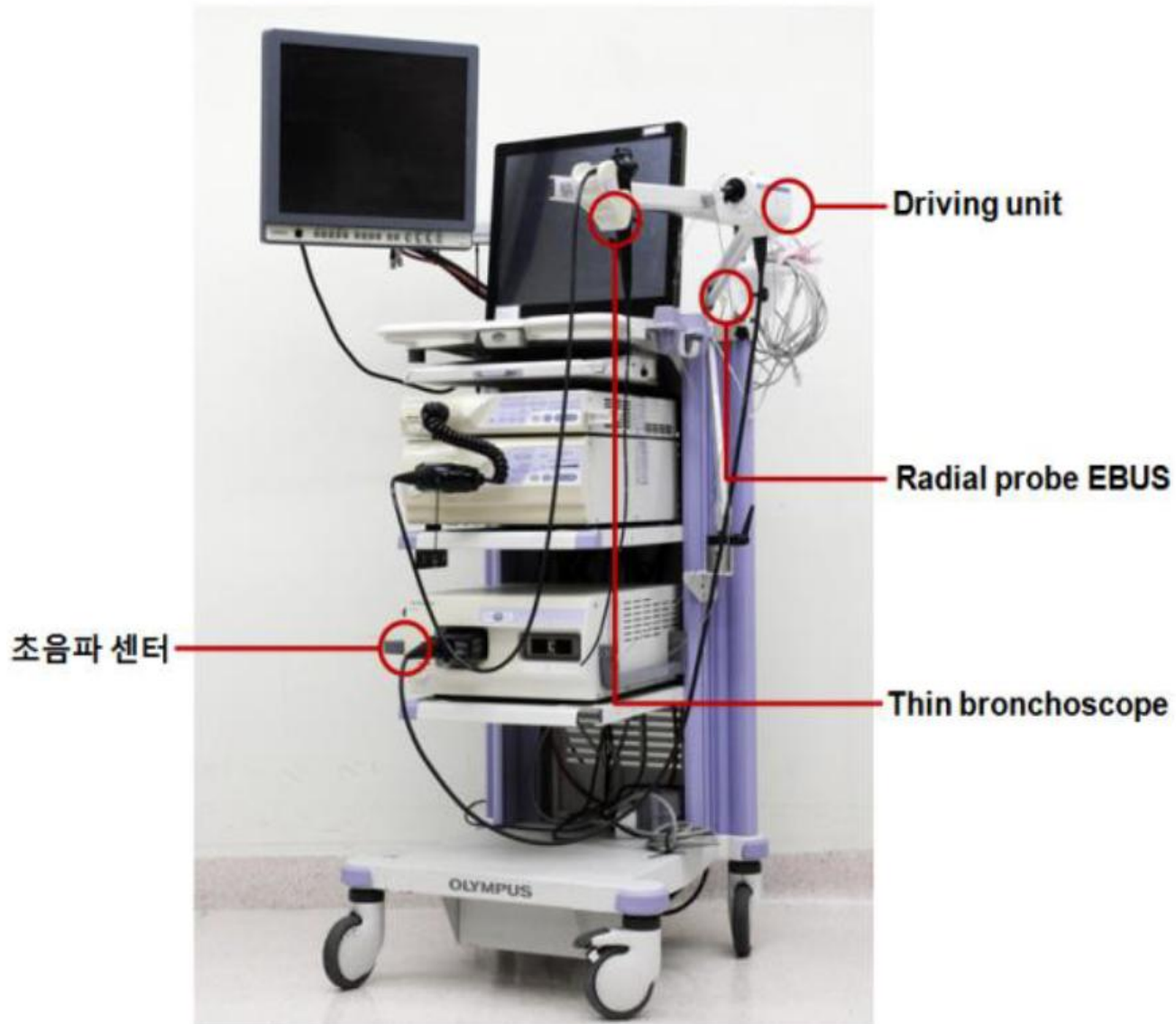


Radial probe EBUS for the Diagnosis of Peripheral Lung Cancer

Dongil Park

Contents

- ✓ Overview of Radial Probe EBUS (rEBUS)
- ✓ Diagnostic Yield (DY) & Complications
- ✓ Favorable Factors for High DY
- ✓ Guide sheath (GS) technique
- ✓ Ultrathin bronchoscope
- ✓ Initial Hurdles in Starting rEBUS-TBLB
- ✓ Beyond the Initial Hurdles



PROBE DRIVING UNIT MAJ-1720



ULTRASONIC PROBE UM-S20-17S



그림 2-9-1. Radial EBUS 사용에 필요한 장비

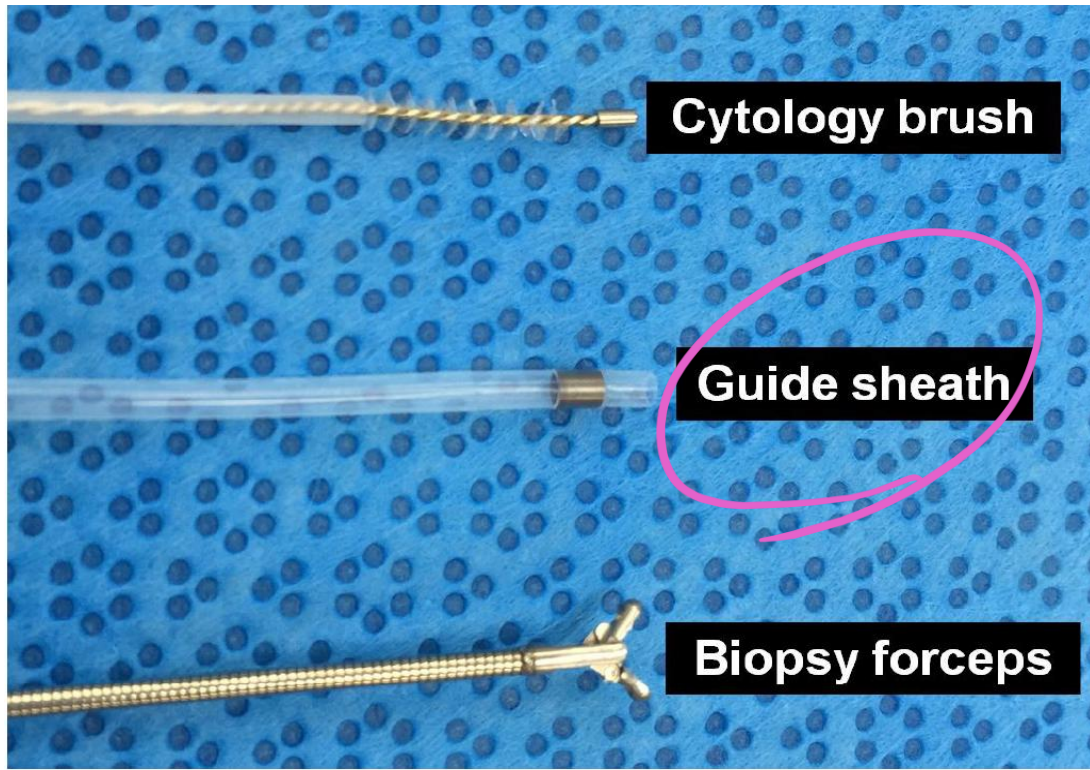


그림 2-9-3. Guide sheath kit의 구성

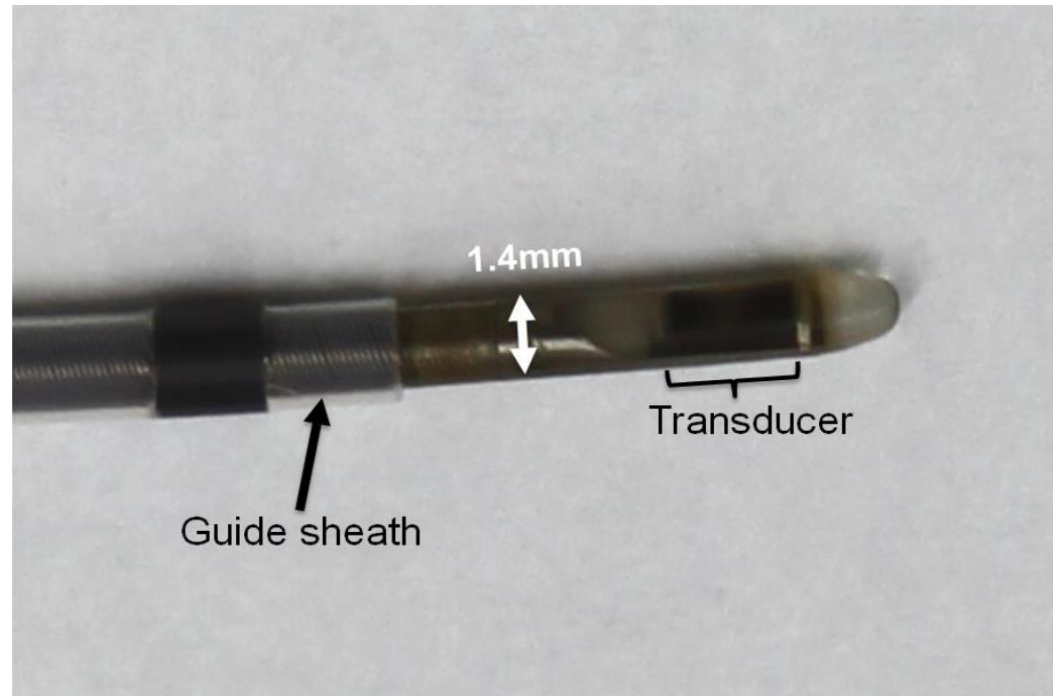


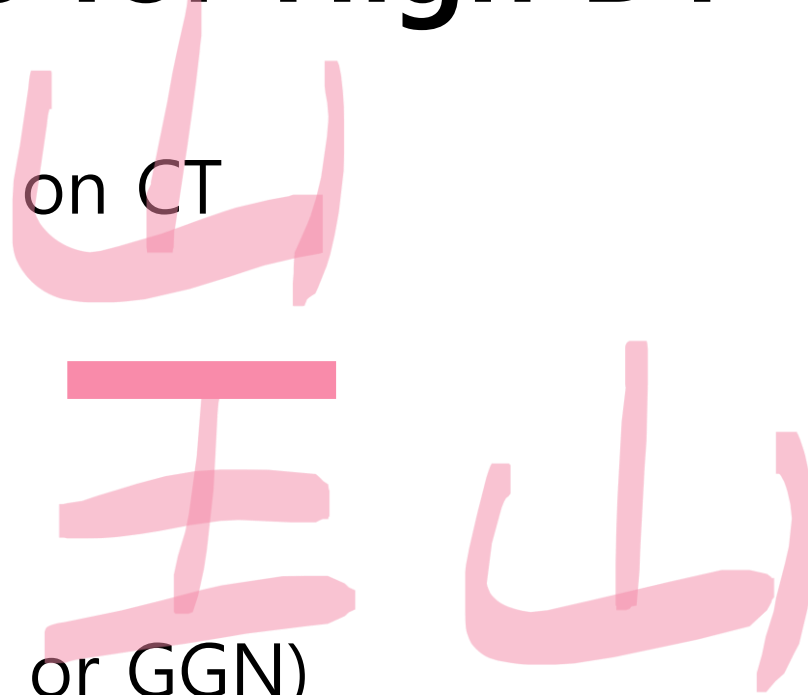
그림 2-9-2. Guide sheath와 결합한 radial EBUS.

DY & Complications

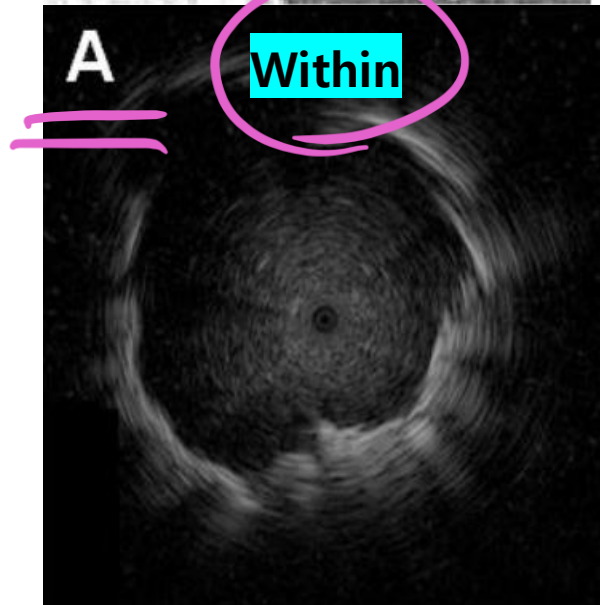
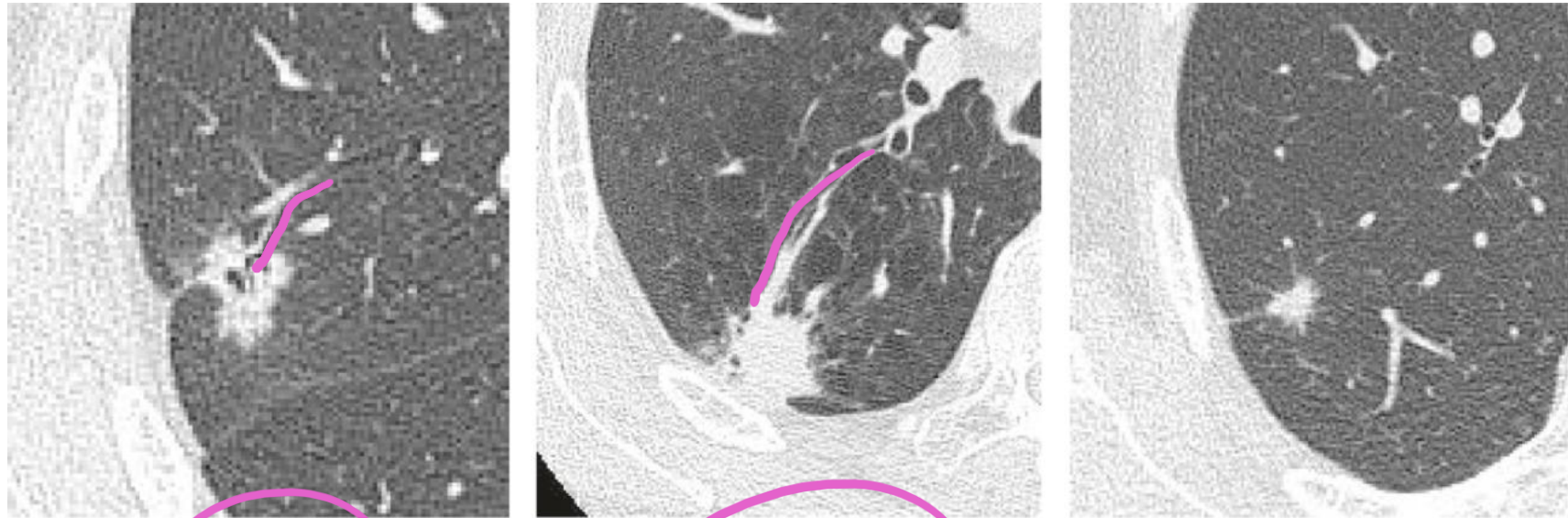
- Diagnostic yield: about 60~70%
- Complication
 - Pneumothorax: 0.7~2% (chest tube insertion: 0.2~0.9%)
 - Bleeding: 1.5~2.5%
 - Infection: 4.5% (Pneumonia: 2.3%, lung abscess: 0.3%, empyema: 0.3%)
 - Risk factors: cavitation, low-density intralesional area on CT, airway segmental/subsegmental stenosis on bronchoscopy

Favorable Factors for High DY

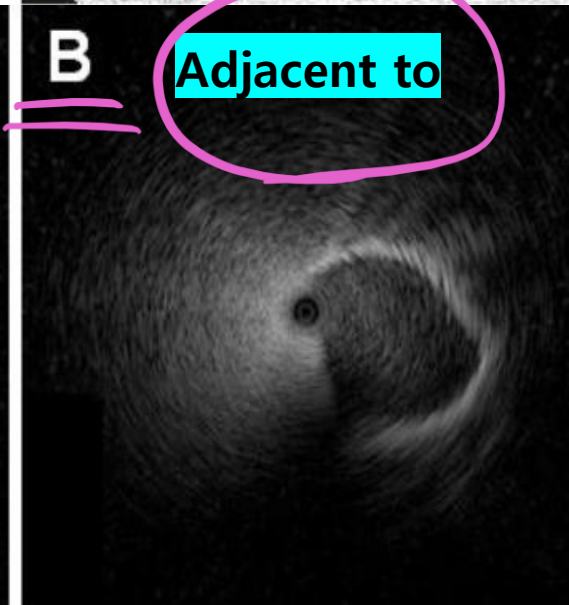
- Presence of bronchus sign on CT
- Lesion size > 2 cm
- Use of guide sheath (GS)
- Solid lesions (vs. part-solid or GGN)
- Malignant histology
- Within-lesion probe orientation



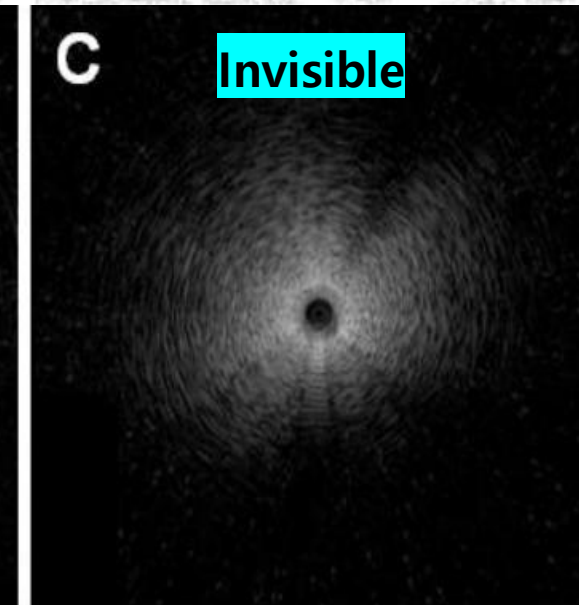
CT Bronchus sign



CT bronchus sign A



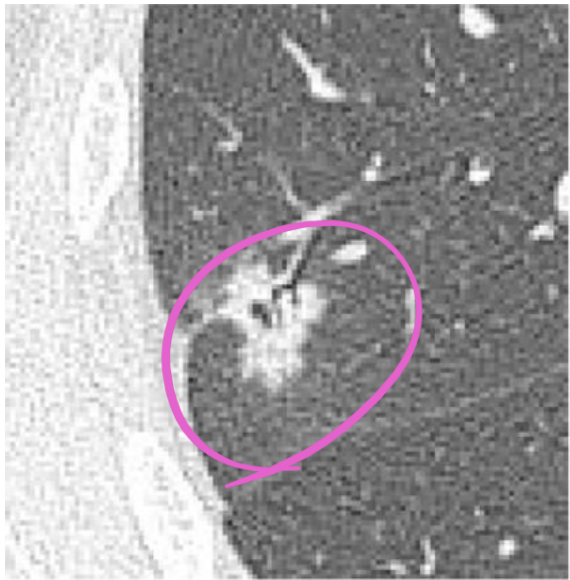
CT bronchus sign B



CT bronchus sign C

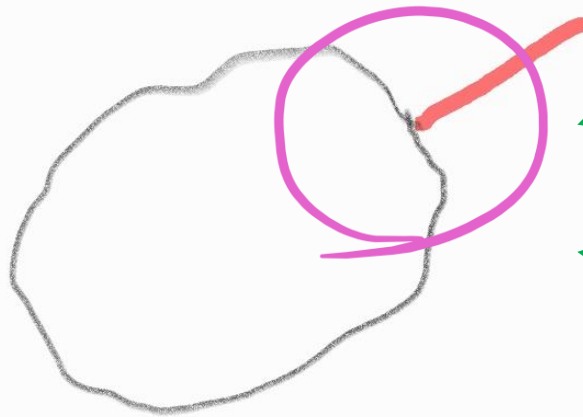
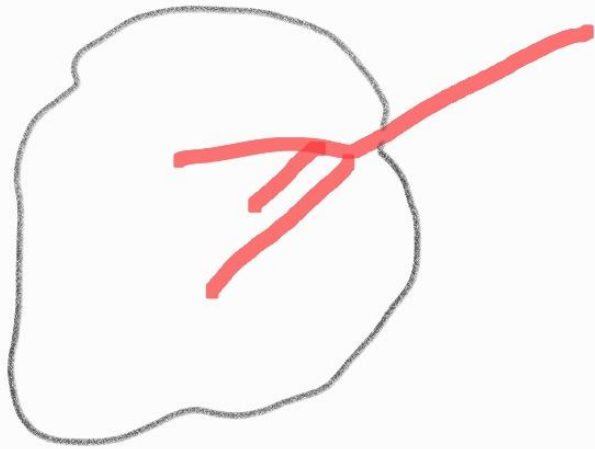
Table 4 Contribution of clinical factors available before bronchoscopy to diagnostic yield (all cases)

Variables		Diagnostic yield	<i>p</i> value
Lesion diameter	<20 mm	51/80 (63.8 %)	0.01*
	≥20 mm	57/69 (82.6 %)	
Lesion location	Upper lobe or sup segment of lower lobe	40/56 (71.4 %)	0.82
	Middle or lower lobe ^a	68/93 (73.1 %)	
Feature of the lesion	GGO	12/18 (66.7 %)	0.24
	Solid	96/131 (73.2 %)	
Visibility of the lesion on Chest X-ray	Clearly visible	59/72 (81.9 %)	0.01*
	Vague or invisible	49/77 (63.6 %)	
Number of bronchial branch to reach the lesion	≥5	35/50 (70.0 %)	0.63
	≤4	73/99 (73.7 %)	
Operator's experience (years)	≥7	34/52 (65.4 %)	0.16
	≤6	74/97 (76.3 %)	
CT bronchus sign ^b	A	72/86 (83.7 %)	0.001*
	B	32/49 (65.3 %)	
	C	4/14 (28.6 %)	

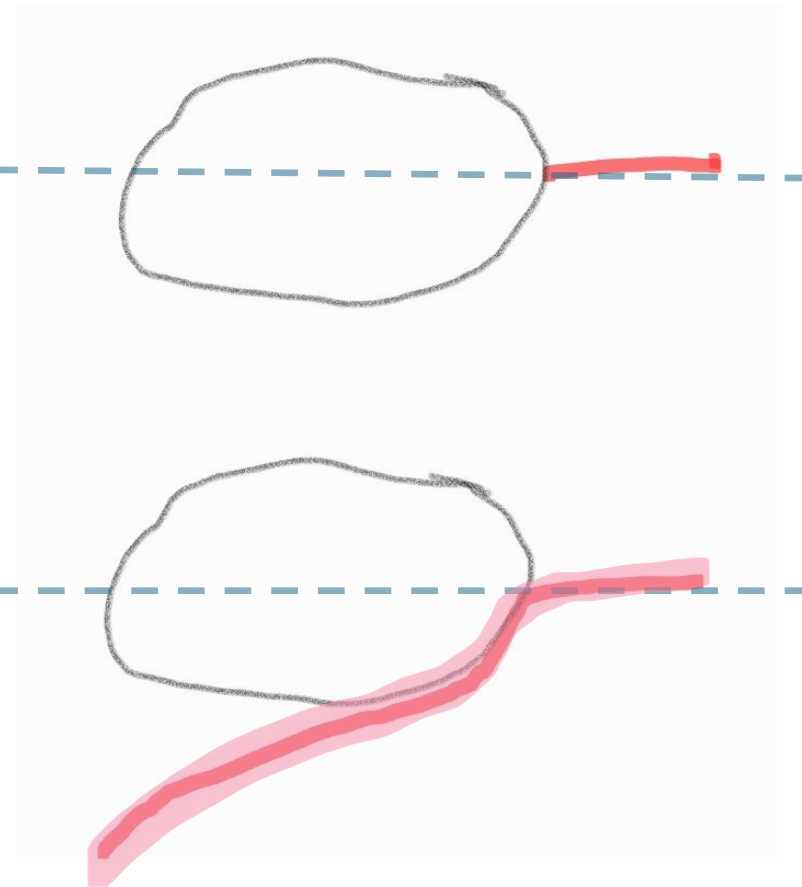


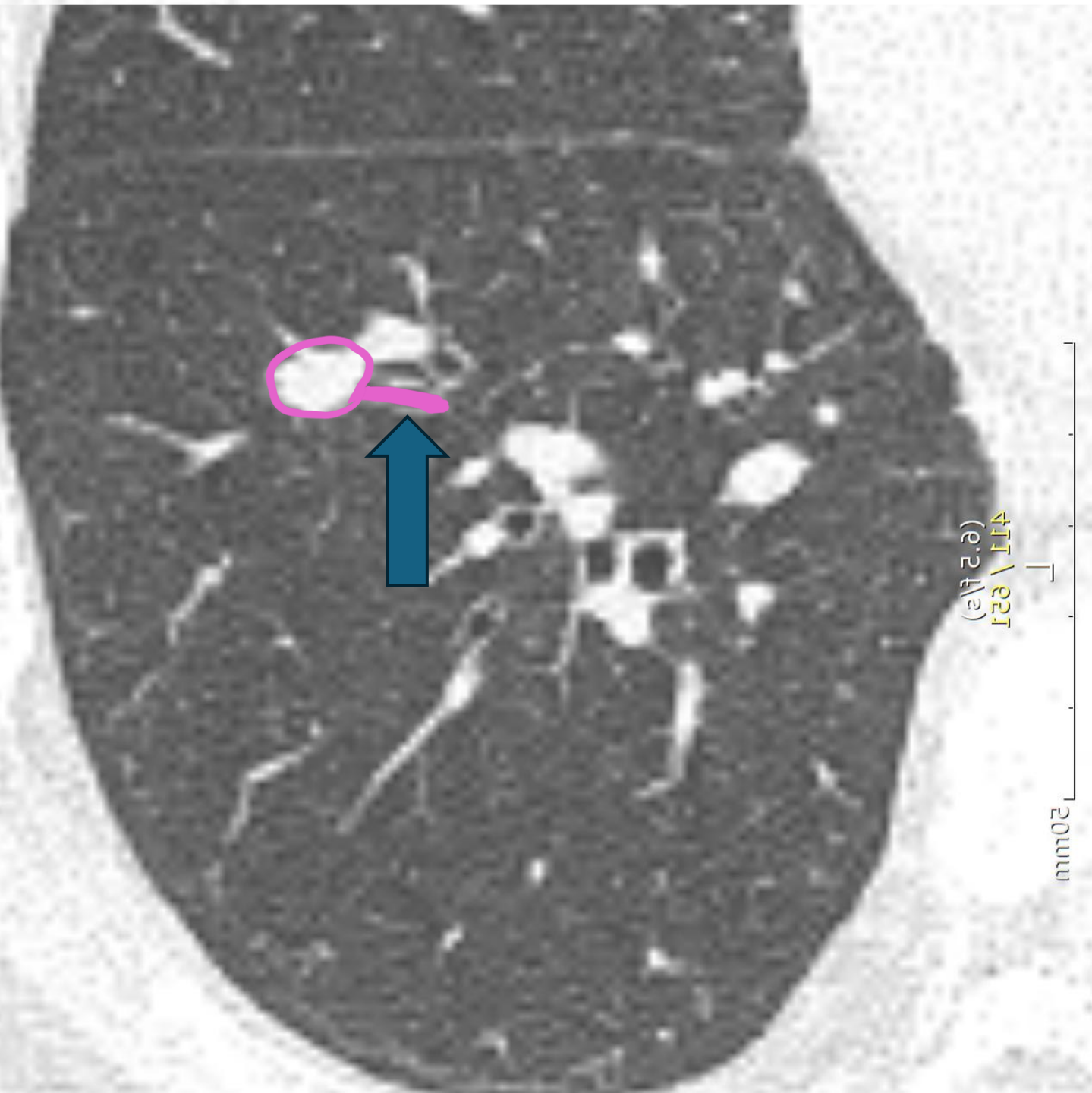
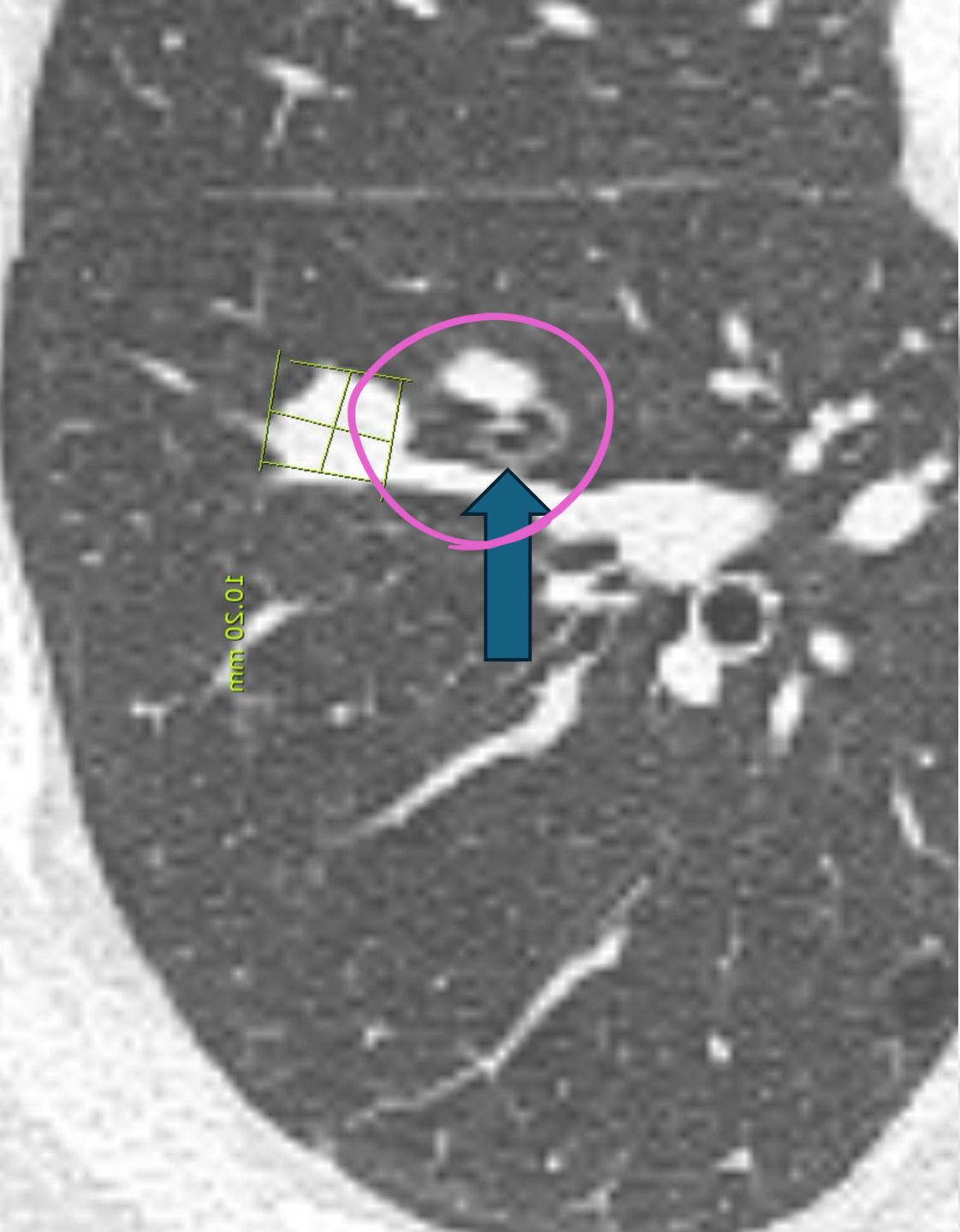
CT bronchus sign A

Axial plane

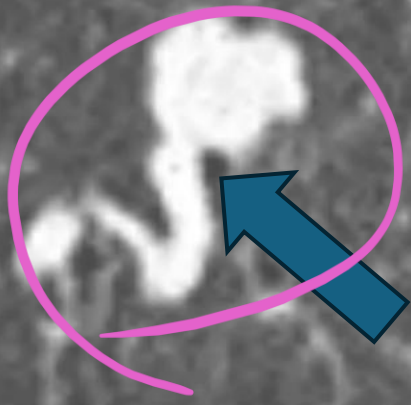


Coronal plane





✓ Sagittal
✓ Coronal

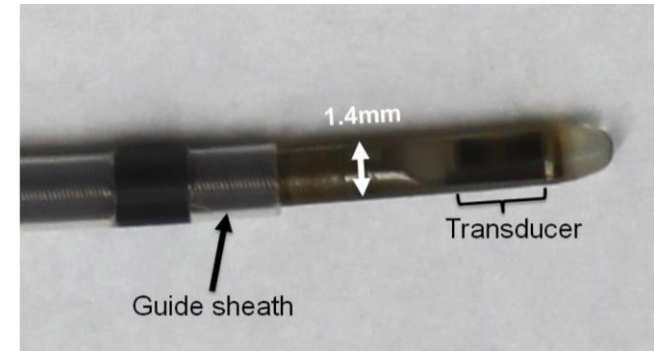
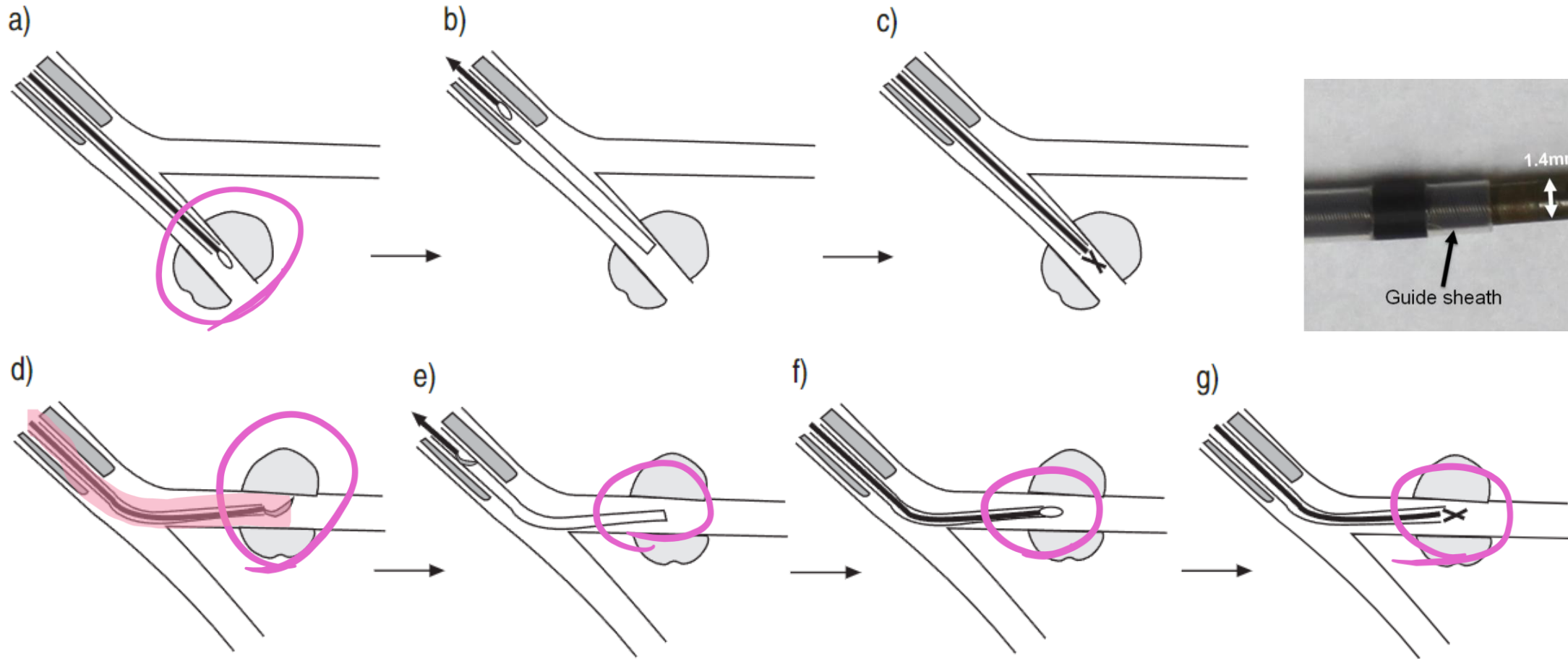


