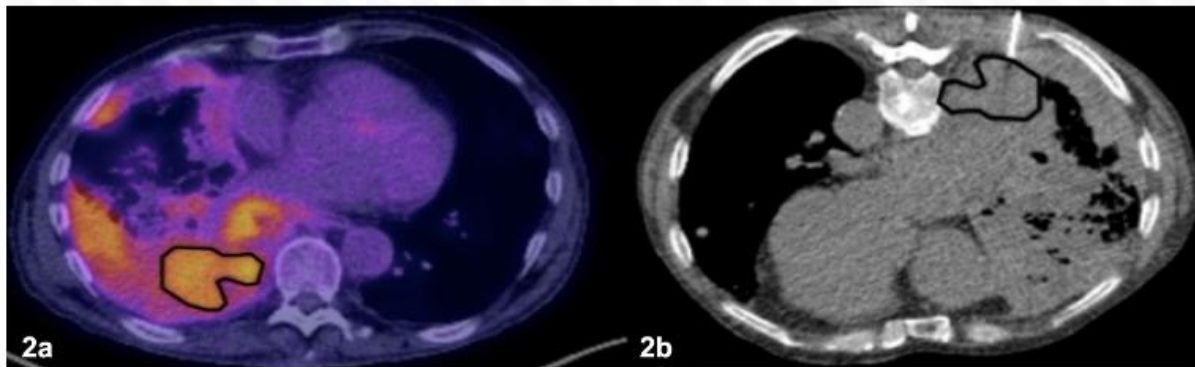
5 BMC Pulmonary Medicine volume 22, Article number: 311 (2022)

6 European Journal of Radiology, 2024-02-01, Volume 171, Article 111315

## 2. Percutaneous approach; PET guided <sup>1</sup>



1a Highly suspicious lesion in the left upper lobe (arrows) in the background of moderate centrilobular emphysema. The lesion did not have a PET-CT prior to biopsy. 1b. A lateral approach was attempted (circle) with a non-diagnostic biopsy. 1c. The PET-CT showed that that the medial component of the lesion was more metabolically active. 1d. The patient had a repeat biopsy following PET-CT targeting the higher activity medial area and showing a squamous cell carcinoma.



Patient with extensive lung and pleural disease. 2a. The PET-CT was available prior to the biopsy showing a heterogeneous SUV uptake and delineating the most accessible area of increased metabolic activity. 2b. The biopsy was targeted to the area of increased activity area and was positive for malignant diagnosis.

### Biopsy success rate (p-value < 0.01 Fisher exact test) <sup>1</sup>

- PNB **with PET-CT pre-PNB** ; **88.8 %**
- PNB **without PET-CT upfront**; **78.9 %**
- Correct targeting to PET-CT-maximum activity area; 87.1 %

### Multivariate logistic regression analysis

#### The significant factor associated with correct targeting

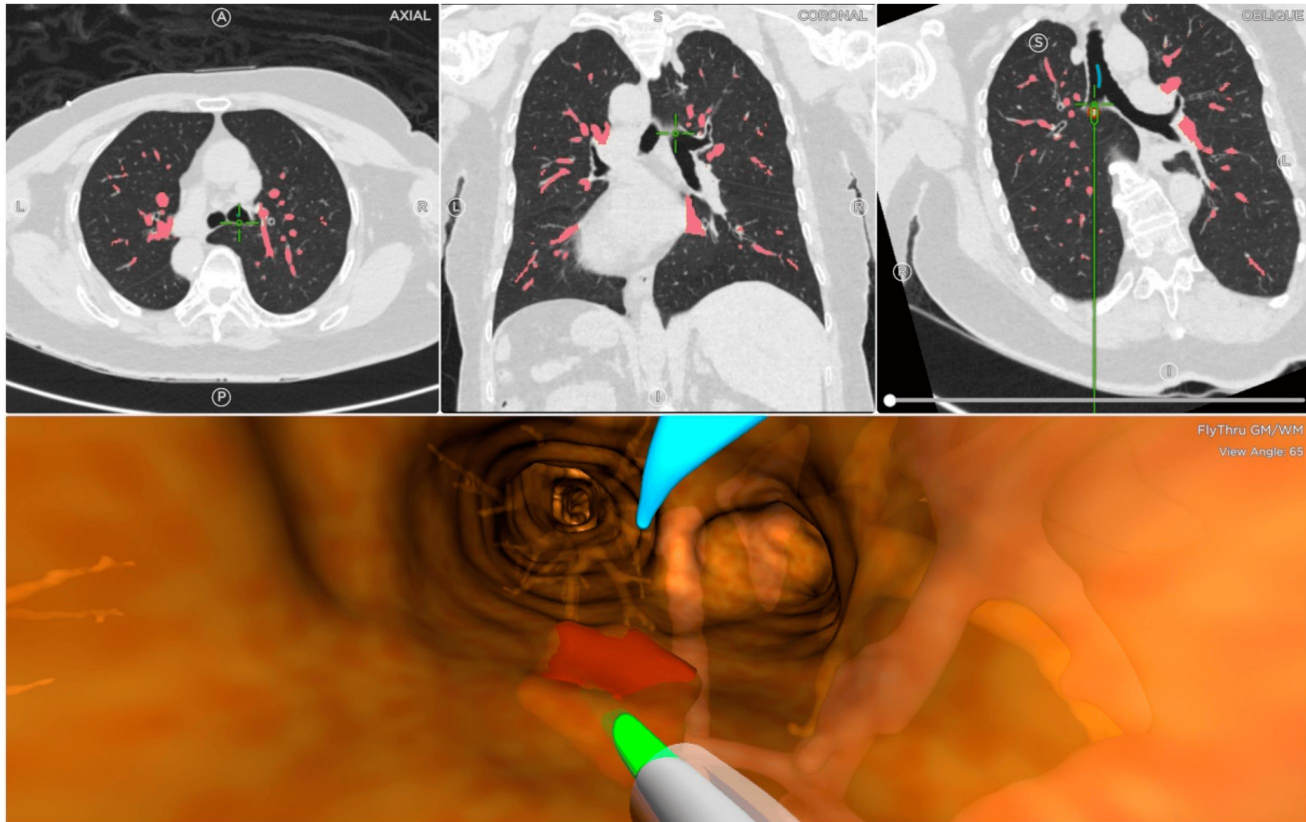
1. the availability of PET-CT before the PNB (p-value: 0.008)
2. lesion size (p-value: 0.004)
3. patient age (p-value: 0.017)

# Bronchoscopic approach

1. Electromagnetic navigation bronchoscopy (ENB)
2. Radial probe EBUS (rEBUS)
3. Radial probe EBUS guide sheath (rEBUS GS)
4. Transbronchial needle aspiration (TBNA)
5. Cryo-biopsy
6. Cone beam CT-assisted bronchoscopy

# 1. Electromagnetic Navigation Bronchoscopy system

1



2



# ENB outcomes

- ENB diagnostic yields; **49%-74.9%**
  - Trial registration number NCT03716284. <sup>1</sup>
  - The median lesion size was 20.9 (IQR, 15.9–25.9) mm <sup>1</sup>
  - The overall diagnostic yield was 74.9% (359/479) <sup>1</sup>
  - The overall accuracy by ENB was 71.7% <sup>2</sup>
  - The yield of ENB alone was 49% (74 of 150; 95% CI, 41–58%) <sup>3</sup>
  - The diagnostic yield was 70.9% (95%-CI 68.4%-73.2%) <sup>4</sup>

**Table 3** Diagnostic yield of different guided strategy

Guided strategy	Diagnostic yield (%)	P value
ENB+rEBUS+GS+thin bronchoscope	254/343 (74.1%)	0.02
ENB+rEBUS+GS+fluoroscopy+ thin bronchoscope	70/93* (75.3%)	
ENB+rEBUS+fluoroscopy+thin bronchoscope	21/21 (100.0%)	
ENB+rEBUS+fluoroscopy+ultrathin bronchoscope	6/10† (60.0%)	
ENB+rEBUS+thin bronchoscope	5/6 (83.3%)	
ENB+rEBUS+GS+thick bronchoscope	3/4 (75.0%)	
ENB+rEBUS+GS+fluoroscopy+thick bronchoscope	0/2 (0.0%)	
Overall diagnostic yield	359/479 (74.9%)	

\*Two cases used standard bronchoscope, four cases used cone-beam CT.  
 †One case used cone-beam CT.  
 ENB, electromagnetic navigation bronchoscopy; GS, guide sheath; rEBUS, radial endobronchial ultrasound.

**Table 5** Multivariable analysis for predictors of diagnostic yield.

Variable	OR	95% CI	P value
Lesion size (>20 mm vs ≤20 mm)	2.27	1.40 to 3.68	<0.001
Lesion density			<0.001
Pure GGO			Ref
Solid	7.21	2.00 to 25.97	0.003
Mixed GGO	2.72	0.73 to 10.12	0.13
CT bronchus sign			<0.001
Adjacent to			Ref
Leading to	3.10	1.68 to 5.71	<0.001
Outside	1.07	0.37 to 3.07	0.90
Distance to the hilum			0.97
Peripheral			Ref
Central	1.09	0.51 to 2.30	0.83
Intermediate	1.00	0.57 to 1.75	0.99
Distance to the pleura (≤20 mm vs >20 mm)	0.86	0.50 to 1.48	0.58
Lobar location (RUL+LUS vs others)	1.02	0.65 to 1.60	0.95
Lesion nature (malignant vs benign)	0.75	0.42 to 1.32	0.31
Anaesthesia type (general vs local±sedation)	1.03	0.60 to 1.79	0.90
GS (yes vs no)	0.61	0.20 to 1.84	0.38
Fluoroscopy (yes vs no)	1.69	0.91 to 3.15	0.10
Rapid on-site evaluation (yes vs no)	1.23	0.76 to 2.01	0.40

The multivariable analysis was performed by a full logistic regression model.  
 GGO, ground glass opacity; GS, guide sheath; LUS, left upper segment; Ref, reference; RUL, right upper lobe.

1 Thorax 2023;78:1197–1205. doi:10.1136/thorax-2022-219664

2 J Thorac Dis 2019;11(4):1697-170

3 Am J Respir Crit Care Med Vol 208, Iss 8, pp 837–845, Oct 15, 2023

4 Lung Cancer. 2023 Jun;180:107196.

# ENB outcomes

- **ENB diagnostic yields; 83.8-85.0%**

- ✓ The overall diagnostic yield was significantly higher for **ENB** than for **R-EBUS**
- ✓ (ENB vs. R-EBUS; **83.8%** vs. **70.5%**,  $p=0.021$ ) <sup>1</sup>
- ✓ The overall diagnostic yield did not differ significantly between ENB and transthoracic needle biopsy
- ✓ (ENB vs. transthoracic needle biopsy; **85.0%** vs. 89.9%,  $p = 0.124$ ) <sup>2</sup>
- ✓ The final diagnostic yield was **75.5%** <sup>3</sup>
  
- ✓ The diagnostic yield of the strict definition was not statistically different among the three groups
- ✓ ENB vs **Combination** vs radial probe-EBUS 63.8% vs **64.2%** vs 62.6%,  $p = 0.944$  <sup>4</sup>
- ✓ Superior in the **ENB + radial probe-EBUS group** for a bronchus type II or III solid part <20 mm
- ✓ (odds ratio 1.96, 95% confidence interval 1.09-3.53,  $p = 0.02$ ) <sup>4</sup>

- **High-risk target**

- Percutaneous procedure was not recommended because of the inaccessible location of lung nodules or the high risk of procedure-related complications
  - ✓ The diagnostic yield of ENB-guided biopsy was **53.0%** <sup>5</sup>

1 Arch Bronconeumol. 2023 Jun;59(6):356-363.

2 Lung Cancer. 2023 Jul;181:107234.

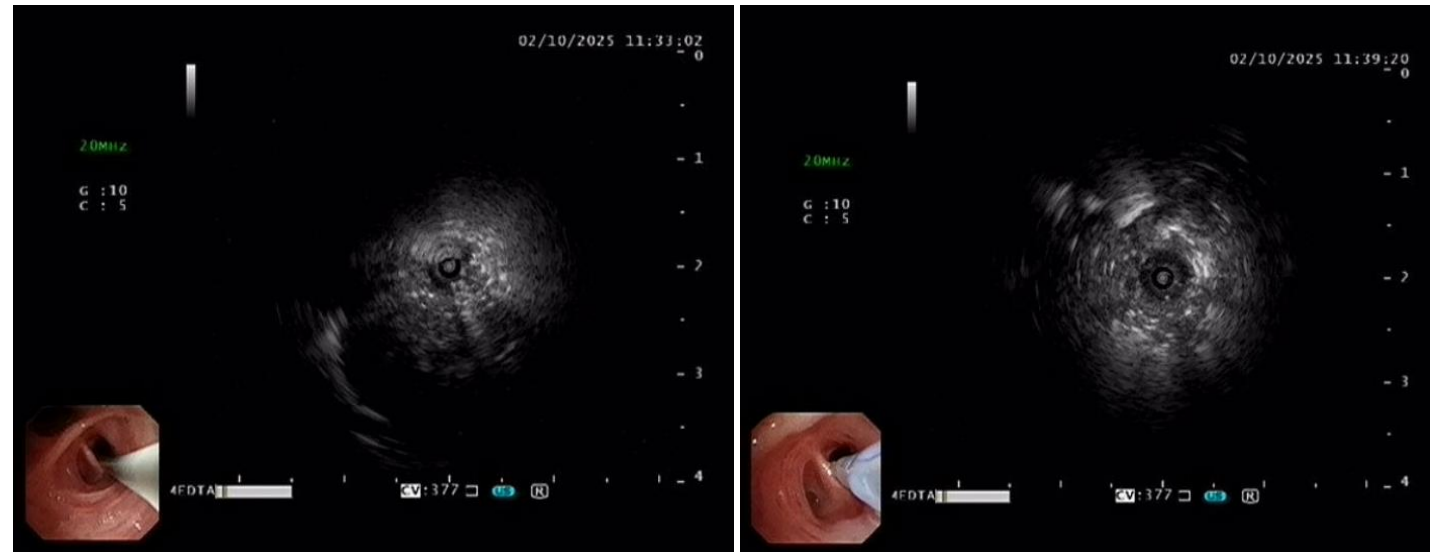
3 Medicine (Baltimore). 2023 Oct 20;102(42):e35362

4 Thorac Cancer. 2024 Jul;15(21):1638-1645.

5 Thorac Cancer. 2021;12:1503–1510.

## 2. Radial-probe EBUS (rEBUS)

- The radial probe EBUS-TBLB uses a miniature ultrasound probe (rEBUS probe) that emits ultrasound waves that are reflected by the tissue, creating a 360° real-time image of the airway and the surrounding lung tissue.



# Radial probe EBUS TBLB outcome

- Radial EBUS (rEBUS) outcome; **70-73%**
  - ✓ Diagnostic yield of R-EBUS-guided TBB without fluoroscopy was **70%** <sup>1</sup>
  - ✓ **Meta-analysis**
    1. Pooled overall diagnostic yield of R-EBUS-guided TBB without fluoroscopy was **70%** (95% confidence interval [CI], 67%-74%) <sup>2</sup>
    2. r-EBUS pooled sensitivity was **72%** (95% CI, 70%-75%), and area under the sROC curve was 0.96 (95% CI, 0.94-0.97) <sup>3</sup>
    3. r-EBUS pooled diagnostic yields was **73%** (95 % CI: 69%–76%) <sup>4</sup>
  - ✓ In subgroup and meta-regression analyses, 1) **air bronchus sign** on chest computed tomography scans, 2) **larger size PPLs**, 3) **probe location within lesions**, and 4) **heterogeneous echogenicity** were associated with significantly higher diagnostic yield.
- Pooled pneumothorax rate was 1.0% <sup>1</sup>, 0.7% <sup>3</sup>, 3.1 % <sup>4</sup>

1 Thorac Cancer. 2022 Dec 8;14(2):195–205

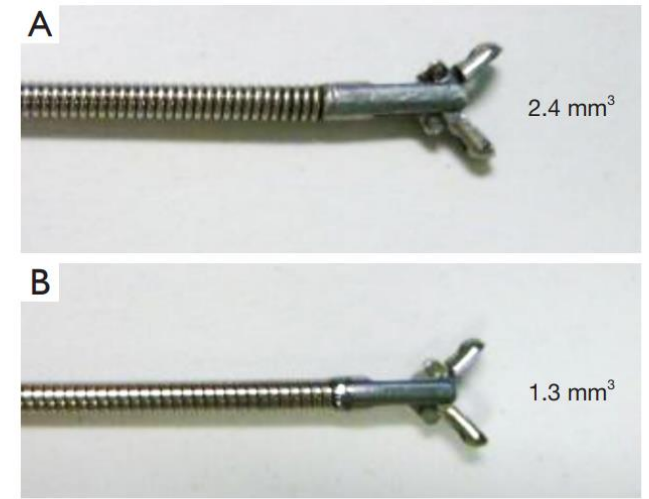
2 Thorac Cancer. 2023 Jan;14(2):195-205.

3 Chest, 2020-04-01, Volume 157, Issue 4, Pages 994-1011

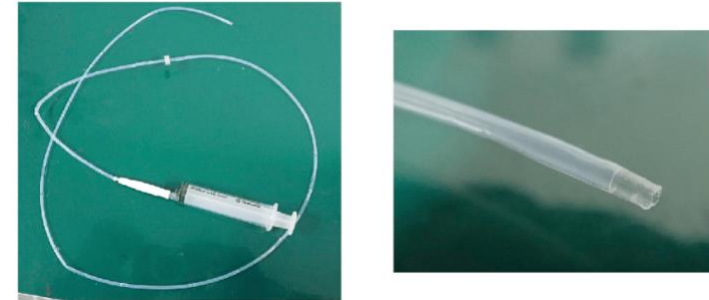
4 Heliyon 10 (2024) e29446

### 3. rEBUS Guide-sheath (rEBUS GS)

- Radial EBUS (rEBUS) GS forceps outcome; **53%-78%**
- The diagnostic yields for PPLs RCT (GS vs non-GS) ( $p=0.033$ )<sup>1</sup>
  - ✓ **GS group** vs non-GS group; **55.3%** vs. 46.6%
- The diagnostic yields for PPLs [83.2% R-EBUS within] ( $p=0.649$ )<sup>2</sup>
  - ✓ **rEBUS with GS** vs. rEBUS-TBB without GS; **78%** vs. 79%
  - ✓ The procedure time was significantly longer in the EBUS-TBB+GS group than in the EBUSTBB–GS group (29 min versus 24 min;  $p<0.001$ )
- The diagnostic yields for PPLs [67.4% R-EBUS within] ( $p=0.033$ )<sup>3</sup>
  - ✓ **rEBUS with GS** vs. rEBUS without GS; **55.3%** vs. 46.6%
- The diagnostic yields for GGN PPLs<sup>4</sup>
  - ✓ for lesions <20 mm; 50.0%
  - ✓ for 20-30 mm lesions; 65.1%
  - ✓ for lesions >30 mm; **85.7%**



**Figure 2** Difference in the biopsy size. (A) Forceps without the GS (1.8-mm outer diameter, 4.0-mm open width diameter, and 2.4 mm<sup>3</sup> cup capacity); (B) forceps with the GS (1.5-mm outer diameter, 4.3-mm open width diameter, and 1.3 mm<sup>3</sup> cup capacity).