(3.4 f/s)
58 / 292

RAF

50mm

Guide sheath (GS) technique



With GS or without GS

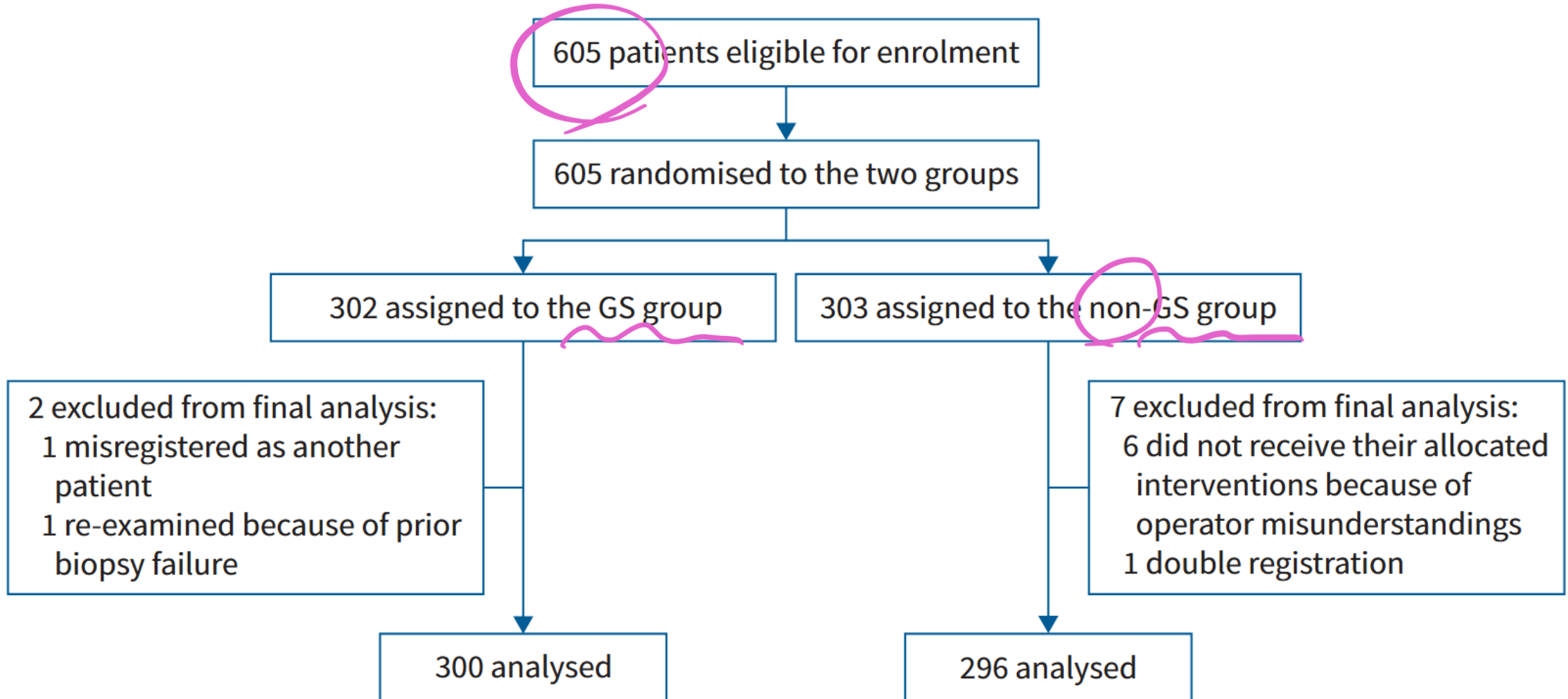


TABLE 3 Histopathological diagnostic yields of the allocated procedures

	GS group (n=300)			Non-GS group (n=296)			p-value [#]	p _{interaction} -value [¶]
	n/total (%)	95% CI	p-value	n/total (%)	95% CI	p-value		
Total	166/300 (55.3)	49.5–61.1		138/296 (46.6)	50.8–52.5		0.033	
Lesion size, mm								
≤20	79/159 (49.7)	41.7–57.7	0.037	76/163 (46.6)	38.8–54.6	0.999	0.583	0.140
>20–30	87/141 (61.7)	53.2–69.8		62/133 (46.6)	37.9–55.5		0.012	
Lesion type								
Malignant	155/237 (65.4)	59.0–71.4	<0.001	128/231 (55.4)	46.6–59.8	<0.001	0.027	0.531
Benign	11/61 (18.0)	9.4–30.0		10/60 (16.7)	8.3–28.5		0.843	
Unknown	0/2 (0)			0/5 (0)				
Lobar location								
Upper lobe	101/160 (63.1)	55.2–70.6	0.004	63/147 (42.9)	34.7–51.3	0.197	<0.001	0.003
Other lobes	65/140 (46.4)	38.0–55.1		75/149 (50.3)	42.0–58.6		0.507	
Lesion location with respect to the hilum								
Intermediate	31/47 (66.0)	50.7–79.1	0.111	28/45 (62.2)	46.5–76.2	0.023	0.709	0.639
Peripheral	135/253 (53.4)	47.0–59.6		110/251 (43.8)	37.6–50.2		0.032	
Positional relationship with the pleura								
Distant from the pleura	106/184 (57.6)	50.1–64.9	0.318	90/167 (53.9)	46.0–61.6	0.004	0.484	0.191
Abutting the pleura	60/116 (51.7)	42.3–61.1		48/129 (37.2)	28.9–46.2		0.022	
Bronchus sign								
Present	142/240 (59.2)	52.7–65.5	0.008	115/234 (49.1)	42.6–55.7	0.091	0.029	0.497
Absent	24/60 (40.0)	27.6–53.5		23/62 (37.1)	25.2–60.3		0.742	
Lesion texture on CT								
Solid	148/260 (56.9)	50.7–63.0	0.158	116/256 (45.3)	39.1–51.6	0.253	0.008	0.072
Part-solid	18/40 (45.0)	29.3–61.5		22/40 (55.0)	38.5–70.7		0.371	

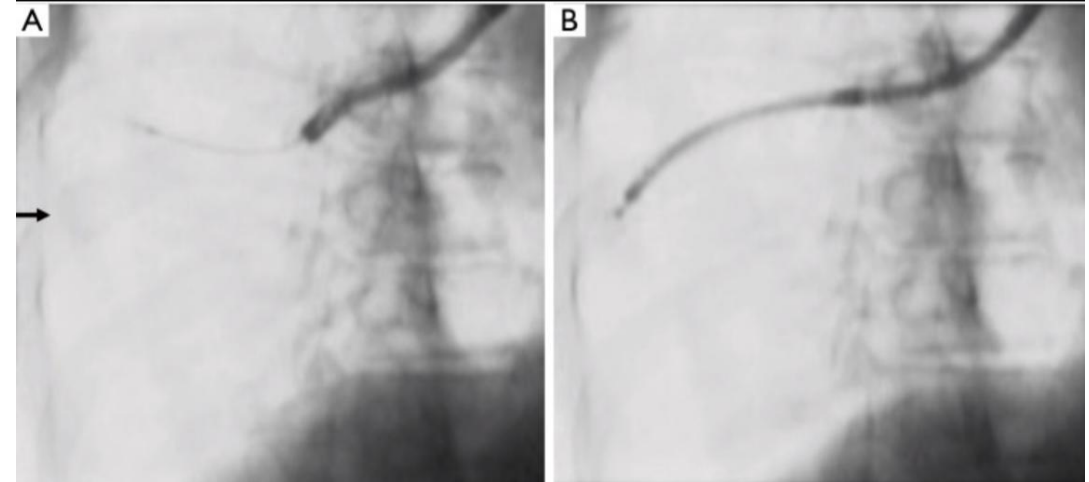
Ultrathin bronchoscope (UTB)

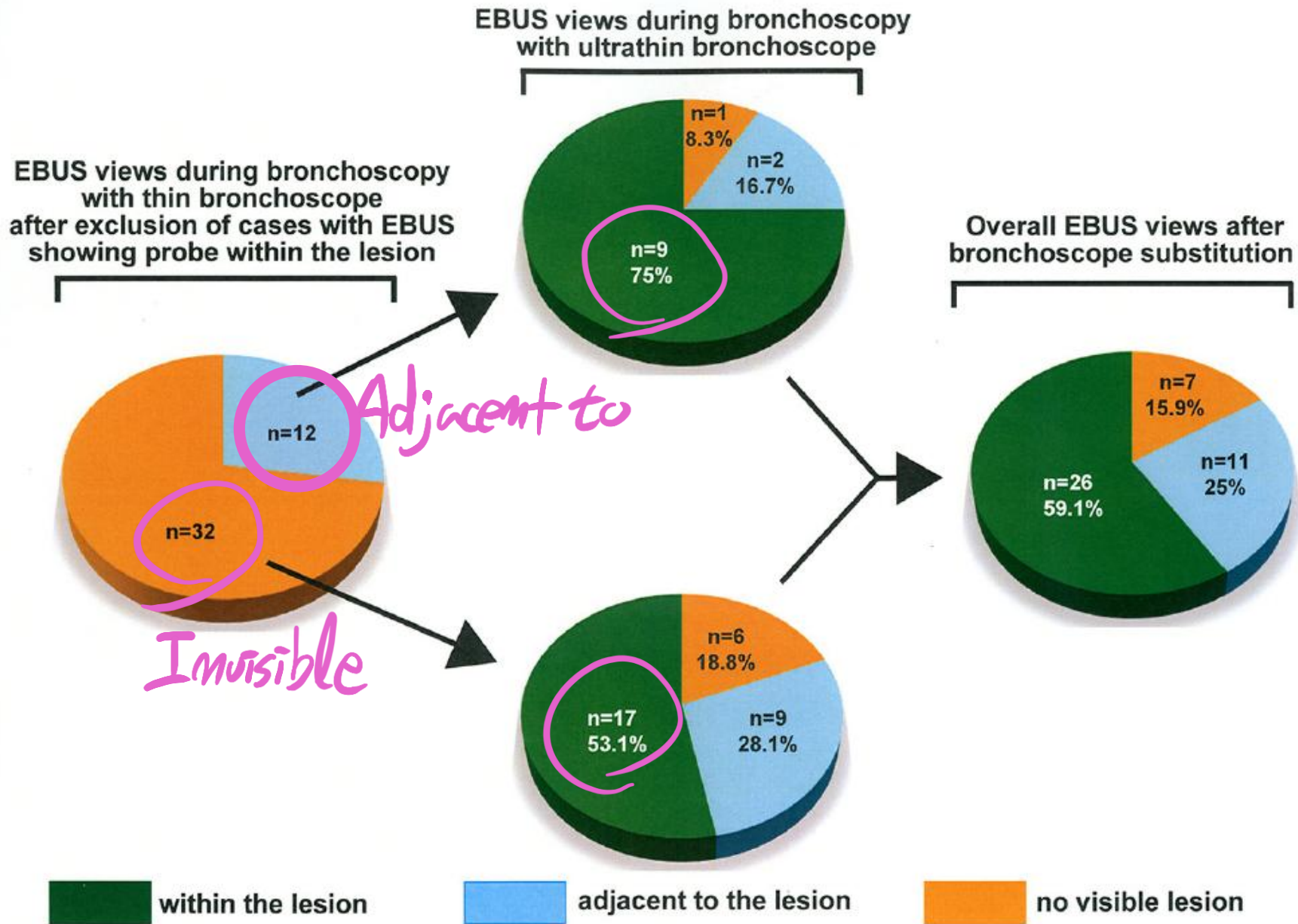
- TB

- Outer diameter – 4 mm
- Working channel – 2 mm

- UTB

- Outer diameter < 3.0~3.5 mm *
- Working channel 1.2 mm/1.7 mm

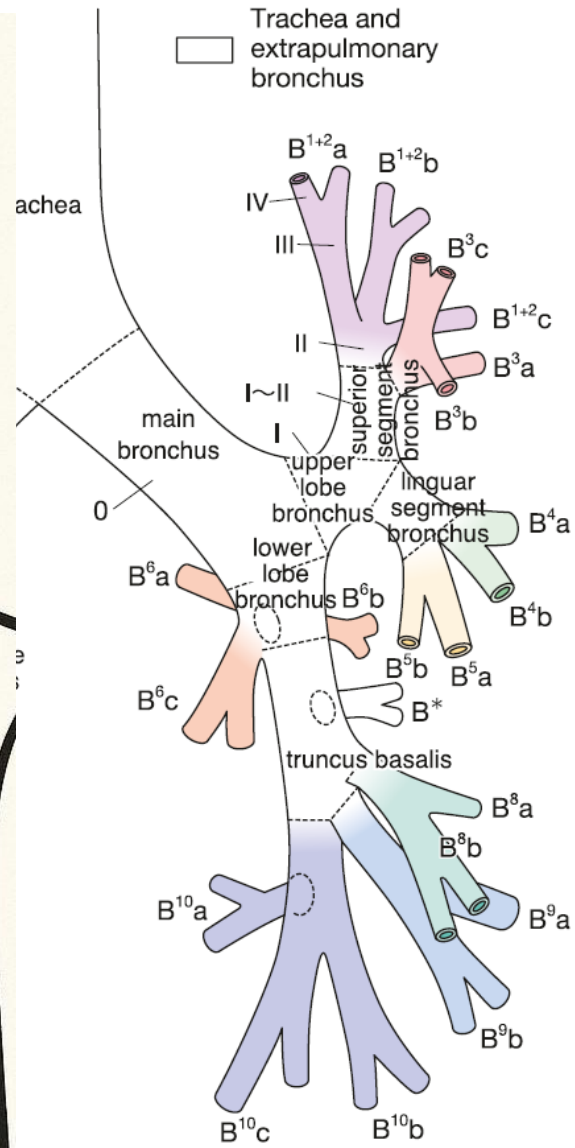


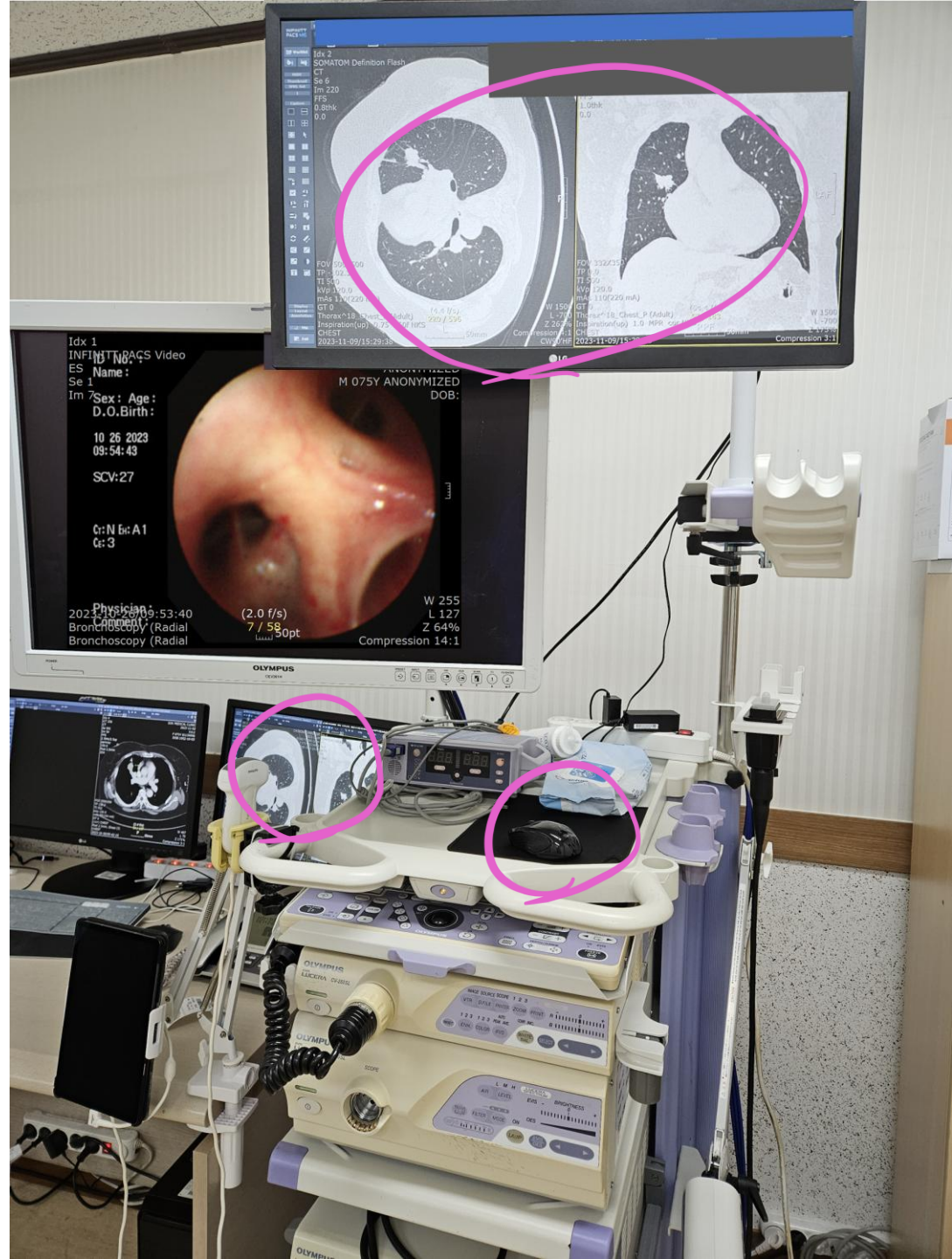


Overall DY: 65.9%
'Within': 80.8%
'Adjacent to': 72.7%
'Invisible': 0%

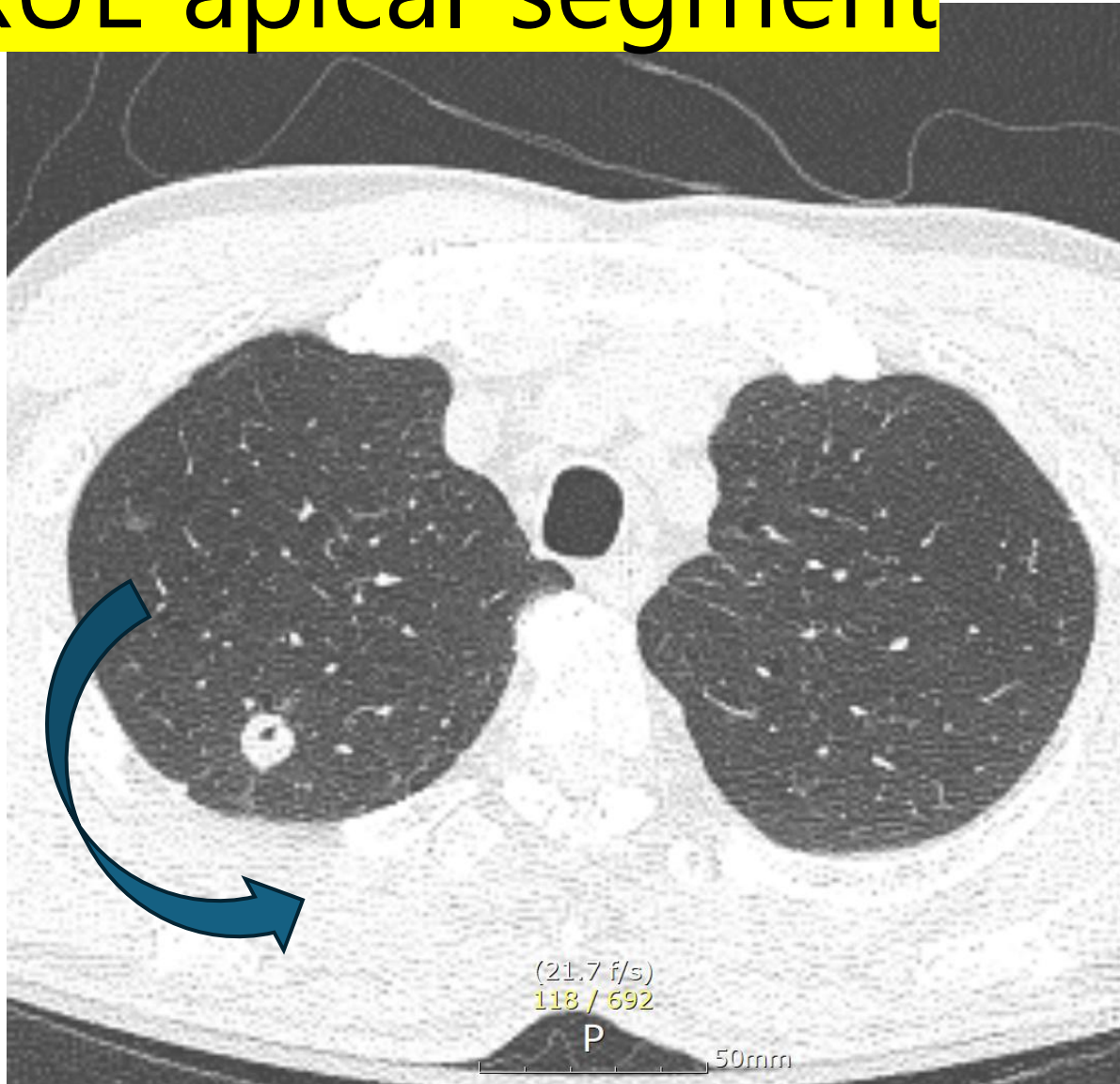
Initial Hurdles in Starting rEBUS-TBLB

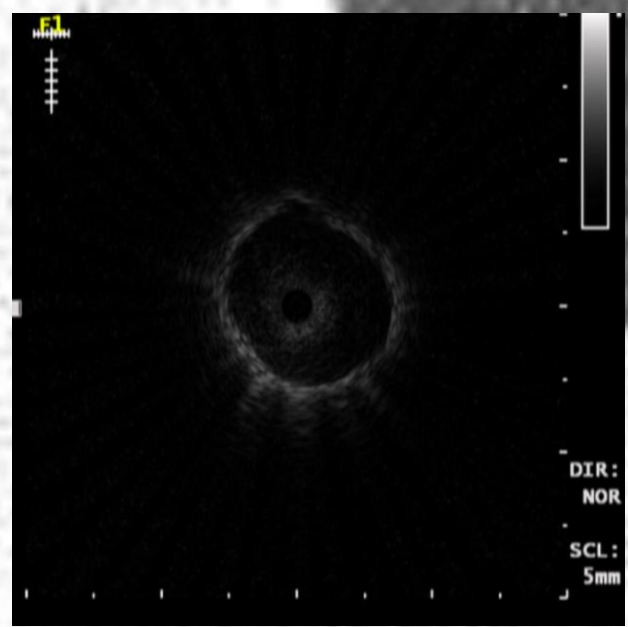
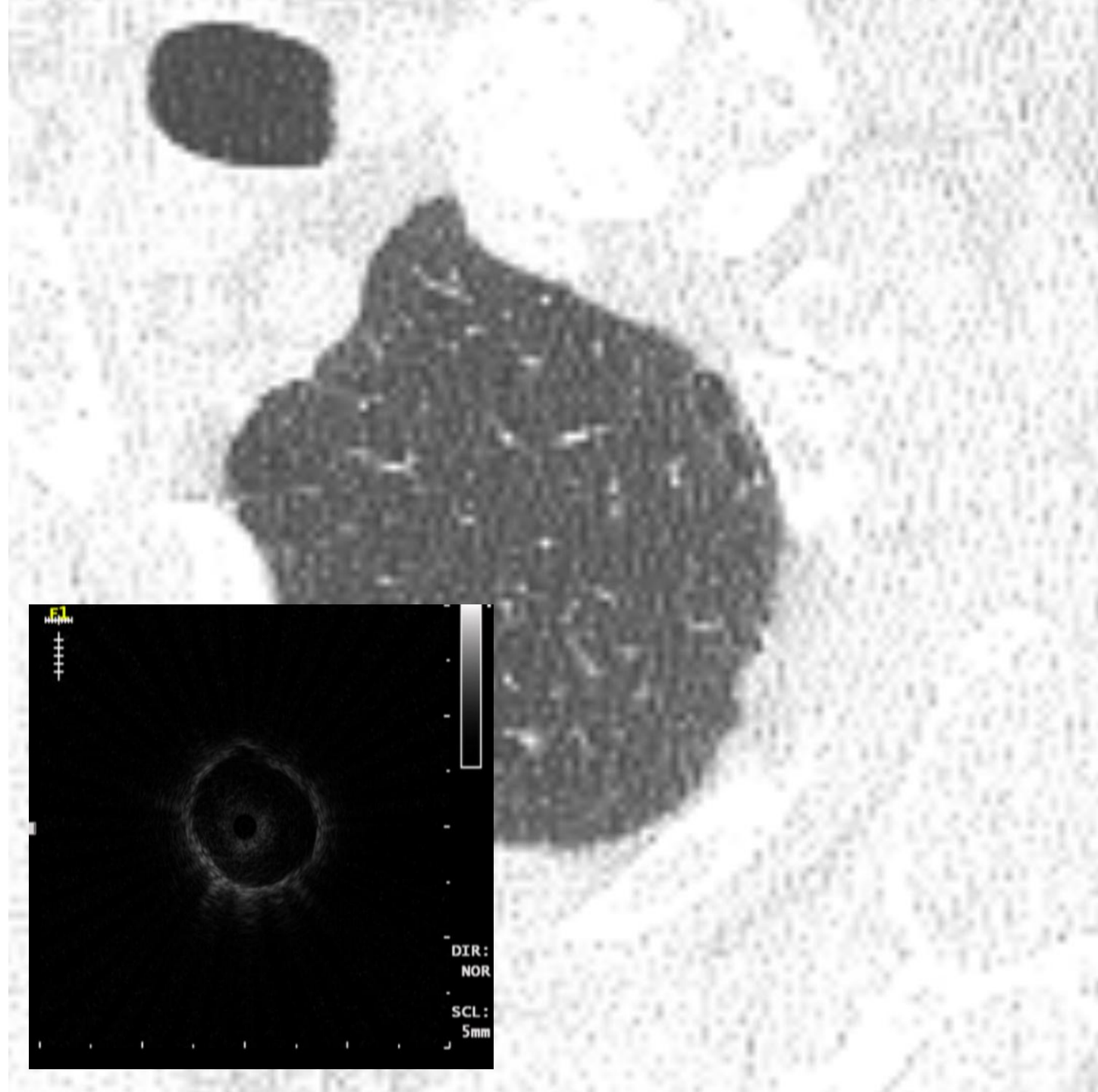
1. Failure to localize the target lesion (Navigation)
2. Inability to position the probe within the lesion (Orientation)