1 European Respiratory Journal 2022 59(5): 2101678

2 ERJ Open Res 2021;7:00267-2021.

3 Eur Respir J 2022;59:2101678

4 Cancers (Basel). 2024 Mar 19;16(6):1203.

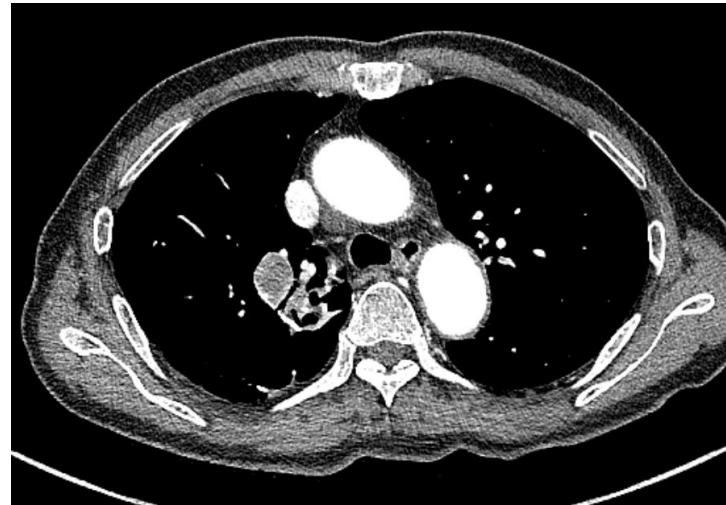
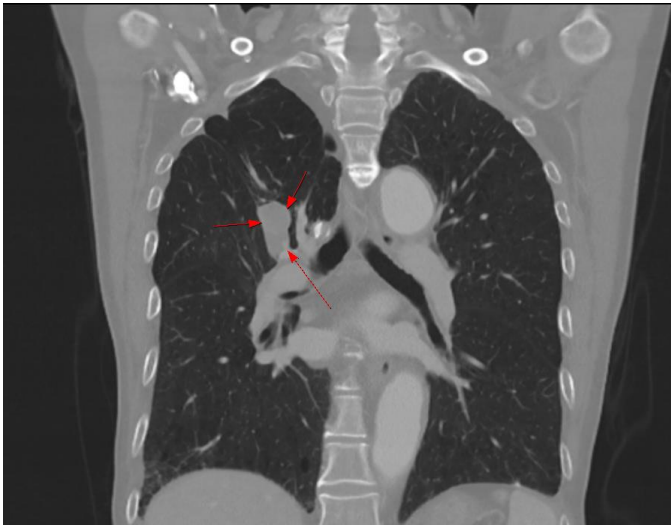
5 Journal of Thoracic Disease, Vol 9, No 7 July 2017

# Additional conventional TBLB with standard forceps after rEBUS-GS-TBLB for the diagnosis of PPLs

- The results showed that of the 88 eligible patients, **57 (65%)** were successfully diagnosed by rEBUS-GS-TBLB.
- In the 31 patients not diagnosed by rEBUS-GS-TBLB, **15 (48%)** were successfully diagnosed by additional conventional TBLB. <sup>1</sup>
- The results showed that rEBUS-GSTBLB was diagnostic in **30/55 (54.5%)** patients
- In the 25 patients, subsequent conventional TBLB yielded additional diagnostic information in **8/25 (32%) patients** <sup>2</sup>

# Radial probe EBUS TBNA

- R-EBUS TBNA outcome; **79%-83%**
- R-EBUS-TBNA diagnostic yield [over all diagnostic yield: 84%, with no adverse events reported] <sup>1</sup>
- R-EBUS-GS TBNA diagnostic yield [overall diagnostic yield: 70% (52/74)] <sup>2</sup>
  - 47 (63.5%) were successfully diagnosed by rEBUS GS TBLB.
  - 27 PLLs not diagnosed by rEBUS GS TBLB
  - 5 (18.5%) were further diagnosed by rEBUS GS TBNA
- The overall EBUS-TBNA diagnosis yield (Malignancy) is **79%** (95% CI 72%-88%) <sup>3</sup>
- Combined EBUS-TBNA with conventional bronchoscopy **83%** (95% CI 79%-87%) <sup>3</sup>



## CASE

- No endobronchial lesion
- R-EBUS no within after #3 cryobiology
- ➔ Add EBUS TBNA via flexible bronchoscopy
- ➔ No endobronchial lesion
- ➔ R-EBUS adjacent image

<sup>1</sup> BMC Pulmonary Medicine volume 23, Article number: 485 (2023)

<sup>2</sup> J Thorac Dis. 2024 Jun 30;16(6):3818-3827.

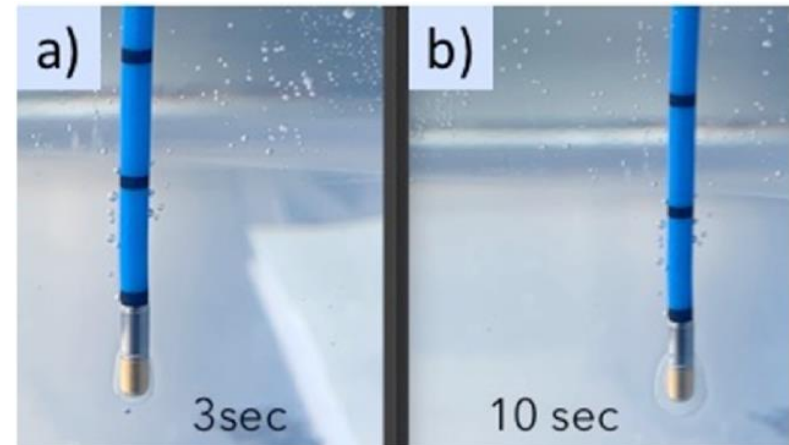
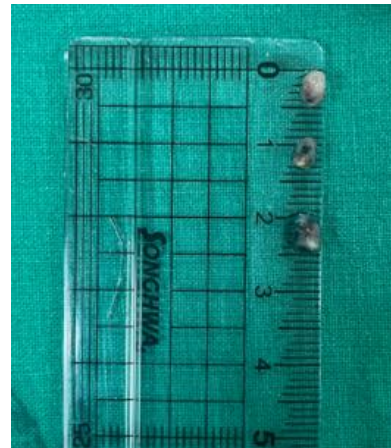
<sup>3</sup> Clin Exp Metastasis. 2023 Feb;40(1):45-52.

# Radial probe EBUS cryobiopsy (TBLC)

- Radial probe EBUS TBLC diagnostic yields; **71.5%-84.4%**
  - The diagnostic yields of **forceps biopsy** and **cryobiopsy** were **65.3%** (130/199) and **84.4%** (168/199), respectively, and the total diagnostic yield was 91.5% (182/199) ( P <0.001 vs. forceps biopsy) <sup>1</sup>
  - The pooled diagnostic yield of **rEBUS-GS-guided TBCB** without fluoroscopy was **71.5%** (103/144). In 133 patients, the diagnostic yield of TBCB was significantly higher than that of TFBF (77.4% vs. 59.4%; p < 0.05) <sup>2</sup>
  - The pooled diagnostic yield of **rEBUS-GS-guided TBLC** without fluoroscopy 90.7%, pneumothorax risk 5.8% (unpublished data N=89)



Guide sheath with CRYO probe 1.1



1 J Bronchology Interv Pulmonol. 2024 Jan 1;31(1):13-22

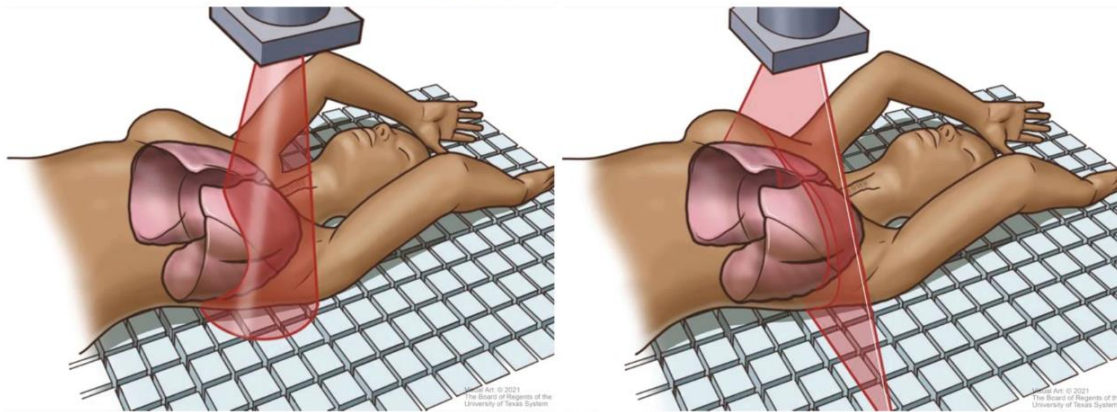
2 J Bras Pneumol. 2023 Jan 9;49(1):e20220200

# Cone beam CT-assisted bronchoscopy <sup>1</sup>

- The pooled navigational success rate (odds ratio [OR] 5.12)
  - ✓ Without CBCT; 81.6% vs **CBCT-assisted group; 97.0%**
- The pooled diagnostic rate (OR 2.51)
  - ✓ Without CBCT; 55.7% vs **CBCT-assisted group; 78.5%**
- Significantly higher than those without CBCT.
- The complication rate of CBCT-assisted bronchoscopy was 4.4% (95%CI: 0.02-0.07)

2

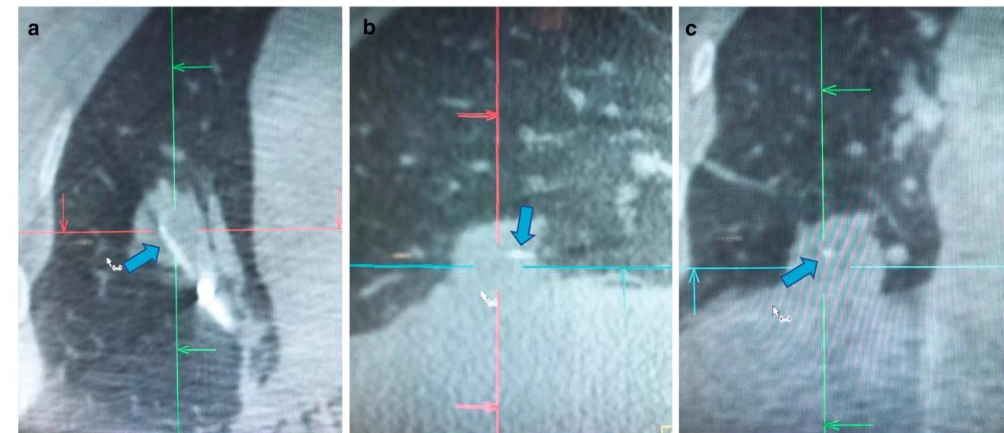
From: **Cone Beam Computed Tomography-Guided Bronchoscopy**



Schematic of X-ray emission by cone beam computed tomography in a cone-shape distribution (left) compared to multislice detector computed tomography in a fan-beam shape distribution (right). (Image courtesy of the University of Texas MD Anderson Cancer Center)

**Fig. 25.3**

From: **Cone Beam Computed Tomography-Guided Bronchoscopy**



Multiplanar reconstruction of intraoperative CT image demonstrating needle (blue arrow) within the lesion in axial (a), sagittal (b), and coronal (c) planes

1 Pulmonology. 2025 Dec 31;31(1):2420562.

2 Sabath, B.F., et al. Cone Beam Computed Tomography-Guided Bronchoscopy.

In: Díaz-Jiménez, J.P., Rodríguez, A.N. (eds) Interventions in Pulmonary Medicine. Springer

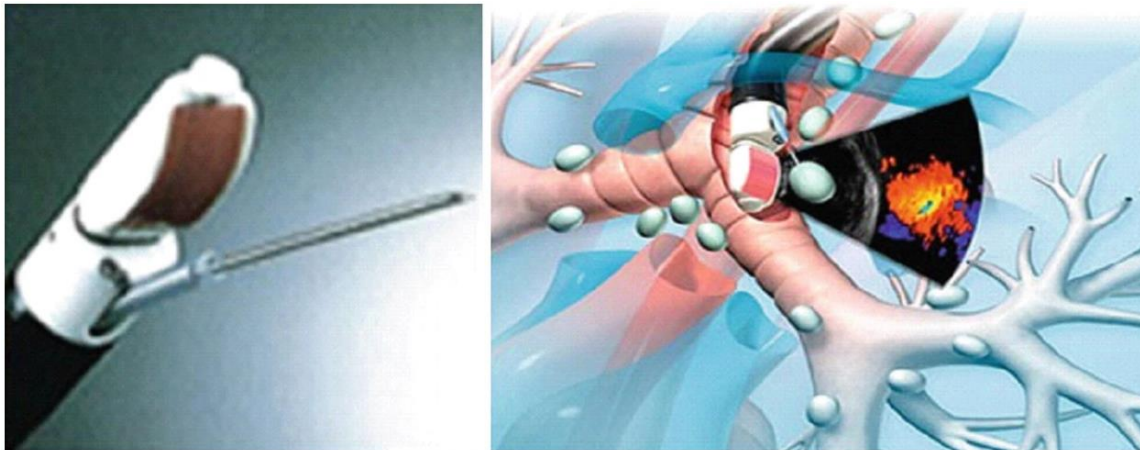
# Bronchoscopic approach

- Lymph node biopsy
  1. Mediastinal cryobiopsy
  2. EBUS guided intra-nodal forceps
  3. EBUS TBNA (22G, 19G)
  4. Additional EUS approach

# Linear EBUS (convex probe endobronchial ultrasound)

- Linear EBUS (convex probe endobronchial ultrasound)
  - ✓ The diagnostic yield of endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is typically between **93–97%** <sup>1</sup>
  - ✓ Identification for malignancy in lymph-node sensitivity **92.3%**, specificity 100% <sup>2</sup>
  - ✓ EBUS-TBNA and mediastinoscopy produced similar results for mediastinal staging of NSCLC <sup>3</sup>
  - ✓ The area under the summary ROC curve EBUS-TBNA vs. mediastinoscopy (0.9881 vs. 0.9895)

4



Tip of linear EBUS bronchoscope (courtesy of Olympus)

1 European Respiratory Journal 2023 62(suppl 67): PA1793

2 Eur Respir J 2006;28:910-4

3 J Bras Pneumol. 2020 Oct 23;46(6):e20190221.

4 Papanikolaou, N.I., et al. (eds) Imaging in Clinical Oncology.

Springer, Cham. [https://doi.org/10.1007/978-3-319-68873-2\\_32](https://doi.org/10.1007/978-3-319-68873-2_32)

# Next step of Linear EBUS (1)

- Mediastinal cryo-biopsy Diagnostic yields; **89.59%-93%**
  - ✓ Inserting a cryoprobe into the lesion combined with EBUS-TBNA<sup>1</sup>
  - ✓ The overall diagnostic yield increased from **81% to 93%** (p=0.0039)
  
  - ✓ EBUS TBNA vs. EBUS-TMC (Meta) <sup>2,3,4</sup>
  - ✓ EBUS-TBNA; 77.13% (415/538) vs. **EBUS-TMC; 89.59%** (482/538) <sup>2</sup>
  - ✓ EBUS-TBNA; 81% (504 of 554) vs. **EBUS-TMC; 91%** (567 of 704) <sup>3</sup>
  
  - ✓ EBUS TBNA; 80% vs **EBUS-TMC 92%** <sup>4</sup>
    - ✓ cryoEBUS was especially useful in cases of **lymphomas or non-pulmonary carcinomas**
    - ✓ EBUS-EBNA; 42% vs **EBUS-TMC; 83%**
    - ✓ cryoEBUS was especially useful in cases of **Benign**
    - ✓ EBUS TBNA 60.1% vs **EBUS-TMC; 87%**

1 Lancet Respir Med 2023;11:256-64.

2 Respiration. 2024;103(7):359-367.

3 J Thorac Dis. 2024 Jul 30;16(7):4217-4228.

4 Respir Med. 2023 Nov:218:107389.

# Next step of Linear EBUS (2)

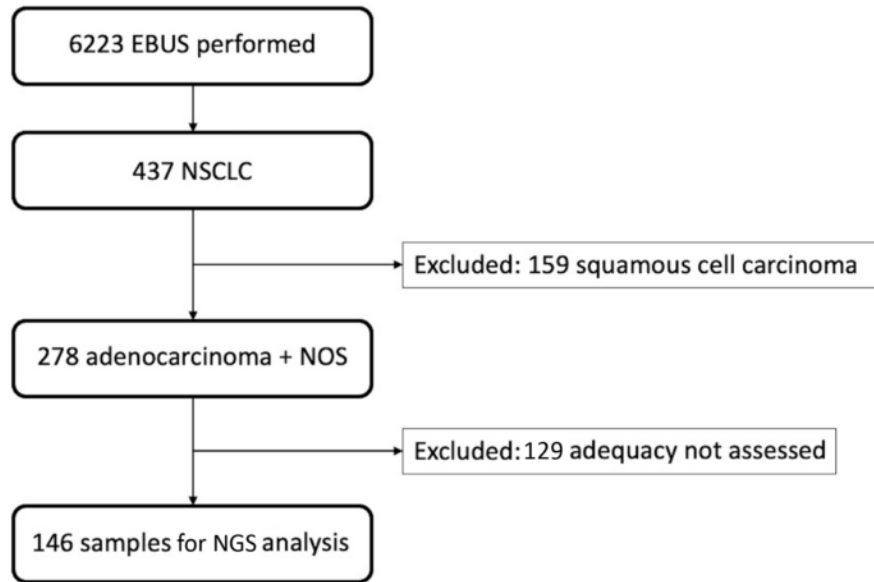
1 Respiration. 2024;103(12):752-764.  
2 Ann Thorac Surg 2022;114:340-8  
3 Thorac Cancer. 2023 Aug;14(22):2149-2157  
4 Respiration 2018;96:275-82  
5 J Clin Med. 2023 Jun 13;12(12):4033

- EBUS guided intranodal forcep <sup>1,2</sup> diagnostic yields; **90.84%-94%**
  - ✓ EBUS TBNA vs. EBUS TBNB (Meta) <sup>1</sup>
  - ✓ EBUS TBNA; 84.53% (590/698) vs. **EBUS TBNB; 90.84%** (476/524)
  - ✓ EBUS TBNA + EBUS TBNB vs EBUS TBNA <sup>2</sup>
  - ✓ **Both** vs. EBUS TBNA alone; **92% (428/467) vs.** 67% (312/467)
  - ✓ **For lymphoma**
  - ✓ **Both** vs. EBUS TBNA alone; **86%** vs. 30%
  
  - ✓ Diagnostic yield ( $p = 0.023$ ) <sup>3</sup>
  - ✓ **Combined with EBUS-IFB** vs. EBUS-TBNA alone; **94% (49/52) vs.** 77% (40/52)
- 19G Needle for TBNA <sup>4,5</sup>
  - ✓ No significant difference was observed in diagnostic yield and overall specimen quality <sup>4</sup>
  - ✓ Sensitivity ( $p = 0.80$ )<sup>5</sup>
  - ✓ **19-G needle** vs. 22-G needle; **93.4%** (CI: 87.4-97.1%) vs. 92.6% (CI: 86.3-96.5%)

# Linear EBUS 19G Needle for TBNA

- **Sample adequacy rates**
  - ✓ 19G vs. 21G; 96% vs. 92.8% in cytology
  - ✓ 19G vs. 21G; 90.6% vs. 75% in histology
- **Diagnostic accuracy**
  - ✓ 19G vs. 21G; 80% vs. 77.1% (p=0.77) in cytology
  - ✓ 19G vs. 21G; 68.6% vs. 48.6% (p=0.08) in histology
- **AUC for the diagnosis of malignancy**
  - ✓ 19G vs. 21G; 0.85(95%CI:0.7-0.9, p<0.0001) vs. 0.76(95%CI:0.6-0.9, p=0.001) vs
  - ✓ No major complication occurred.

# EBUS TBNA and driving mutation test (1)



EBUS was performed using an Olympus® BF-Convex Scope XBF-UC160 F-OL8 with a 21g needle or Pentax® convex scope EB-1970UK with a 21g cytology needle

Two dedicated needle passes from each target lesion are used to create four slides, two that are stained using the Dif-Quick method and immediately reviewed by an on-site cytotechnician for adequacy

Stained using the Diff-Quick method immediately reviewed by an on-site cytotechnician for adequacy

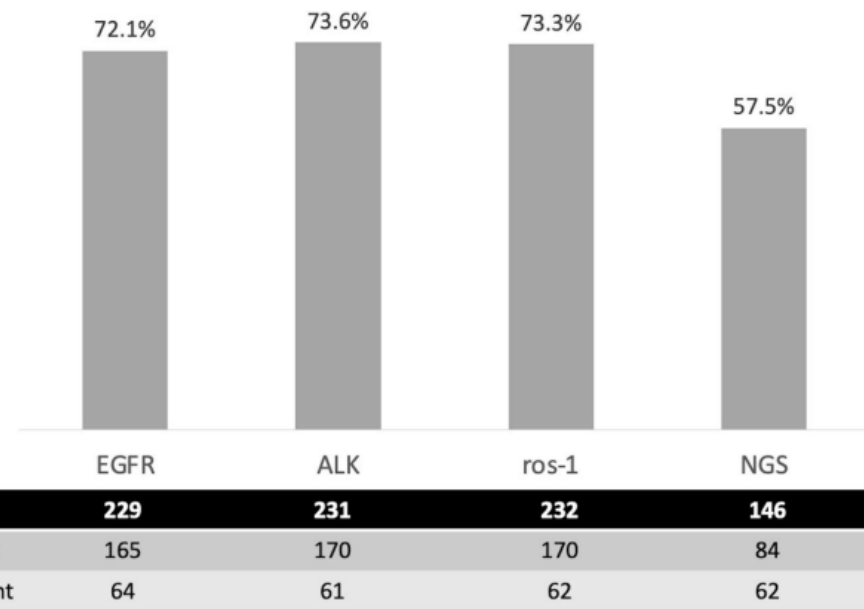
An additional third needle pass is rinsed to create processing by pathology  
**Additional three to five rinses are placed in a separate conical of saline and labeled for NGS testing**

US, Wake Forest University School of Medicine, Winston-Salem

- ✓ General anesthesia 210 (75%), mean procedure time 51.6min
- ✓ Moderate sedation 68 (24%), mean procedure time 36.9min

**Table 3** Molecular genetic sufficiency in adenocarcinoma, NOS, and poorly differentiated samples

	EGFR		<i>p</i> -value
	Insufficient	Sufficient	
<i>N</i>	64	165	
Primary location			0.7335
Mass/nodule	56 (87.5%)	147 (89.1%)	
Lymph node	8 (12.5%)	18 (10.9%)	
Size			0.0428
Number of aspirations			0.5731
	ALK		<i>p</i> -value
	Insufficient	Sufficient	
<i>N</i>	61	170	
Primary location			0.6826
Mass/nodule	55 (90.2%)	150 (88.2%)	
Lymph node	6 (9.8%)	20 (11.8%)	
Size			0.0115
Number of aspirations			0.2702
	ROS1		<i>p</i> -value
	Insufficient	Sufficient	
<i>N</i>	62	170	
Primary location			0.6556
Mass/nodule	56 (90.3%)	150 (88.2%)	
Lymph node	6 (9.7%)	20 (11.8%)	
Size			0.0106
Number of aspirations			0.2105

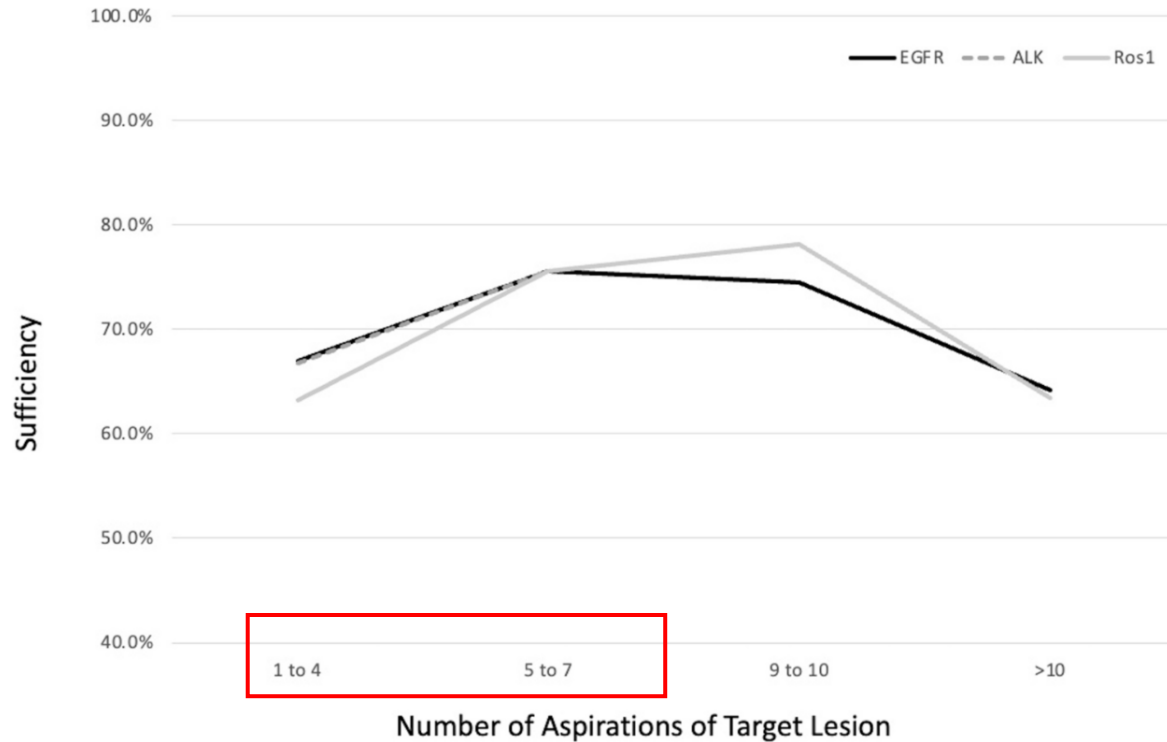


- BASIC Driving mutation

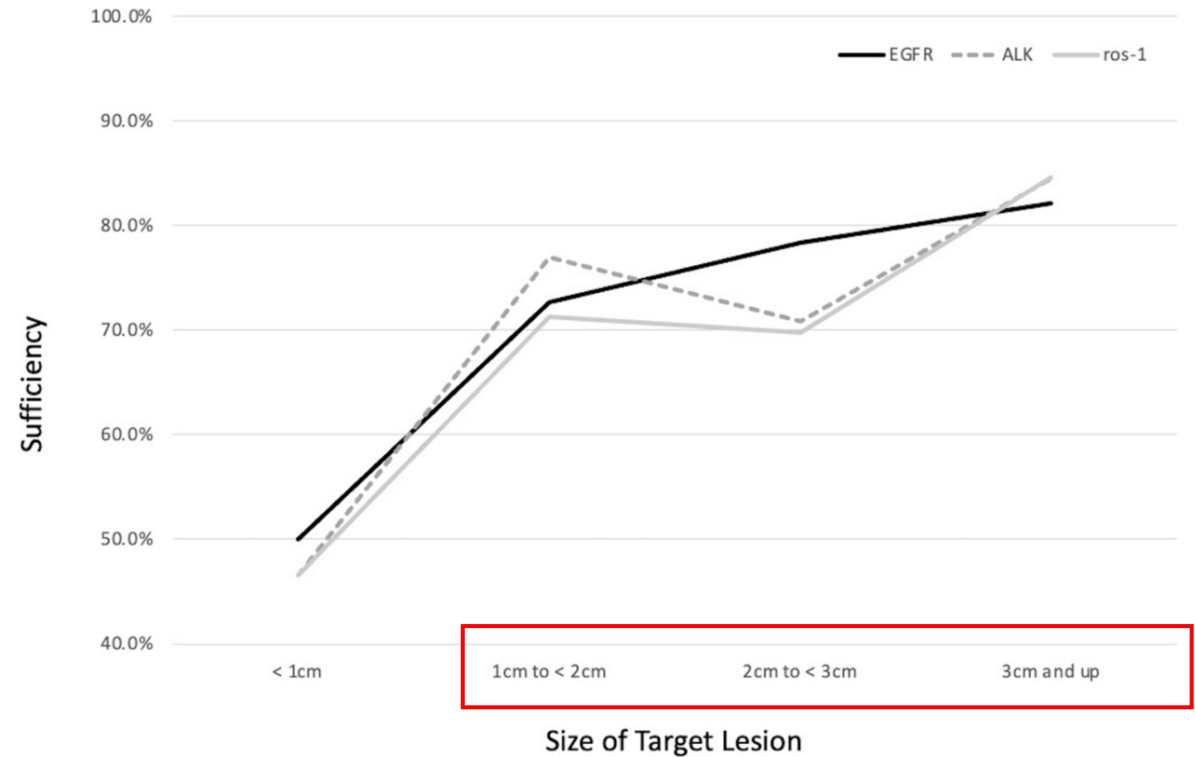
1. Biopsy site (Primary lesion vs LN)는 Tissue Sufficiency에 연관이 없음
2. Biopsy target size는 연관이 있음
3. Aspiration number는 연관이 없음

# EBUS TBNA and driving mutation test

From: Endobronchial Ultrasound Guided Transbronchial Needle Aspiration and Next Generation Sequencing Yields

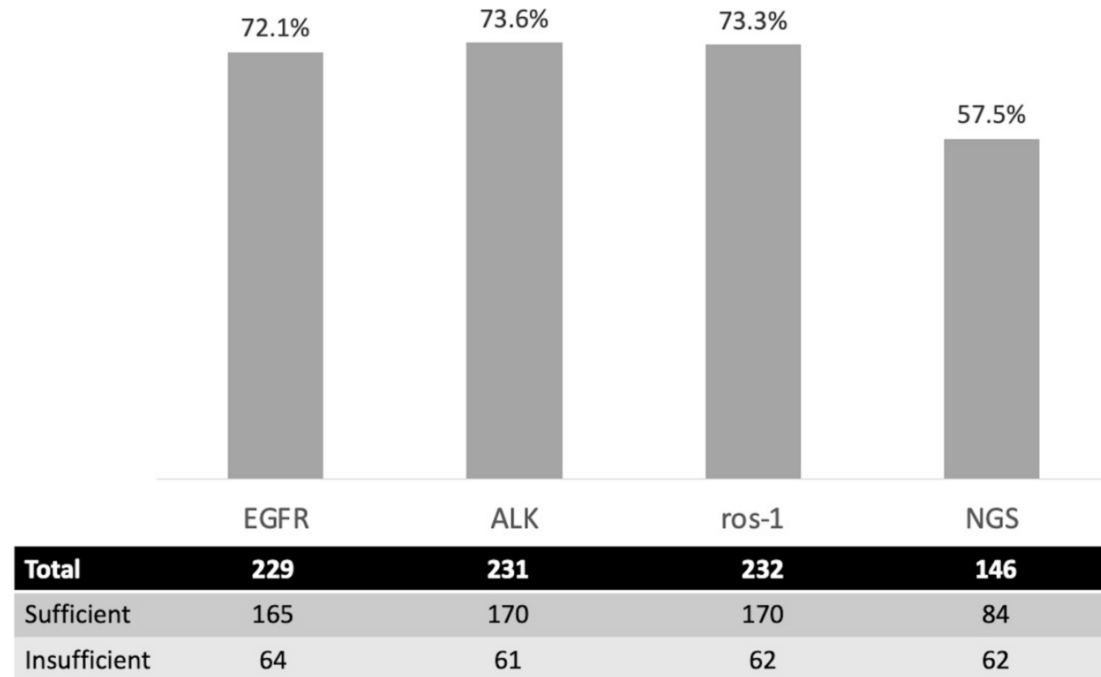


From: Endobronchial Ultrasound Guided Transbronchial Needle Aspiration and Next Generation Sequencing Yields

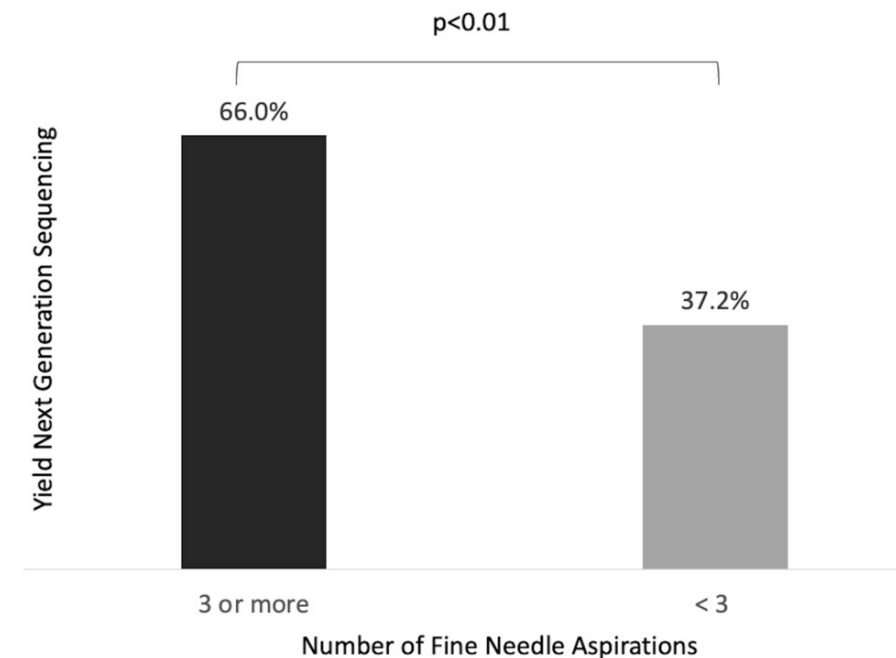


# EBUS TBNA and driving mutation

From: Endobronchial Ultrasound Guided Transbronchial Needle Aspiration and Next Generation Sequencing Yields



From: Endobronchial Ultrasound Guided Transbronchial Needle Aspiration and Next Generation Sequencing Yields



Next generation sequencing yields based on protocol adherence ( $\geq 3$  aspirations). Samples tested for next generation sequencing were stratified by number of aspirations taken from the target lesion. Yields were higher when three or more aspirations were obtained compared to less than three aspirations (66% vs 37.2%)

- **Conclusion**

- ✓ When choosing biopsy locations for molecular genetics and NGS, proceduralists should consider aiming for larger lesions and obtaining **three or more aspirations for NGS**

# EBUS TBNA and driving mutation test (2)

- The success rates of NGS using EBUS-TBNA samples were 92.5% <sup>1</sup>
- Samples from higher N stage** (N2 and N3 lymph nodes) and with **higher tumor cellularity** (>25%) resulted in higher success rate for DNA NGS
- FDG-avidity on PET CT** and **>3 EBUS passes per lymph node** during the procedure **were not associated with NGS success**

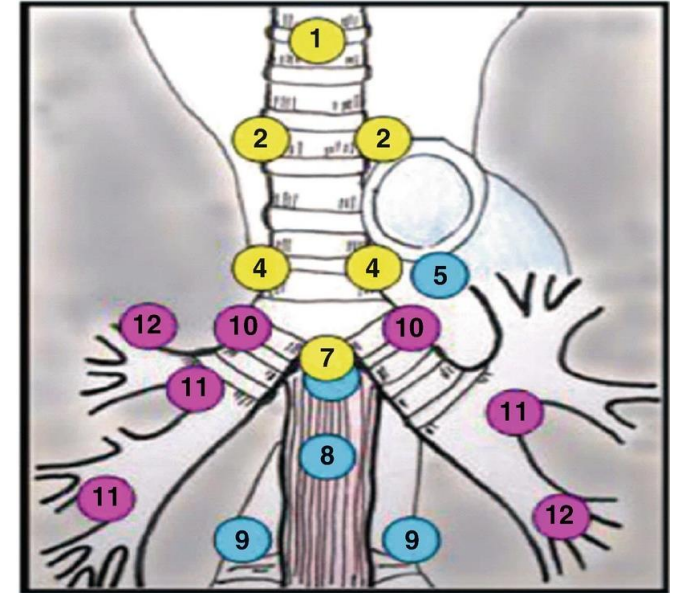
**TABLE**  
**Table 4**  
Univariable Logistic Regression Analysis of Imaging, Procedural and Cytological Characteristics Associated With Success run of NGS Using EBUS- TBNA Samples

	DNA NGS (N=226)		RNA NGS (N=106)	
	Success rate, % (No. of Success Run / total No.)	OR (95% CI)	Success rate, % (No. of Success Run / total No.)	OR (95% CI)
CT short-axis diameter, mm				
>5 to <10	92.0% (46/50)	1.3 (0.3 - 4.7)	90.5% (19/21)	1.4 (0.2 - 9.3)
>10 to <20	93.6% (88/94)	1.4 (0.3-6.0)	93.2% (41/44)	1.1 (0.2 - 6.9)
>20	94.3% (66/70)		90.9% (30/33)	
FDG avidity, SUV				
>2.5 to <5	84.6% (22/26)	2.0 (0.5 - 7.7)	92.3% (12/13)	0.8(0.1 - 8.5)
>5 to <10	91.7% (66/72)	6.2 (0.6 - 59.0)	90.6% (29/32)	/
>10 to <15	97.1% (34/35)	2 (0.3 - 12.1)	100.0% (17/17)	0.5 (0.0 - 5.8)
> 15	91.7% (22/24)		84.6% (11/13)	
Tissue source				
Primary tumor+N1	86.7% (52/60)	3.5 (1.2 - 10.0)	93.3% (28/30)	0.7 (0.1 - 3.4)
N2+N3	95.7% (157/164)		90.3% (65/72)	
Number of passes , n				
<3	94.3% (116/123)	0.8 (0.3 - 2.3)	87.7% (50/57)	3.2 (0.6 - 16.3)
>3	92.9% (92/99)		95.8% (46/48)	
Tumor cellularity, %				
10-25	88.2% (75/85)	3.4 (1.1 - 10.4)	86.4% (38/44)	3.1 (0.7 - 13.2)
>25	96.3% (129/134)		95.2% (59/62)	

# Additional benefit of **endoscopic ultrasound** with bronchoscope-guided fine needle aspiration to endobronchial ultrasound-guided transbronchial needle aspiration in the evaluation of lung cancer

2

- The overall pooled diagnostic yield <sup>1</sup>
  - ✓ EBUS-TBNA alone  
87% [95% CI: 79%-95%, I<sup>2</sup>=96.55%]
  - ✓ **Combined EBUS-TBNA/EUS-B-FNA**  
92% (95% CI: 85%-99%, I<sup>2</sup>=97.89%)
- Among the 832 patients in seven studies, additional diagnostic benefits of EUS-B-FNA were observed in 37 lesions.
- The **most common diagnosed lesion** was in station **4L** (n=10), followed by station **5** (n=8) and station **7-8** (n=8).



- EBUS-TBNA and Mediastinoscopy
- EBUS-TBNA
- EUS-FNA

1 J Thorac Dis. 2024 Aug 31;16(8):5063-5072.

2 Papanikolaou, N.I., et al. (eds) Imaging in Clinical Oncology. Springer, Cham. [https://doi.org/10.1007/978-3-319-68873-2\\_32](https://doi.org/10.1007/978-3-319-68873-2_32)

# Robotic

## The pooled diagnostic yield of RAB <sup>1</sup>

(20 studies, 1,779 lesions)

**84.3%** (95% confidence interval, 81.1–87.2%)

## Significant increase odds of diagnosis with RAB <sup>1</sup>

- Lesion size > 2 cm
- CT bronchus sign
- Concentric rEBUS view

## Complications <sup>1</sup>

- **The overall rates of pneumothorax 2.3%**
- need for tube thoracostomy 1.2%
- significant hemorrhage 0.5%

2

**Table 2** Comparison of the three robotic bronchoscopic platforms

	Monarch™ Robotic Endoscopy System	The Ion™ Robotic Endoluminal System	Galaxy System™
FDA approval	March 2018	February 2019	March 2023
Bronchoscope	4.2 mm inner bronchoscope, 6 mm outer sheath	3.5 mm outer diameter fully articulating catheter with a thin 1.8 mm removable visual probe	4.0 mm outer diameter
Working channel	2.1 mm	2 mm	2.1 mm
Navigation	Electromagnetic navigation along with peripheral vision and real time input from the micro-camera at the tip of the bronchoscope	Fiberoptic shape-sensing and peripheral vision	Electromagnetic navigation with digital tomosynthesis Tool-in-Lesion+ Technology™
Scope reprocessing	Yes	Yes	No (single use disposable scope)
Vision during biopsy	Yes	No	Yes

FDA, United States Food and Drug Administration.