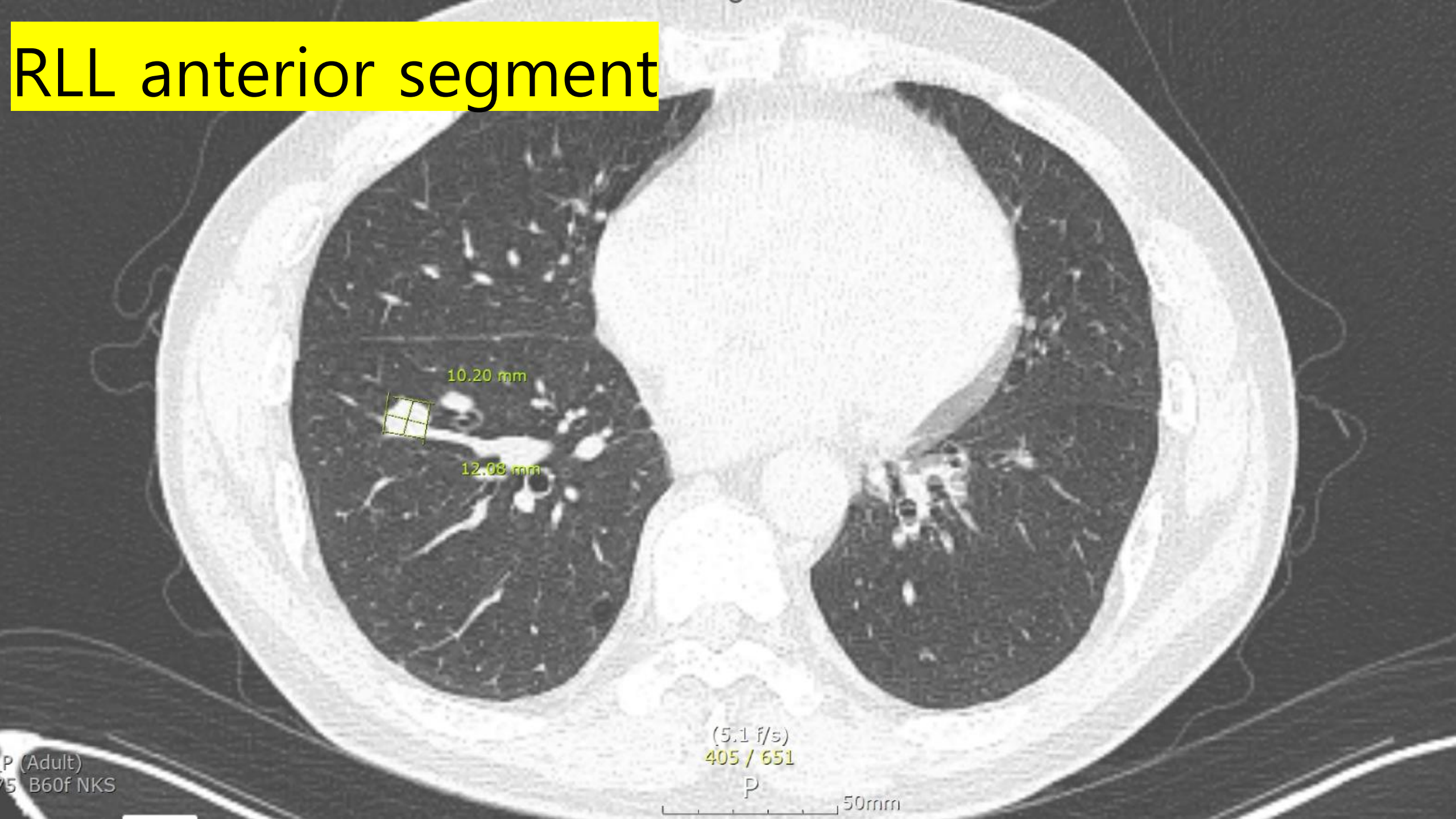


RUL apical segment





RLL anterior segment

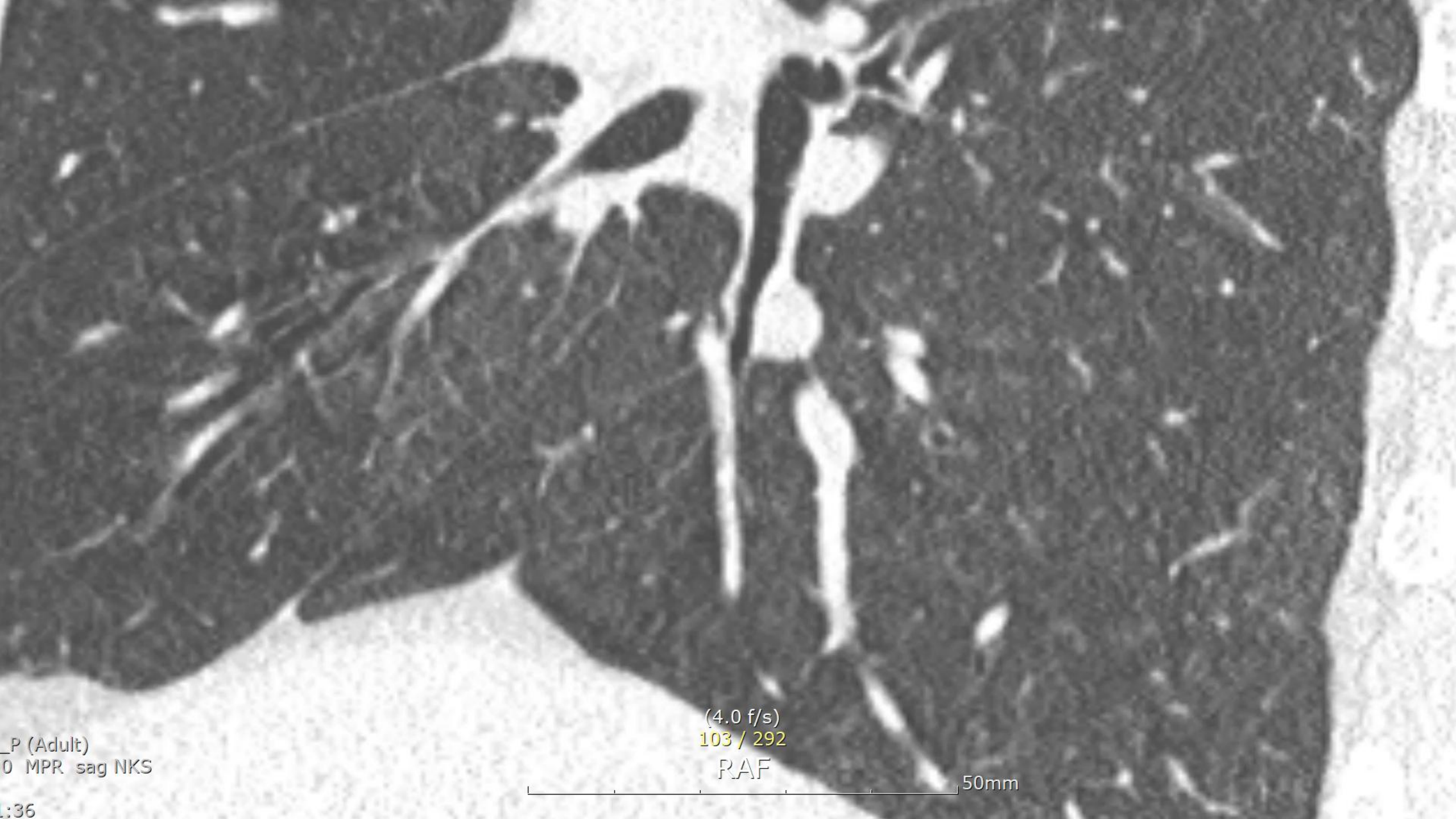


P (Adult)
75 B60f NKS

(5.1 f/s)
405 / 651

P

50mm



P (Adult)
0 MPR sag NKS

(4.0 f/s)
103 / 292

RAF

50mm

:36

P (Adult)
0 MPR sag NKS

(1.3 f/s)
57 / 292

RAF

50mm

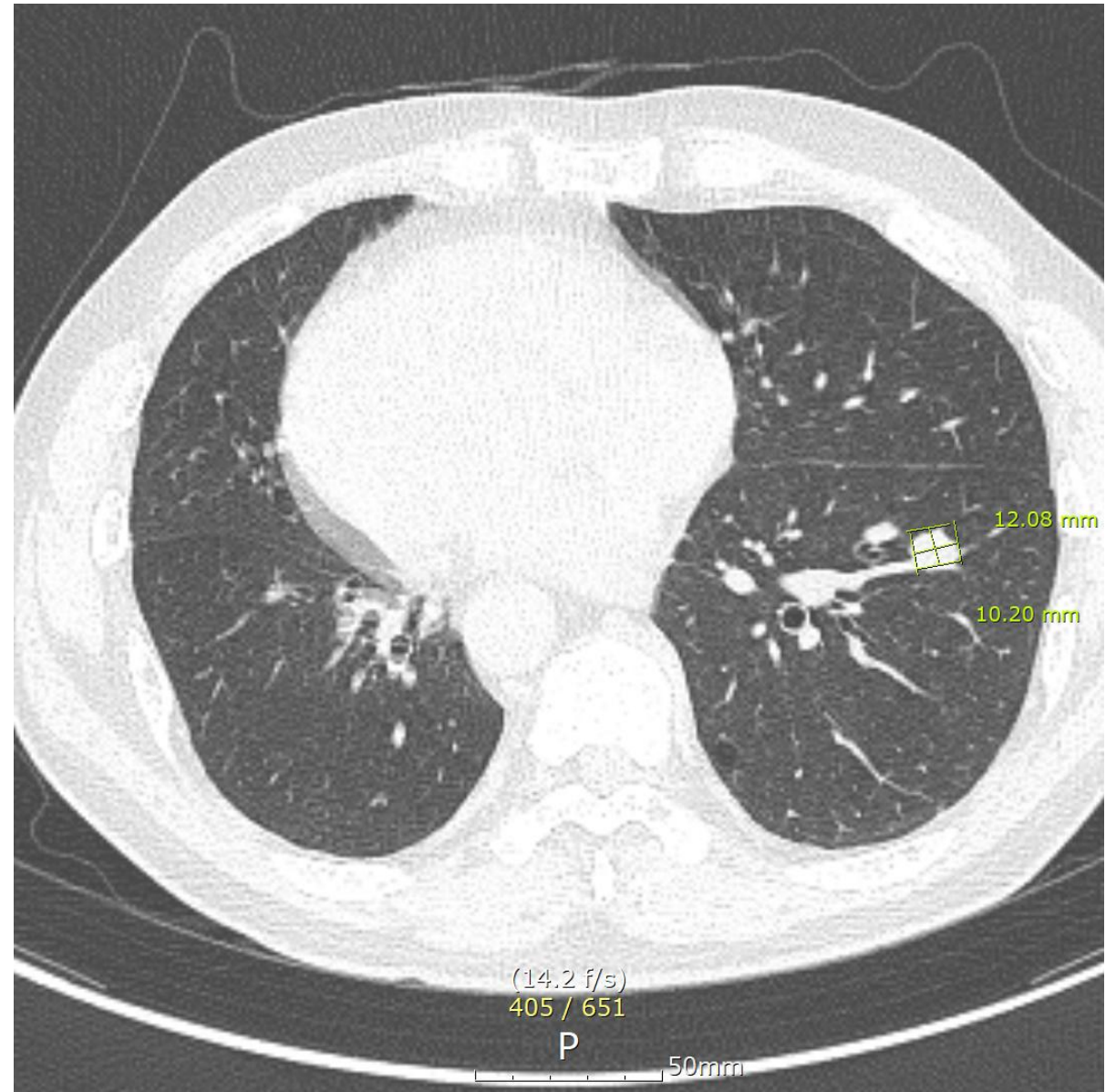
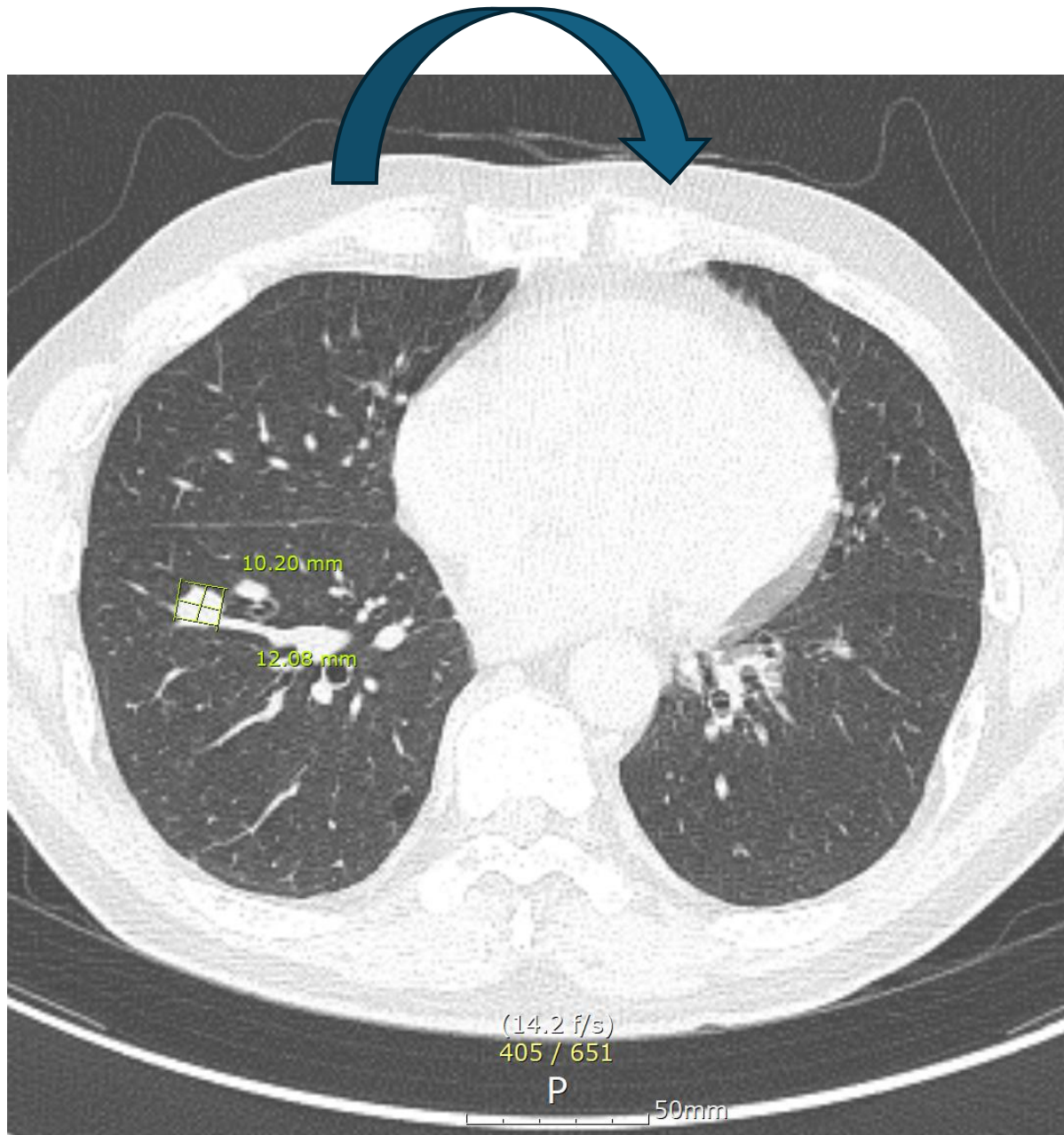
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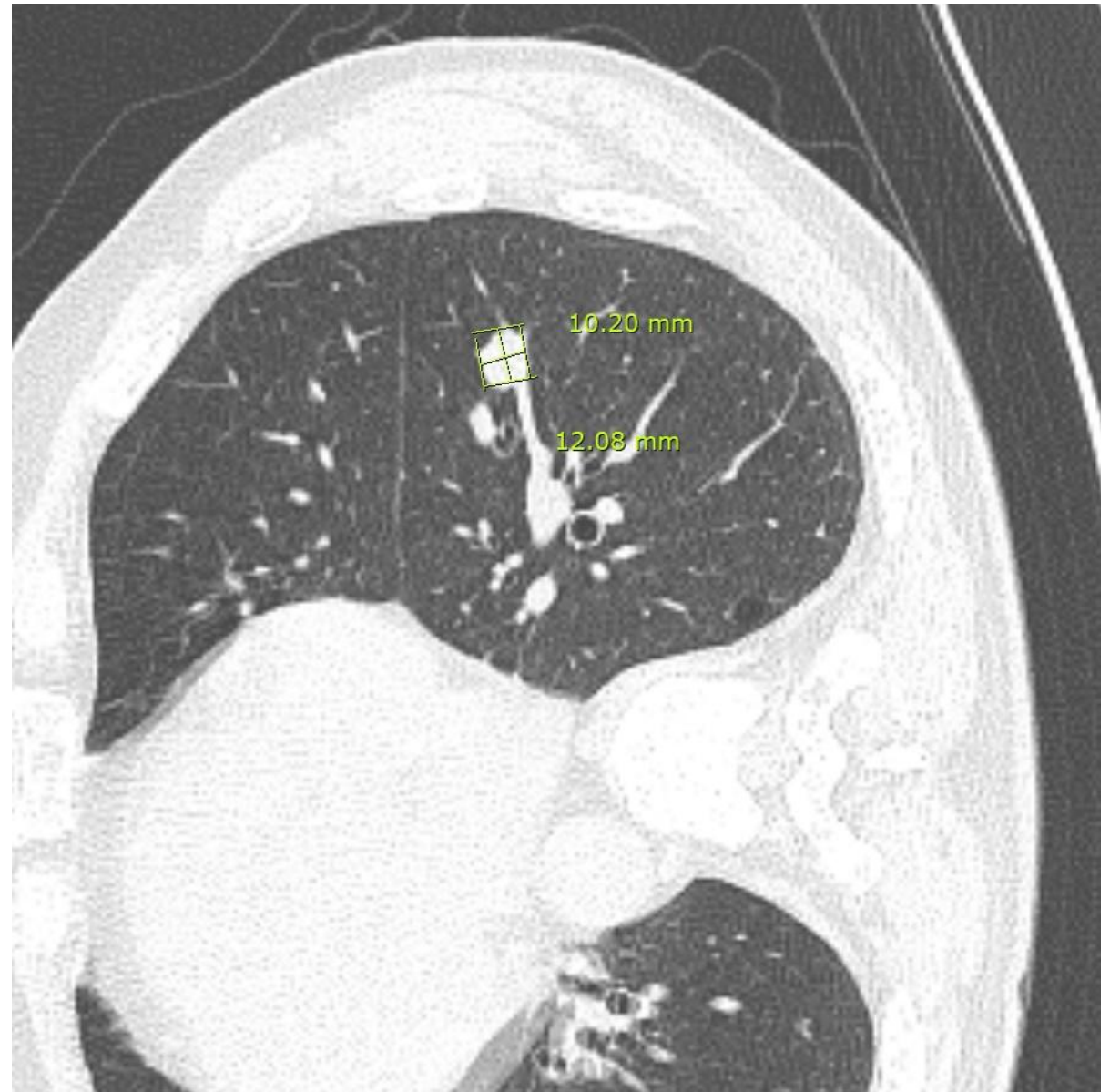
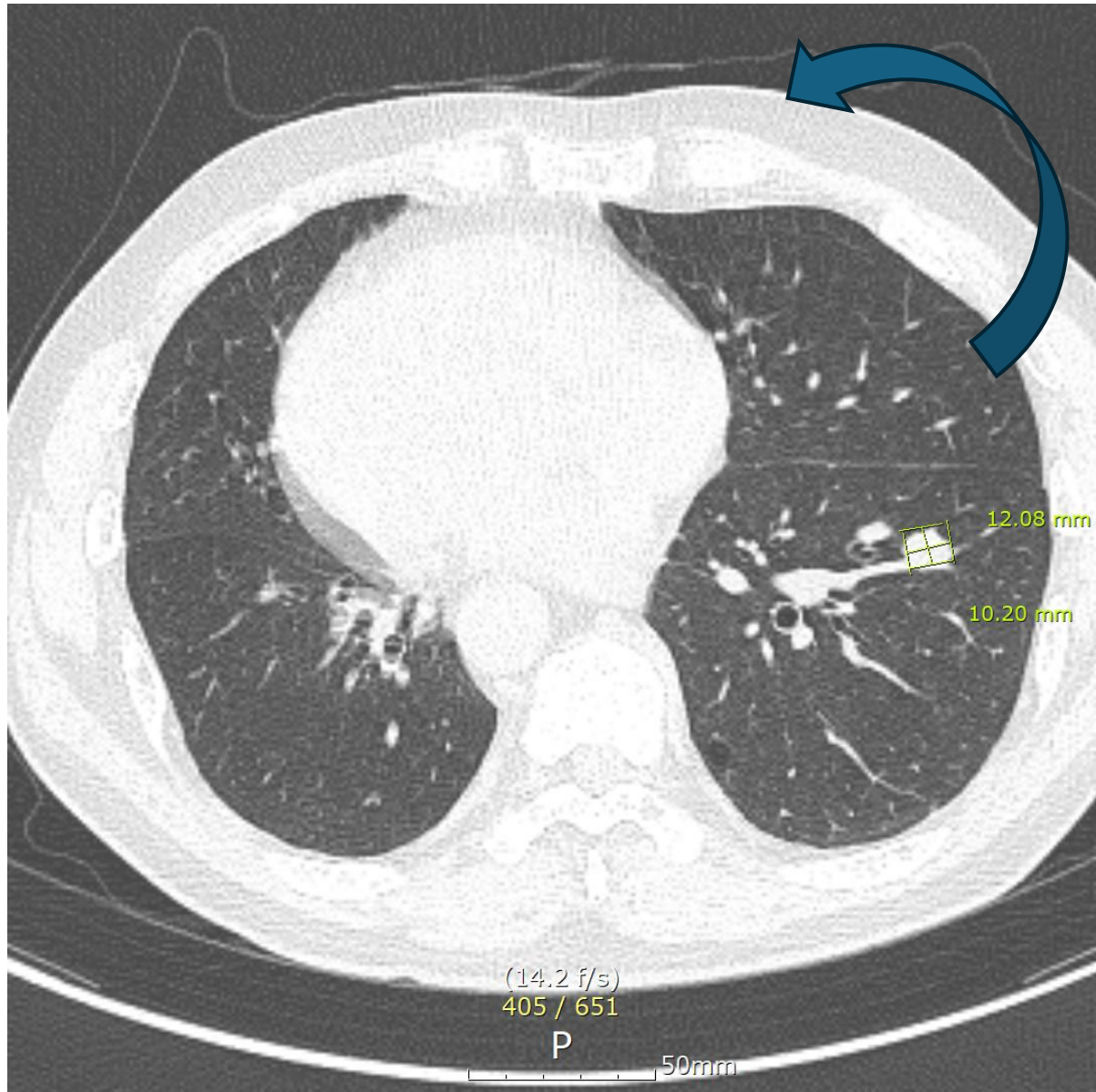
P (Adult)
0 MPR sag NKS

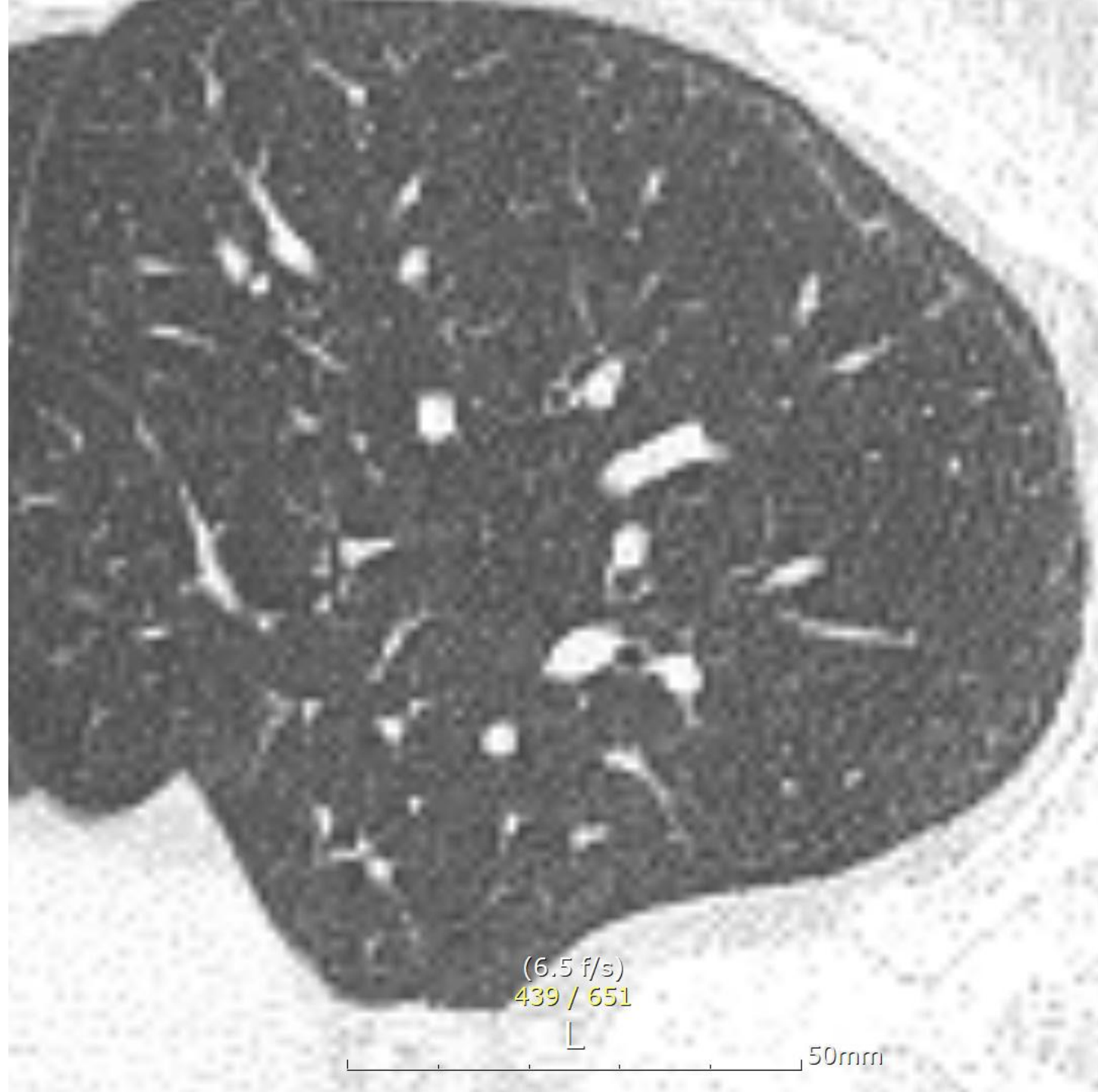
(0.0 f/s)
56 / 292
RAF

50mm

:36

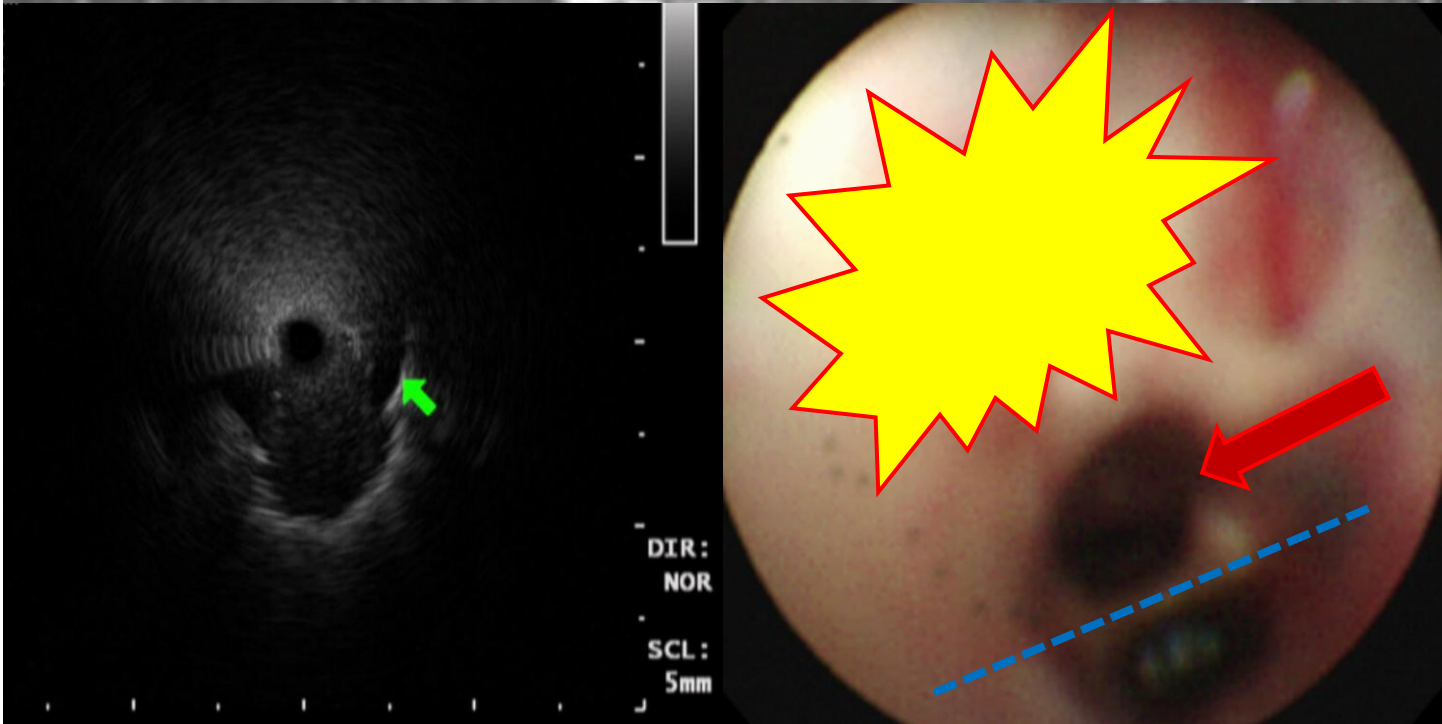
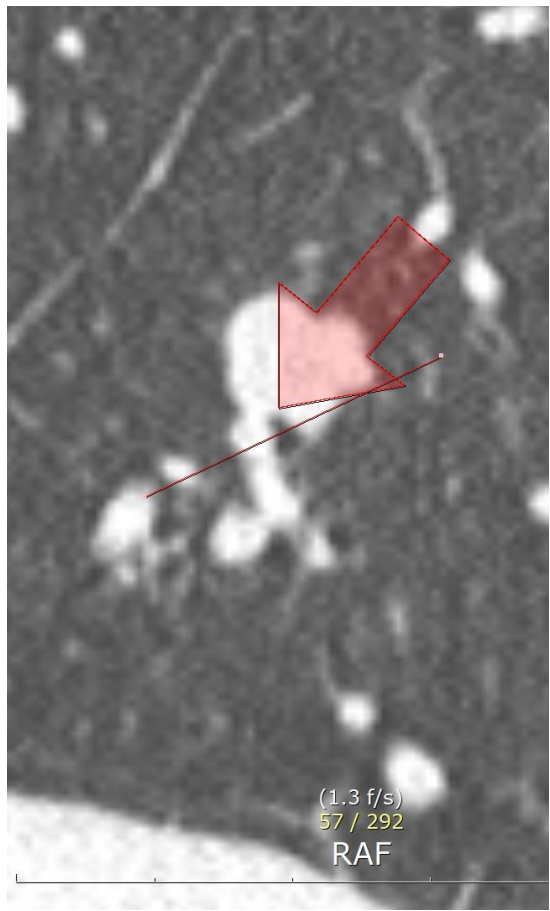




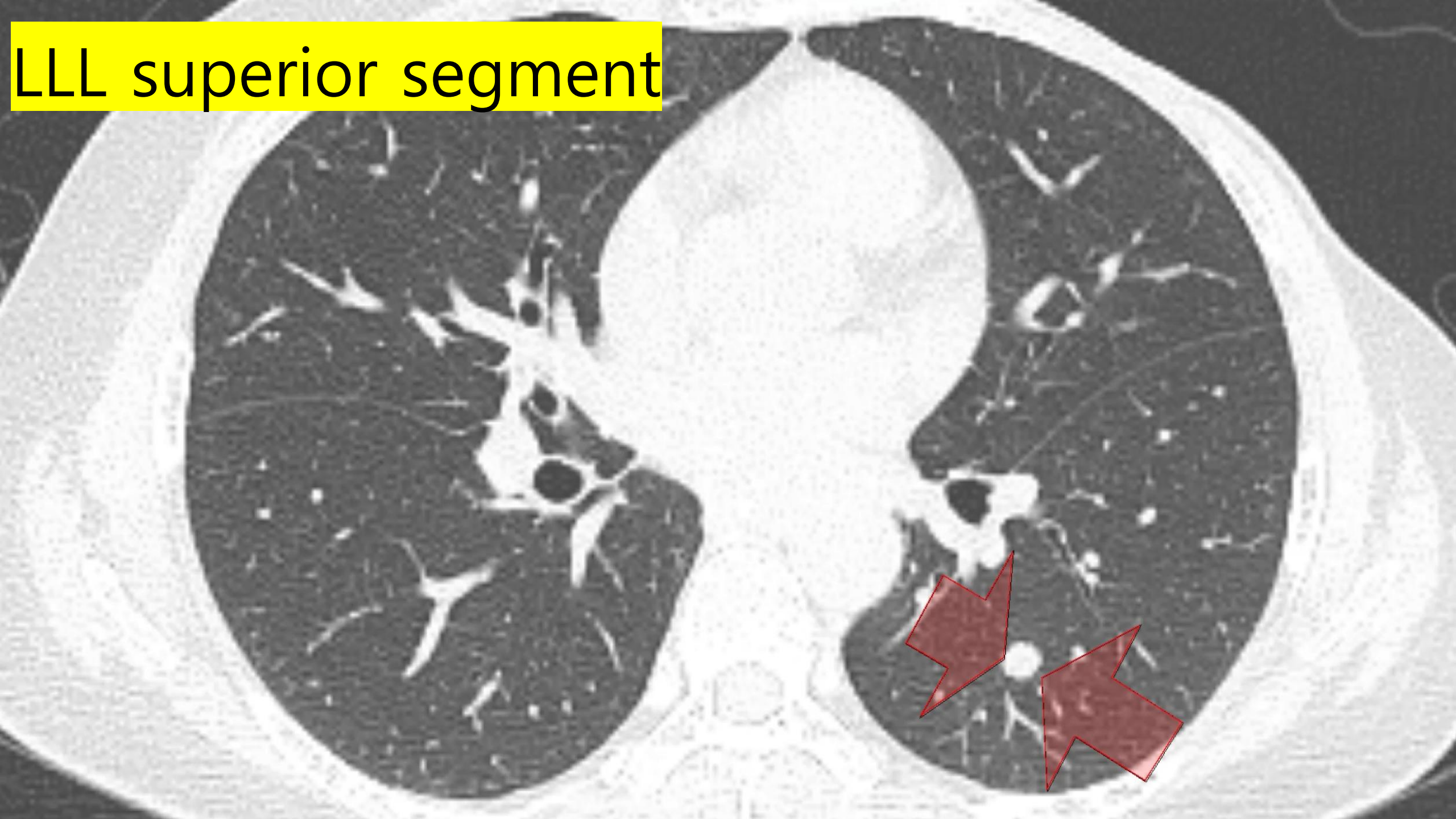


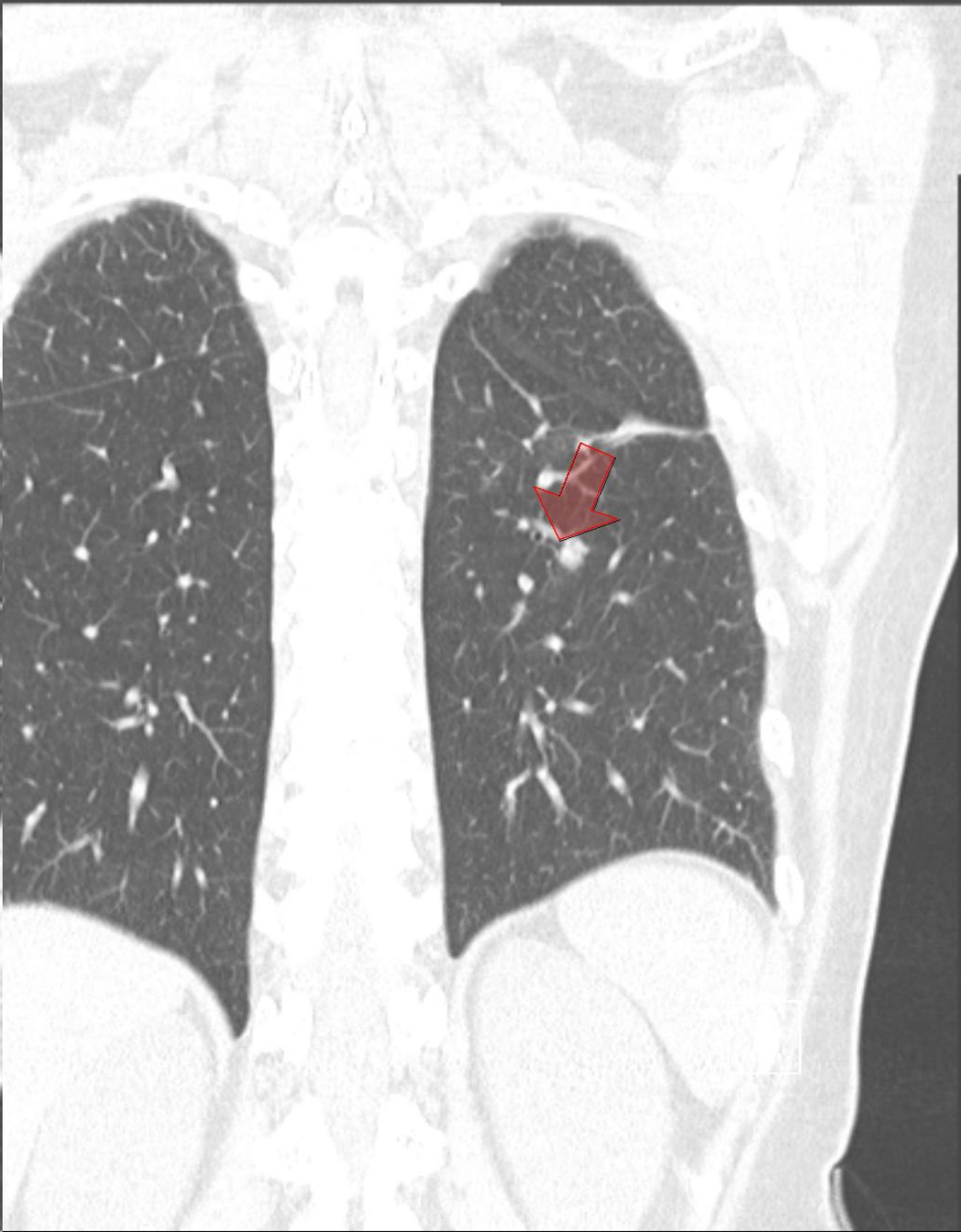
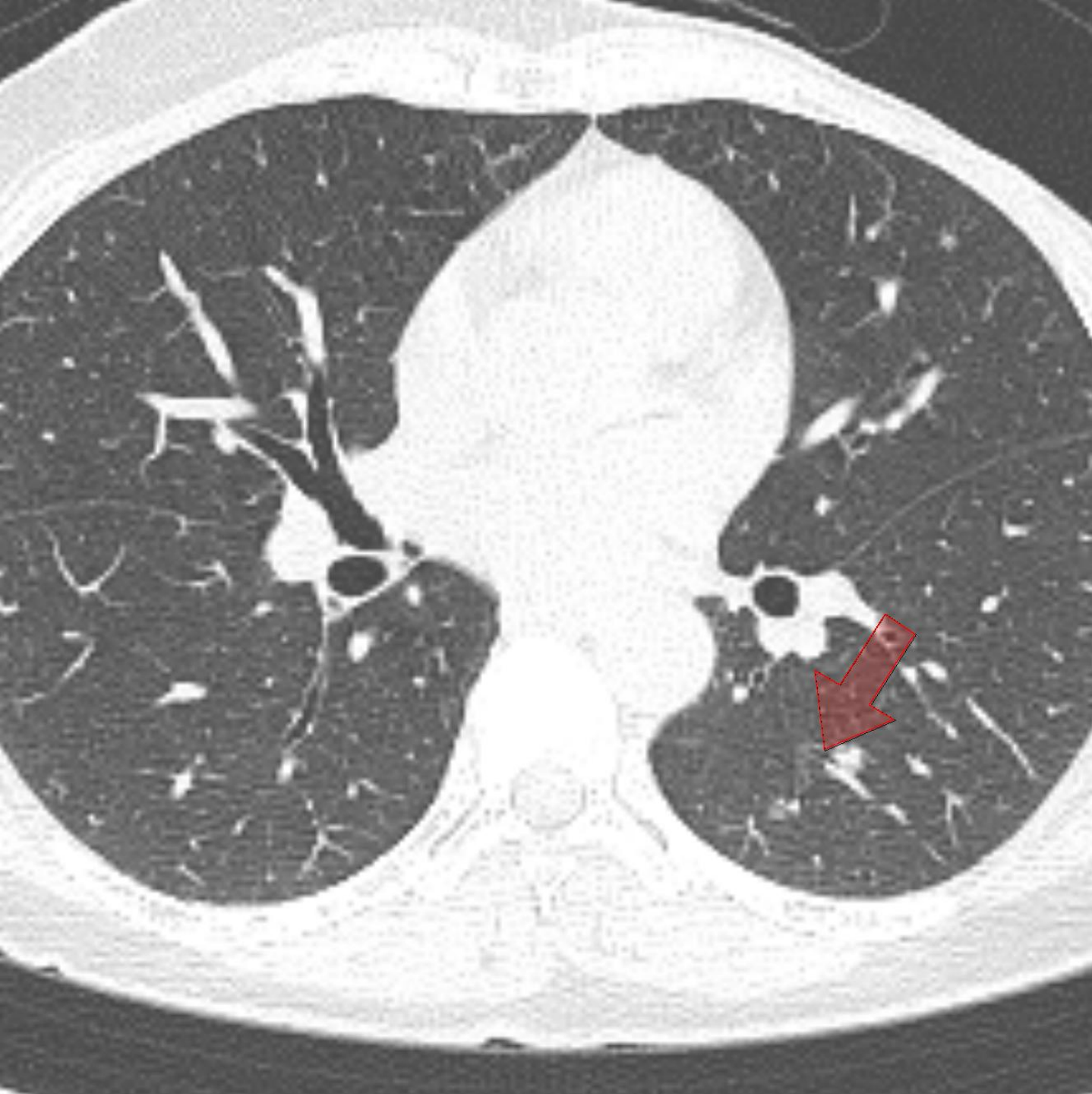
(6.5 f/s)
439 / 651