3



Figure 1. Monarch™ platform (Images courtesy of Auris Health, Inc., Redwood City, CA, USA).

<sup>1</sup> Ann Am Thorac Soc Vol 20, No 12, pp 1801–1812, Dec 2023

<sup>2</sup> J Thorac Dis 2024;16(8):5422-54

<sup>3</sup> Life (Basel). 2023 Jan 28;13(2):354.

# Robotic

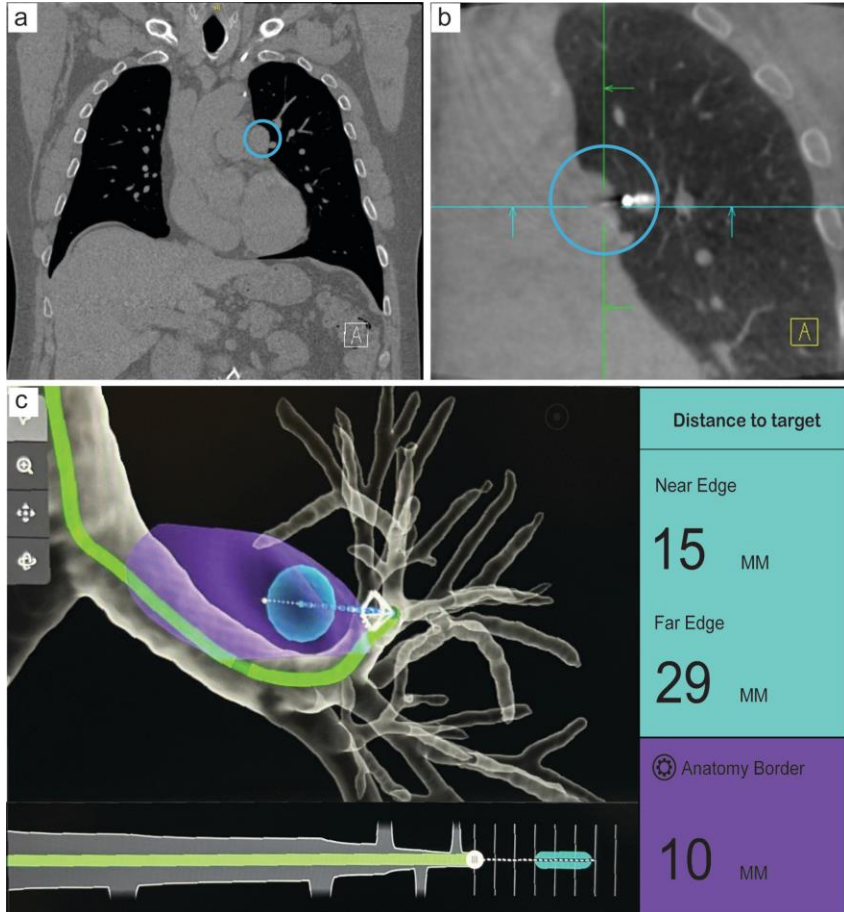
- Observational studies reporting ranges from **76% - 93%**
- Reported pooled diagnostic yield was **84.5%**
- Complication rates were 2.3% for pneumothorax

Table 3 Review of human studies using robotic bronchoscopy platforms

Author, year	Type of study	Patients (n)	Mean/median diameter (mm)	SD/IQR or range	Nodules sampled (n)	Diagnostic yield (%)
<b>Ion™ Robotic Endoluminal System</b>						
Fernandez-Bussy 2024, (12)	Retrospective	22	14	IQR, 1–2	46	86.9
Fernandez-Bussy 2024, (13)	Retrospective	27	16.6	IQR, 13.6–19.9	28	85.7
Abia-Trujillo 2024, (10)	Retrospective	173	12	IQR, 10–14	192	77.4
Abia-Trujillo 2023, (11)	Retrospective	22	18	IQR, 14–20	23	88.9
Gupta 2023, (14)	Abstract prospective	240	16	IQR, 1.1–25	265	76
Hammad Altaq 2023, (15)	Retrospective	42	12	IQR, 10–18	42	88.1
Low 2023, (16)	Retrospective	133	19	IQR, 14–28	143	77
Chambers 2023, (17)	Retrospective	75	20	IQR, 13–35	79	77.2
Styvoky 2022, (9)	Retrospective	198	22.6	SD: 13.3	209	91.4
Oberg 2022, (18)	Retrospective	112	22	IQR, 13–34.3	120	90
Yu Lee-Mateus 2023, (19)	Retrospective	113	18	IQR, 13–27	113	87.6
Reisenauer 2022, (20)	Prospective	30	17.5	SD: 6.8	30	93.3
Tavakoli 2022, (21)	Abstract retrospective	65	21.2	SD: NA	65	86.2
Kalchiem-Dekel 2022, (8)	Prospective	130	18	IQR, 13–27	159	81.7
Ost 2021(22)	Abstract prospective	155	17	SD: 5.5	155	83
Benn 2021, (7)	Prospective	52	19.6	SD: 10.9	59	83
Ross 2021, (23)	Abstract prospective	45	14	Range, 5–44	58	89
Bawek 2021, (24)	Abstract retrospective	76	17	Range, 6–70	76	92
Ghosh 2021, (25)	Abstract retrospective	95	19	Range, 7–69	103	79.6
Pritchett 2021, (26)	Abstract retrospective	192	15	IQR, 10–21	230	92.2
Folch 2020, (27)	Abstract prospective	129	18.4	SD: 5.44	129	80.6
Fielding 2019, (6)	Prospective	29	12.2	SD: 4.2	29	79.3
<b>Monarch™ Robotic Endoscopy System</b>						
Agrawal 2023, (28)	Retrospective	124	24	IQR, 13–30	124	77
Khan 2023, (29)	Retrospective	264	19.3	Range, 32–72.5	264	85.2
Manley 2023, (30)	Prospective	20	14.5	Range, 8–28	20	80
Hedstrom 2022, (31)	Abstract retrospective	45	16.9	Range, 4–35	45	91
Cumbo-Nacheli 2022, (32)	Retrospective	20	22	SD: 7	20	90
Chen 2021, (33)	Prospective	54	23.2	SD: 10.8	54	82.5
Ekeke 2021, (34)	Retrospective	25	NA	NA	25	96
Chaddha 2019, (35)	Retrospective	165	25	SD: 15	167	77
Rojas-Solano 2018, (36)	Prospective	15	26	Range, 10–63	15	86.7
<b>Galaxy™ Robotic Endoscopy System</b>						
Saghaie 2023, (37)	Abstract Prospective	14	20.5	Range, 10–34	15	93

SD, standard deviation; IQR, interquartile range; NA, not available.

# Staging **Aortopulmonary Lymph Nodes** With Robotic-Assisted Bronchoscopy



Ion Endoluminal System (Intuitive Surgical, Sunnyvale, CA, USA) shape-sensing Robotic-assisted bronchoscopy (ssRAB) to navigate

We initially used a 23-gauge needle to cross the mediastinal pleura and obtain a biopsy of the subaortic lymph node. Subsequently, we used a 21-gauge needle to increase the sample size.

Short-axis diameter of 1.8 cm

**A biopsy of the station 5 lymph node** confirmed  
✓ a relapse of mantle cell lymphoma

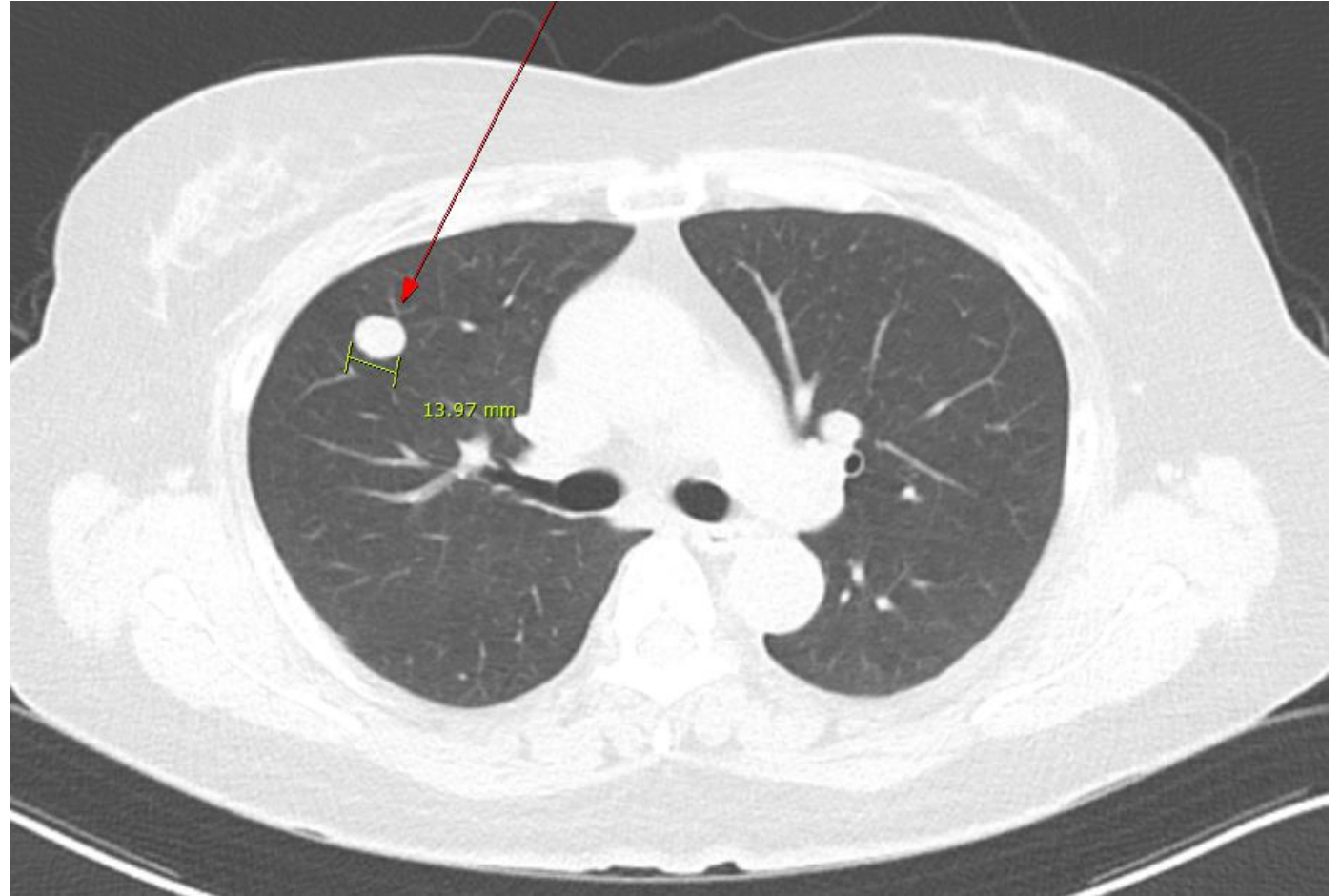
# Cases

1. RUL 11mm solid nodule; Bronchus sign (-)
2. RUL 11mm solid nodule; Bronchus sign (-)
3. RML 24mm part solid nodule; Bronchus sign (+) Pulmonary a (+)
4. RML 15mm solid nodule; Bronchus sign (+) Emphysema Large air cyst
5. LLL 27mm solid nodule; Bronchus sign (+) Descending aorta adj (+), NGS
6. LUL 29mm Part solid nodule; Bronchus sign (+) Pulmonary a (+)
7. LUL non-diagnostic mass
8. LUL 20mm subpleural Solid nodule; Bronchus sign (-)
9. Mediastinal LN biopsy with EBUS TBNA, central airway necrosis

# Case

RUL 11mm nodule  
Bronchus sign (-)

- 58/F
- C/C
- Abnormal CT image
- # HTN
- # Panic disorder
- 흡연력 ex-smoker 2015., 0.5P \* 25yrs
- 직업력 주부

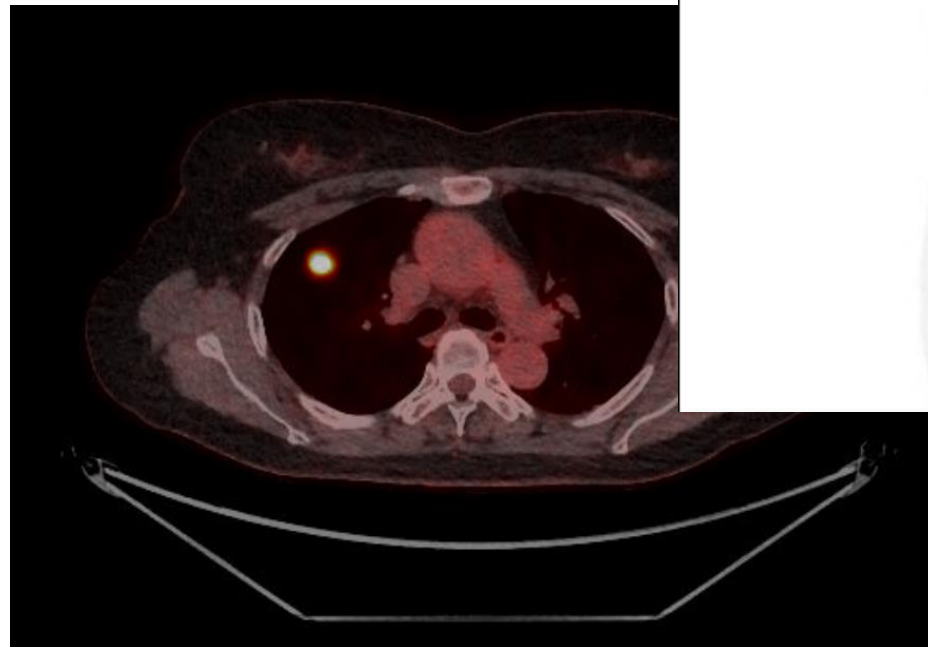


# CT guided lung biopsy



ADDITIONAL DIAGNOSIS:  
Lung, right upper, CT guided lung biopsy:  
Consistent with small cell carcinoma

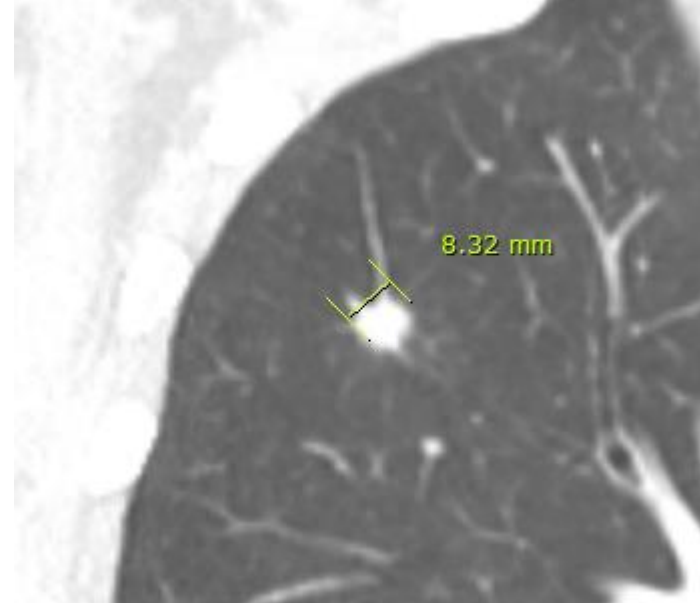
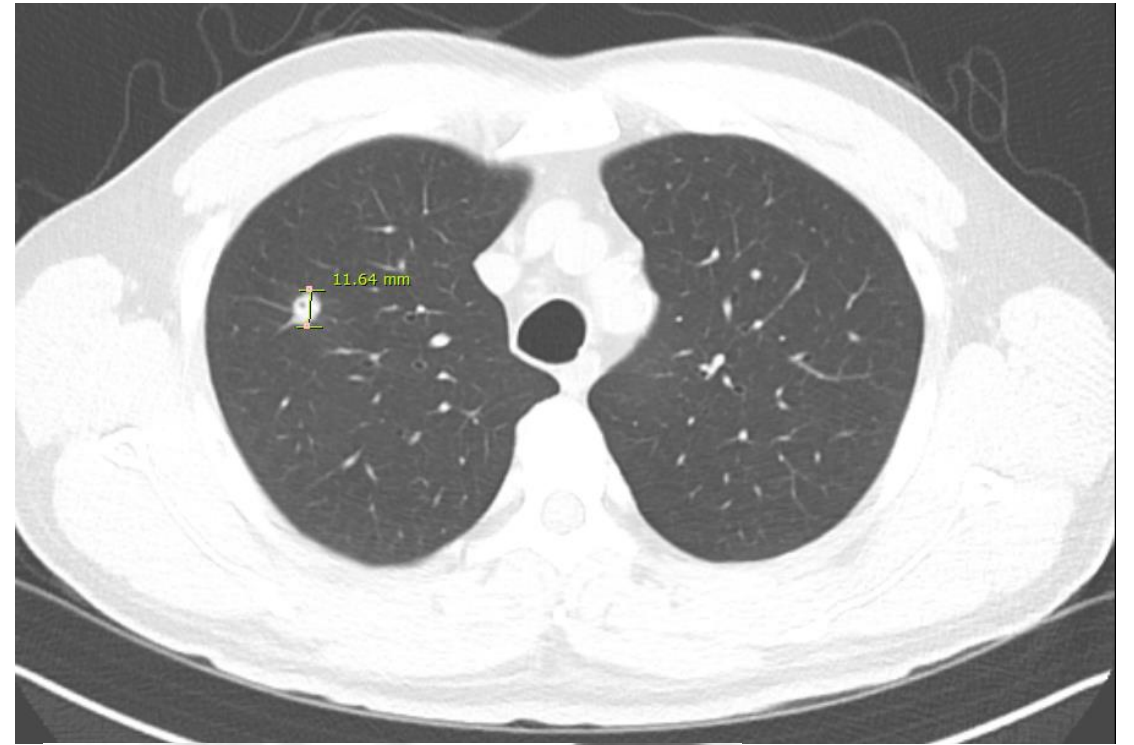
IMMUNOHISTOCHEMISTRY:  
CK-pan (+), TTF-1 (-), CD56 (+, weak),  
Synaptophysin (+), INSM1 (+), P63 (-)

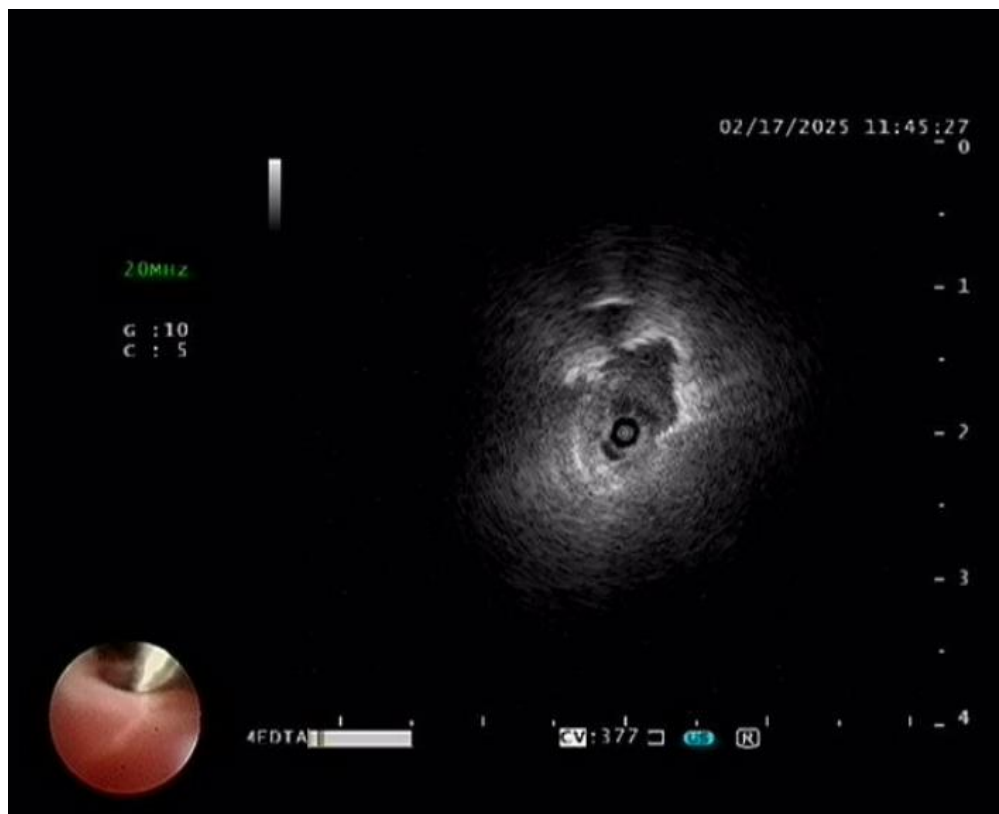


# Case

RUL 11mm nodule  
Bronchus sign (-)

- 62/M
- C/C
- Abnormal CT image
- # RUL nodule
- 흡연력 non-smoker
- 직업력 트럭운전





ADDITIONAL DIAGNOSIS:

Lung, bronchus, right upper, R-EBUS guided transbronchial lung biopsy:  
Adenocarcinoma

NOTE:

정확한 진단에 필요하며 면역조직화학 검사(TTF-1, Napsin A, Claudin18)를 병리과에서 오더 후 미리 시행하였으니, 본 검사에 대한 수납 안내 부탁드립니다.

IMMUNOHISTOCHEMISTRY:

TTF-1 (+), Napsin A (+), Claudin18 (-)

EGFR 유전자돌연변이검사(PNA기반의 실시간 PCR PANAMutyper):

RESULTS: EGFR MUTANT DETECTED

Exon 21, L858R- MUTANT DETECTED

Exon 21, p.L858R (c.2573T>G, Cosmic No. 6224)

Exon 21, p.L858R (c.2573\_2574T>GT, Cosmic No. 12429)

Exon 20, S768I- MUTANT DETECTED

Exon 20, p.S768I (c.2303G>T, Cosmic No. 6241)

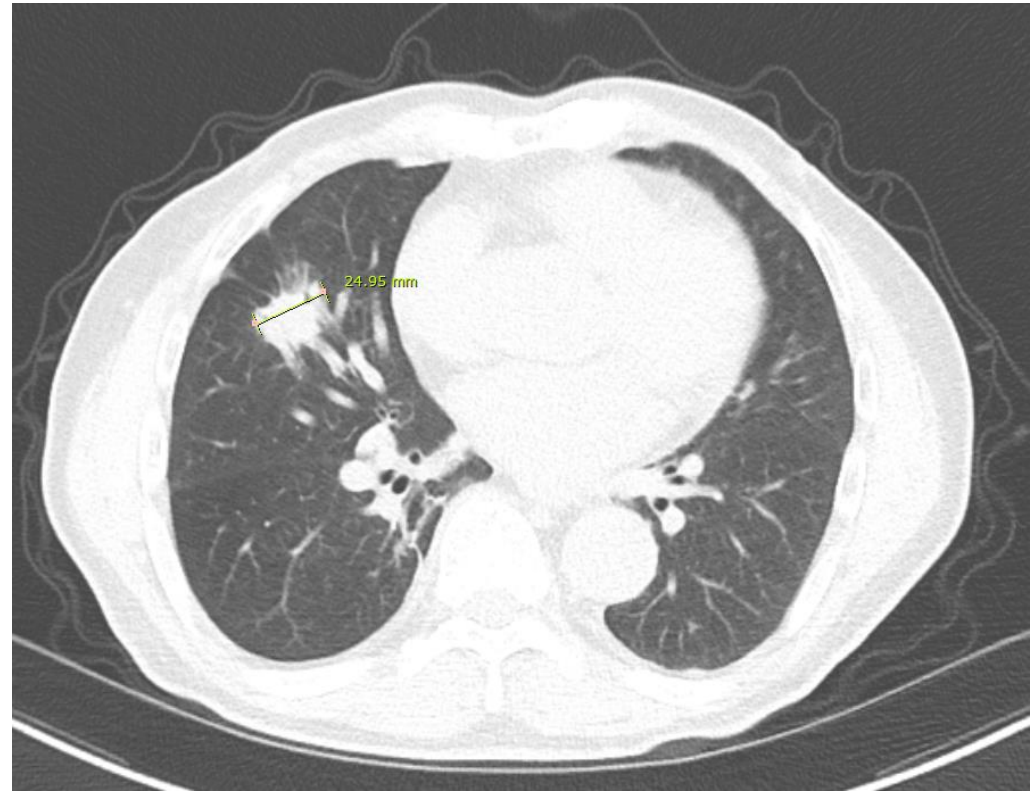
Mutation Type

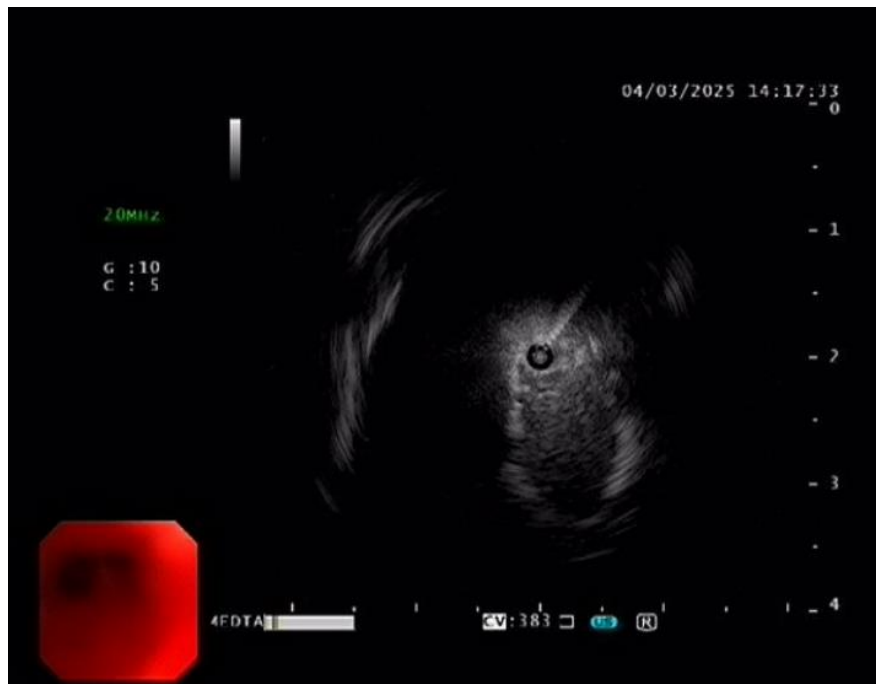
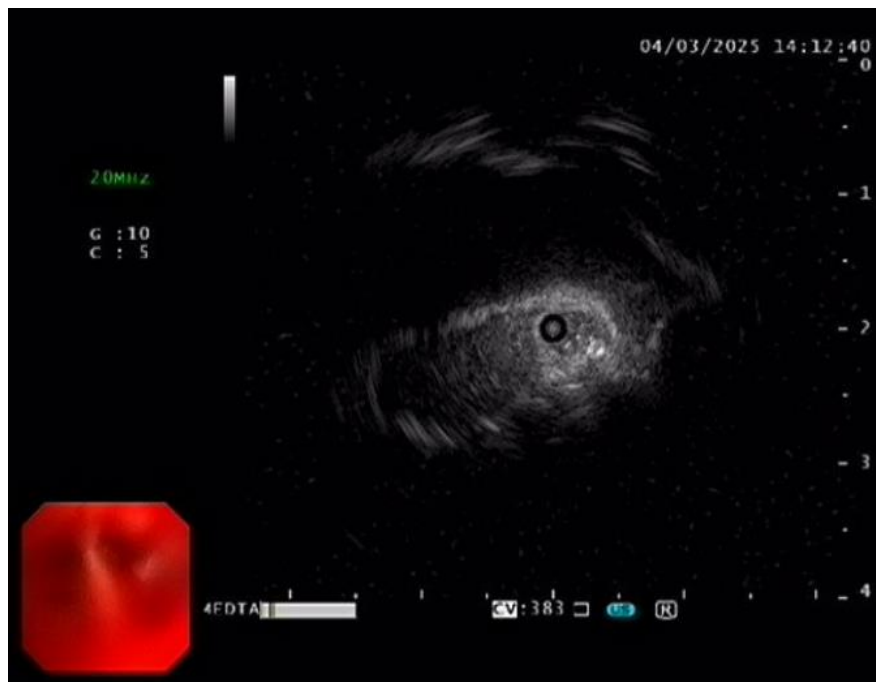
Exon	Codon	Mutation
18	719	NOT DETECTED
19	745-753	NOT DETECTED
20	768	DETECTED
20	769-775	NOT DETECTED
20	790	NOT DETECTED
21	858	DETECTED
21	861	NOT DETECTED

# Case

RML 24mm nodule  
Bronchus sign (+)  
Pulmonary a (+)

- 78/M
- # Lung nodule
- # CKD
- C/C CT abnormality
- 흡연력 ex-smoker 1980 . 1P \* 4Yr
- 음주력 none
- 직업력 풍강 금속 30년 탄약 만드는데곳
- Tb hx none





채취부위 : RML  
수술명 : R-EBUS TBLC  
임상진단 : R/O lung cancer R/O pneumoconiosis

-----  
DIAGNOSIS:

Lung, bronchus, right middle, R-EBUS guided transbronchial lung biopsy:  
Atypical micropapillary, papillary and glandular structure,  
consistent with adenocarcinoma.

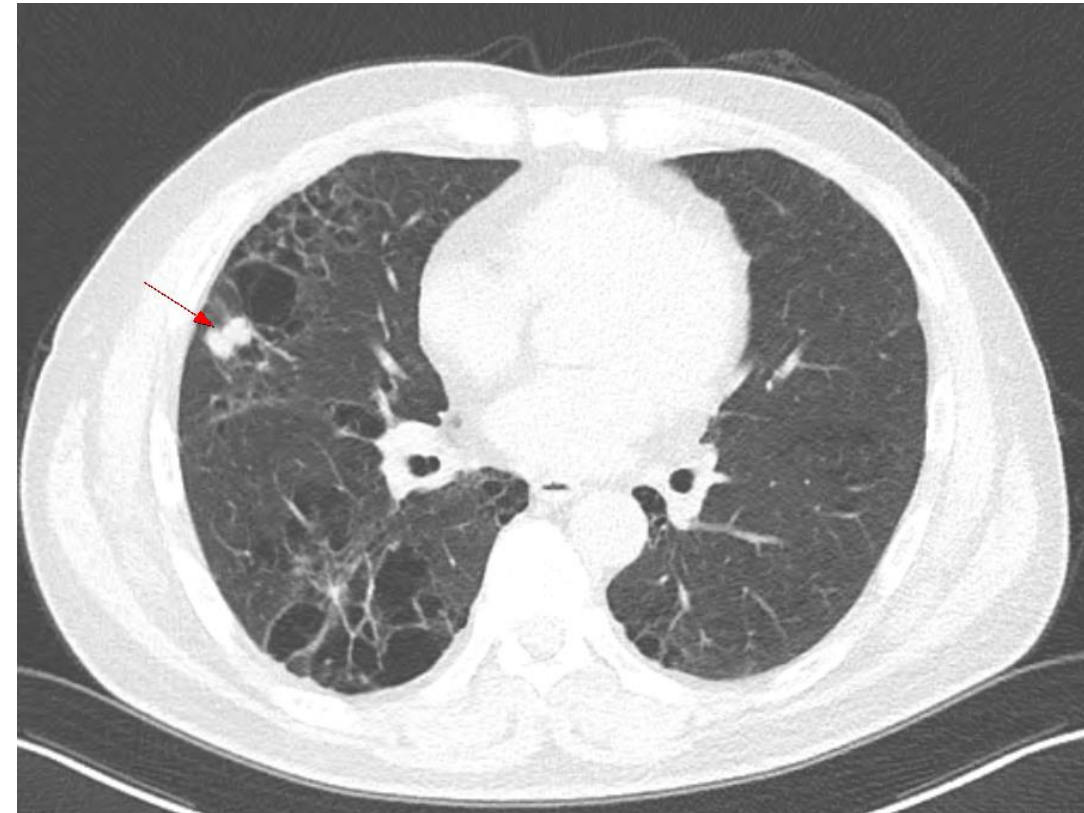
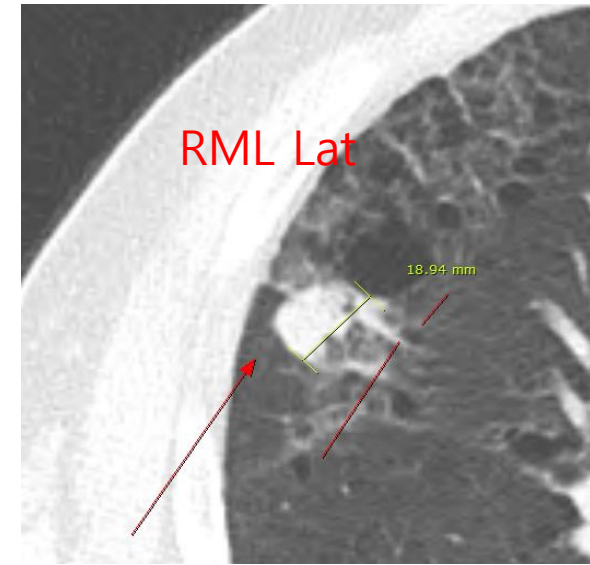
GROSS:

Specimen status: Formalin fixed  
Specimen: Pale tan tissue, 5 pieces, 0.8 x 0.4 x 0.3 cm in aggregates

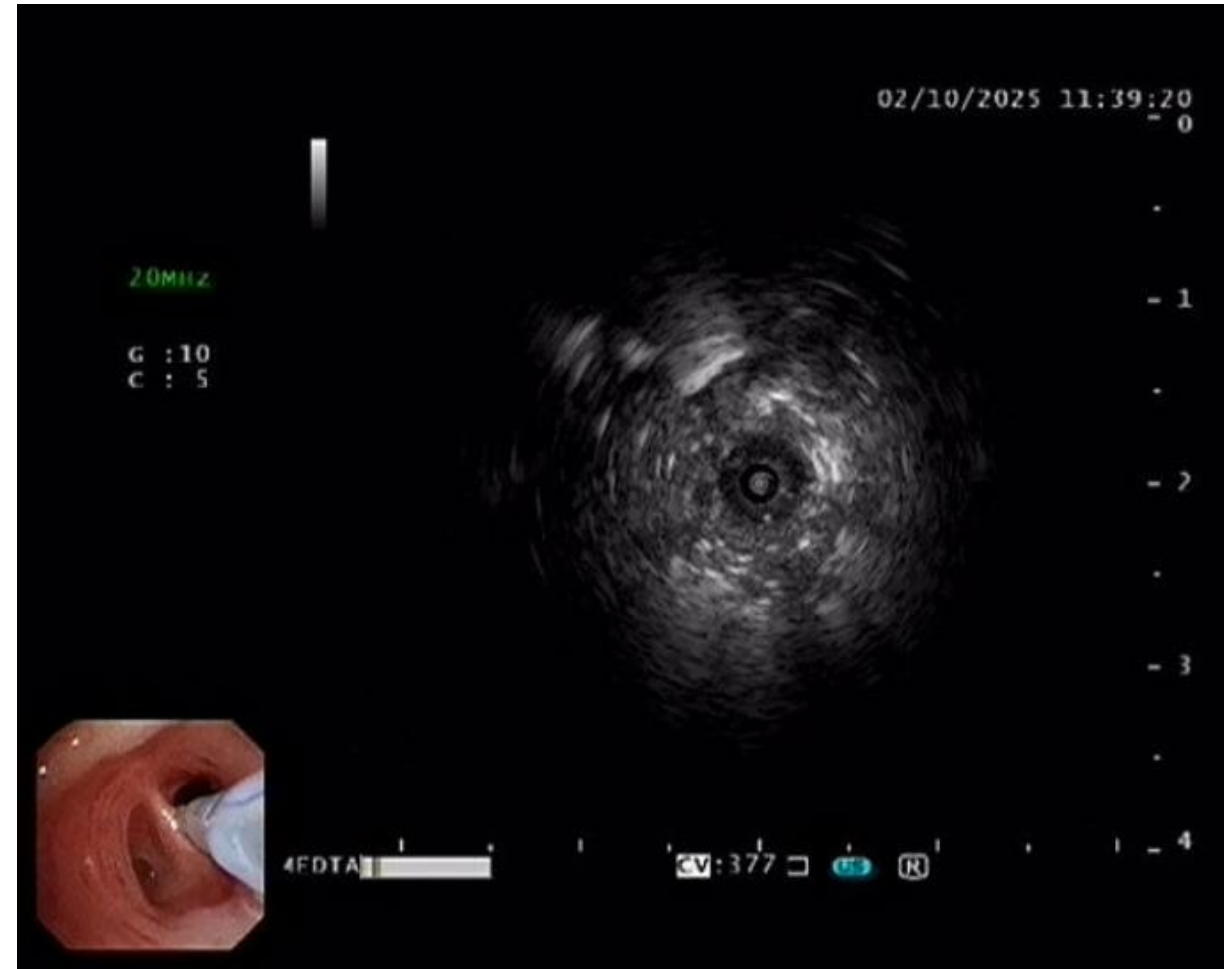
# Case

- 64/M
- C/C Chest CT image abnormality
- 흡연력 ex-smoker 2024.02. 1P \* 40Yr
- 직업력 섬유공장 30Yrs
- Tb hx none

RML 15mm nodule  
Bronchus sign (+)  
Emphysema  
Large air cyst



# Radial probe EBUS



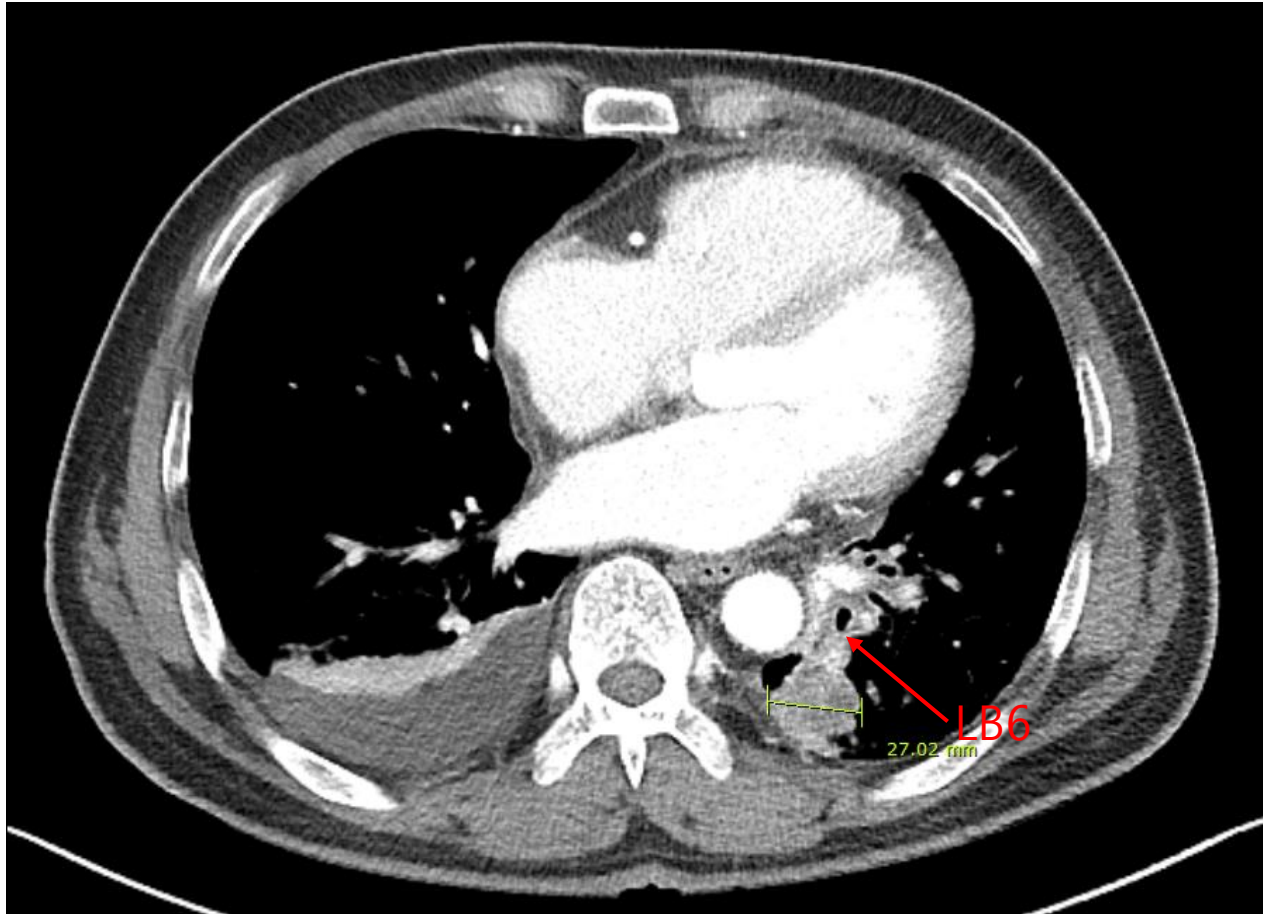
# Case

- 46/M
- C/C dyspnea
- 흡연력 Never smoker
- 음주력 Social
- 직업력 자영업
- Tb hx none



LLL 27mm nodule  
Bronchus sign (+) Descending aorta adj (+)