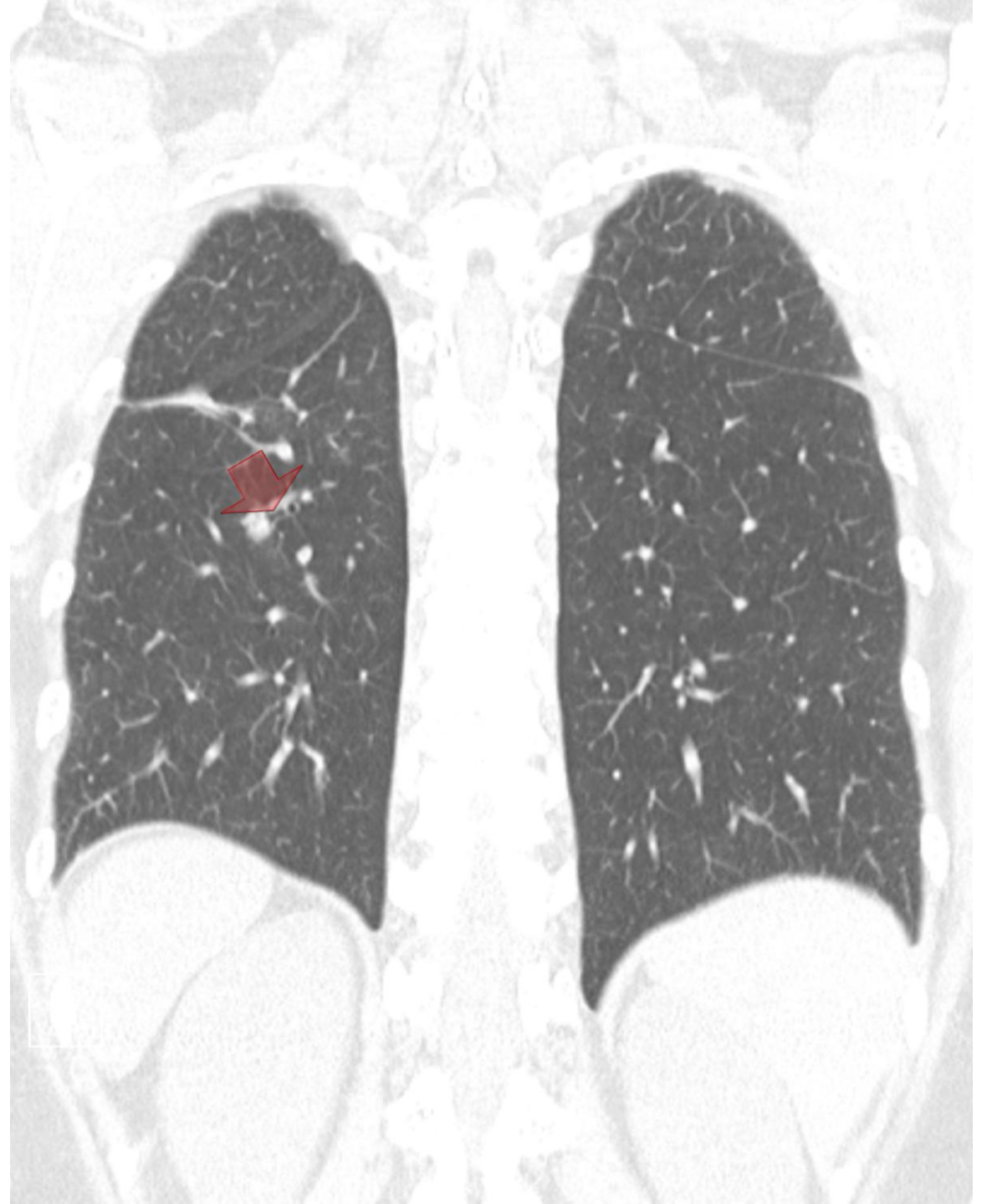
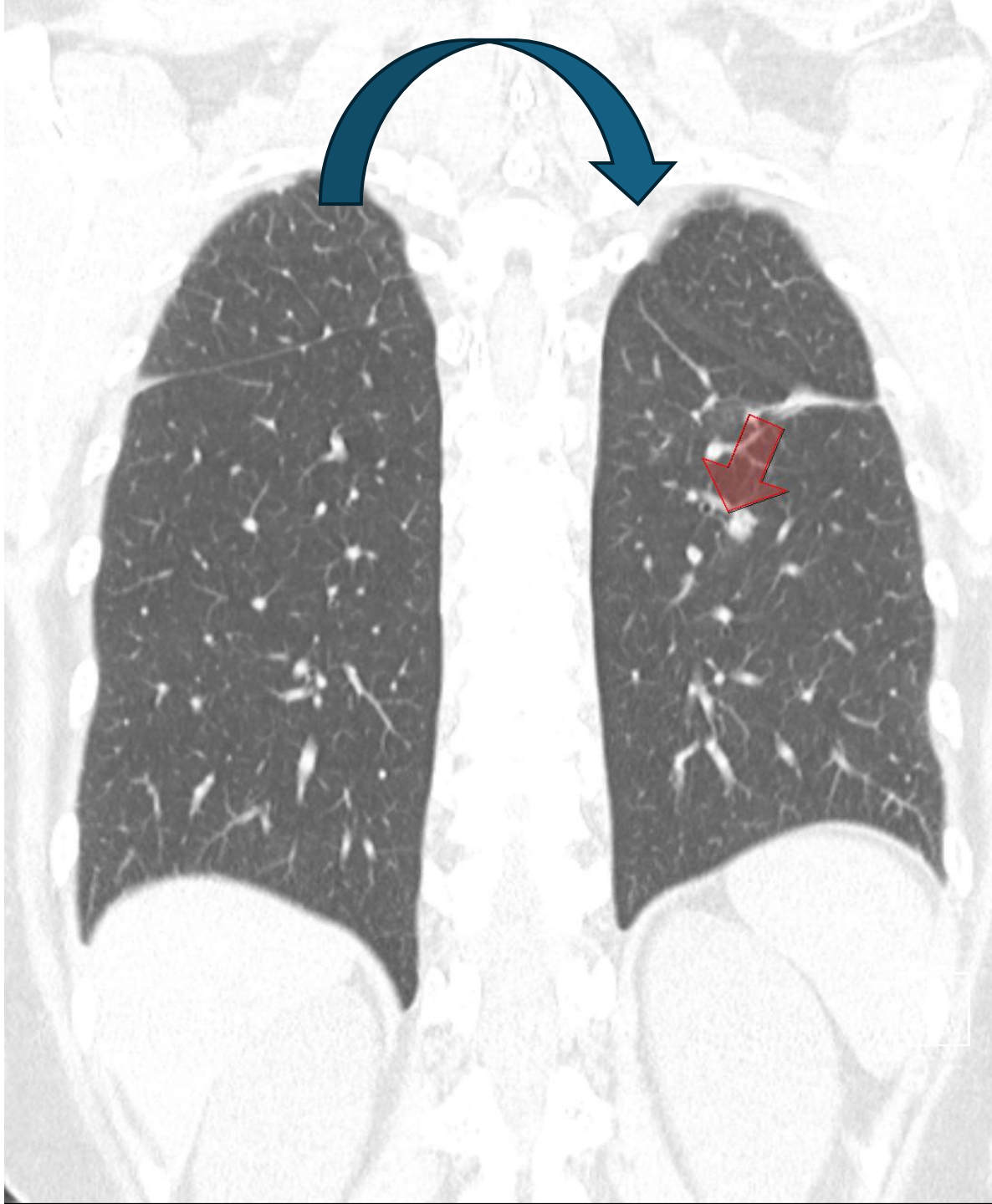
50mm

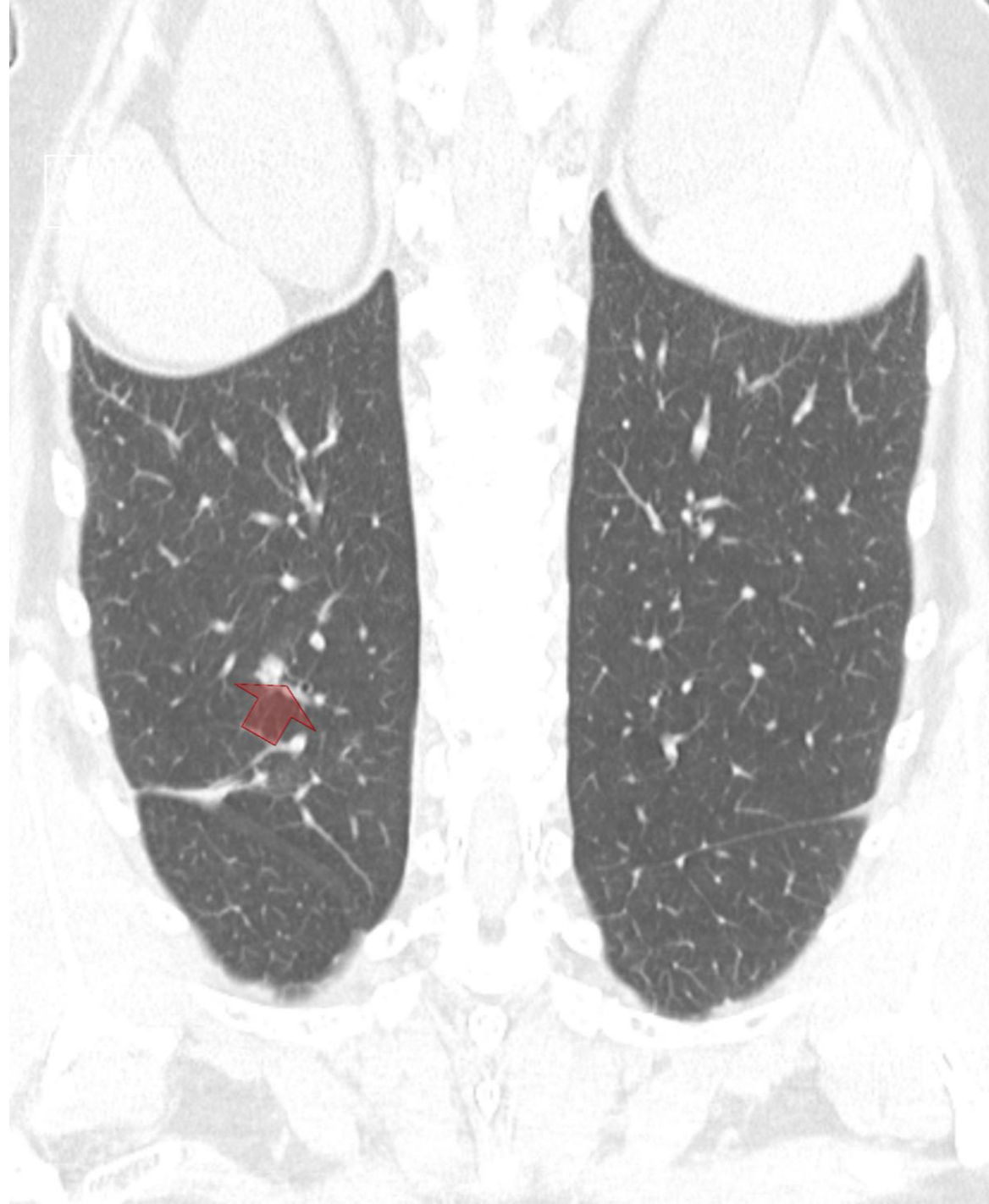
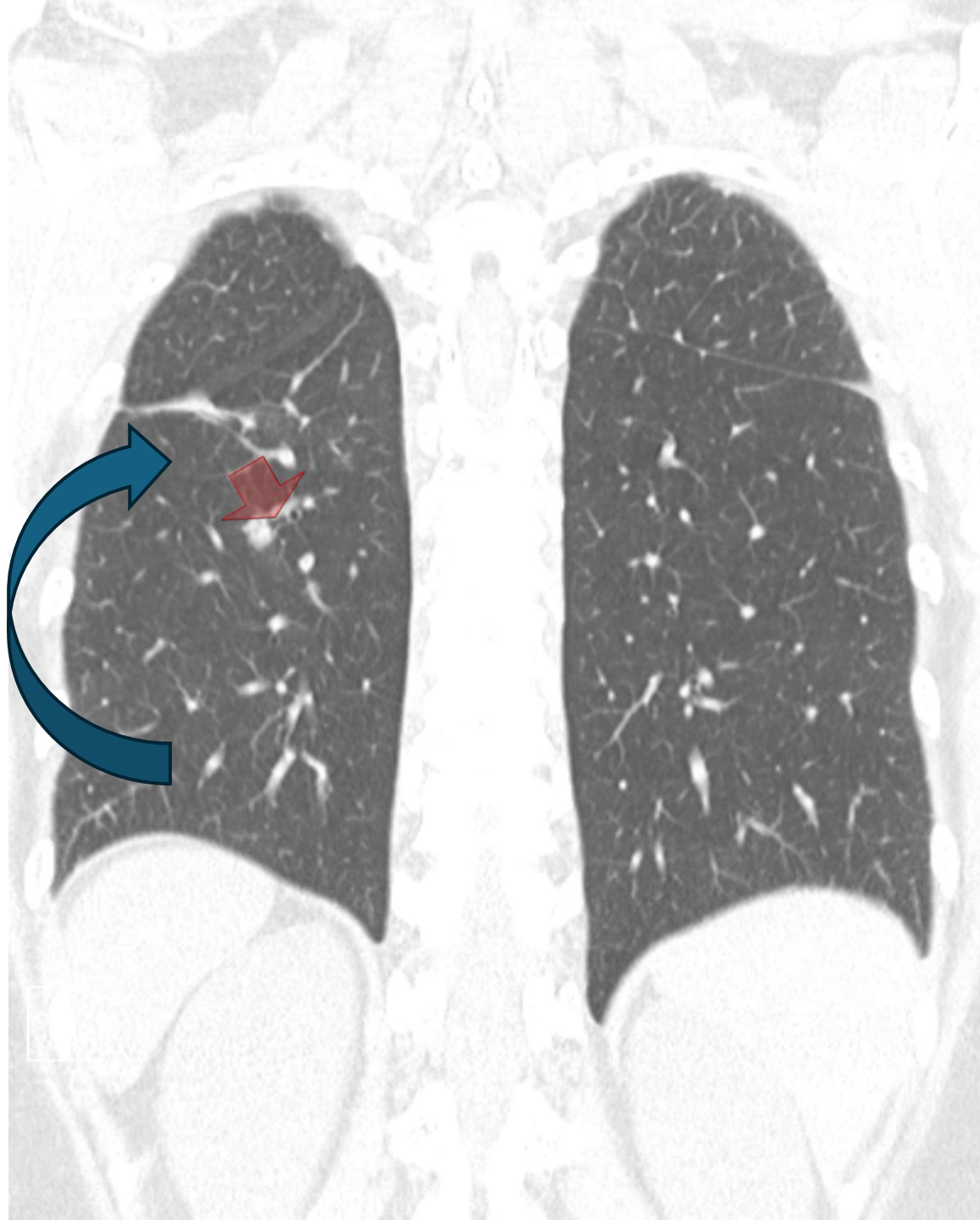


LLL superior segment





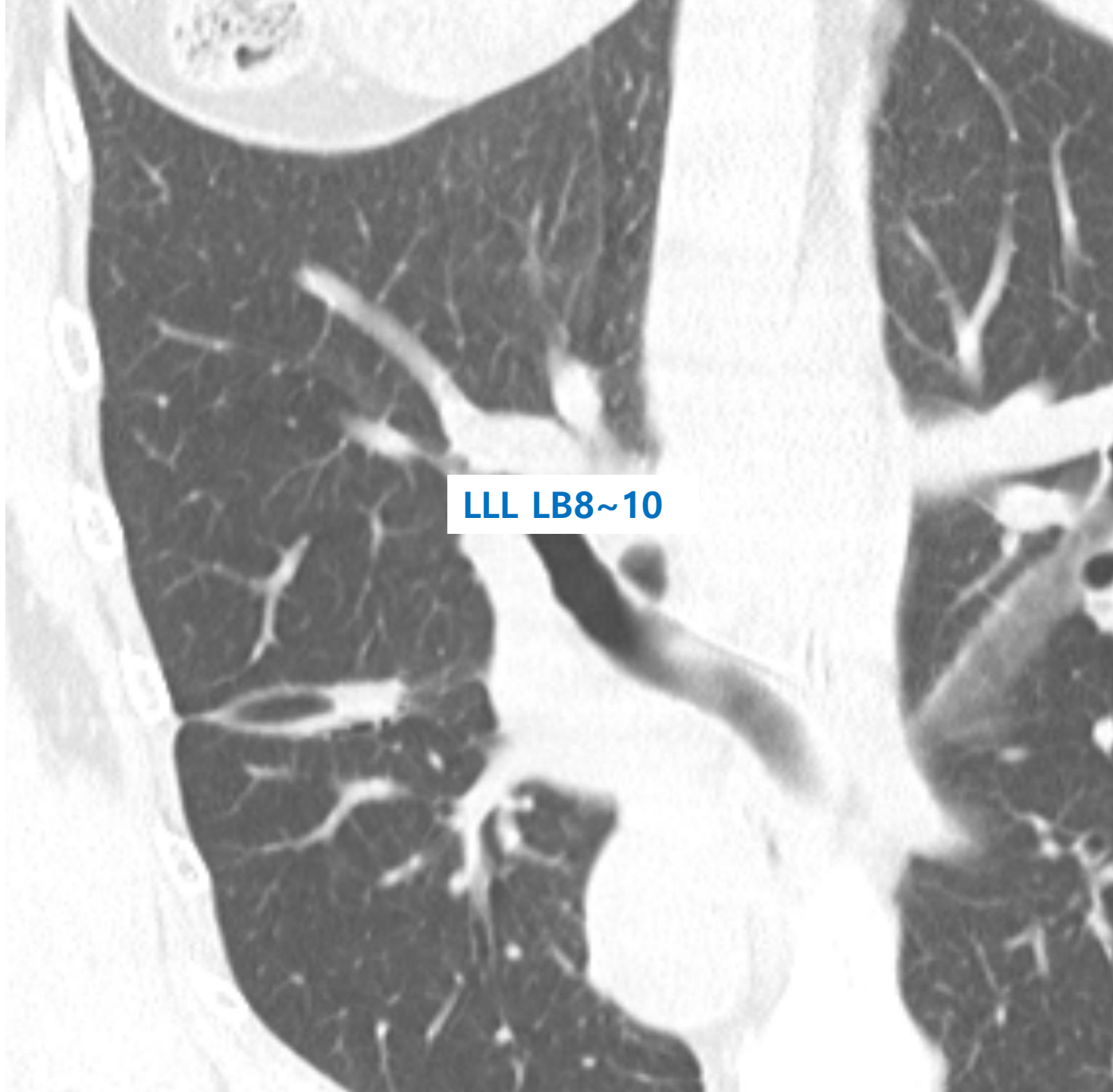




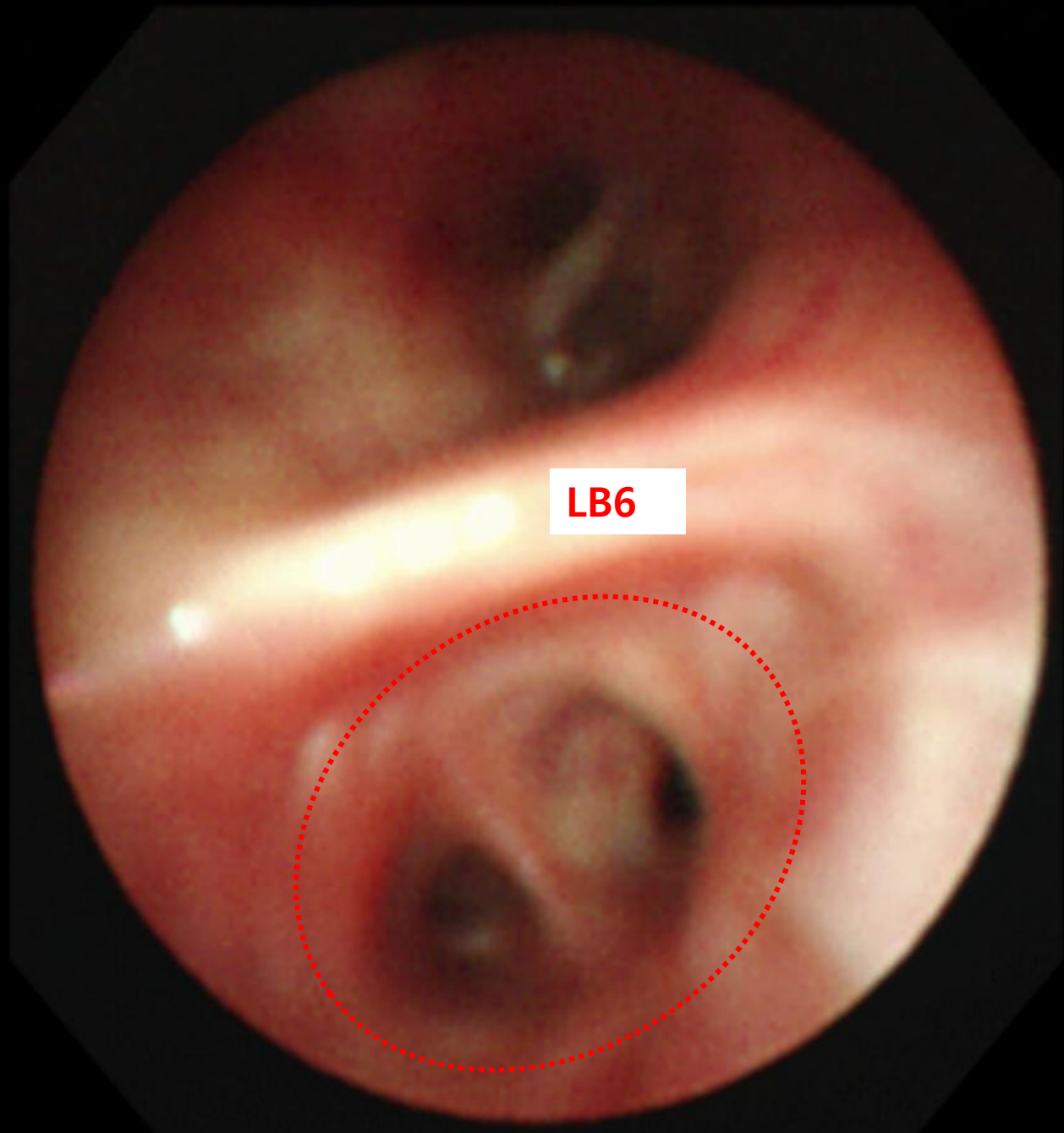
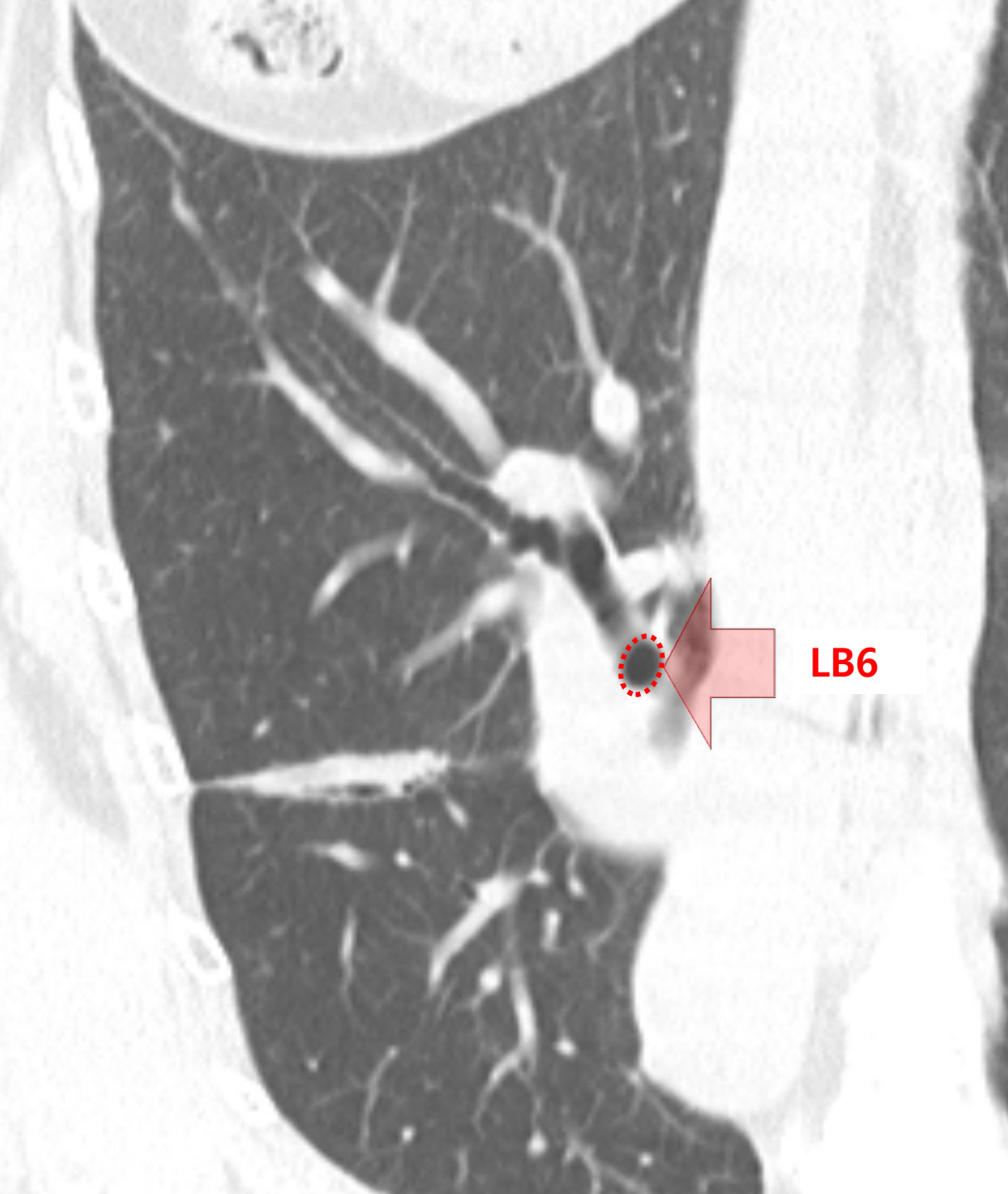


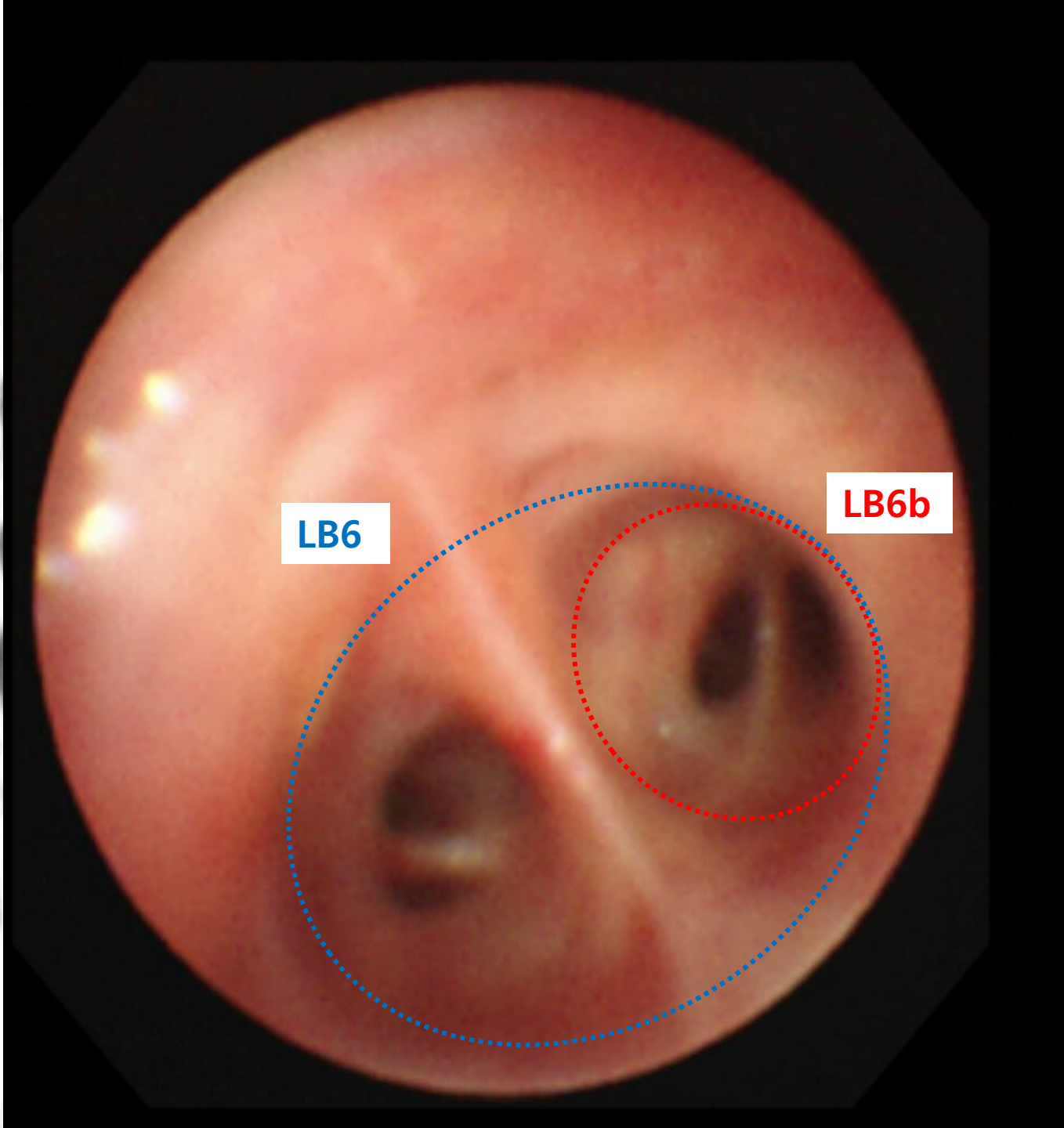
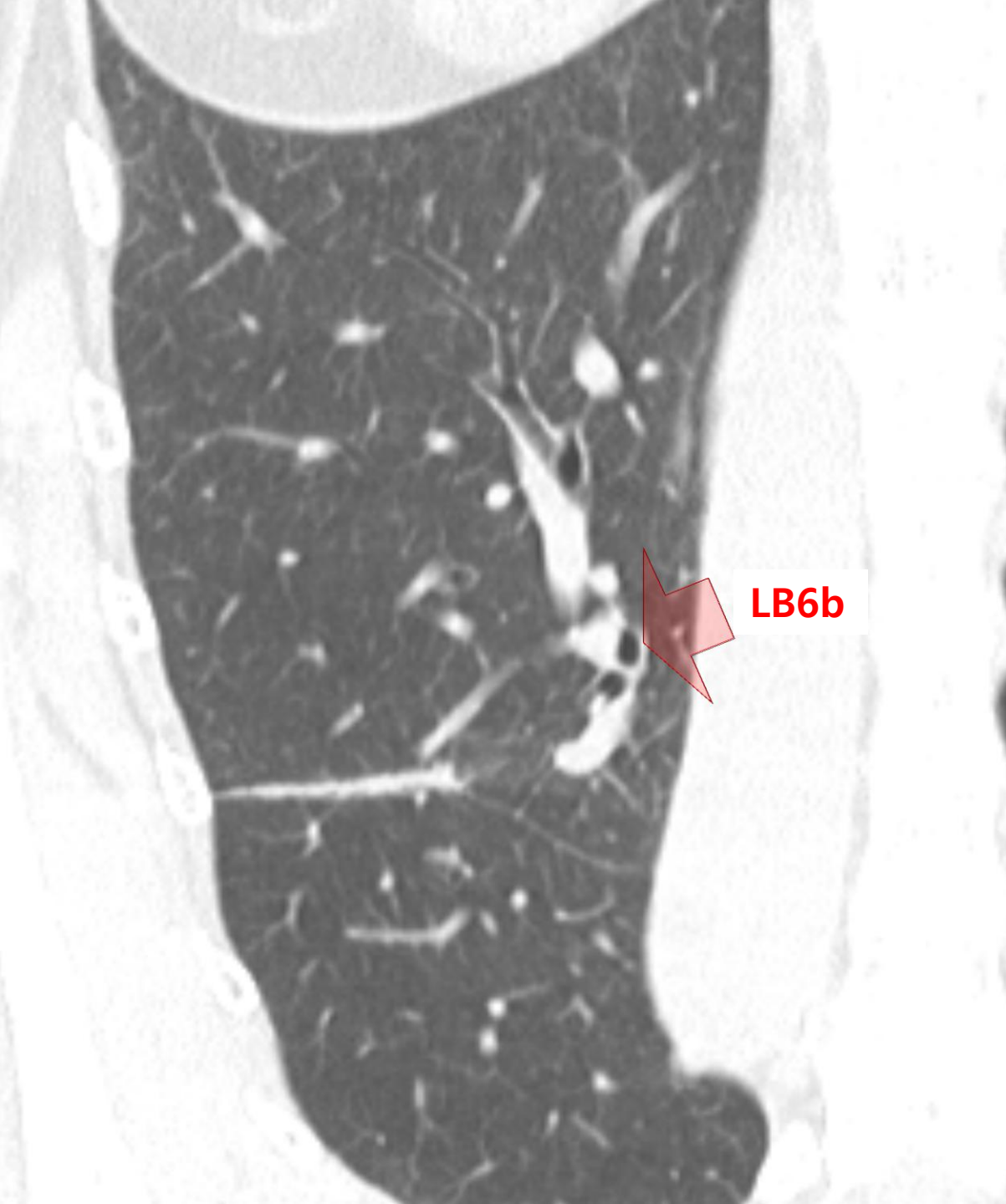


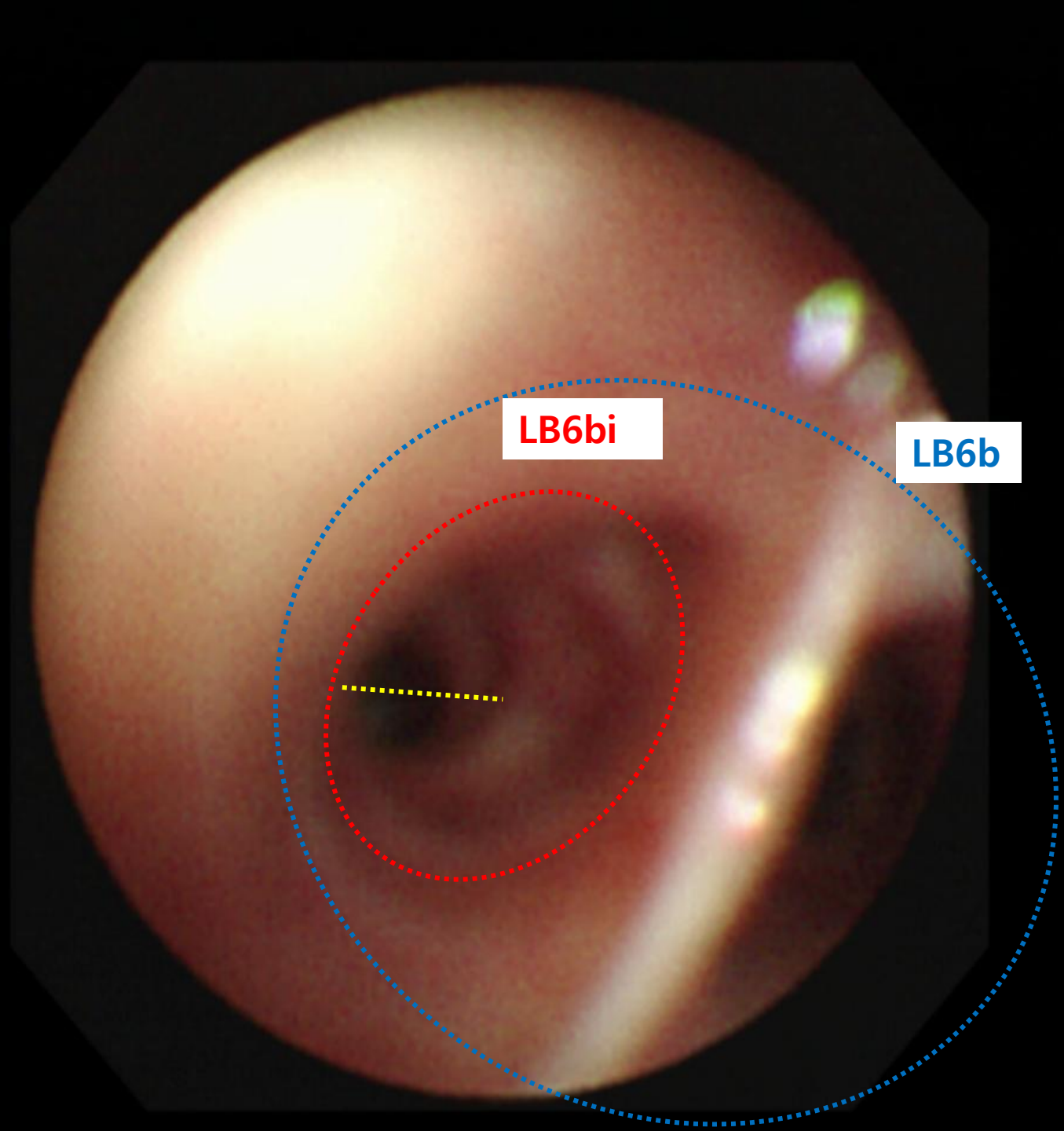
LMB

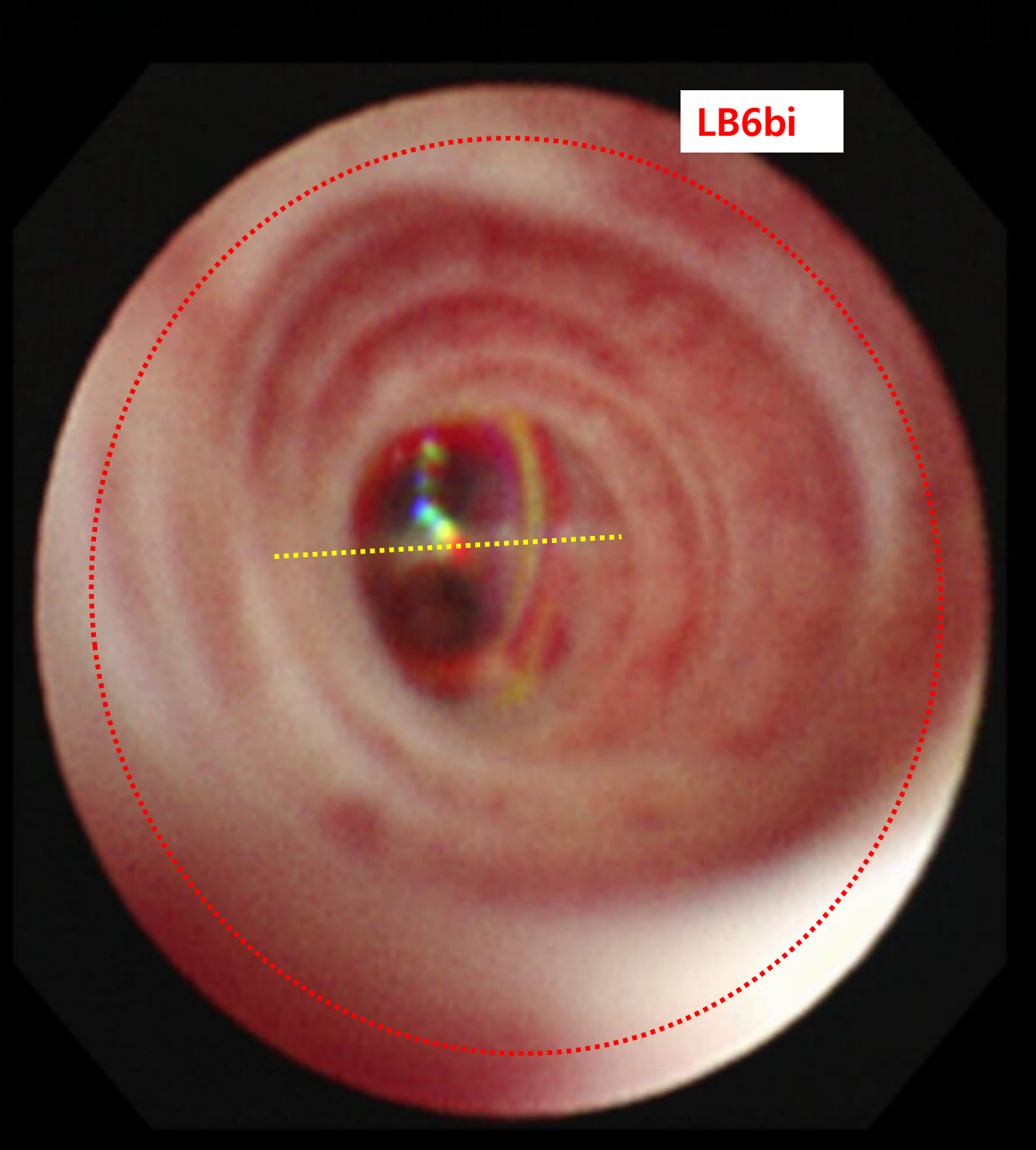


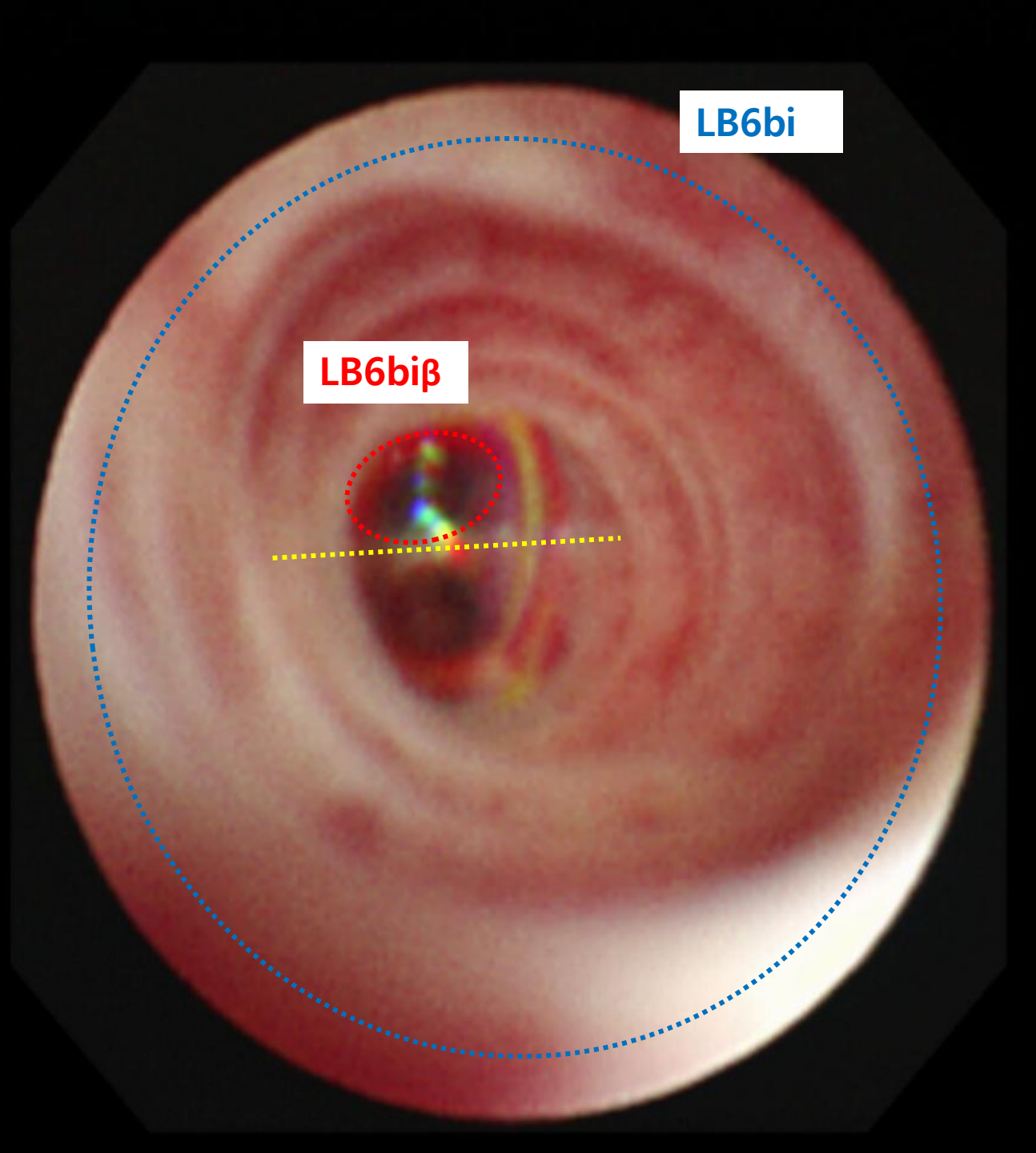
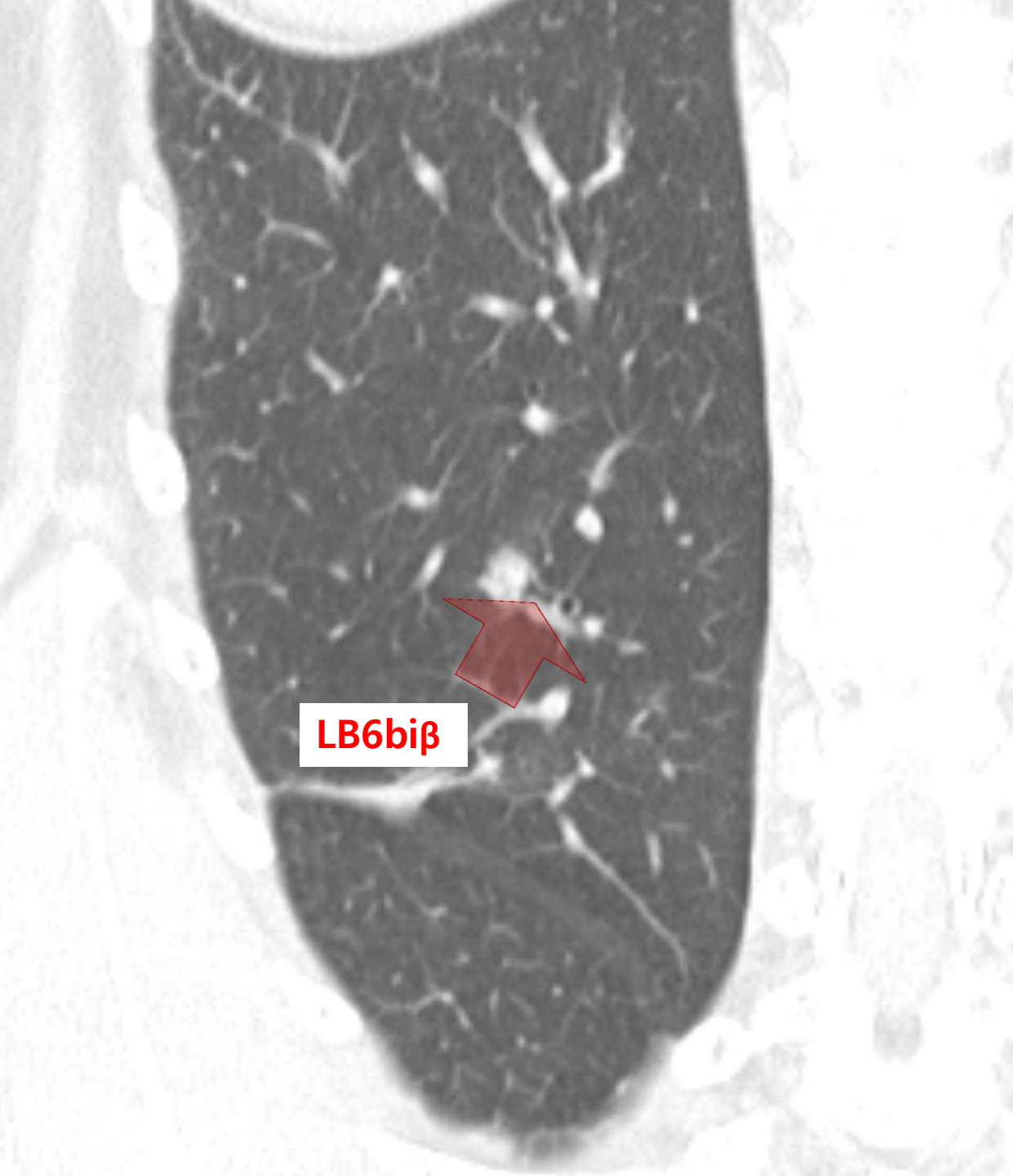
LLL LB8~10

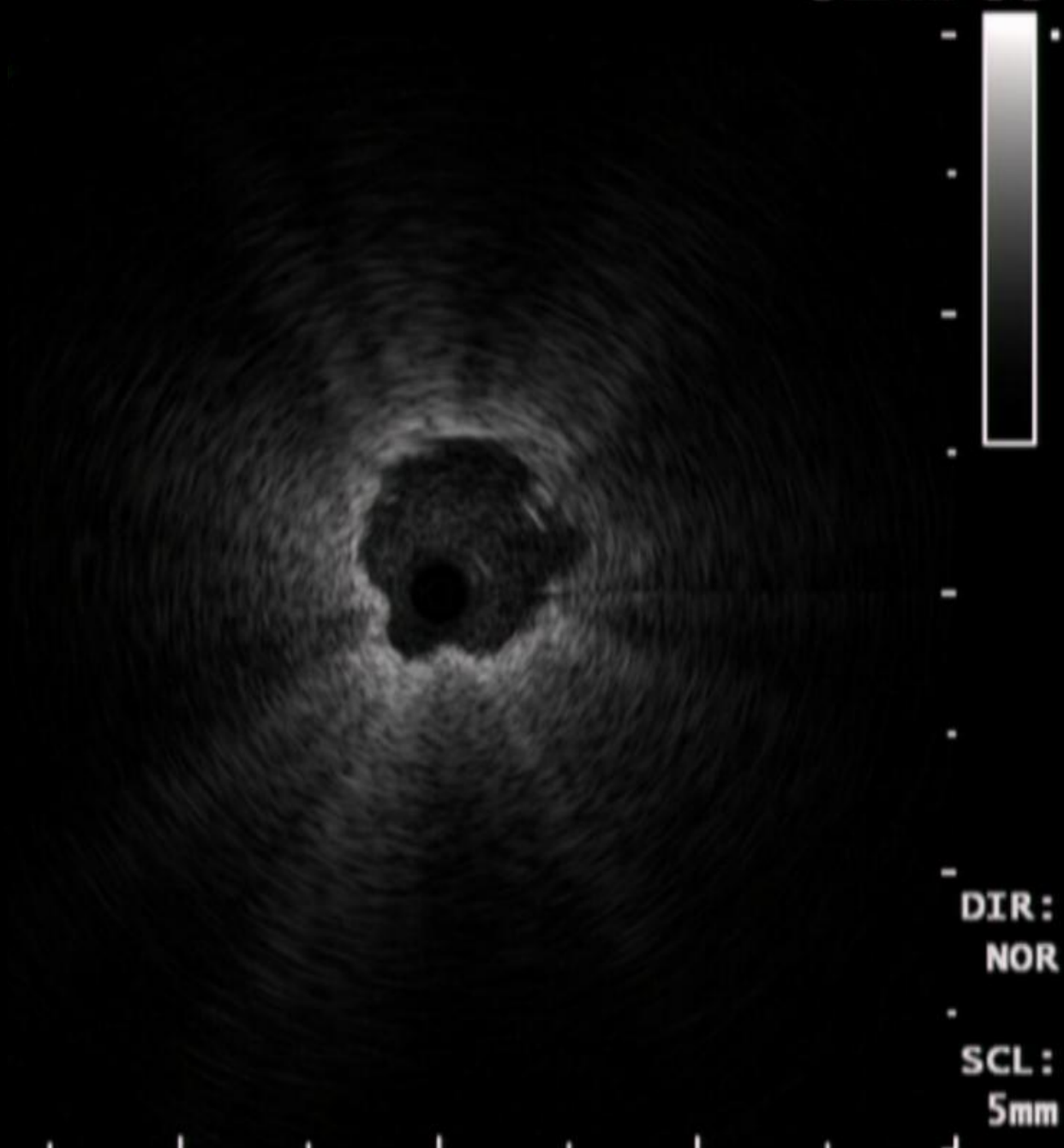
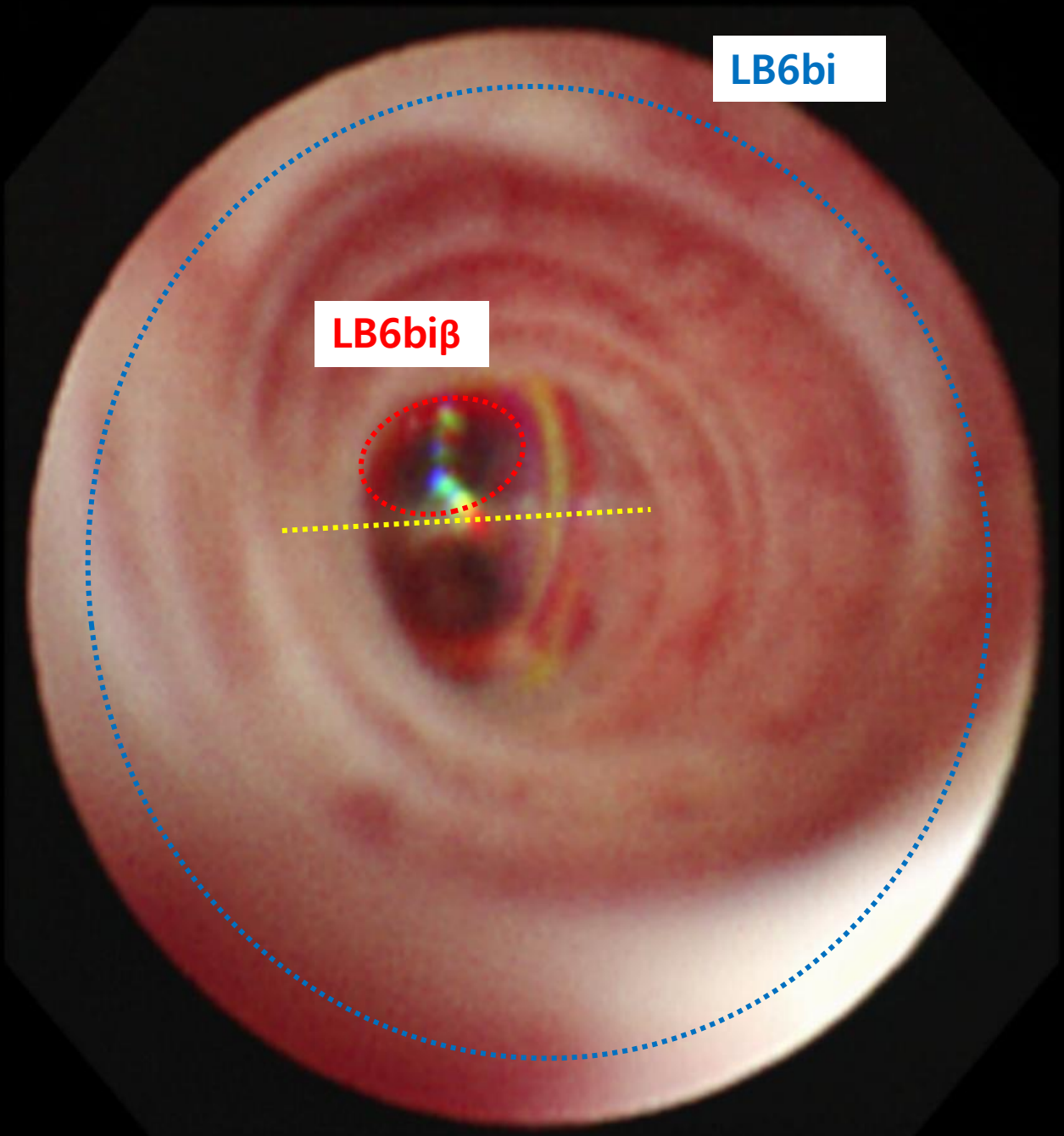












Noriaki Kurimoto
Katsuhiko Morita

Bronchial Branch Tracing

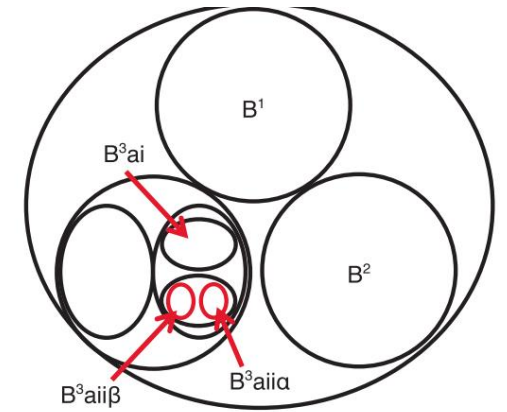
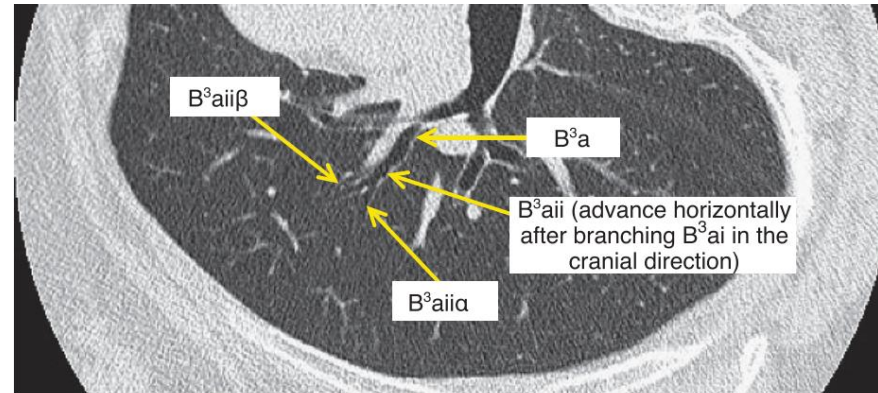
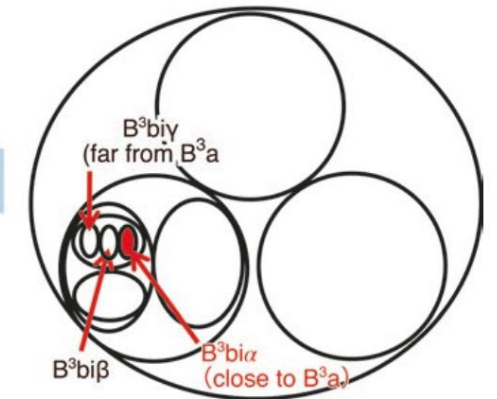
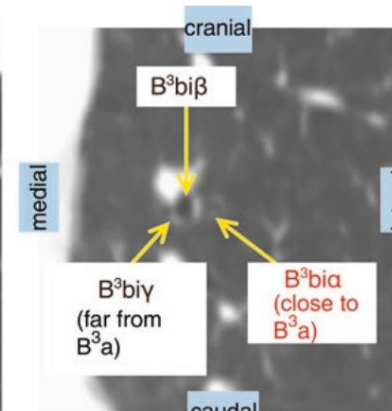
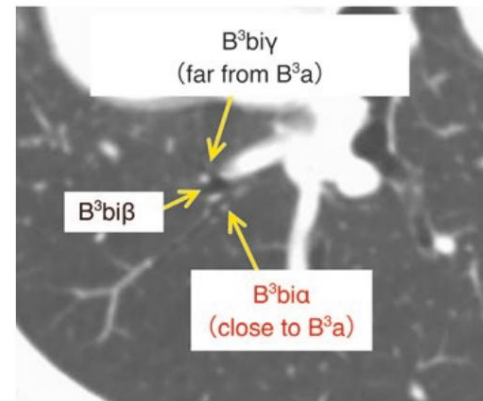


Fig. 1.15 Horizontal–horizontal pattern at the spur of right B³aiiα and B³aiiβ



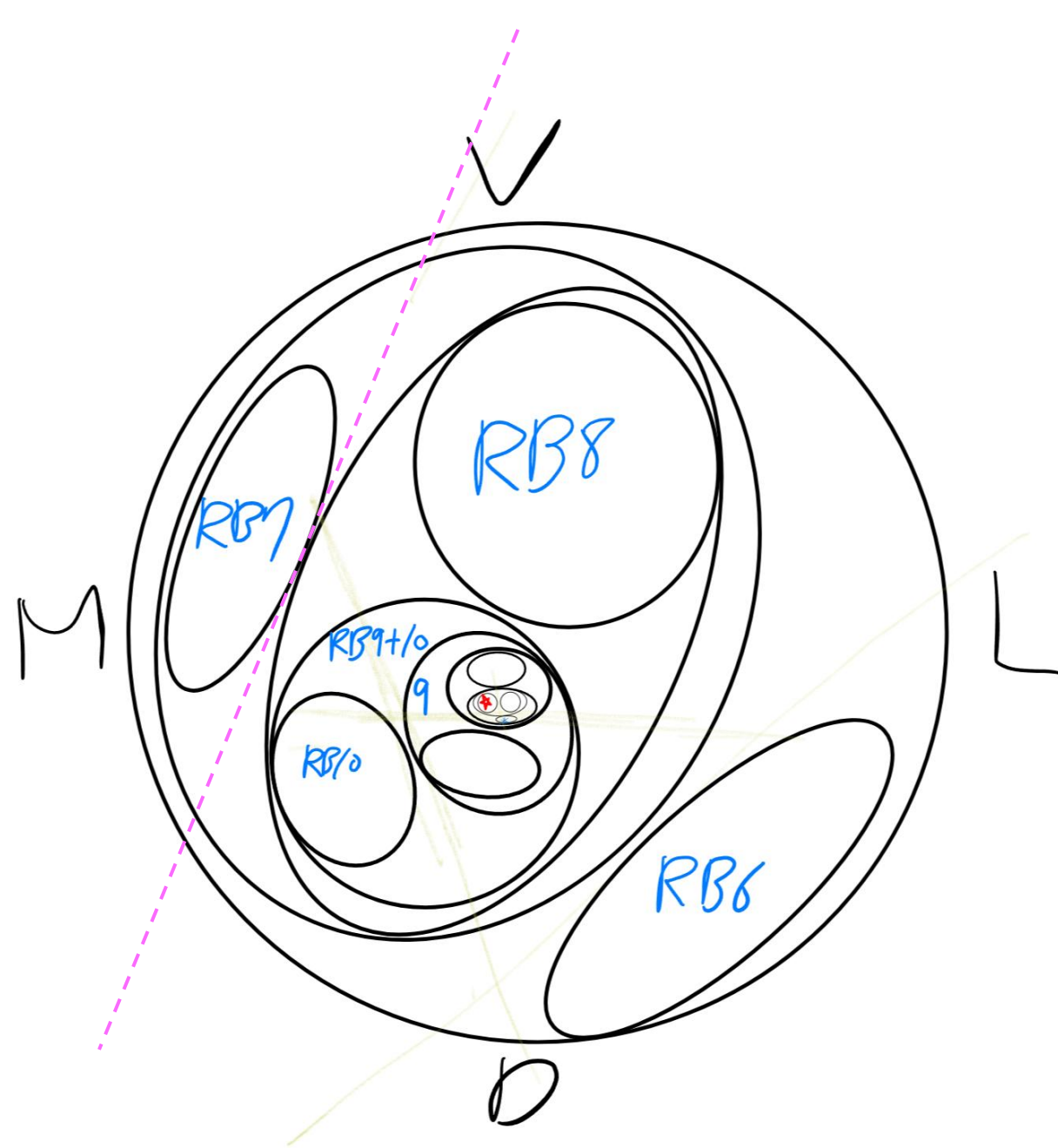
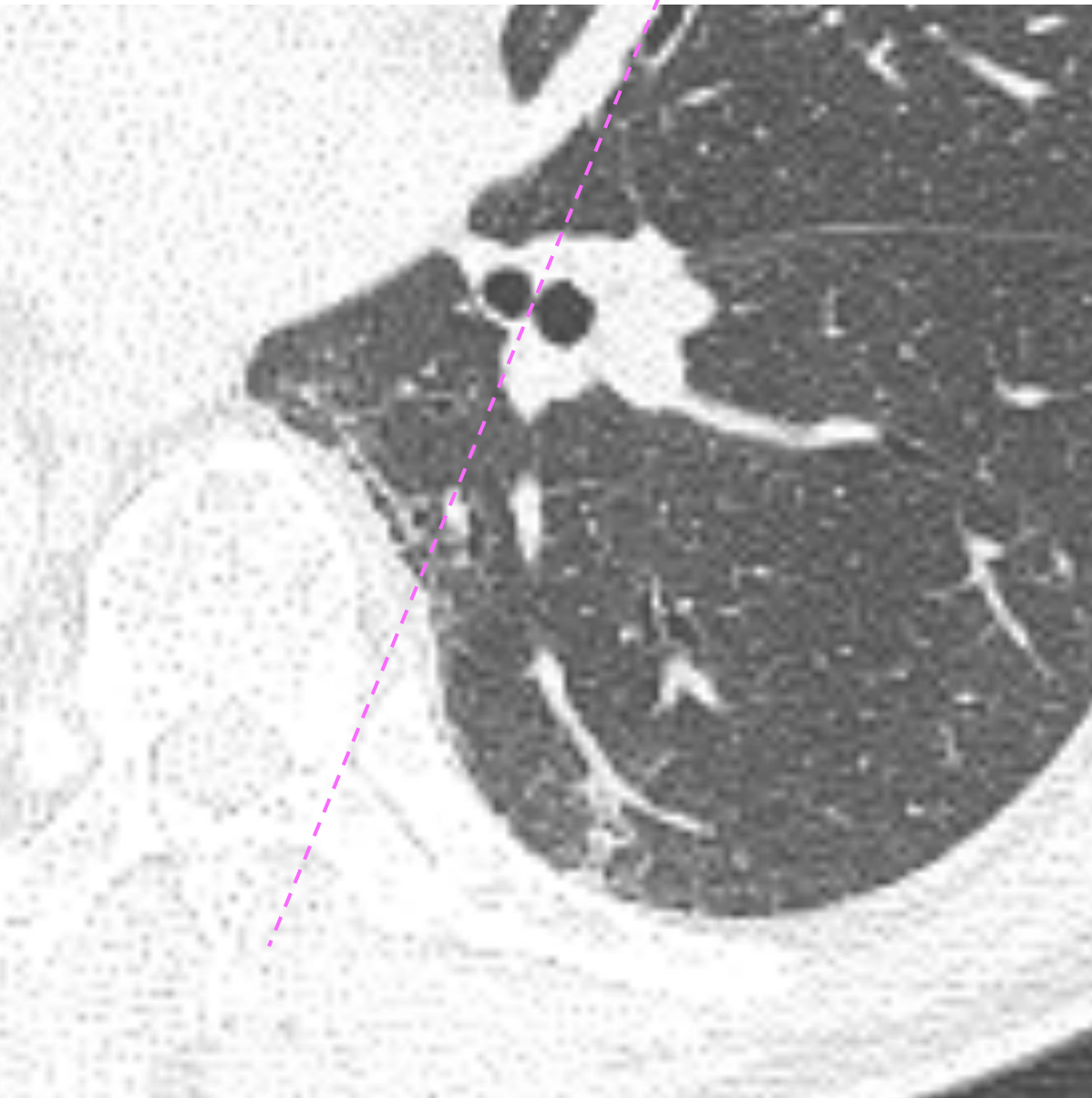
CT image rotated
counter clockwise 90°

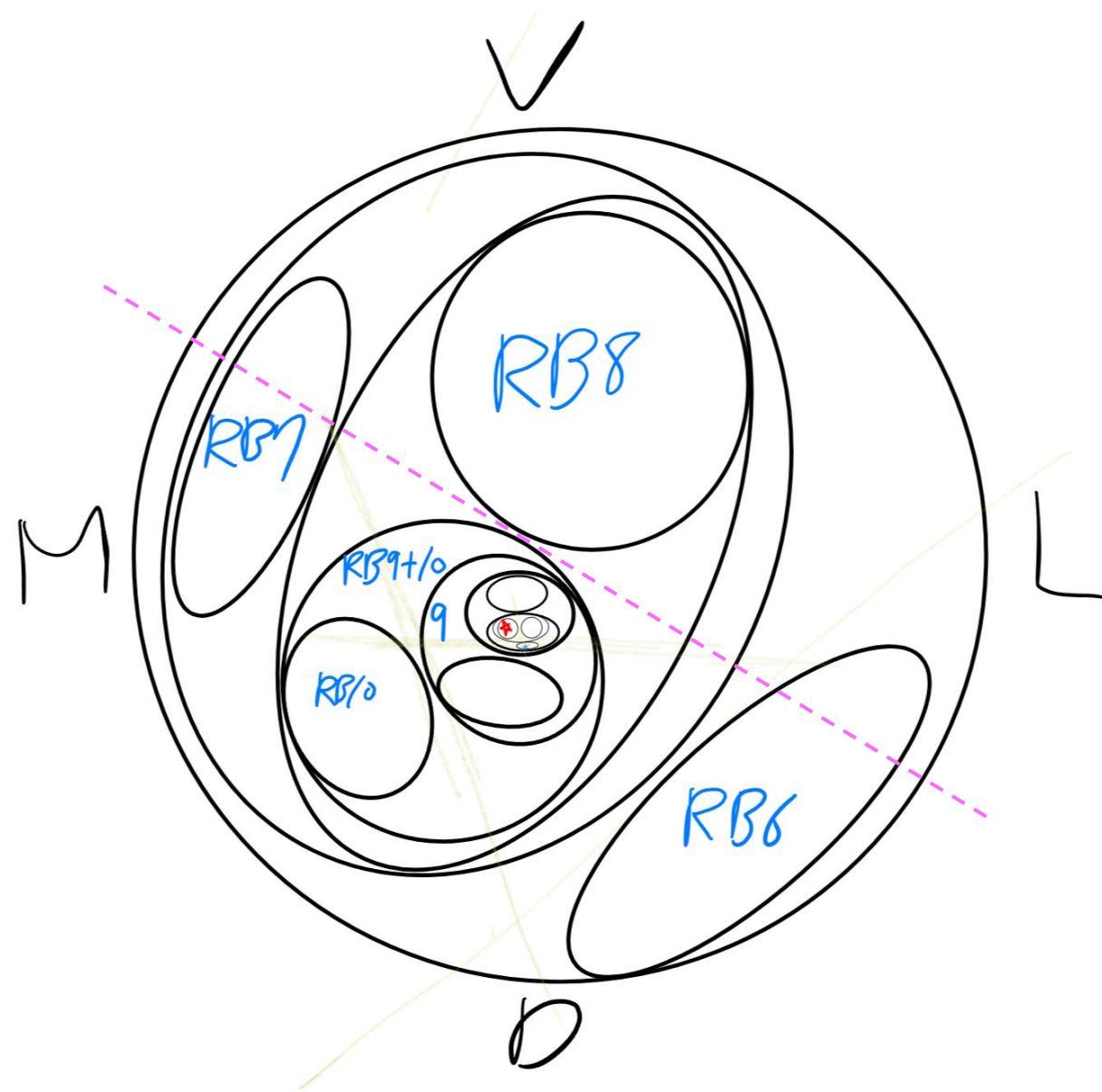
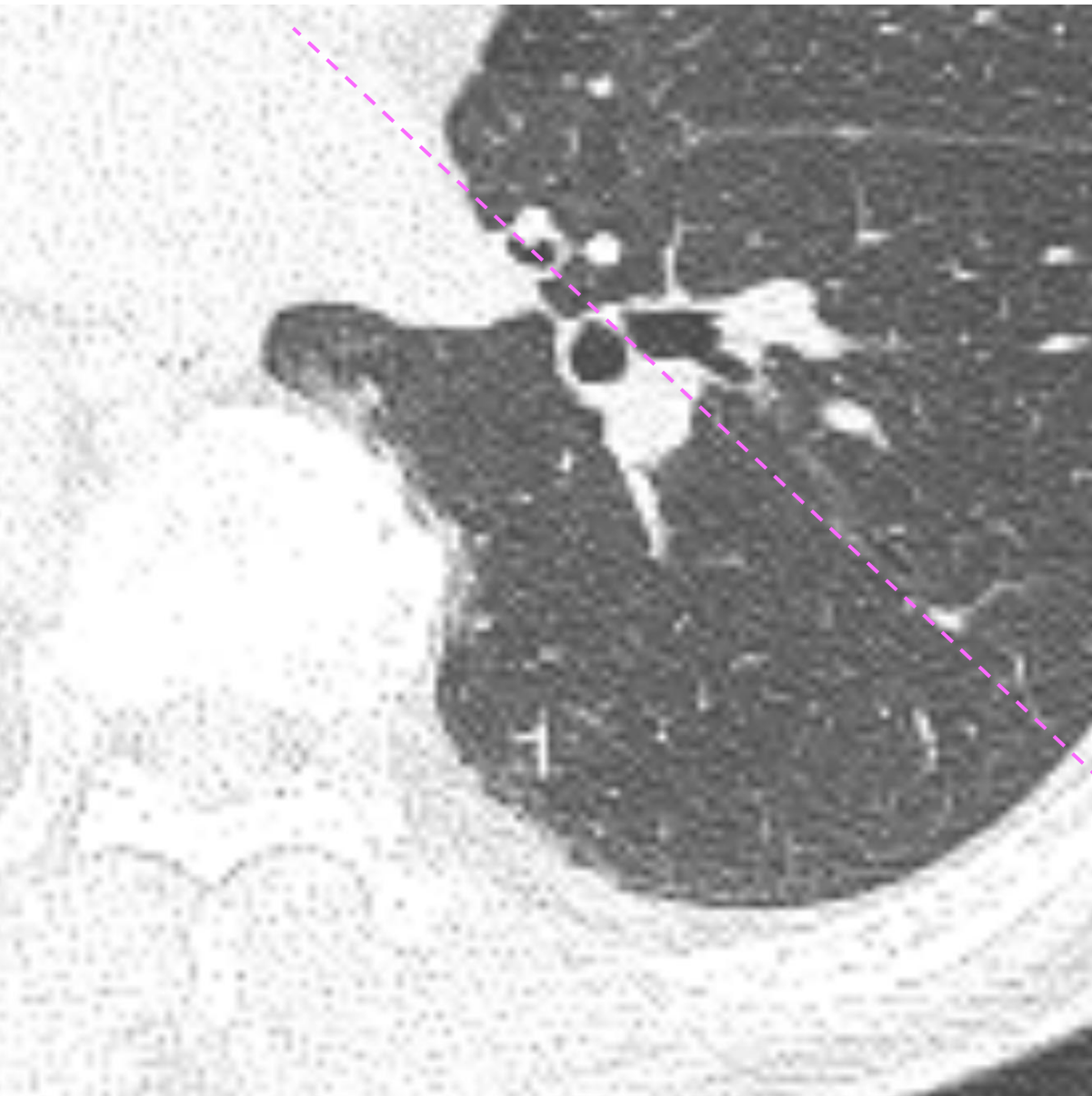
sagittal MPR image