# Chest CT



Pericardiocentesis done  
Right diagnostic thoracentesis done  
Exudate and Tuberculosis less likely  
Cytology pending

타과회신 영상학과 (2025-01-06)

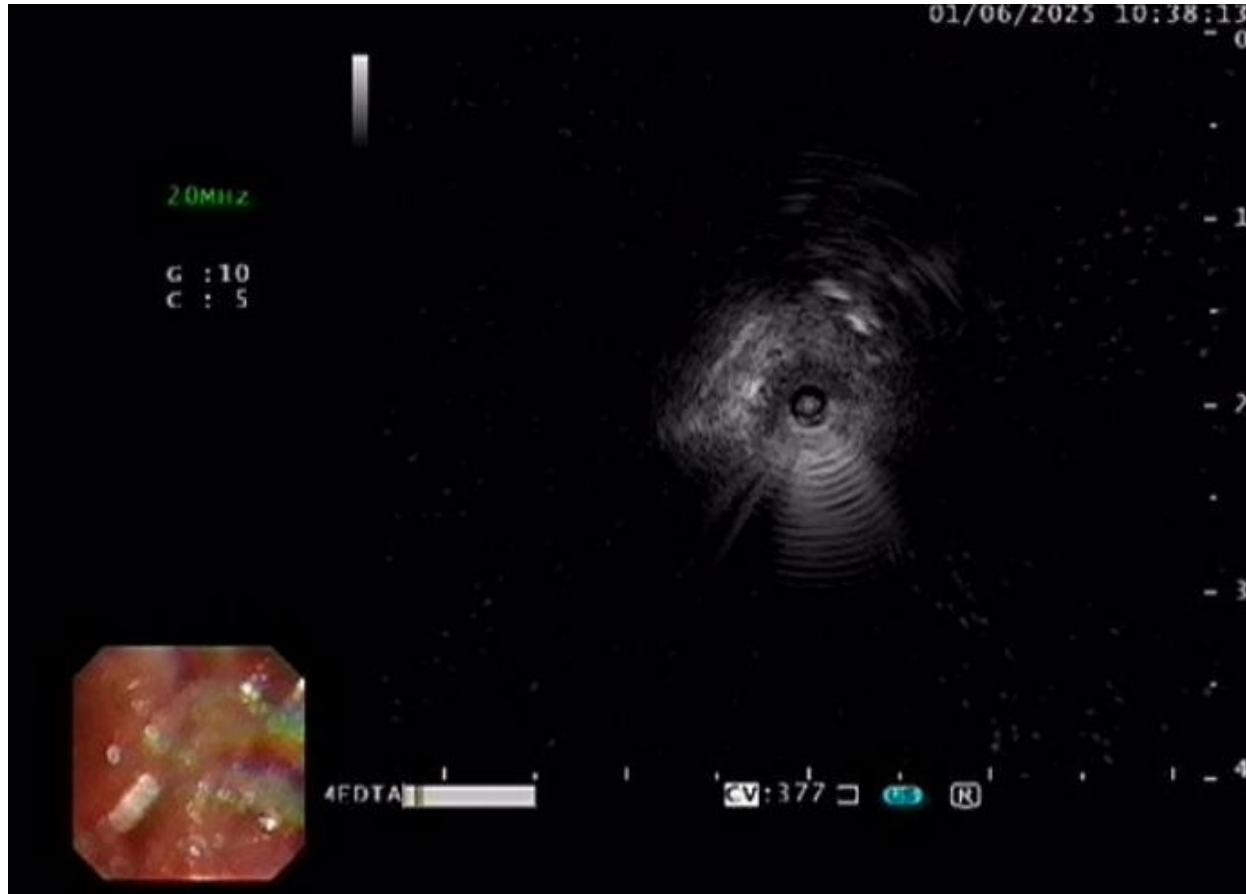
회신내용

의뢰 감사드립니다.

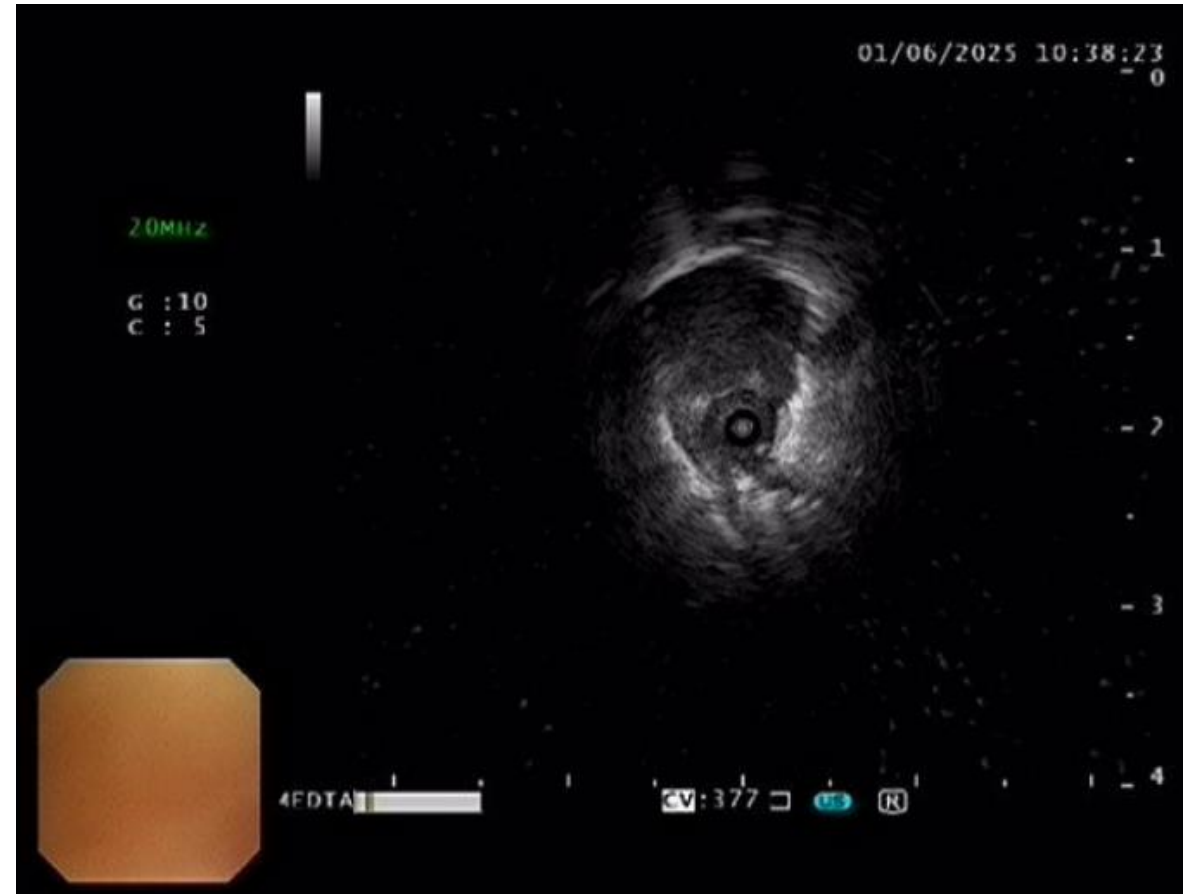
바로 인접하여 LLL posterior basal segmental artery 가 위치하여 시술하기 굉장히 위험한 병변으로 판단됩니다. 필요하시면 시도하겠습니다. 그러나 시술 진행 중 위험도가 많이 높아 보인다면 검체 얻지 못하고 종료할 수 있겠습니다.

감사합니다.

# Bronchoscopy R-EBUS GS TBLC



처음 R-EBUS Image LB6 sub division



TBLC #1 후 진입 R-EBUS Image LB6 sub division  
R-EBUS within dense sign -> TBLC 추가 #5 진행

# Diagnosis

- # NSCLC AD T1cNxM1b (Malignant pericardial effusion, brain single mets)
- EGFR wild **ALK (+++)** **PDL1 SP263 10%** KRAS neg BRAF neg ROS1 neg MET neg

## ADDITIONAL DIAGNOSIS:

Lung, bronchus, left lower, radial EBUS guided transbronchial lung biopsy:  
Non-small cell carcinoma,  
consistent with adenocarcinoma with squamoid differentiation

## IMMUNOHISTOCHEMISTRY:

TTF-1 (+), P63 (+, partial)

## DIAGNOSIS:

Body fluid, cell block:  
Malignant cells present

## SPECIMEN ADEQUACY:

Satisfactory for evaluation

## DIAGNOSIS:

Pleural fluid, cell block:  
Inflammation

## SPECIMEN ADEQUACY:

Satisfactory for evaluation



- 1) Lung cancer in LLL lung, suggestive.
- 2) Several hypermetabolic LNs at the mediastinal 1L, 2R, 4R/L and 12L.  
Reactive LN vs. metastatic LN
- 3) A few small hypermetabolic nodular lesions at the pericardium.  
R/O metastasis Rec) radiologic correlation

# NGS results

- EML4 ALK fusion detected



## 암종류: 비소세포성 폐암

<table border="1"> <tr> <td>목차</td> <td>쪽</td> </tr> <tr> <td>변이 세부 정보</td> <td>2</td> </tr> <tr> <td>관련 치료법 요약</td> <td>2</td> </tr> <tr> <td>바이오마커 설명</td> <td>4</td> </tr> </table>	목차	쪽	변이 세부 정보	2	관련 치료법 요약	2	바이오마커 설명	4	<b>보고서 하이라이트</b> 2 관련 생물표지자 6 가능한 치료법 56 임상 시험
목차	쪽								
변이 세부 정보	2								
관련 치료법 요약	2								
바이오마커 설명	4								

## 비소세포성 폐암 관련 검사 결과

유전자	검사 결과	유전자	검사 결과
ALK	<b>EML4::ALK fusion</b>	NTRK1	미검출
BRAF	미검출	NTRK2	미검출
EGFR	미검출	NTRK3	미검출
ERBB2	미검출	RET	미검출
KRAS	미검출	ROS1	미검출
MET	미검출		

## 기타 결과

CDKN2A deletion, Tumor Mutational Burden

## HRR 상세 내역

유전자/유전자 변이	검사 결과
LOH 비율	<b>34.78%</b>
BRCA1	CNV, CN: 1.0
BRCA1	LOH, 17q21.31(41197602-41276123)x1
BRCA2	LOH, 13q13.1(32890491-32972932)x2
BRIP1	CNV, CN: 1.0
BRIP1	LOH, 17q23.2(59760627-59938976)x1
CDK12	CNV, CN: 1.0
CDK12	LOH, 17q12(37618286-37687611)x1
RAD51D	CNV, CN: 1.0
RAD51D	LOH, 17q12(33427950-33446720)x1

Homologous recombination repair (HRR) genes were defined from published evidence in relevant therapies, clinical guidelines, as well as clinical trials, and include - BRCA1, BRCA2, ATM, BARD1, BRIP1, CDK12, CHEK1, CHEK2, FANCL, PALB2, RAD51B, RAD51C, RAD51D, and RAD54L.

## 관련 생물표지자

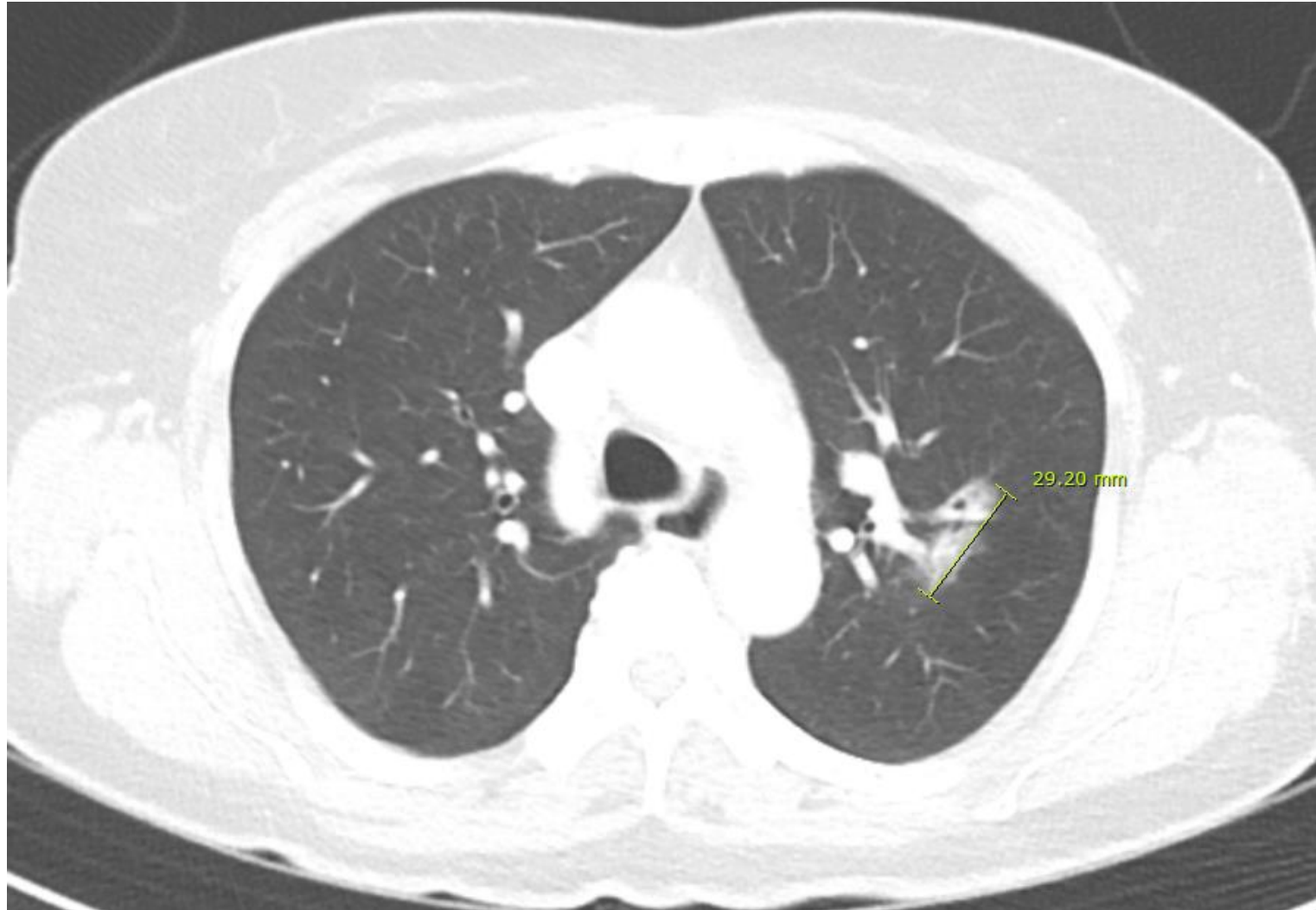
계층	유전적 변이	관련 치료법 (이 암 유형에서)	관련 치료법 (다른 암 유형에서)	임상 시험
IA	EML4::ALK fusion	alectinib <sup>1,2</sup> brigatinib <sup>1,2</sup>	crizotinib <sup>1</sup> alectinib	51

관련 치료법에 포함된 공개 데이터 소스: FDA<sup>1</sup>, NCCN, EMA<sup>2</sup>, ESMO  
 계층 참조: Li et al. Standards and Guidelines for the Interpretation and Reporting of Sequence Variants in Cancer: A Joint Consensus Recommendation of the Association for Molecular Pathology, American Society of Clinical Oncology, and College of American Pathologists. J Mol Diagn. 2017 Jan;19(1):4-23.

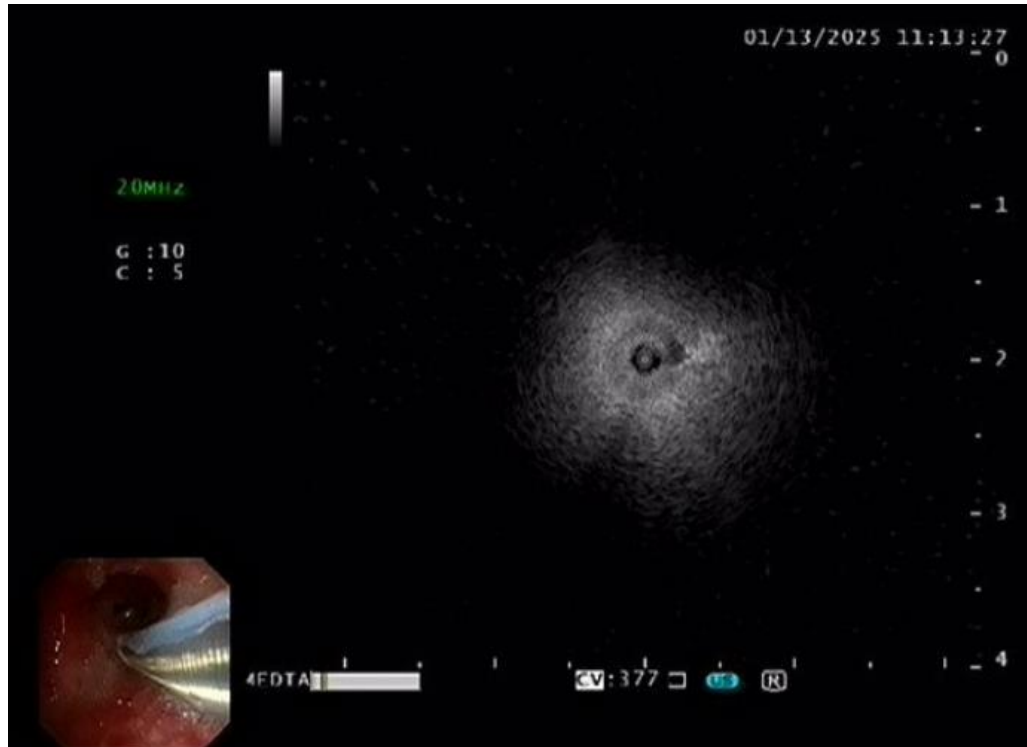
# Case

- 68/F
- C/C CT abnormality
- # HTN
- # DM
- # Dyslipidemia
- 흡연력 non-smoker
- 음주력 non-alcoholics
- 직업력 유통 마트에 종사
- Tb hx none

LUL 29mm  
Part solid nodule  
Bronchus sign (+)  
Pulmonary a (+)