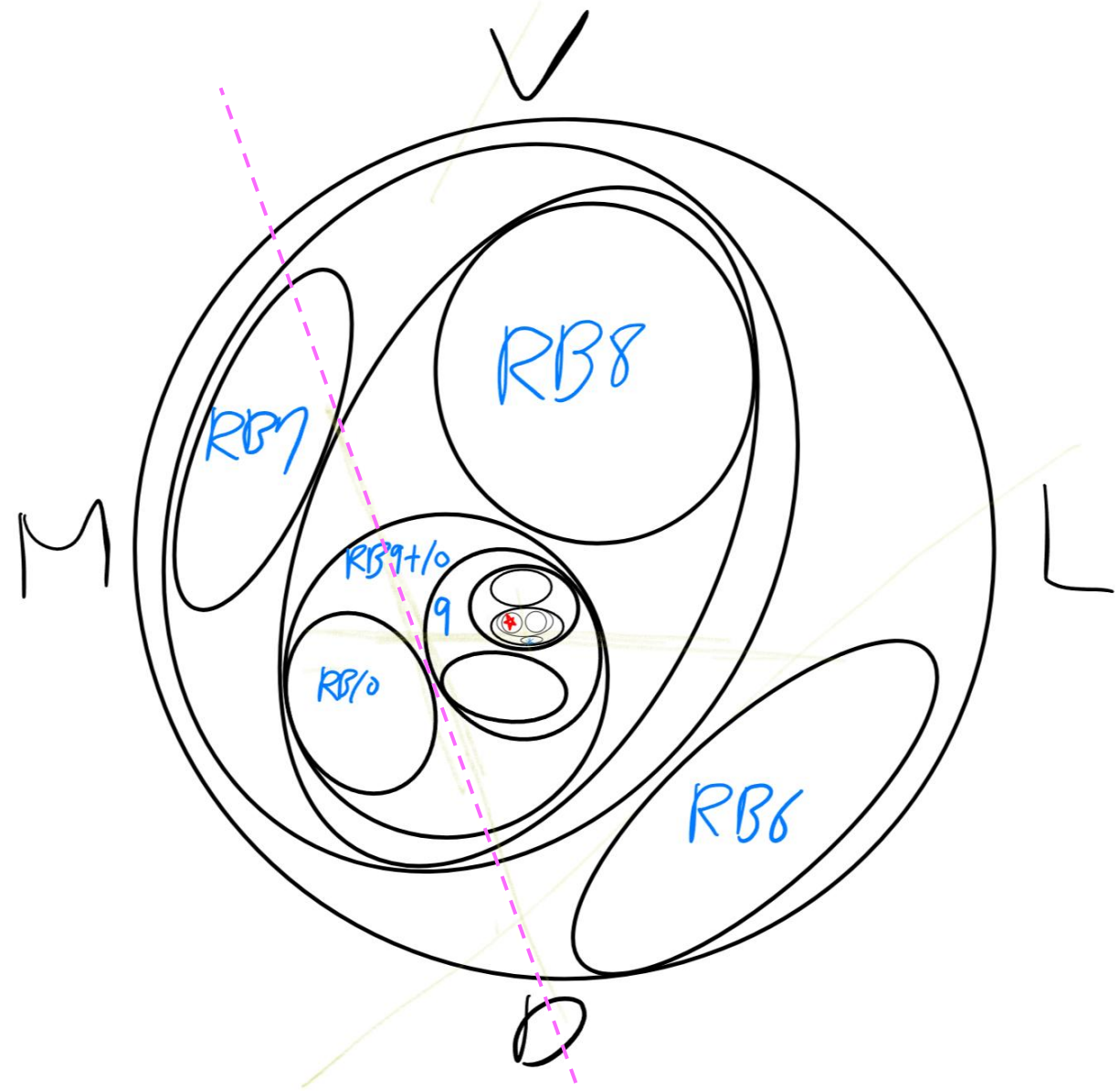
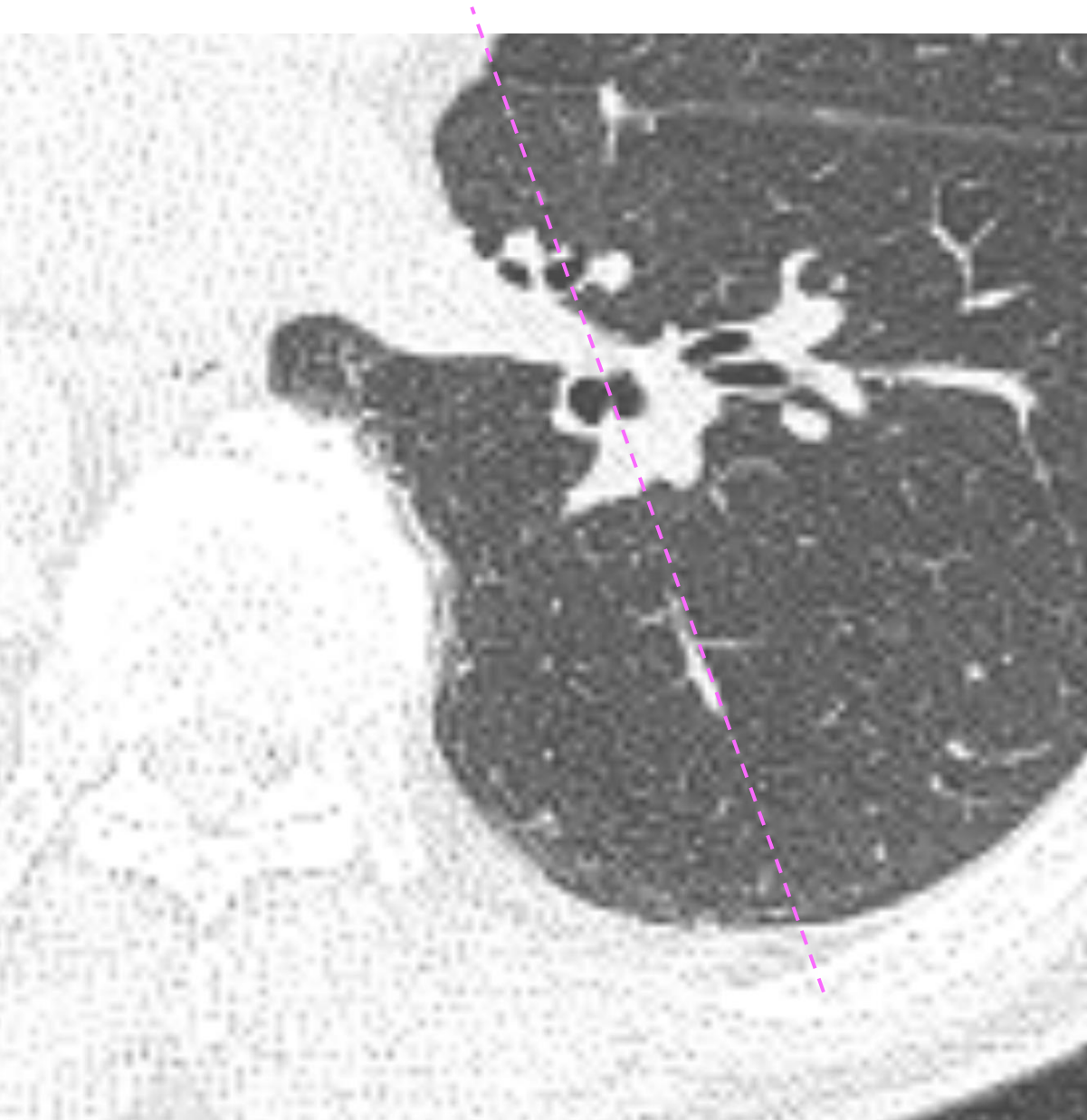
79/M

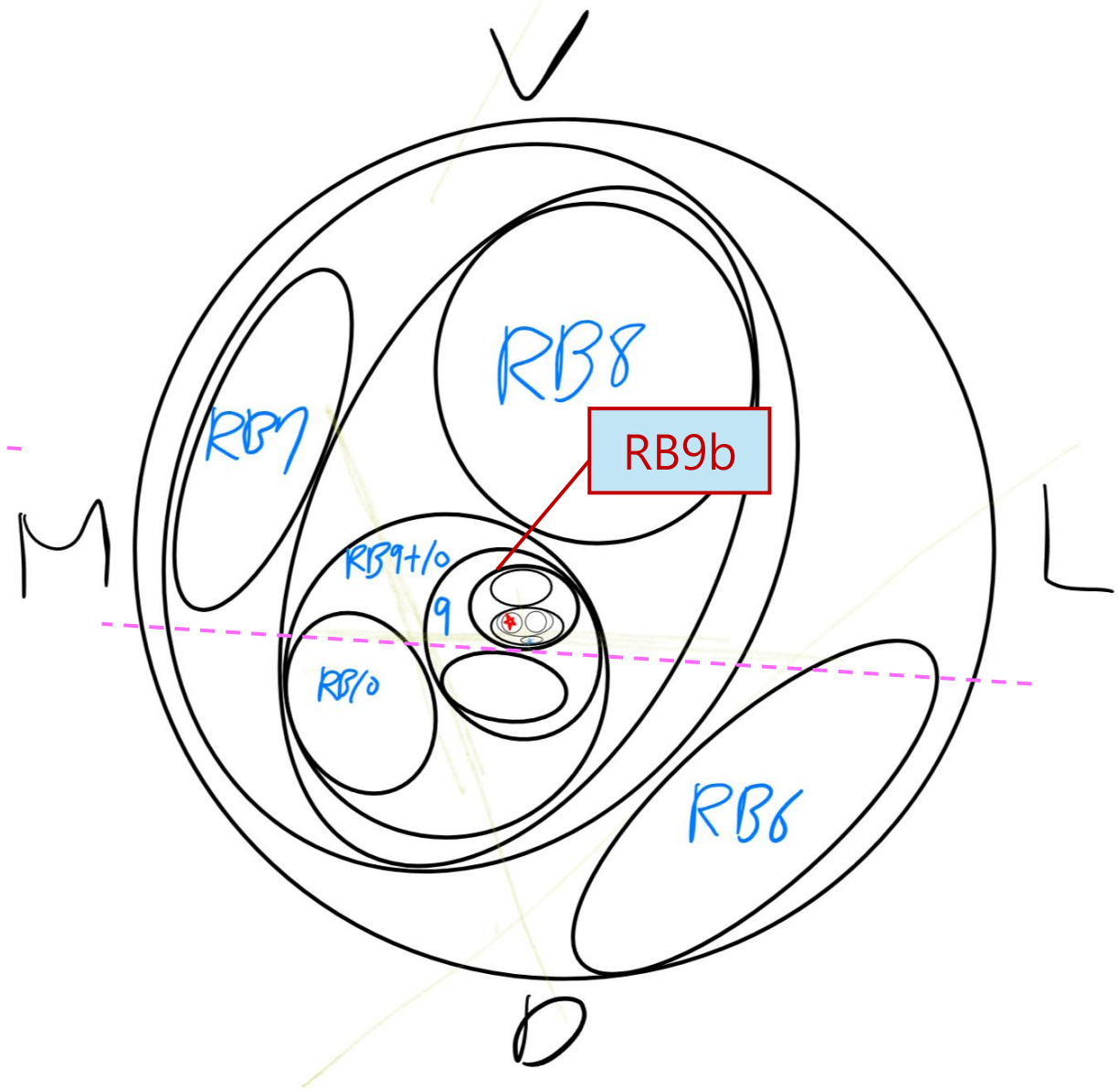
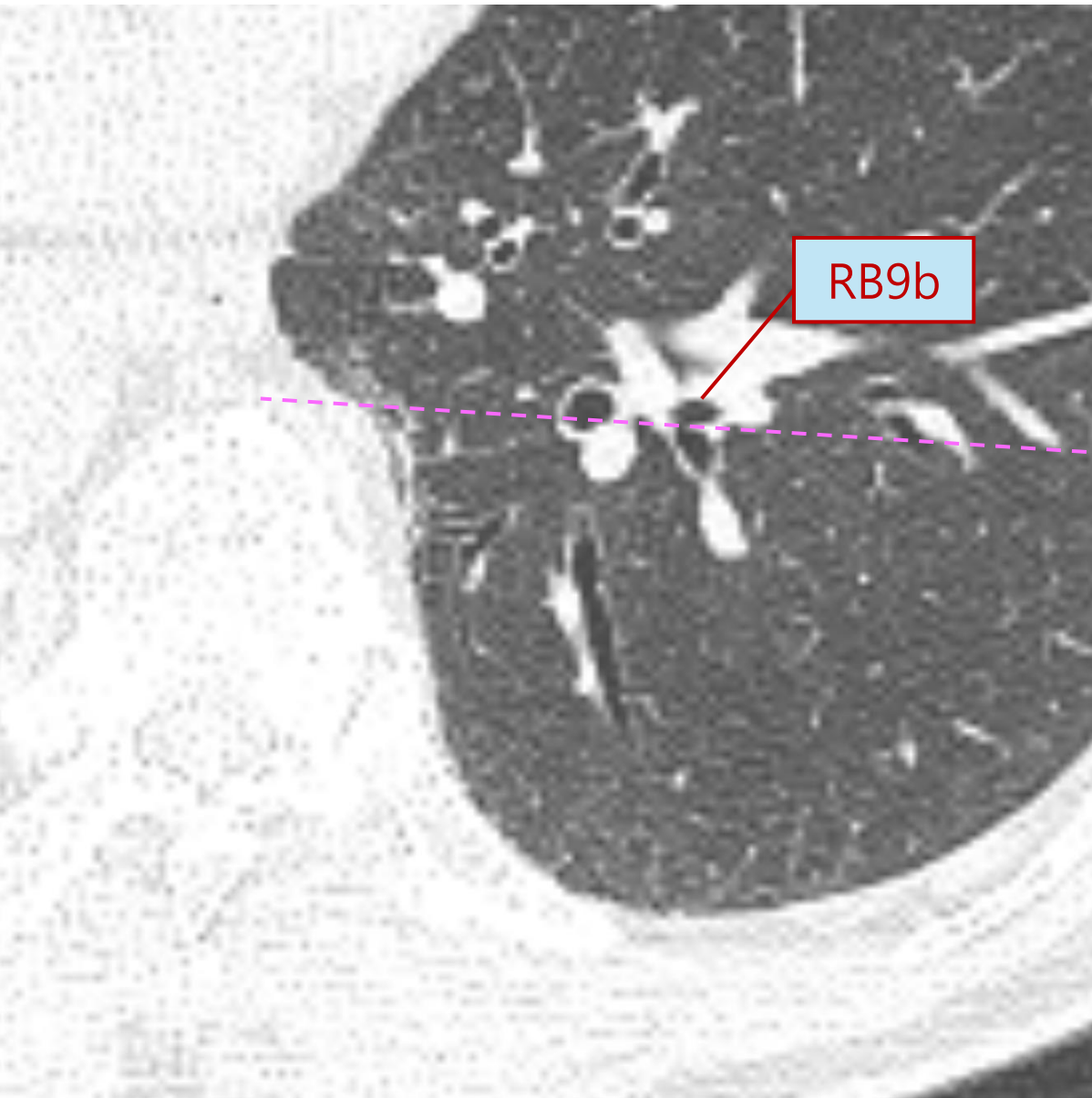
- Bronchial Branch Tracing
- RB9biβ

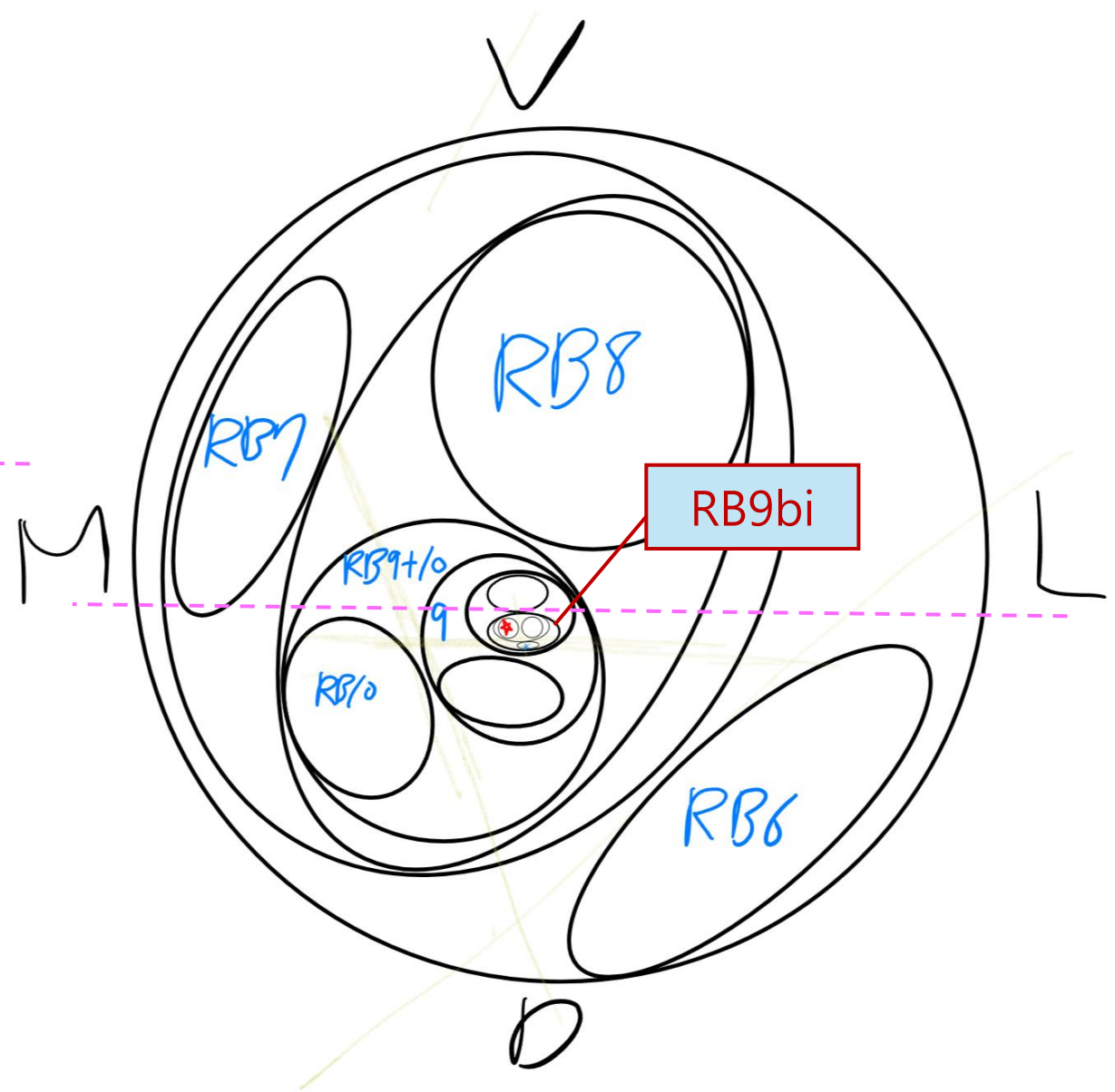
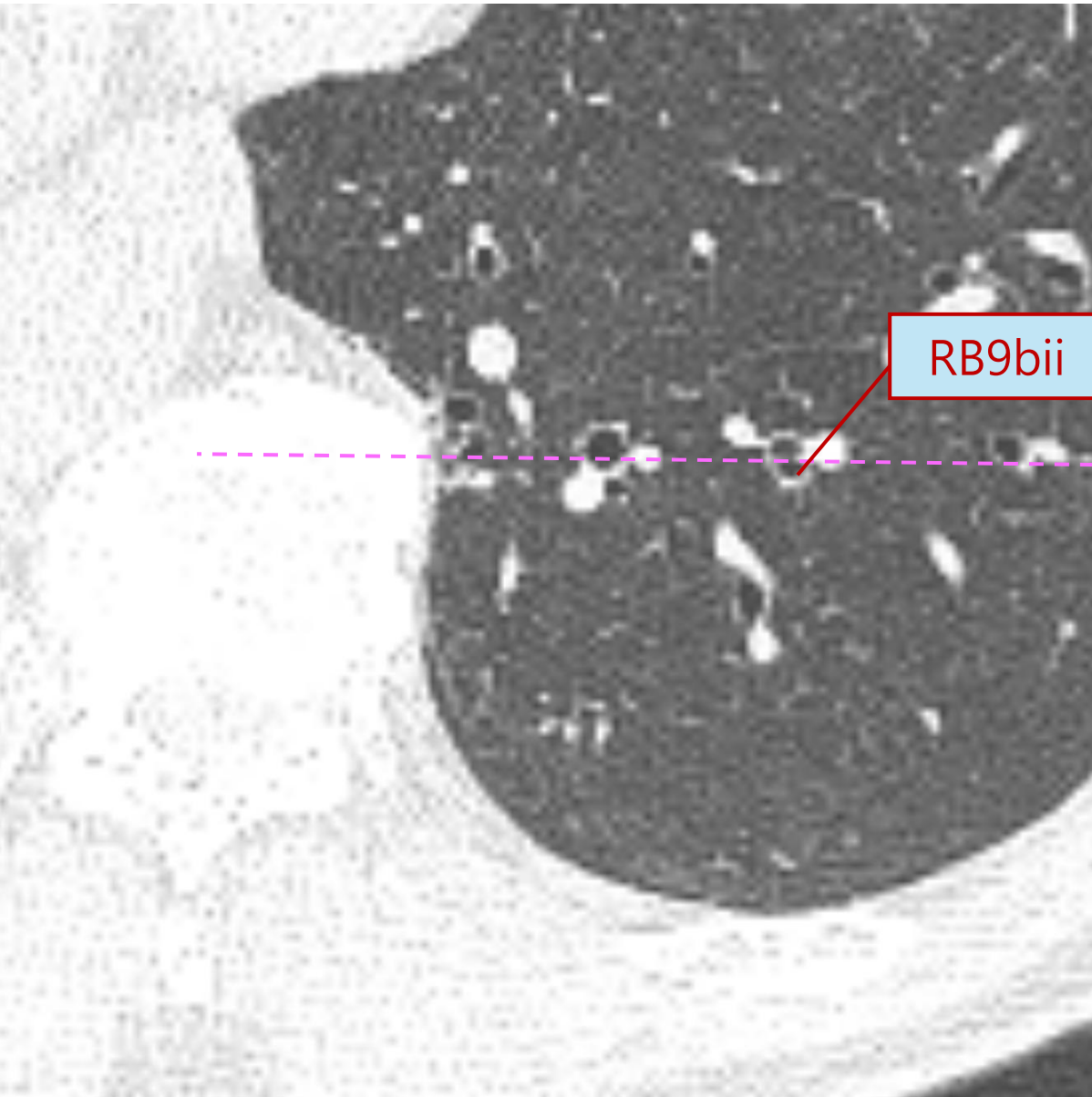
RLL lateral segment

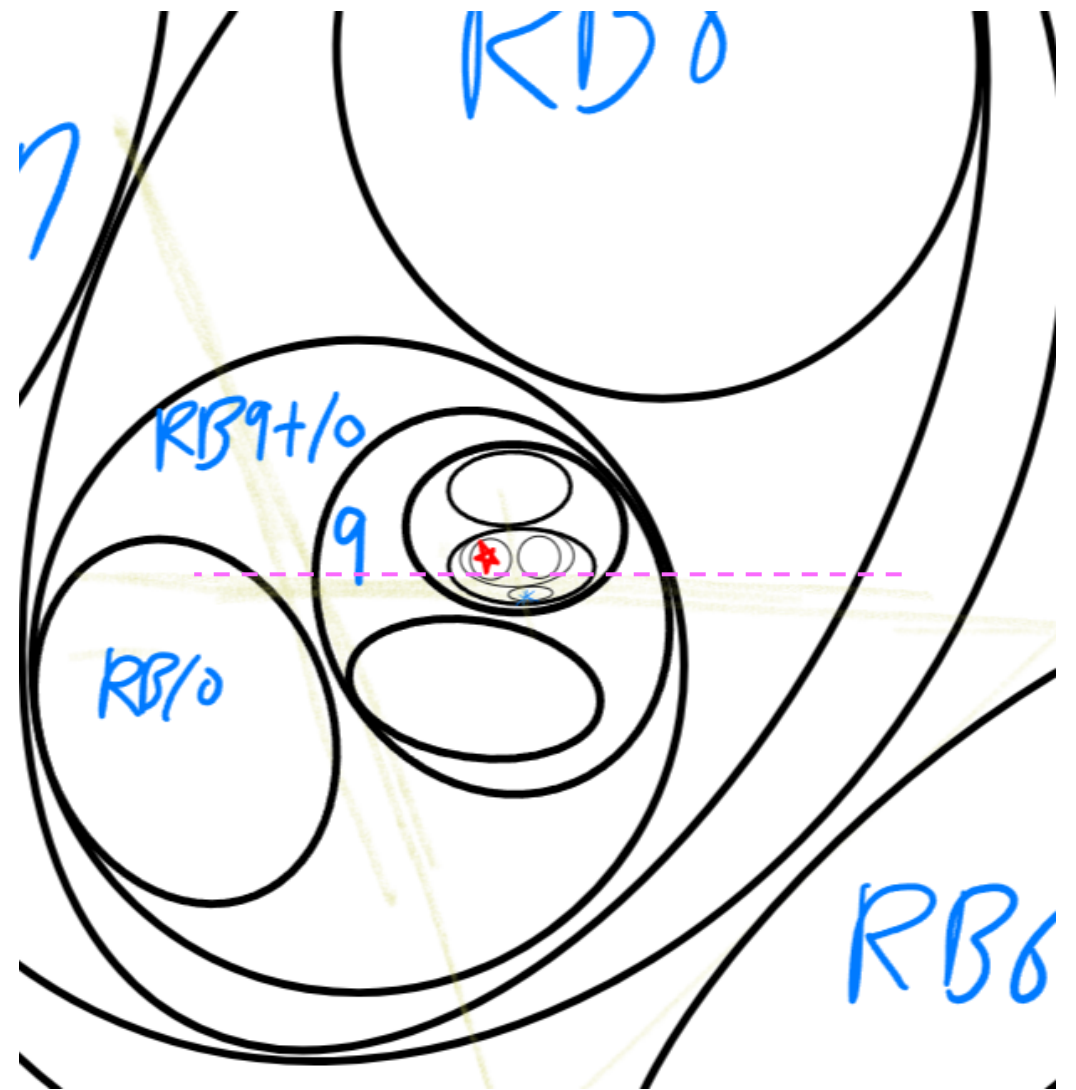
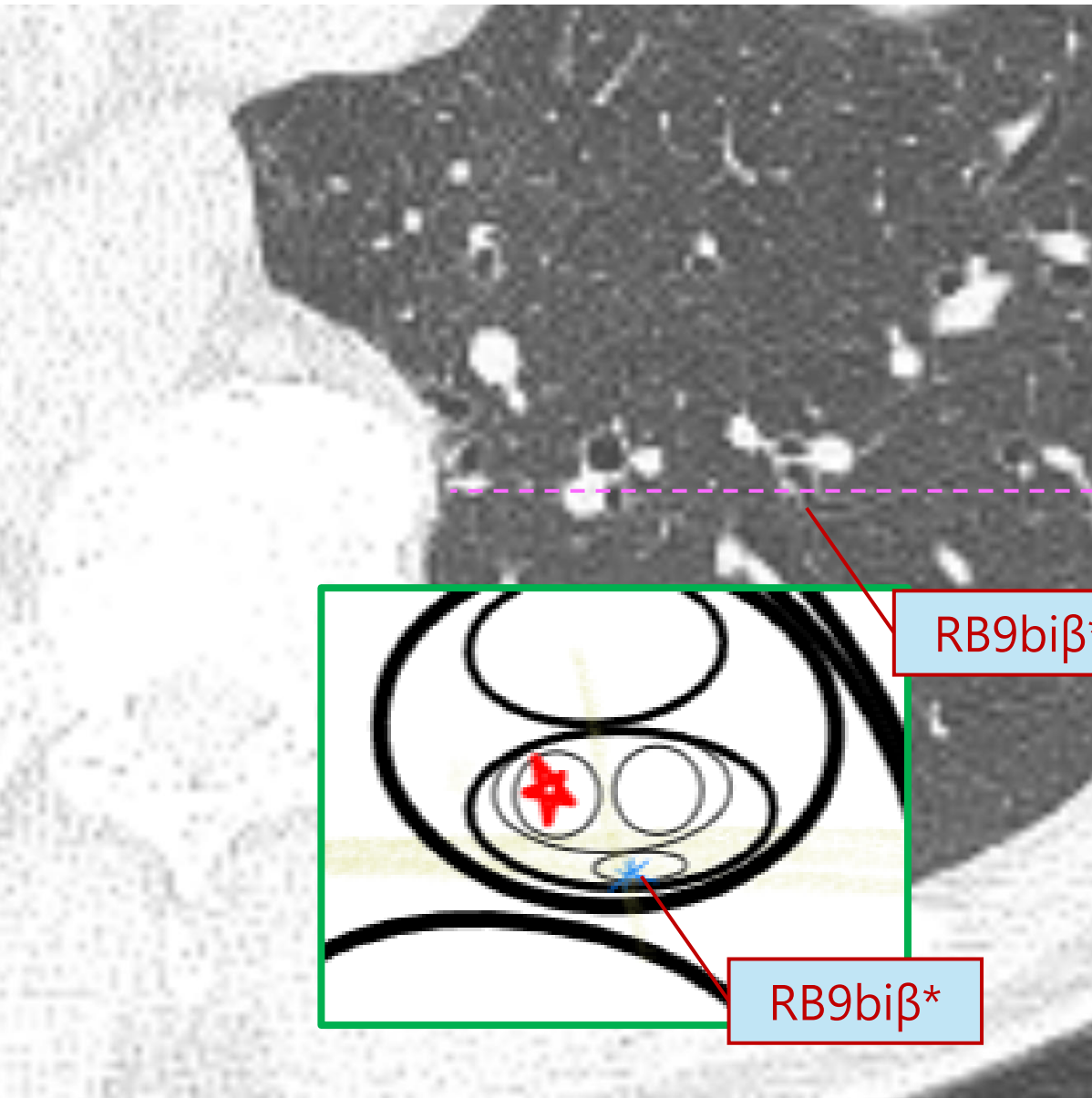


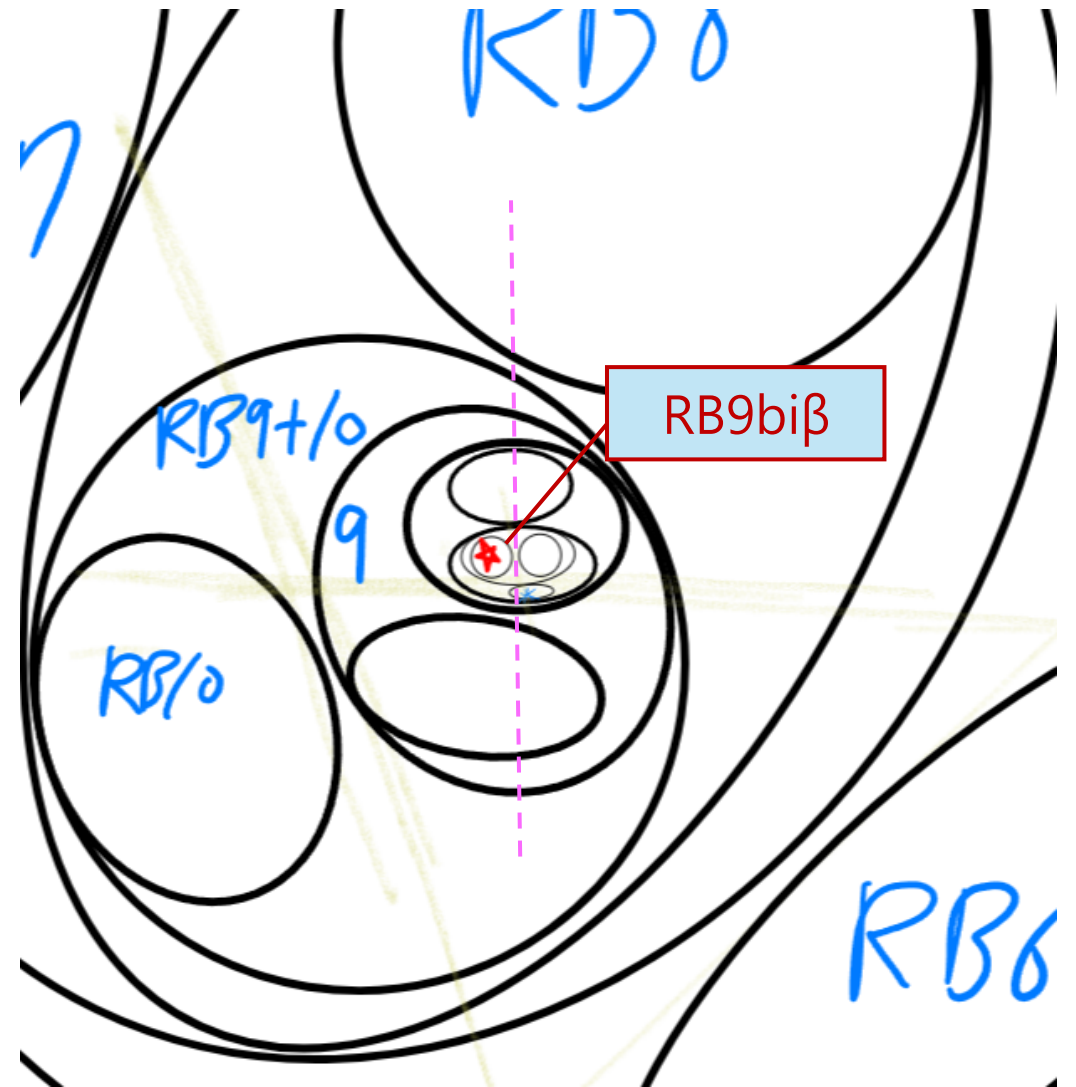
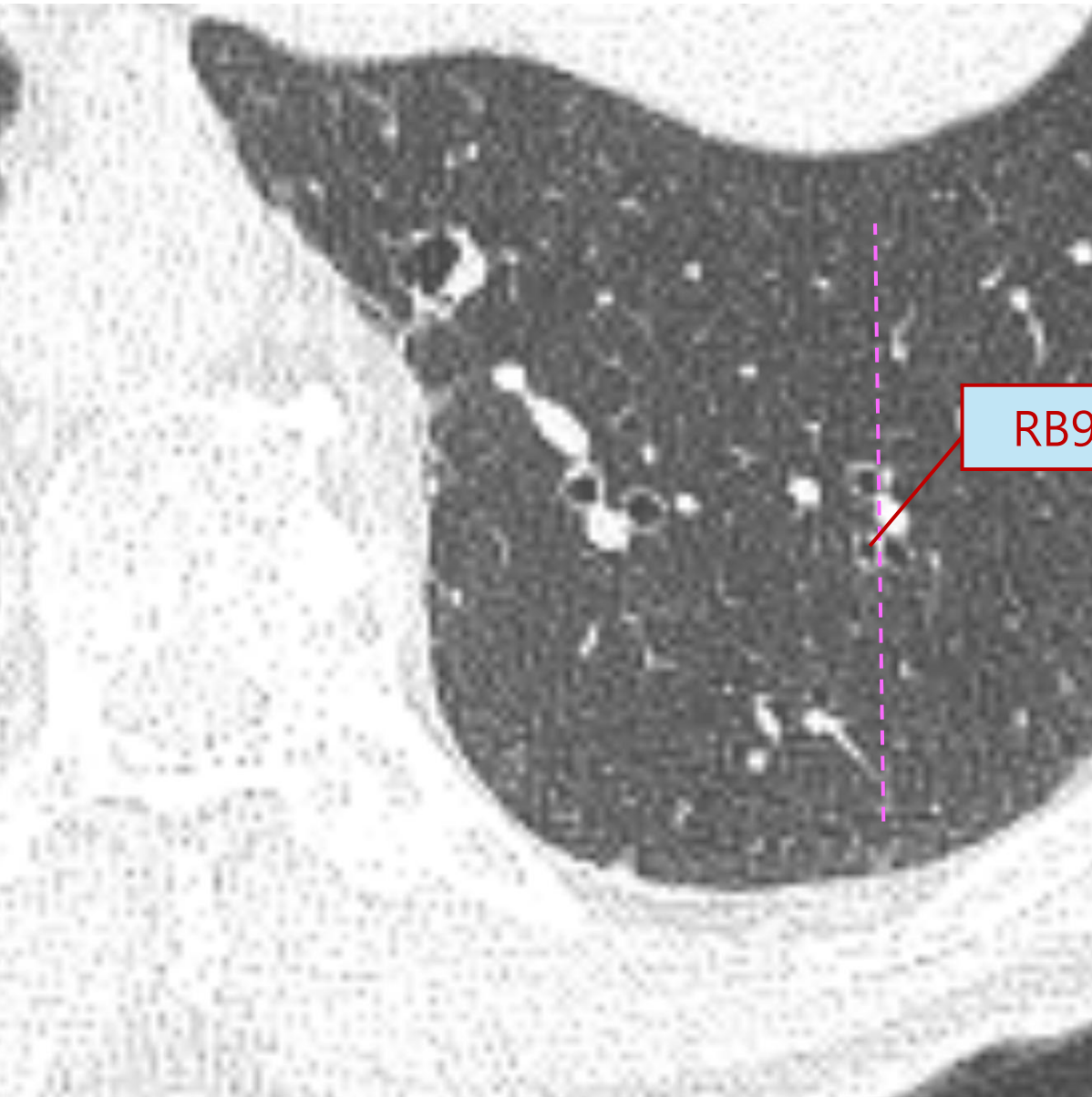