# Consider biopsy before upfront surgery

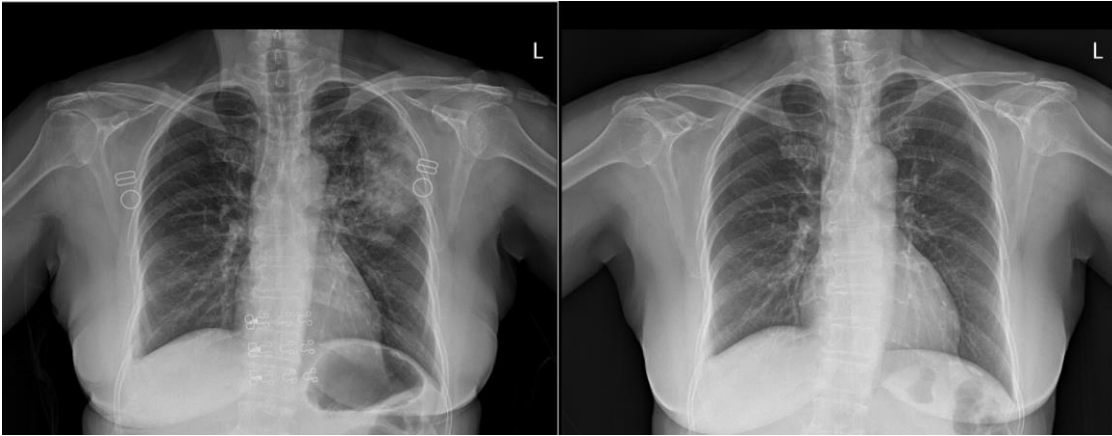


In significant lesion -> LUL subdivision target

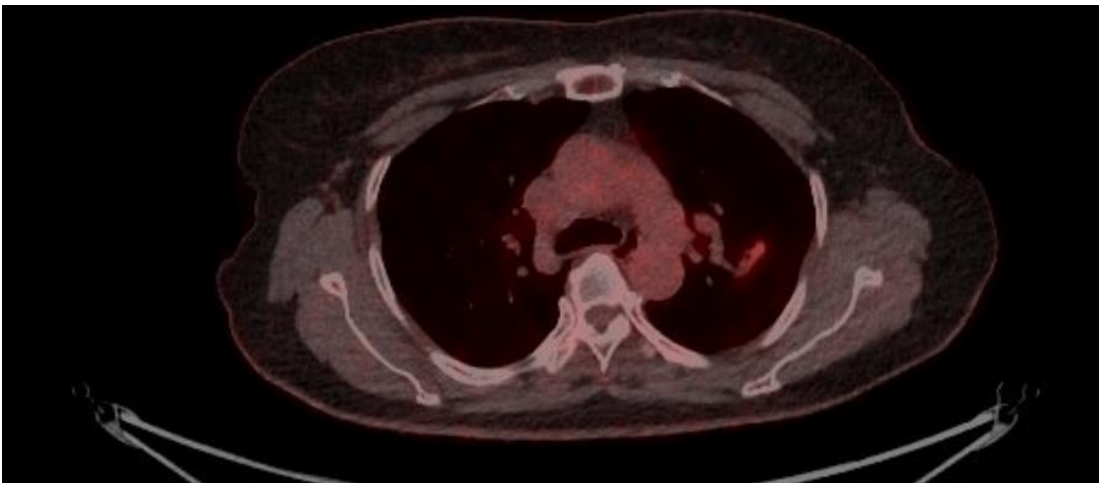


LUL subdivision target -> LUL Blizzard sign  
Forgaty balloon back-up GS TBLC #2  
Grade 3 bleeding -> stop procedure d/t bleeding

# Diagnosis



Post biopsy CXR LULF aspirated blood



DIAGNOSIS:  
Lung, bronchus, left upper, transbronchial lung biopsy:  
Non-small cell carcinoma,  
consistent with adenocarcinoma

GROSS:  
Specimen status: Formalin fixed  
Specimen: Pale tan tissue, 2 pieces, 0.6 x 0.5 x 0.2 cm in aggregates

# NSCLC AD cT1N0M0 cStage 1A3  
EGFRm L858R ALK neg PDL1 SP263 2%  
KRAS neg BRAF neg ROS1 neg

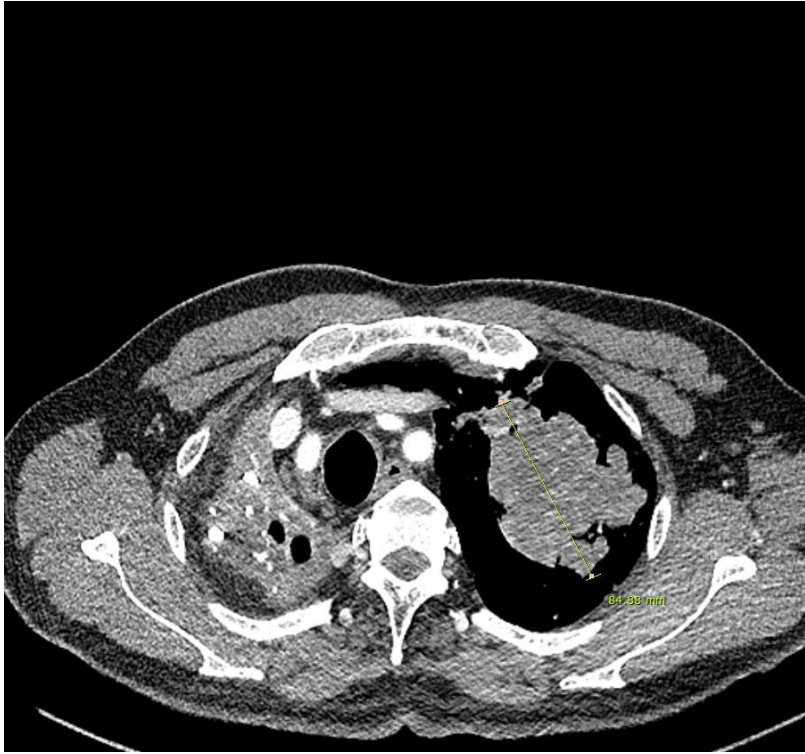
# Case

- 74/M
- C/C lung mass
- 흡연력 ex-smoker 2015 1P \* 30Yr
- 음주력 social
- 직업력 덤프트럭 운전
- Tb hx 2011. 완료



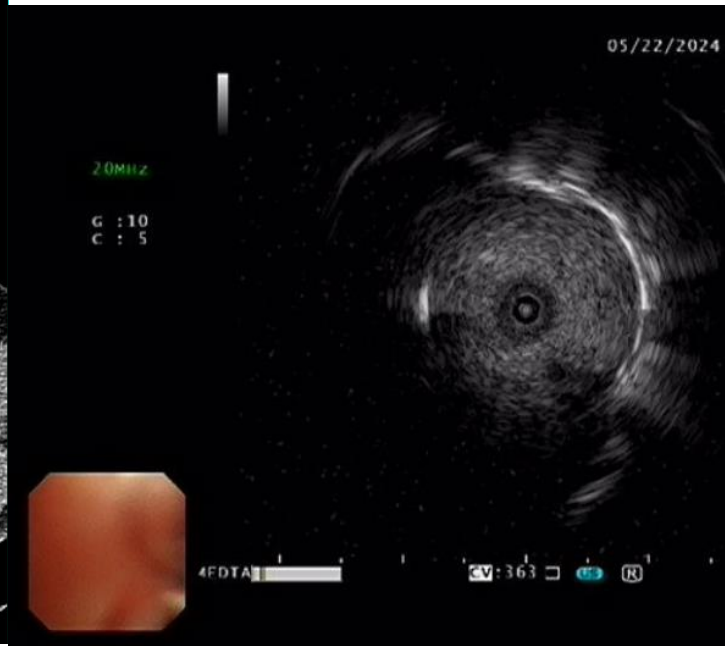
# Chest image

2024.05.10

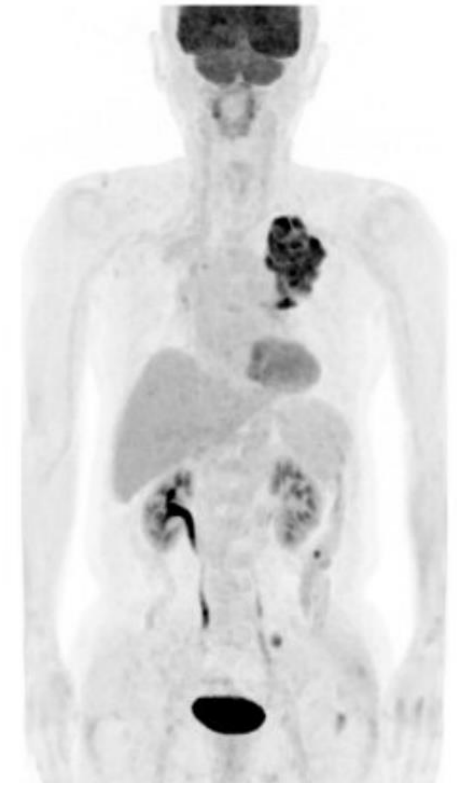


2024.05.14

Radial EBUS CRYO biopsy  
#5 core



2024.05.17



# Diagnosis

## 1. 처음 조직검사 TBLB via forceps:

### ADDITIONAL DIAGNOSIS: 2024.05.14

- Lung, bronchus, bronchoscopic biopsy:
- A few atypical cells, favor carcinoma (see NOTE)
- **ADDITIONAL NOTE:**
- 조직의 양이 적고, 면역 발현이 다양하여 (Adenocarcinoma의 가능성이 있으나) 정확한 진단이 어렵습니다.
- 정확한 진단을 위한 재생검을 권유 드립니다.
- **ADDITIONAL IMMUNOHISTOCHEMISTRY:**
- CK7 (+, focal), CD56 (-), Synaptophysin (-)

## 2. CRYO biopsy (rebiopsy):

### ADDITIONAL DIAGNOSIS: 2024.05.24 Rebiopsy

- Lung, bronchus, left upper, radial EBUS guided transbronchial lung biopsy:
- Adenocarcinoma, primary in lung
- **IMMUNOHISTOCHEMISTRY:**
- CK7 (+), TTF-1 (+, partial), Napsin A (+, weak), CDX2 (-)

EGFR 유전자돌연변이검사(PNA기반의 실시간 PCR PANAMutyper):

RESULTS: Wild

KRAS 동반진단검사(Lung)(실시간중합효소연쇄반응법):

RESULTS: Not DETECTED

(110%)ROS1 Fusion(실시간 PCR)(의뢰) :

RESULTS: Negative - ROS1 gene fusion ABSENT(스캔이미지 참조)

(110%)MET amplification(형광동소교잡반응) (의뢰) :

RESULTS: MET gene amplification Absent (스캔이미지 참조)

RESULTS:

ALK 동반진단: Negative

PD-L1(SP263): Negative (0 %)

선별(50)(110%)NGS기반 유전자패널검사(비소세포성폐선암23종,Level 1 + RNA Fusion)(의뢰):

RESULTS: (스캔이미지 참조)

Sample Adequacy: Adequate

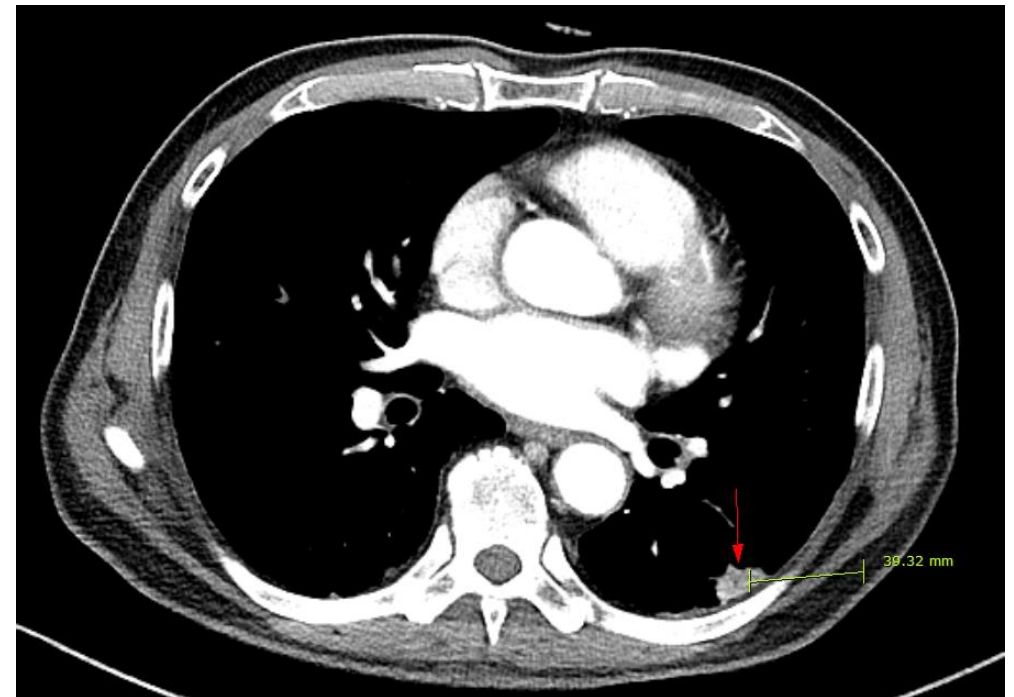
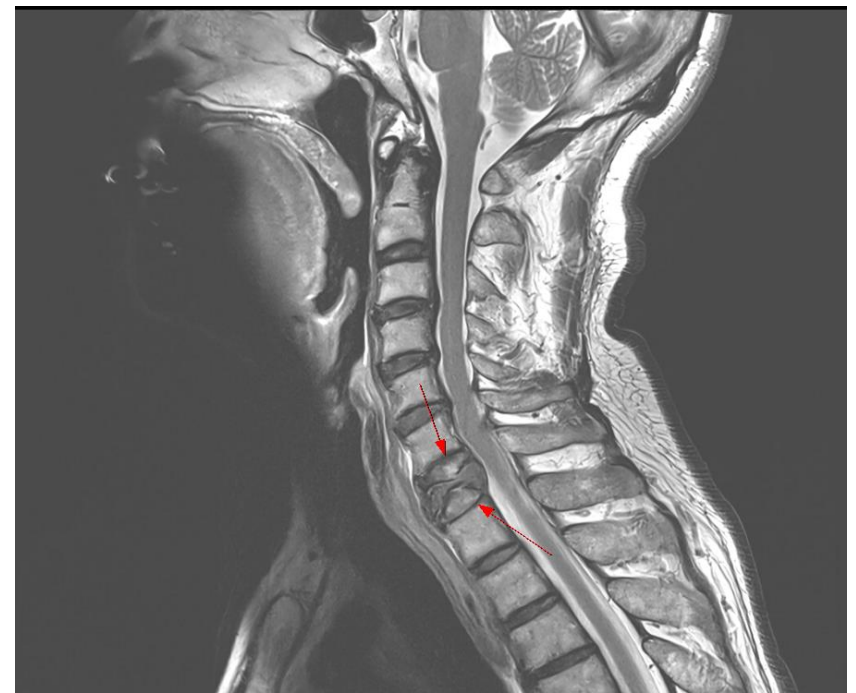
비소세포성 폐암 관련 검사 결과

EGFR 미검출  
EGFR 미검출  
BRAF 미검출  
ROS1 미검출  
RET 미검출

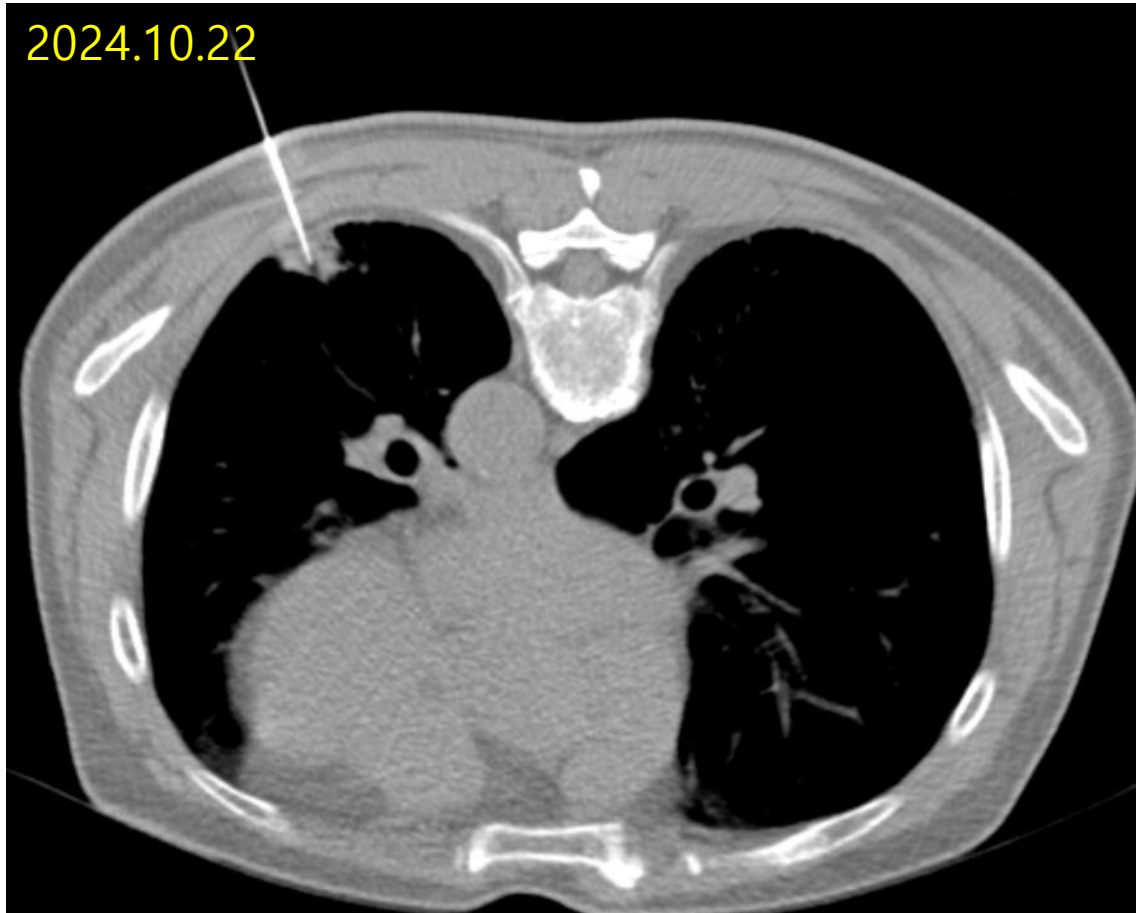
# Case

- 74/M
- C/C Neck pain
- 흡연력 current smoker 0.5P \* 50Yr
- 음주력 heavy
- 직업력 지게차 운전
- Tb hx non

LUL 20mm  
Solid nodule  
Bronchus sign (-)



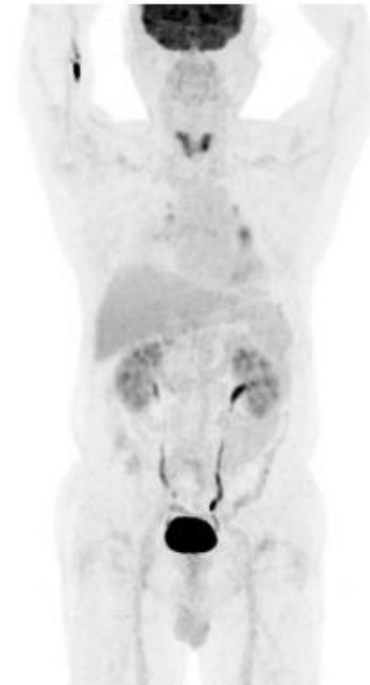
# Percutaneous biopsy



ADDITIONAL DIAGNOSIS:  
Lung, left lower, CT guided lung biopsy:  
Non-small cell carcinoma, consisten with adenocarcinoma

IMMUNOHISTOCHEMISTRY:  
CK7 (+), TTF-1 (+), Napsin A (+), P63 (-)