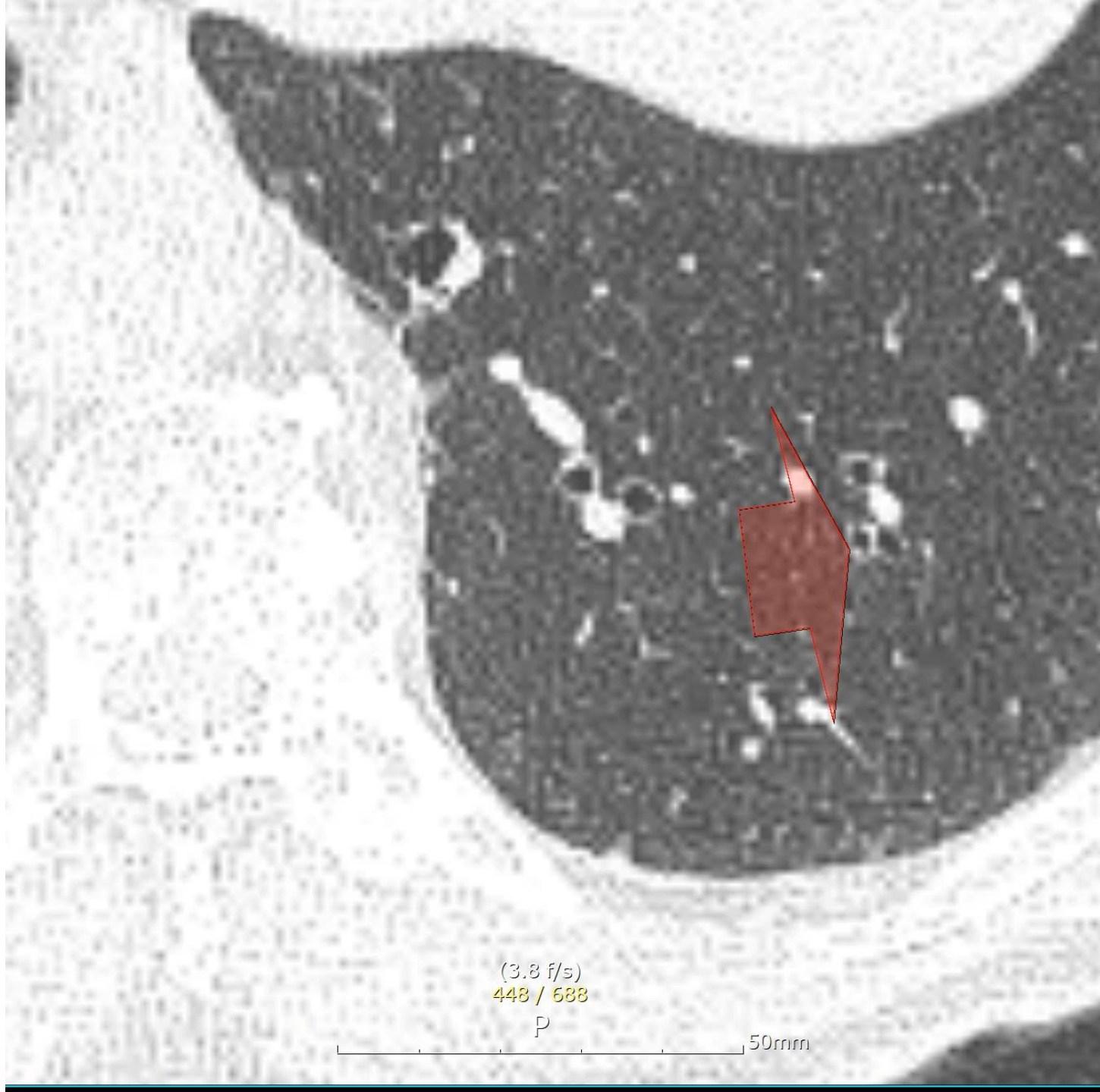












(3.8 f/s)
448 / 688

P

50mm

ID:

Name:

Sex: Age:

D.O.B.:

06/26/2025

10:17:21

■■■■/■■■■(1/2)

Eh:A7 Ce:0

Comment:

BF-P260F

Scope size: 4.0/4.4

Channel: 2.0

Serial No.: 2952016

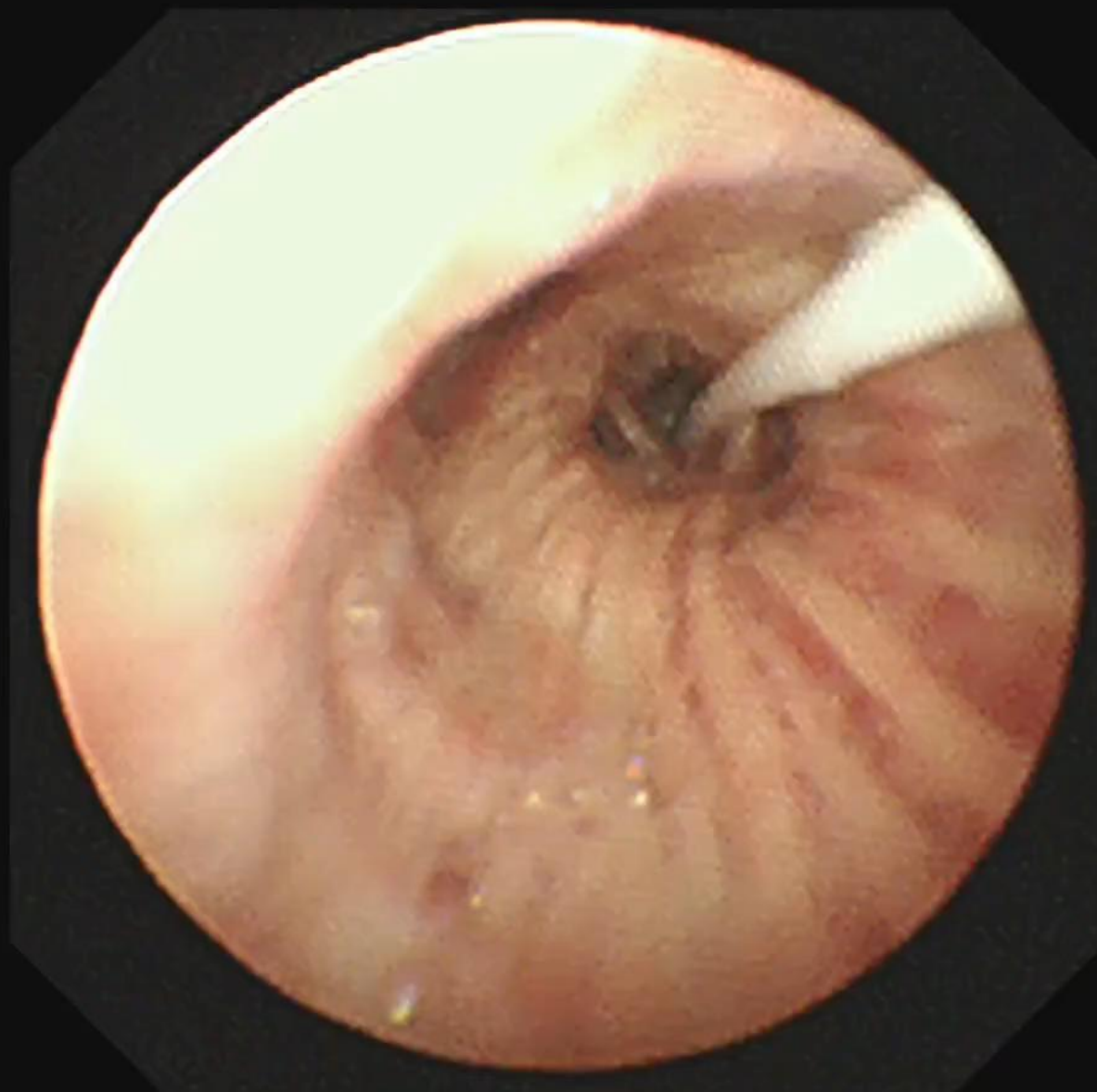
SW1: Freeze

SW2: Enhancement

SW3: NBI

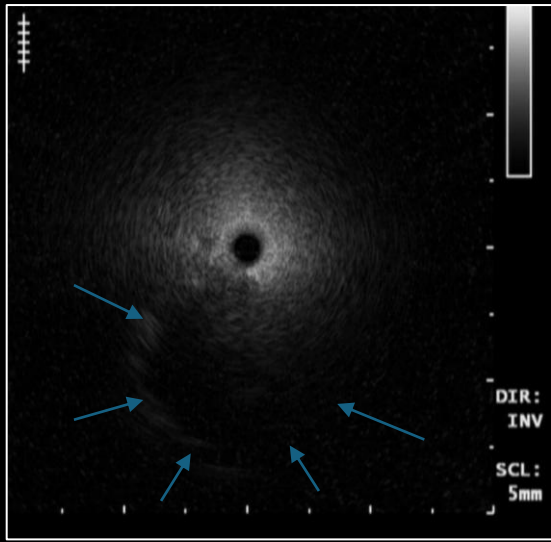
SW4: NBI

SW5: Dual Focus

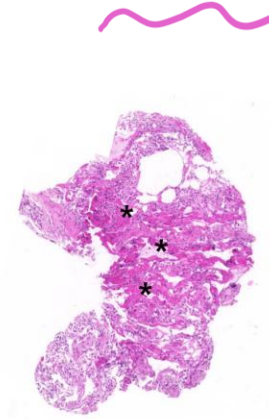


Initial Hurdles in Starting rEBUS-TBLB

1. Failure to localize the target lesion (Navigation)
2. Inability to position the probe within the lesion (Orientation)

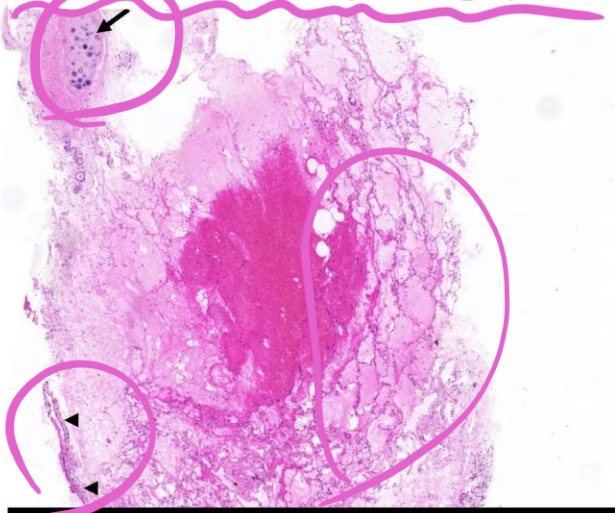


1st specimen (forceps biopsy)

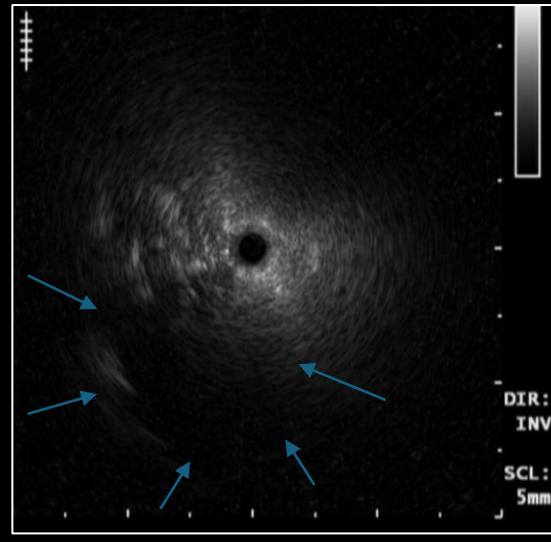


Normal lung parenchyma

2nd specimen (cryobiopsy)



Bronchial wall & cartilage

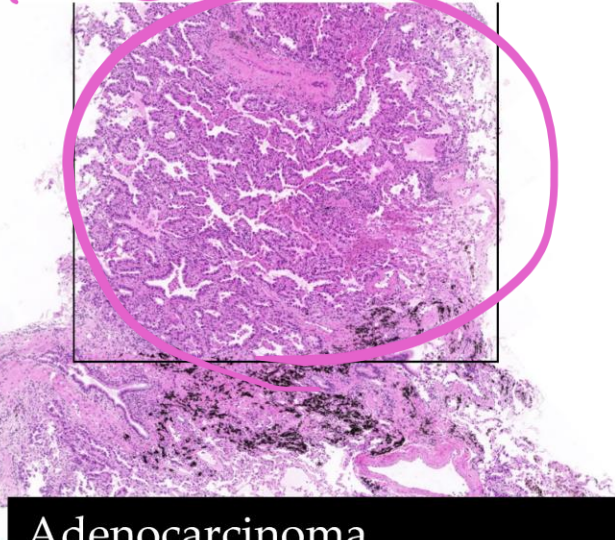


3rd specimen (cryobiopsy)

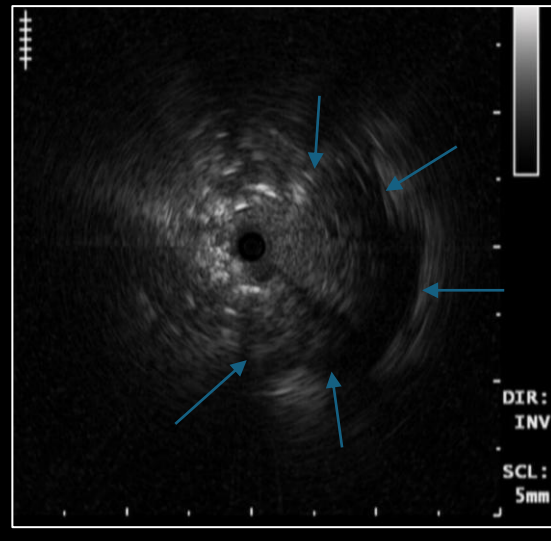


Atypical cells

4th specimen (cryobiopsy)

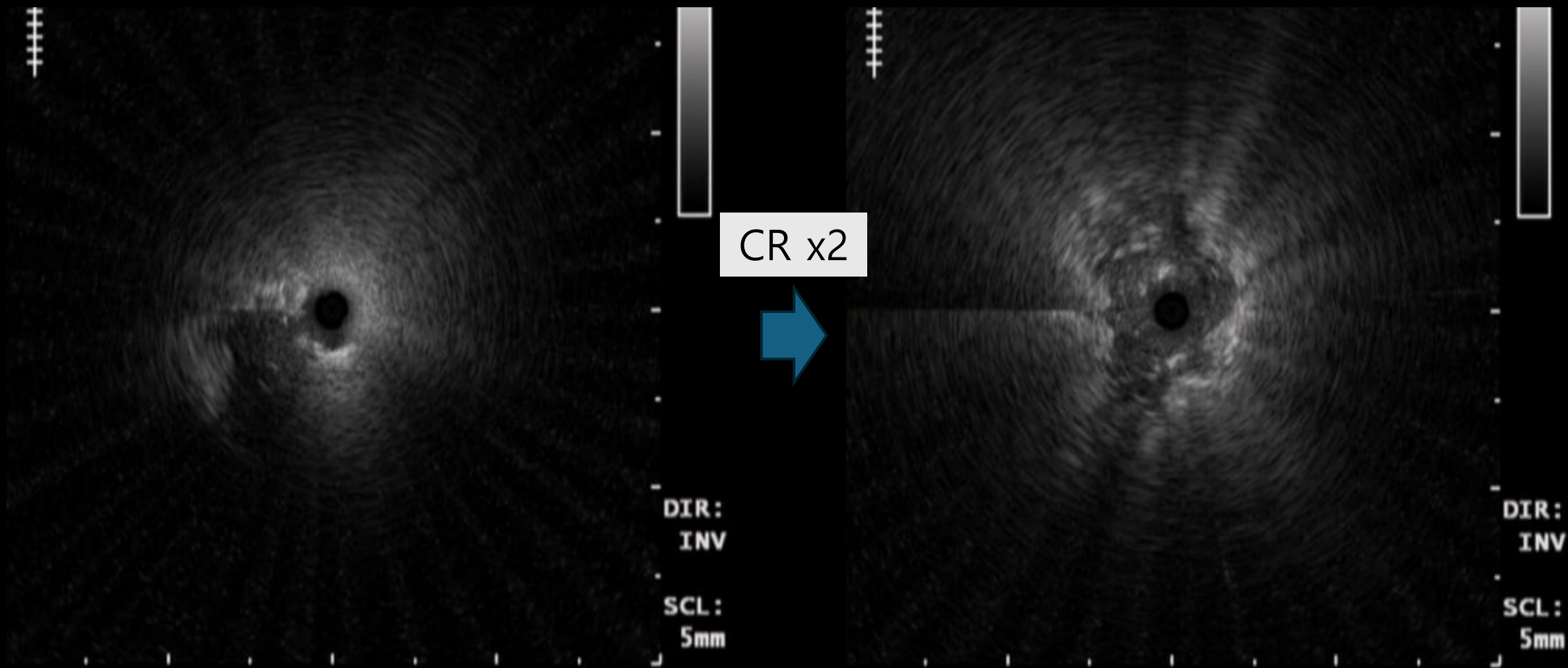


Adenocarcinoma



63/F

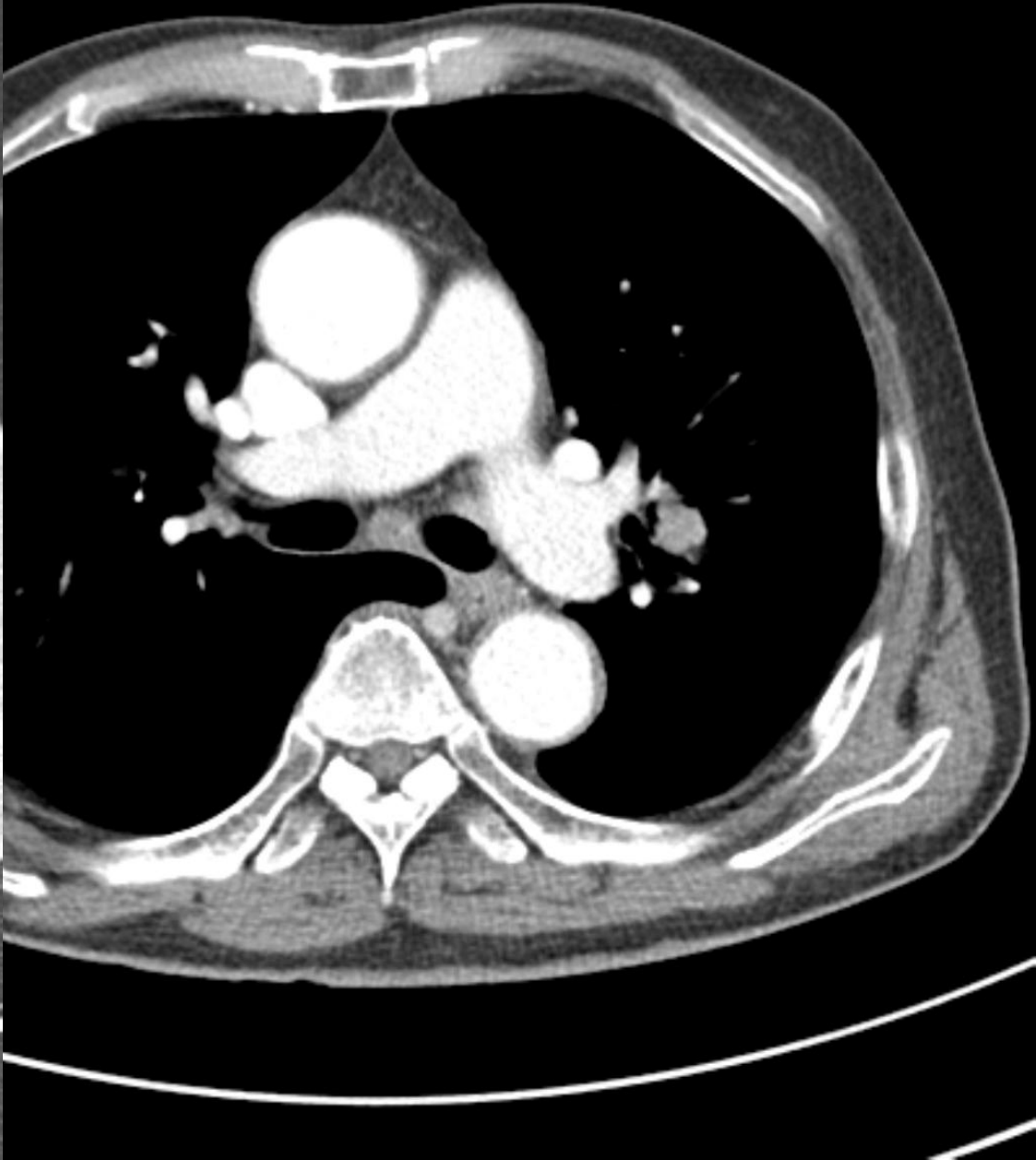
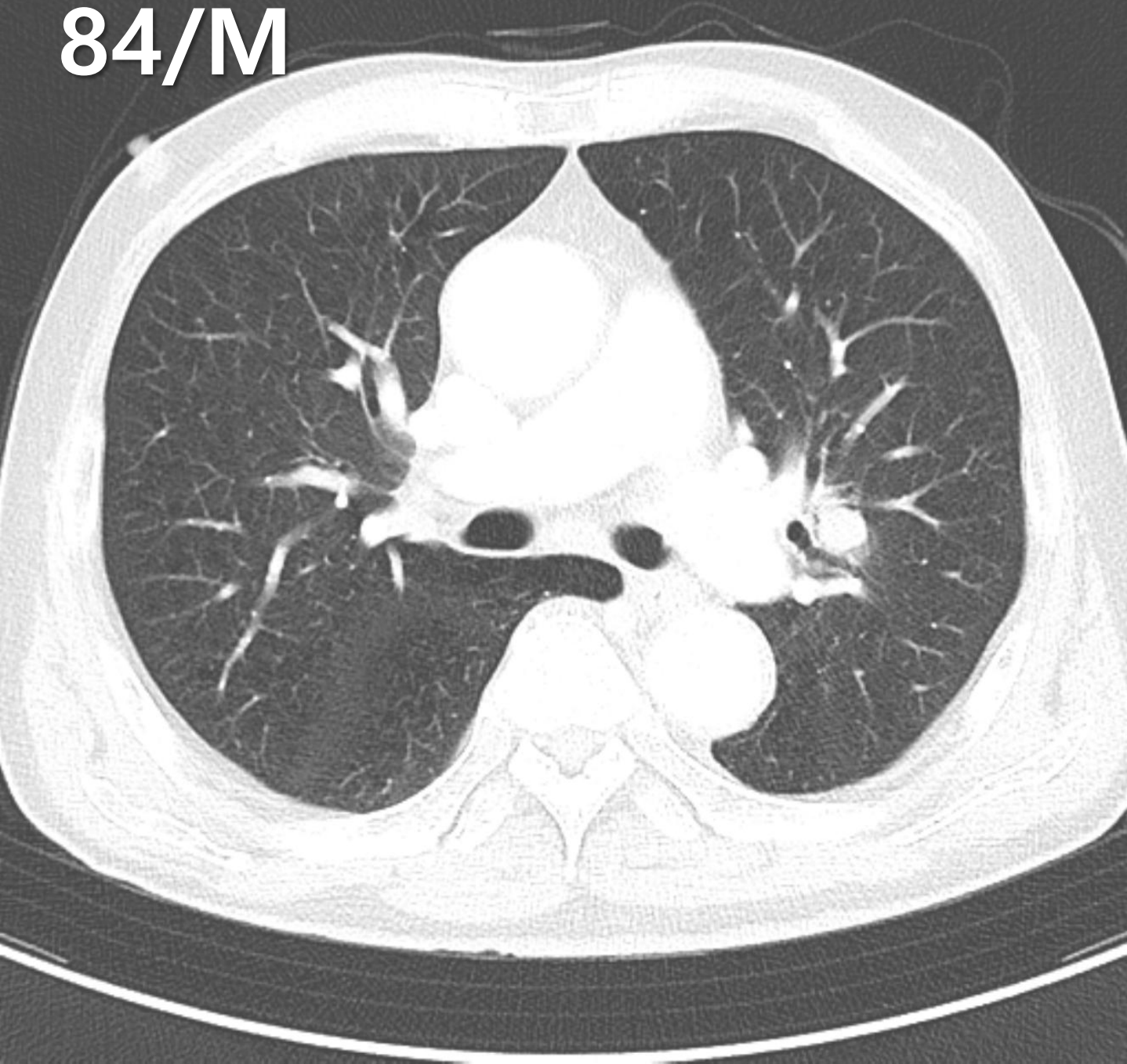


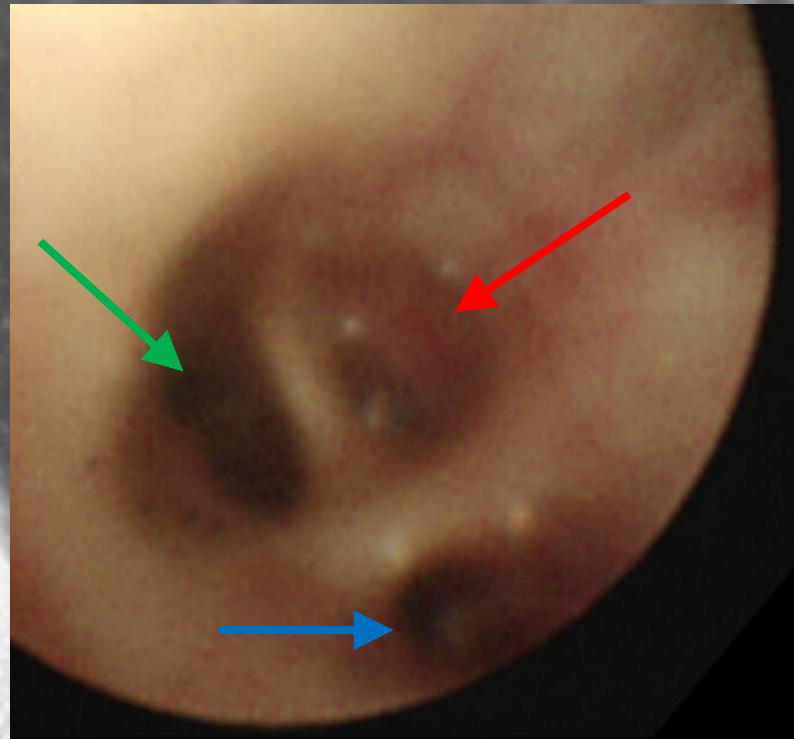
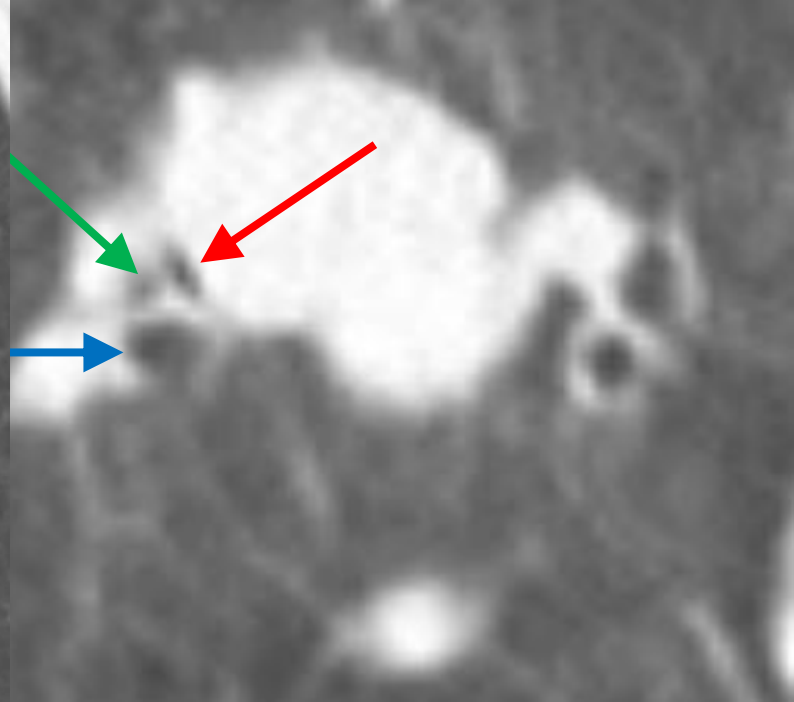
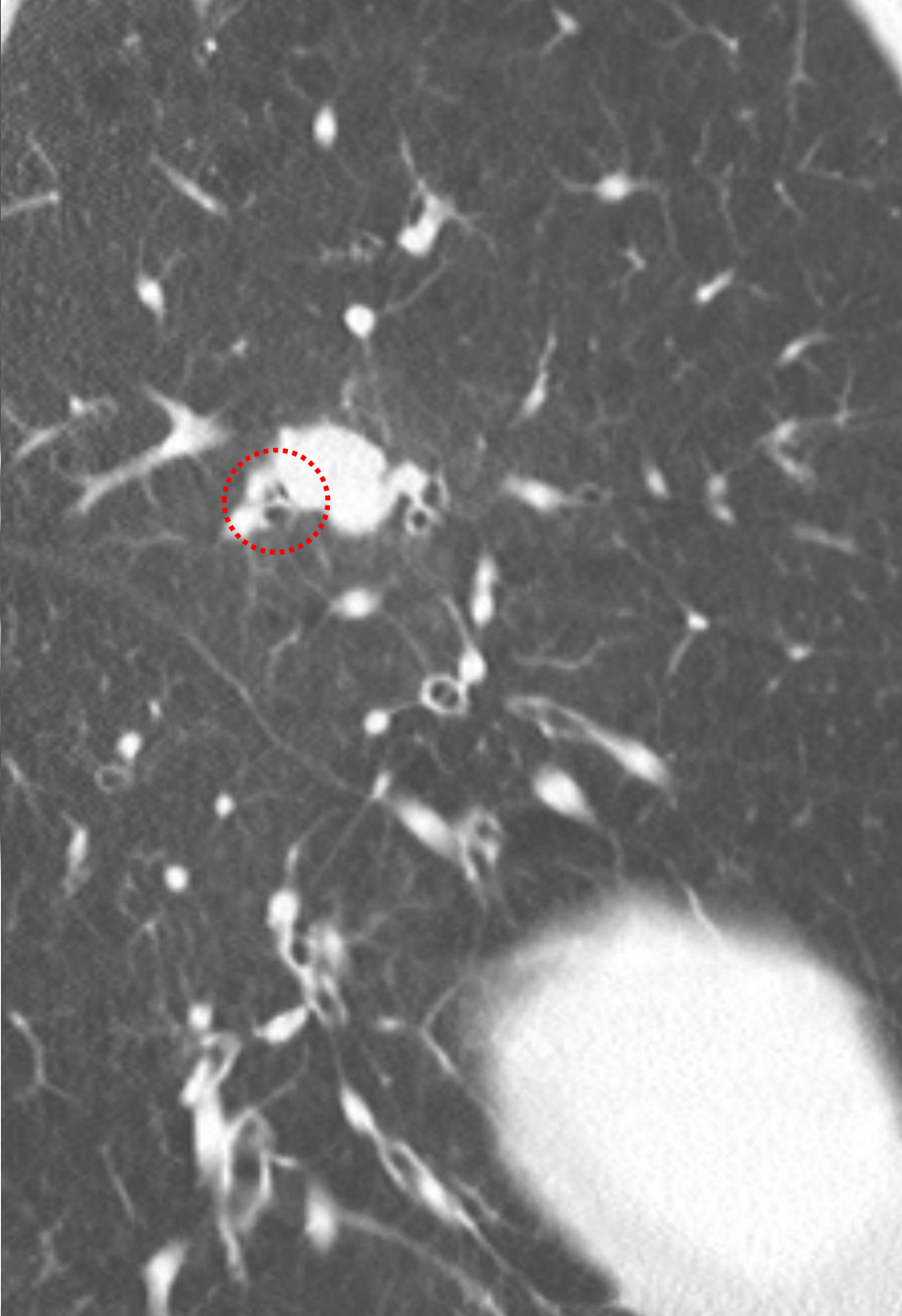
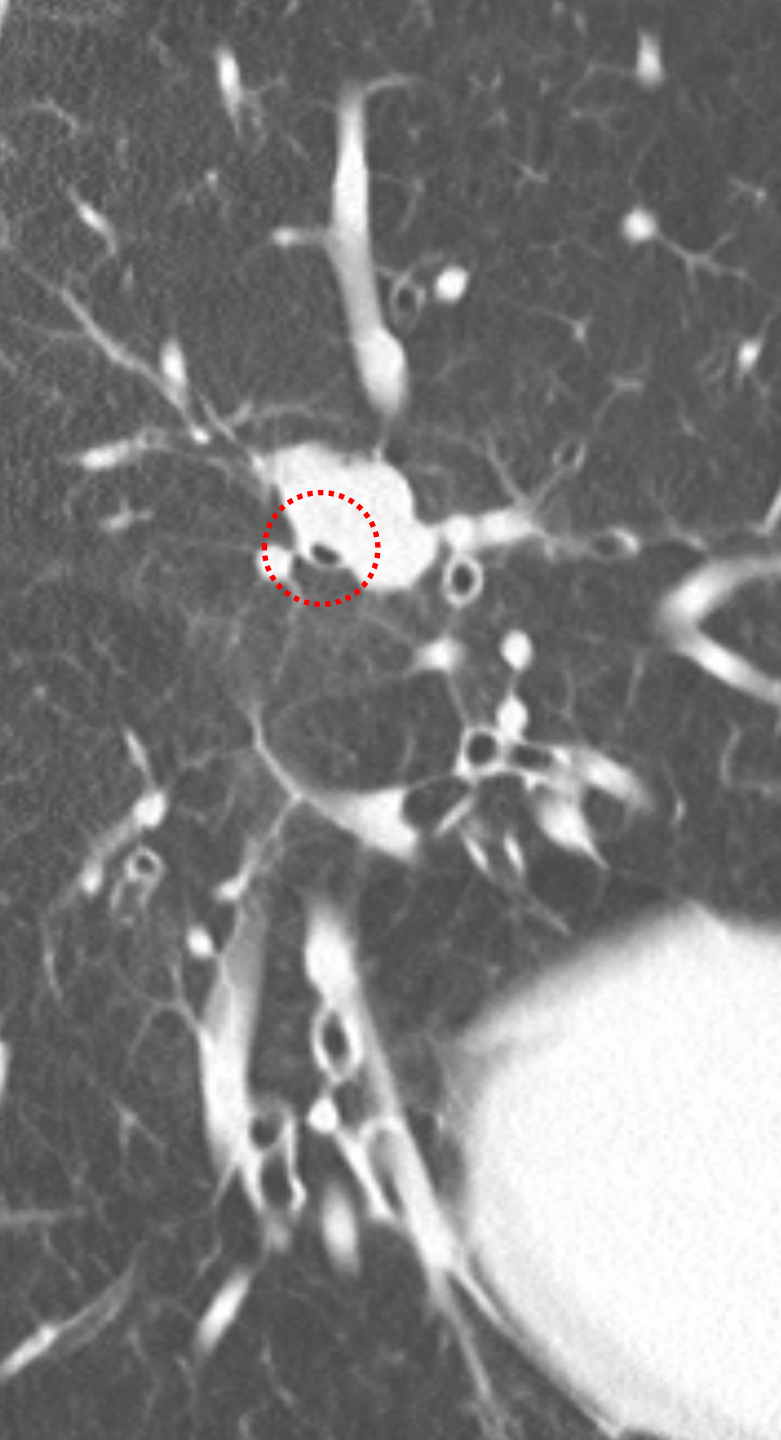