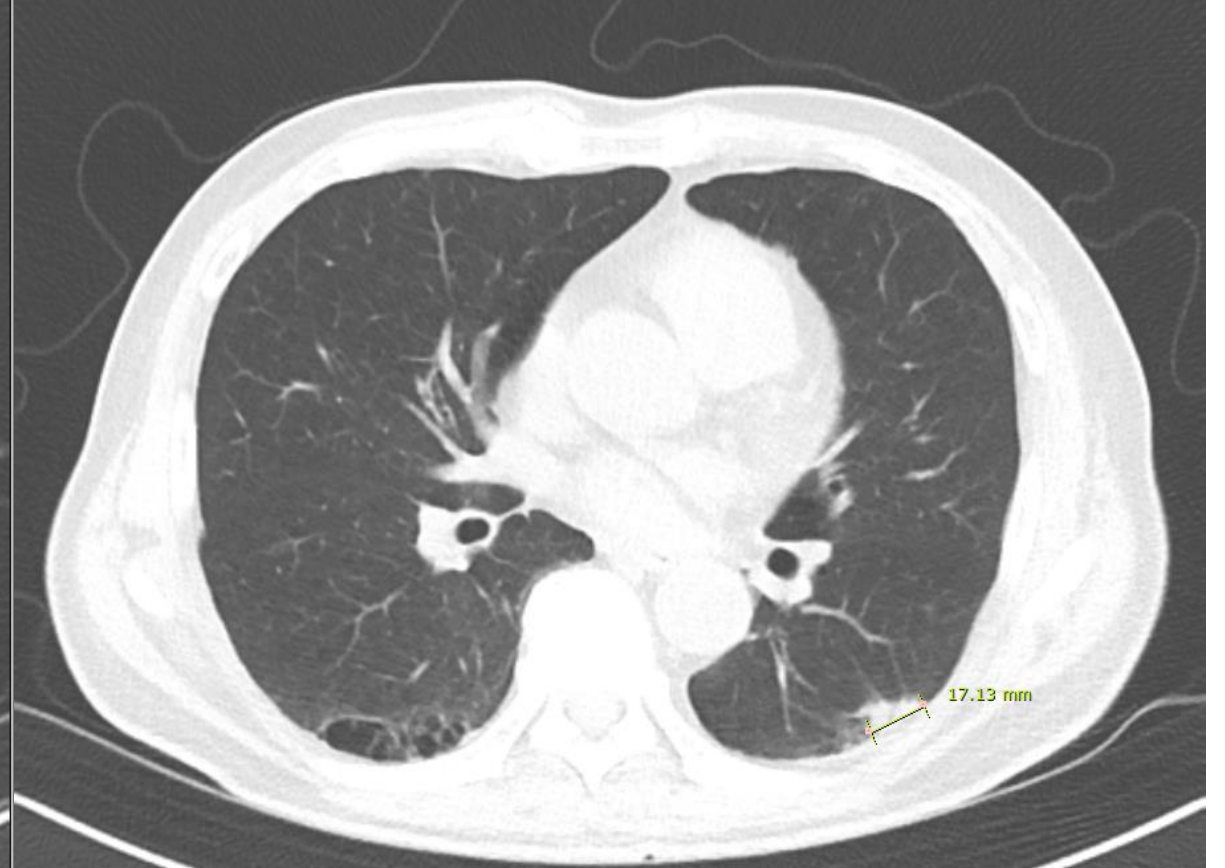
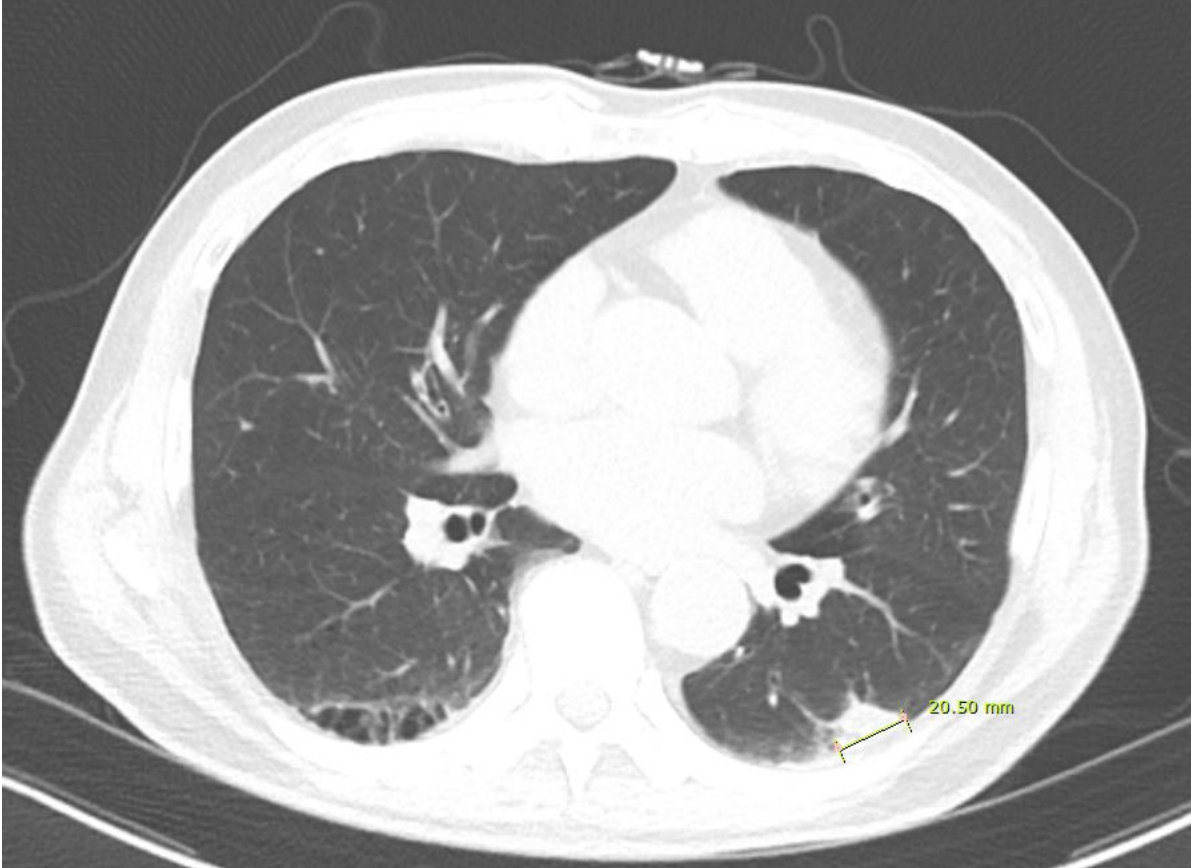
# Lung cancer, adenoca, LLL, cT2aN0M1b  
EGFRw ALK negative PD-L1(SP263): Positive (30 %)  
추가 검사 불가합니다.



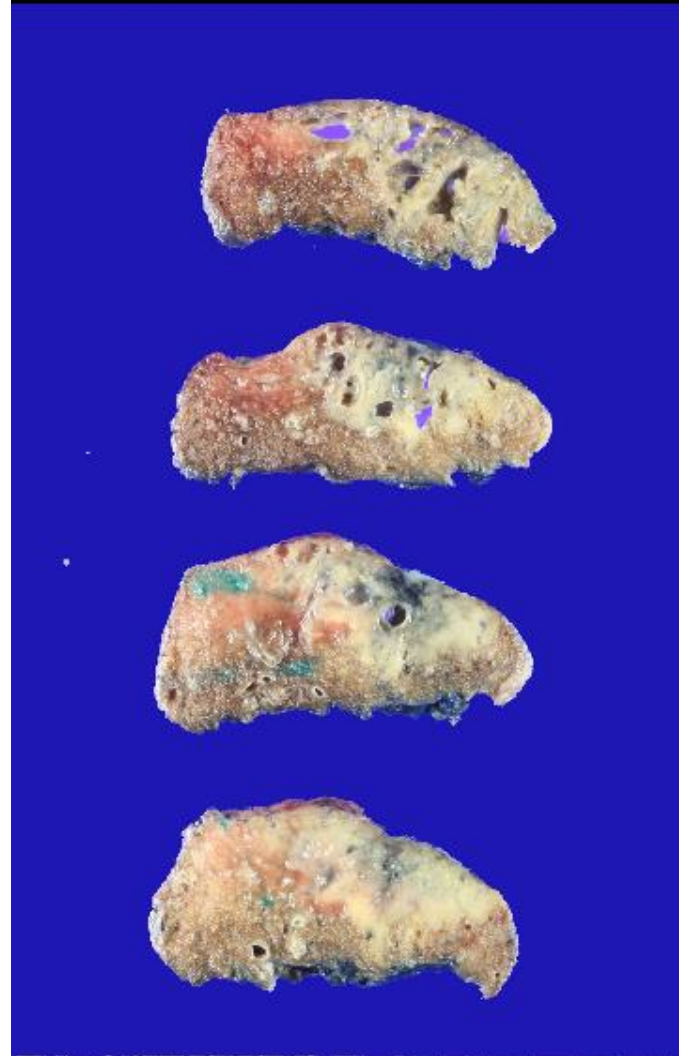
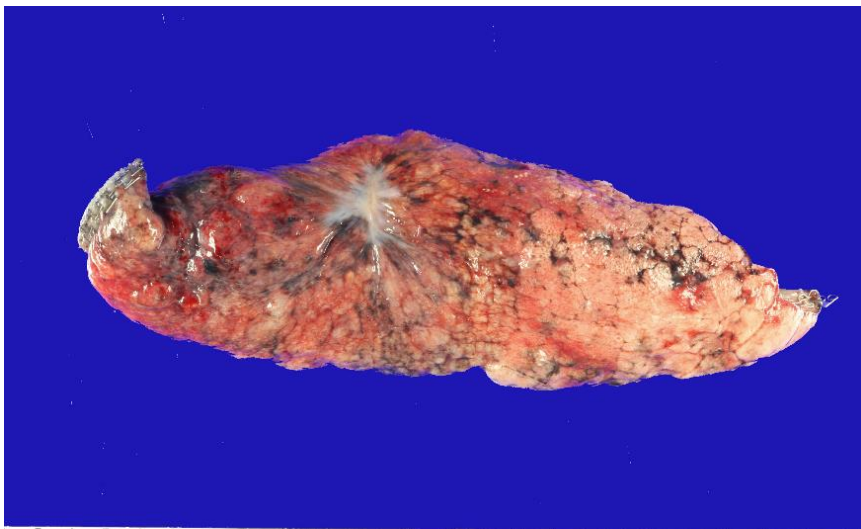
- 1) R/O Lung cancer in LLL lung.
  - 2) A few hypermetabolic LNs at the mediastinal 10R/L. Reactive LN
  - 3) A hypermetabolic bone lesion at the C7 body.
- R/O metastasis Rec) Pathologic correlation

# Treatment 1L IO with Chemotherapy

2024.10.11 → s/p #4 Pembrolizumab+Pemetrexed doublet  
s/p C-spine bone metastasis SB RTx for a week → 2025.01.09



# Wedge resection of lung 2025-01-21



**Lung, left lower lobe, wedge resection:  
Adenocarcinoma, grade 3**

MICROSCOPIC:

**Histologic type: Adenocarcinoma, predominantly solid**

Histologic patterns:

Solid: 60 %

Lepidic: 10 %

Papillary: 10 %

Acinar: 10 %

Micropapillary: 10 %

**Tumor size: 3.6 x 2.7 x 1.3 cm**

Main bronchus: Not applicable

Resection margin: Clear but very closed (less than 0.1 cm)

Pleural invasion: Involved by tumor (PL1)

Lymphovascular invasion: Absent

Spread through air spaces: Present

Perineural invasion: Absent

Necrosis: Absent

Pathologic stage: pT2a Nx (AJCC 8th edition)

pT2a: Tumor > 3 cm but ≤ 4 cm in the greatest dimension

Invades visceral pleura (PL1)

# NGS report with surgical biopsy

(선별50)NGS기반 유전자패널검사(비소세포성폐선암, Level 2 + RNA Fusion):

RESULTS: (스캔이미지 참조)

Sample Adequacy: Adequate

비소세포성 폐암 관련 검사 결과

ALK	미검출
BRAF	미검출
EGFR	미검출
ERBB2	미검출
KRAS	미검출
MET	미검출
NTRK1	미검출
NTRK2	미검출
NTRK3	미검출
RET	미검출
ROS1	미검출

Tumor Mutational Burden 3.79 Mut/Mb 측정됨

MSI Status: MSS

LOH 비율 0.0 %

NGS  
미검출

TP53 neg

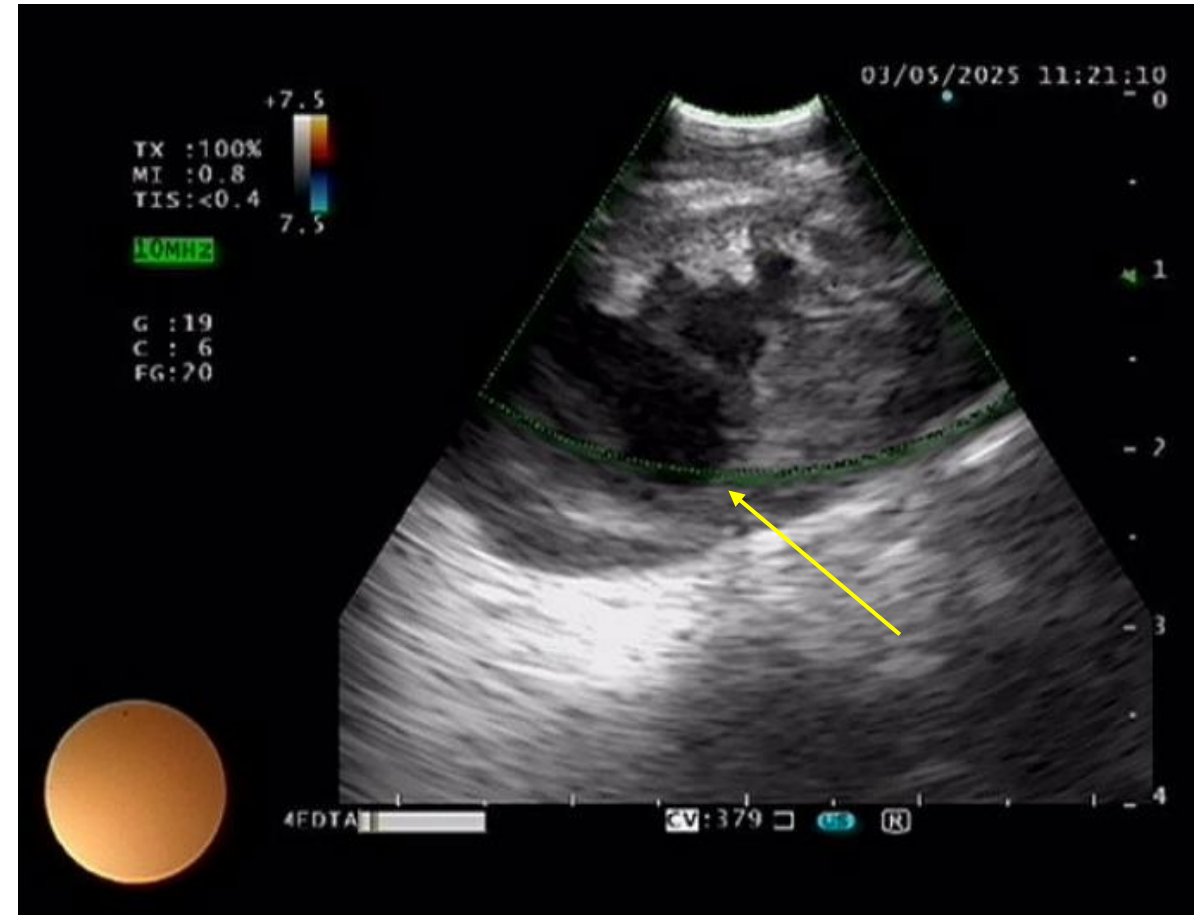
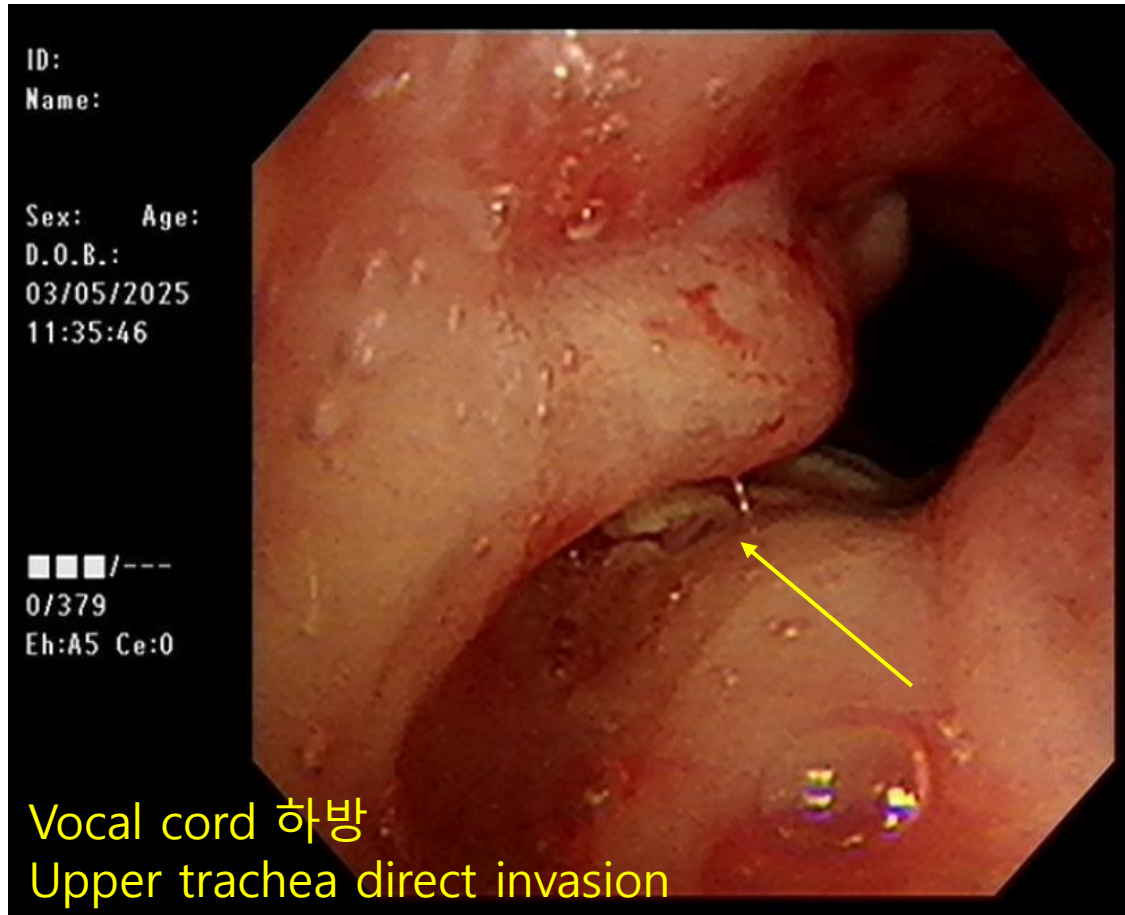
# Case

- 78/F
- Consultation for biopsy
- # Thyroid SqCC, cT4aN1bM0
- CCRT (2024.11.13 ~2024.12.24)



CST for mediastinal LN biopsy

# Bronchoscopic approach



# EUS approach with TBNA

DIAGNOSIS:  
Lymph node, labeled '7', FNA:  
Necrotic tissue

RESULTS:  
CK,pan (+)  
P40 (+, focal)  
PAX8 (+, focal)

DIAGNOSIS:  
Lymph node, '7', endobronchial USG transbronchial needle aspiration biopsy:  
Metastatic carcinoma (see NOTE)

NOTE:  
If the primary site is the thyroid glands, the possibility of anaplastic carcinoma should be considered.



EUS TBNA via 22G #0/#7

EUS TBNA via 19G #2/3

# The end

- Summary

- 환자의 폐와, 병변의 위치, 형태, 특성을 고려한 조직검사 선택이 필요합니다
- 치료를 결정하기위한 충분한, 좋은 질의 조직 확보를 위한 호흡기 의사의 노력이 환자의 예후 개선에 필요하겠습니다

- 경청해 주셔서 감사합니다