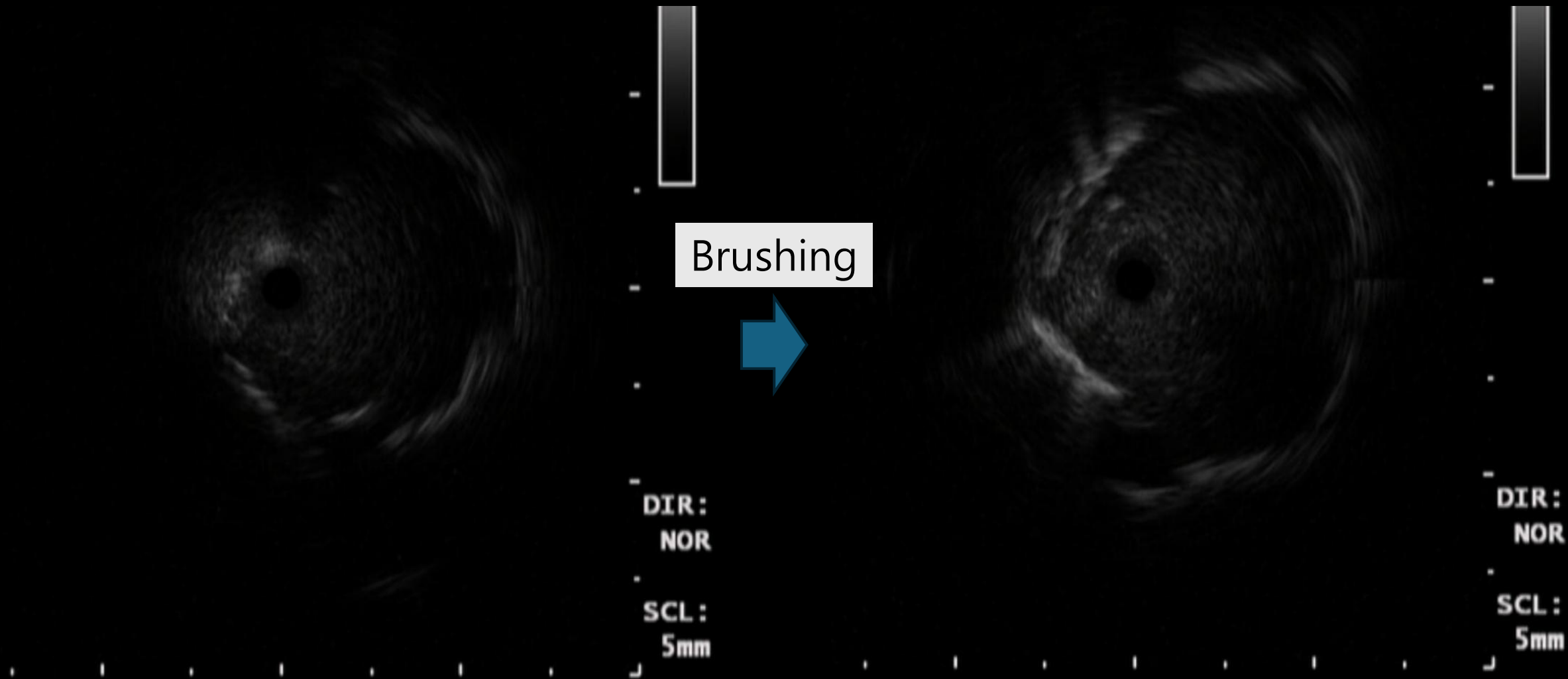
CR x2

Adenocarcinoma with lepidic pattern

84/M



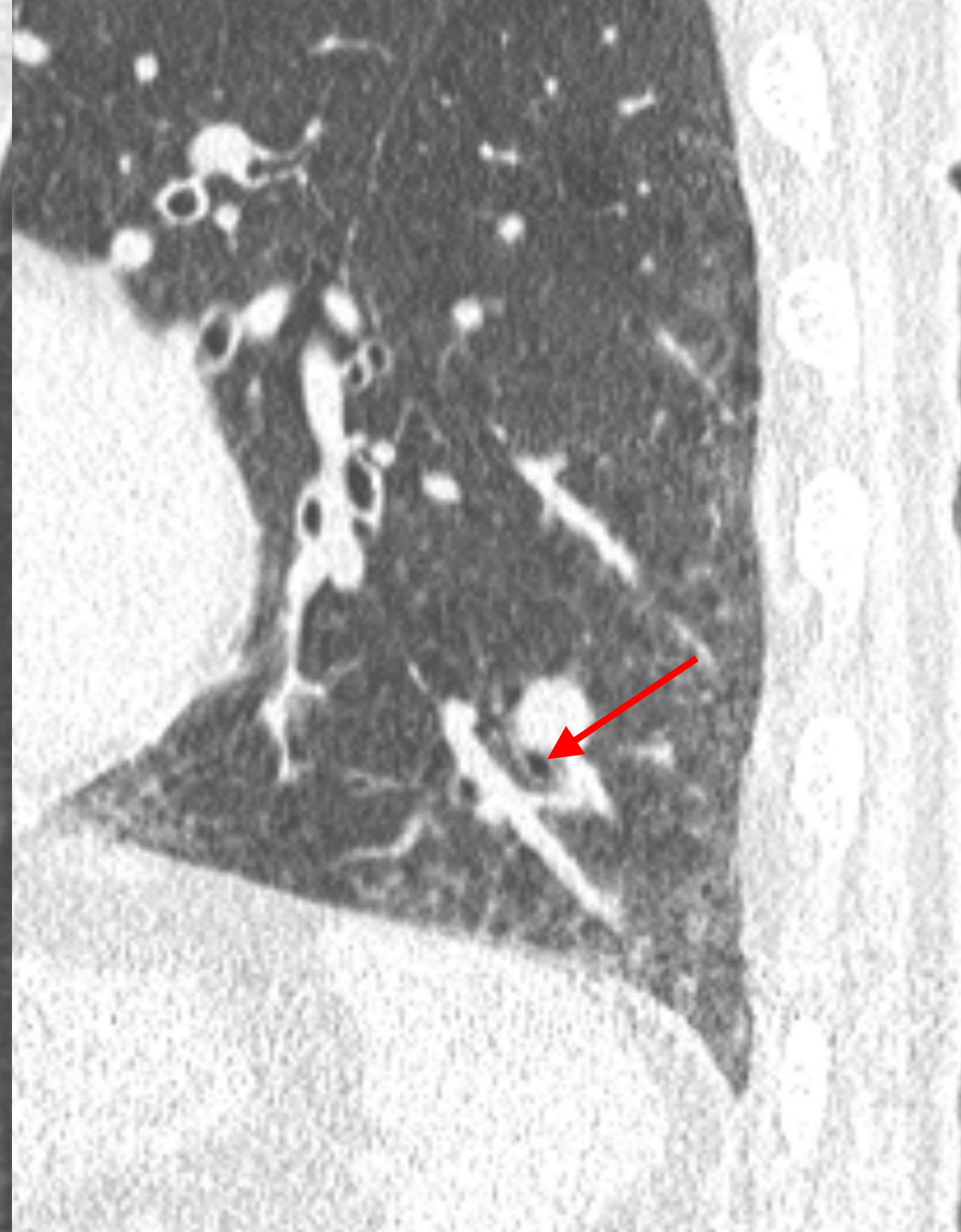






Adenocarcinoma

75/M

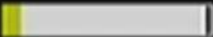


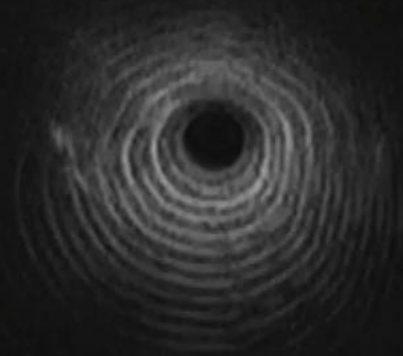
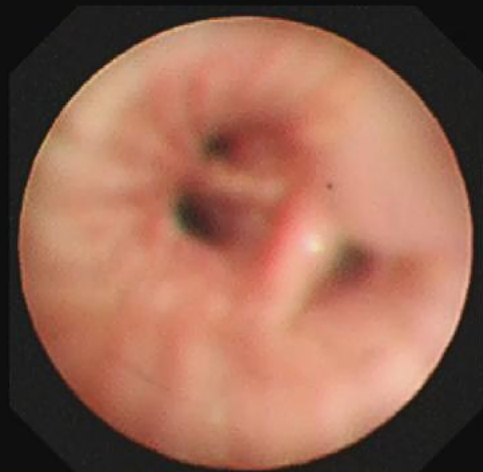


ID:
NAME:

AGE: 
DOB: 04/18/2025
SEX: 
11:37:54


20MHz 4cm
G: 9/19 I:L1
C:4/8

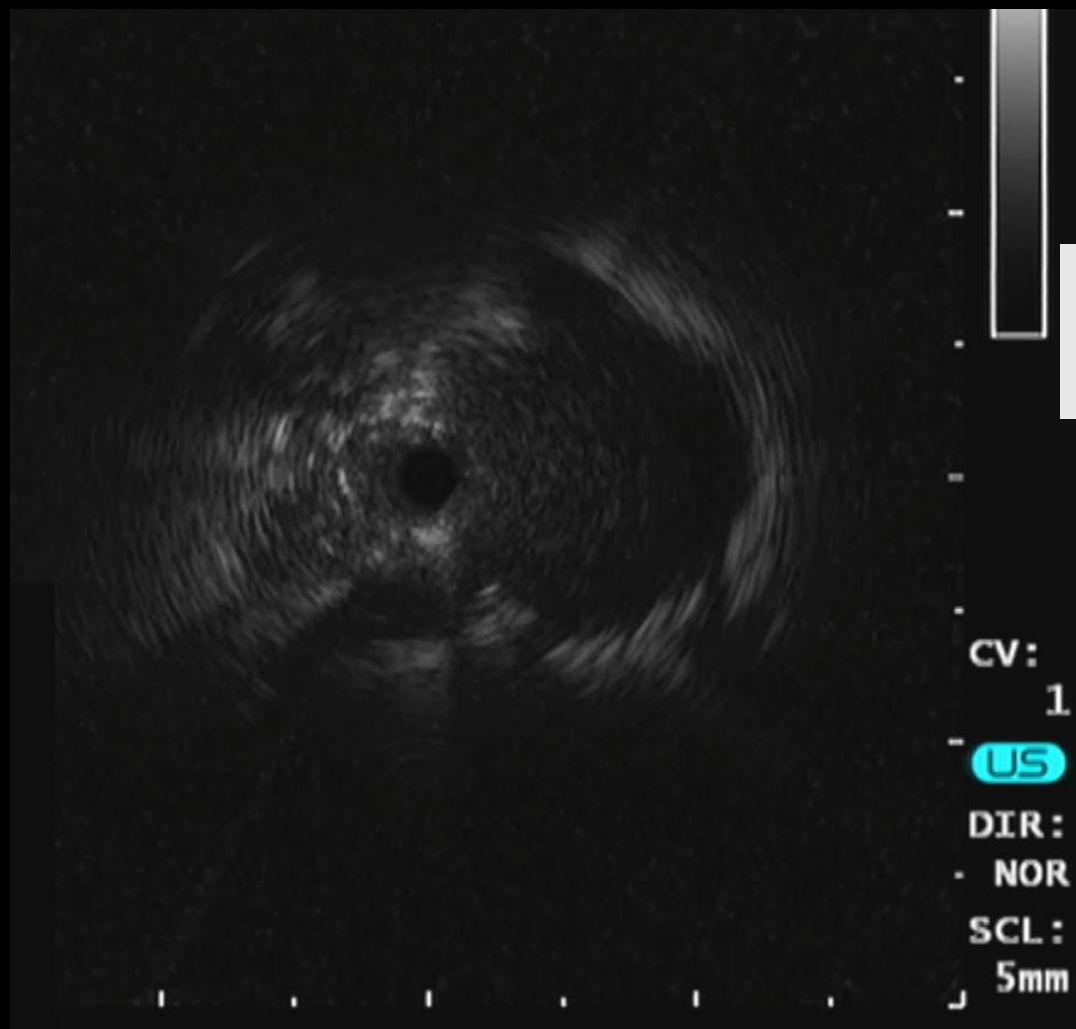
MEDIA 
T/B:CINE REV
1/112



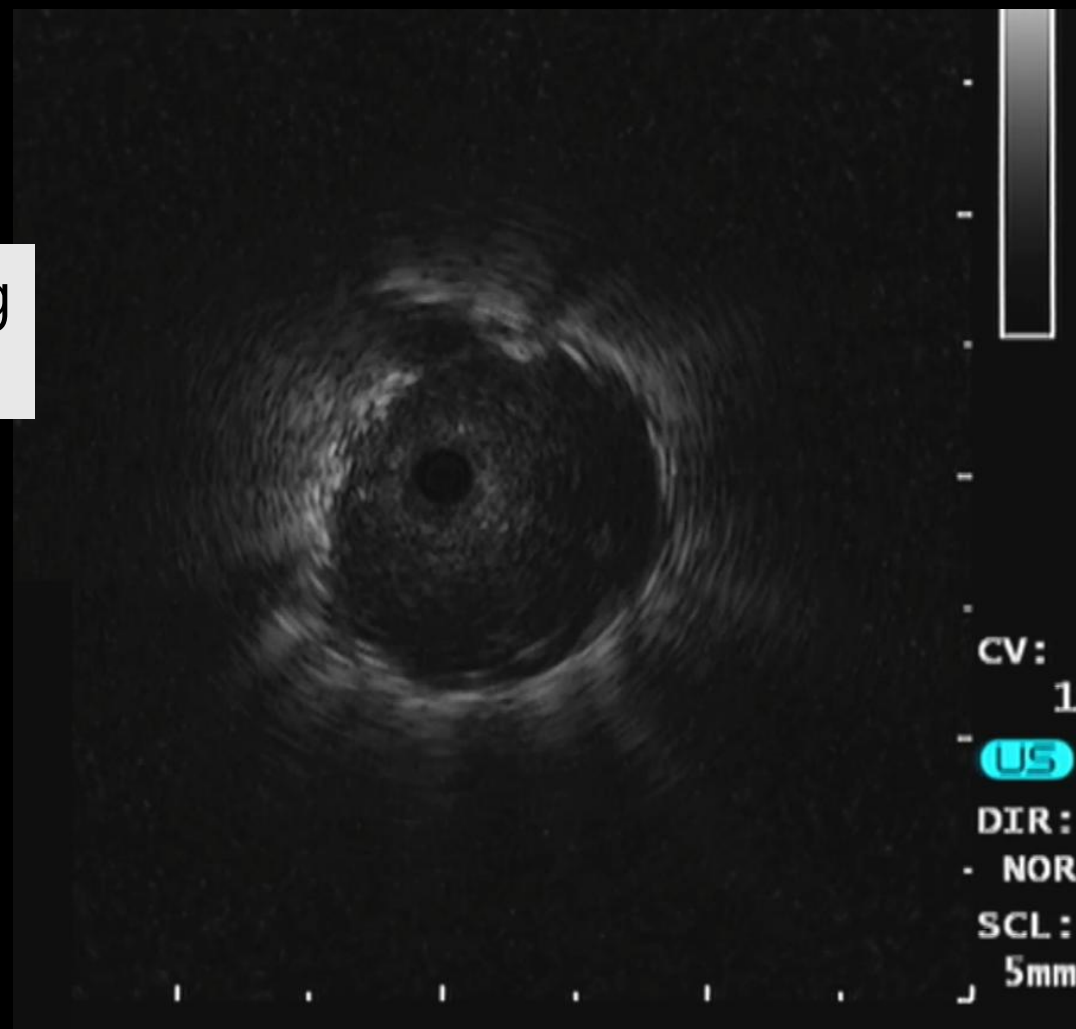
OLYMPUS



CV: 1

DIR: NOR
SCL: 5mm

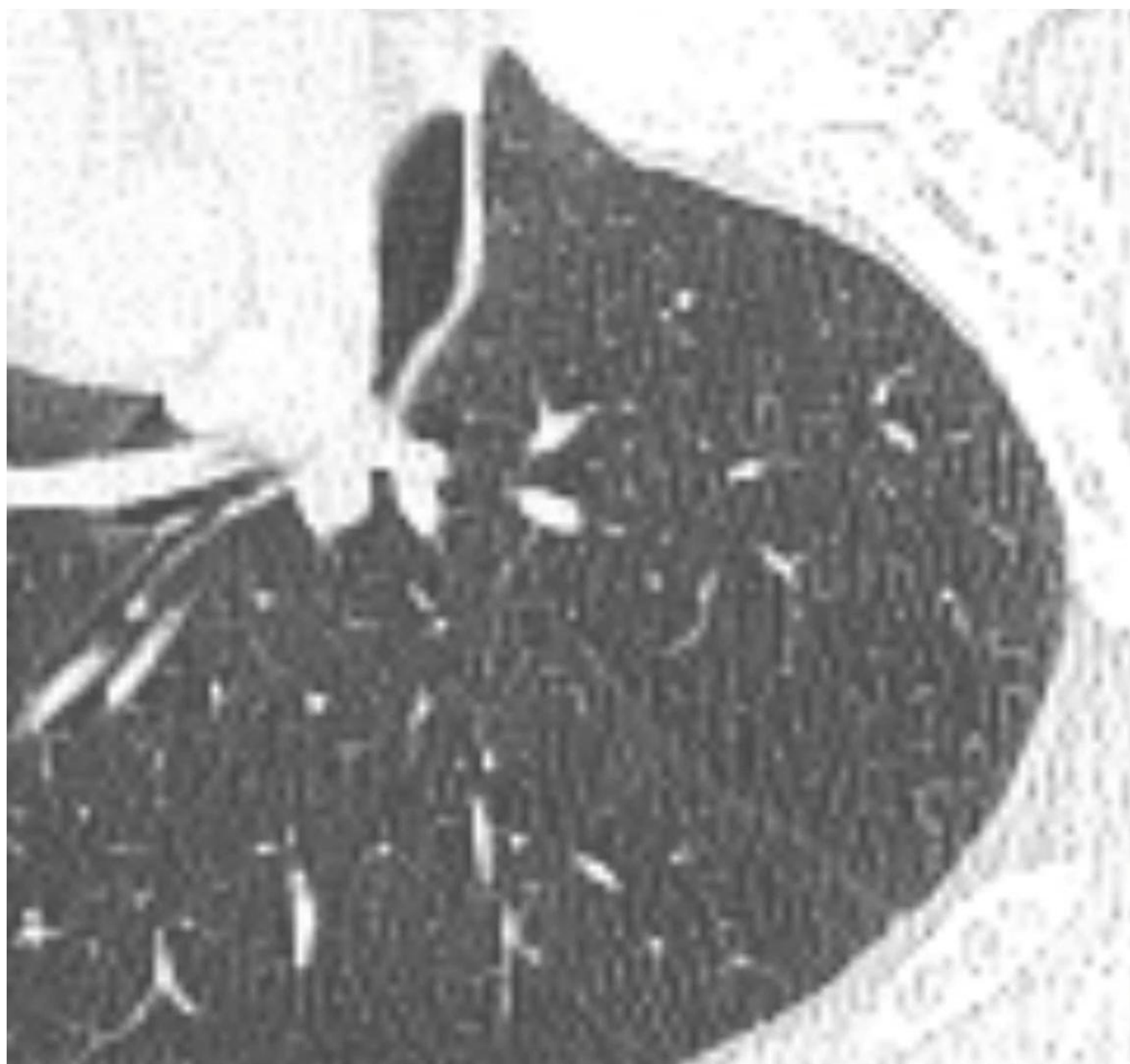


Brushing
x2



Small cell carcinoma

79/M



ID:■

Name:

Sex: Age:

D.O.B.:

01/15/2024

11:50:46

■■■■/■■■■(0/1)

Eh:A5 Ce:0

Comment:

BF-P260F

Scope size: 4.0/4.4

Channel: 2.0

Serial No.: 2952017

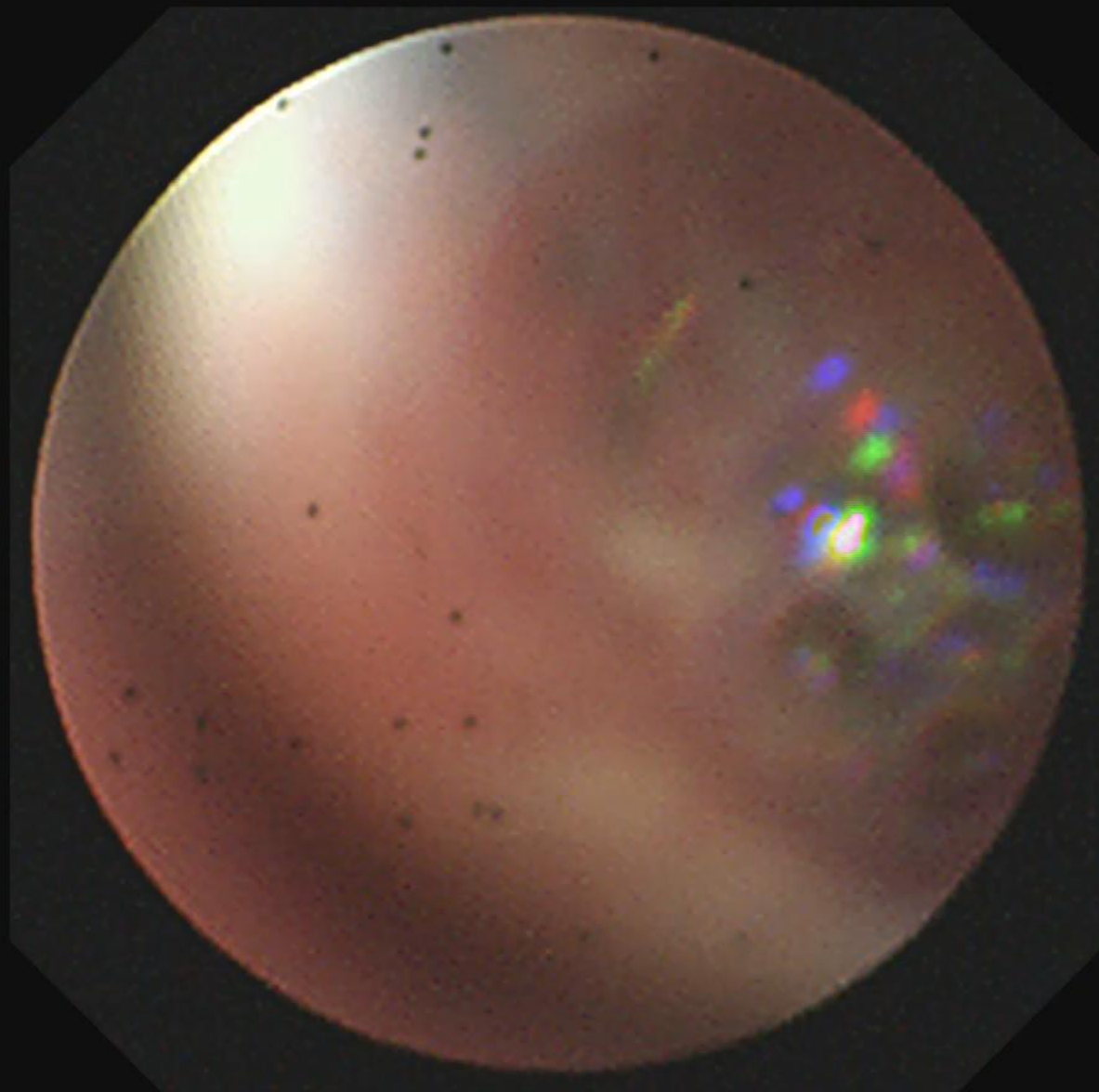
SW1: Freeze

SW2: Enhancement

SW3: NBI

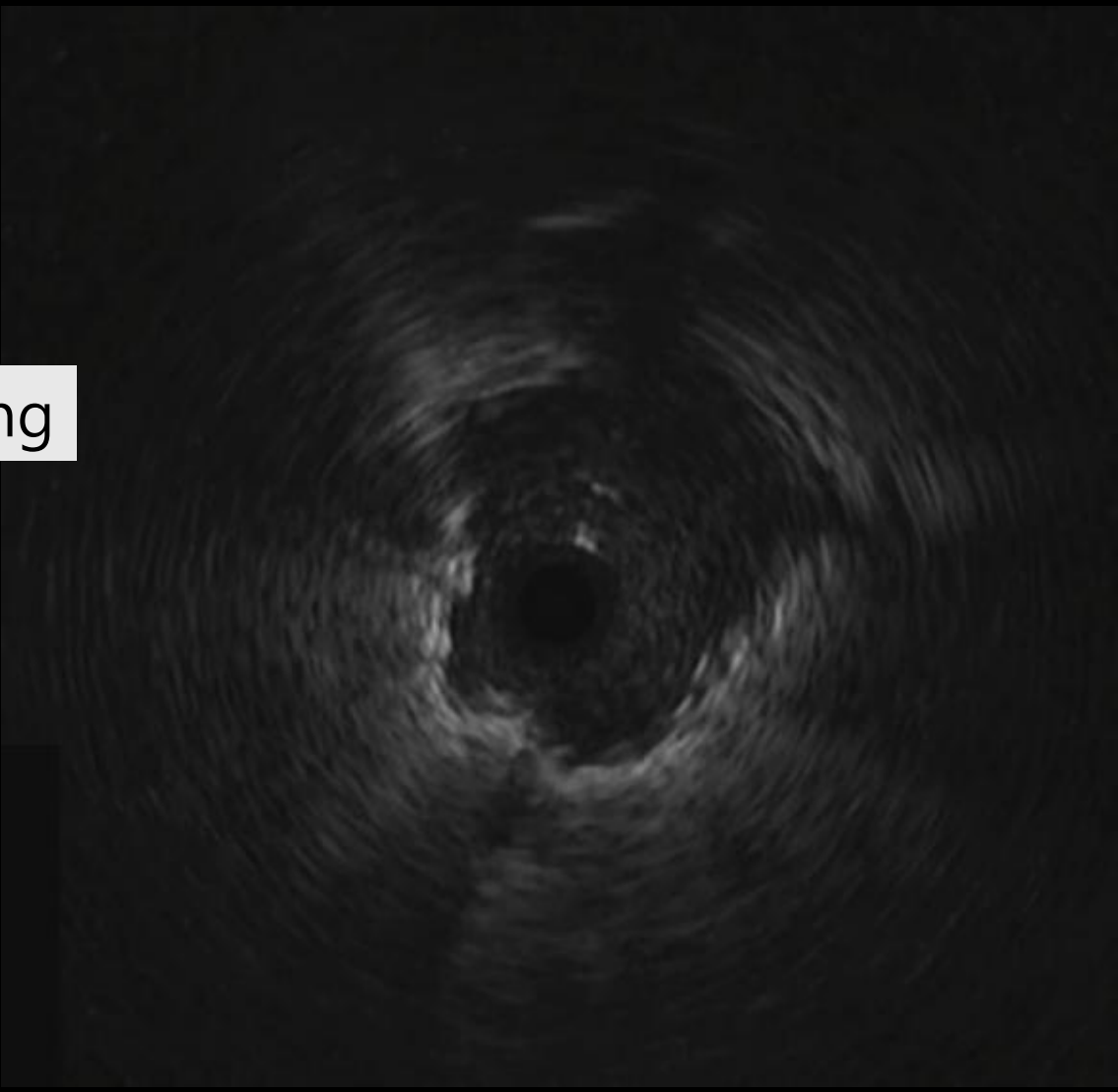
SW4: NBI

SW5: Dual Focus





Brushing

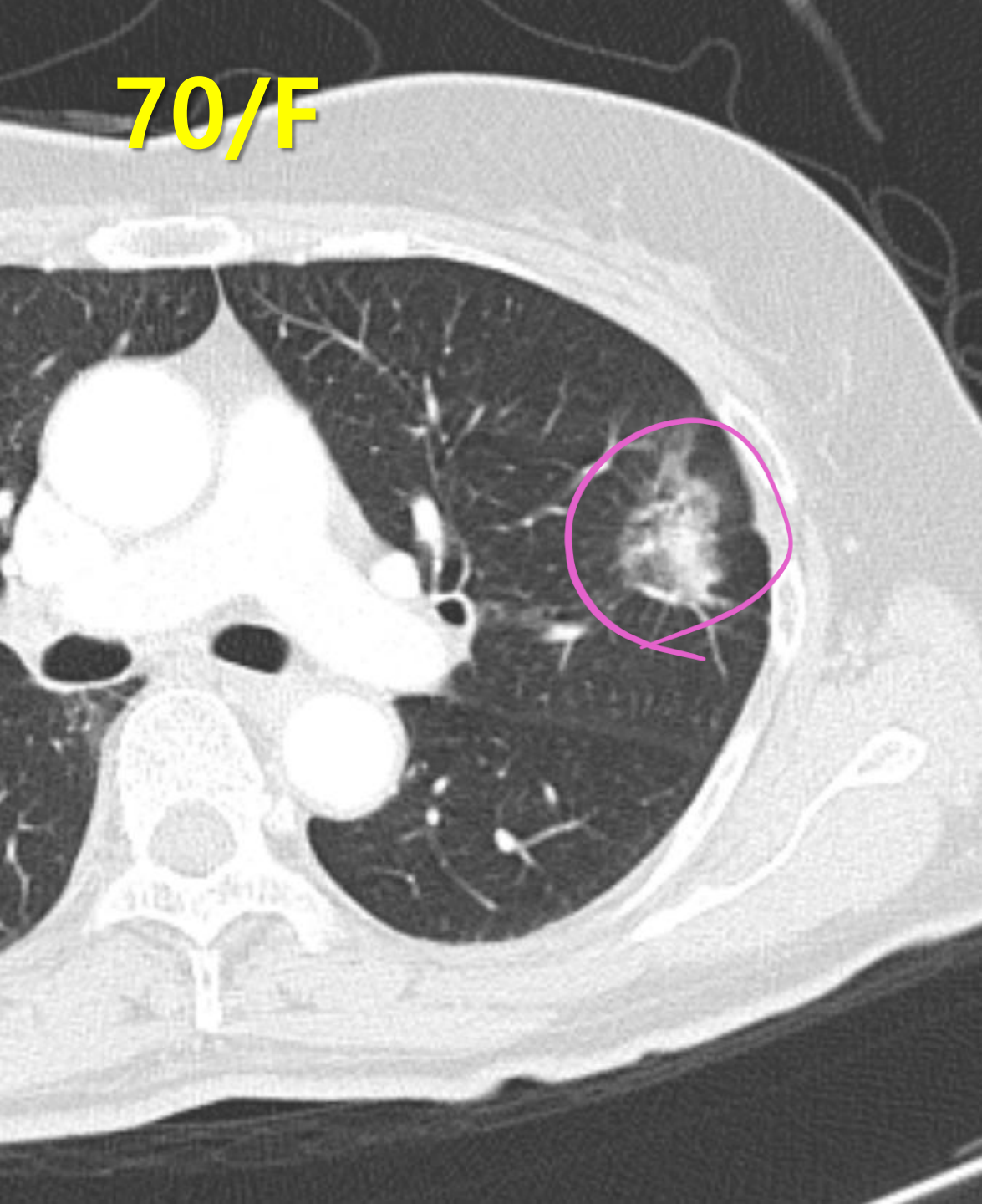


Adenocarcinoma, mucin producing

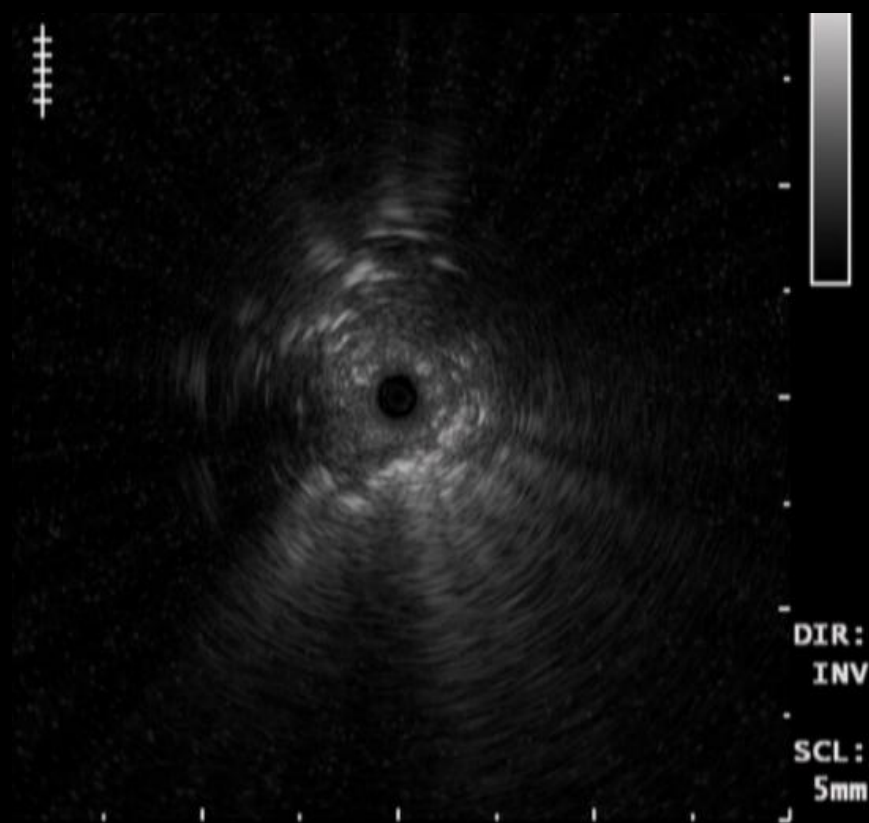
Beyond the Initial Hurdles

1. Proper Orientation Achieved, But Still No Diagnosis!
2. Strategies to Minimize Complications

70/F



(0.1 f/s)
40 / 131

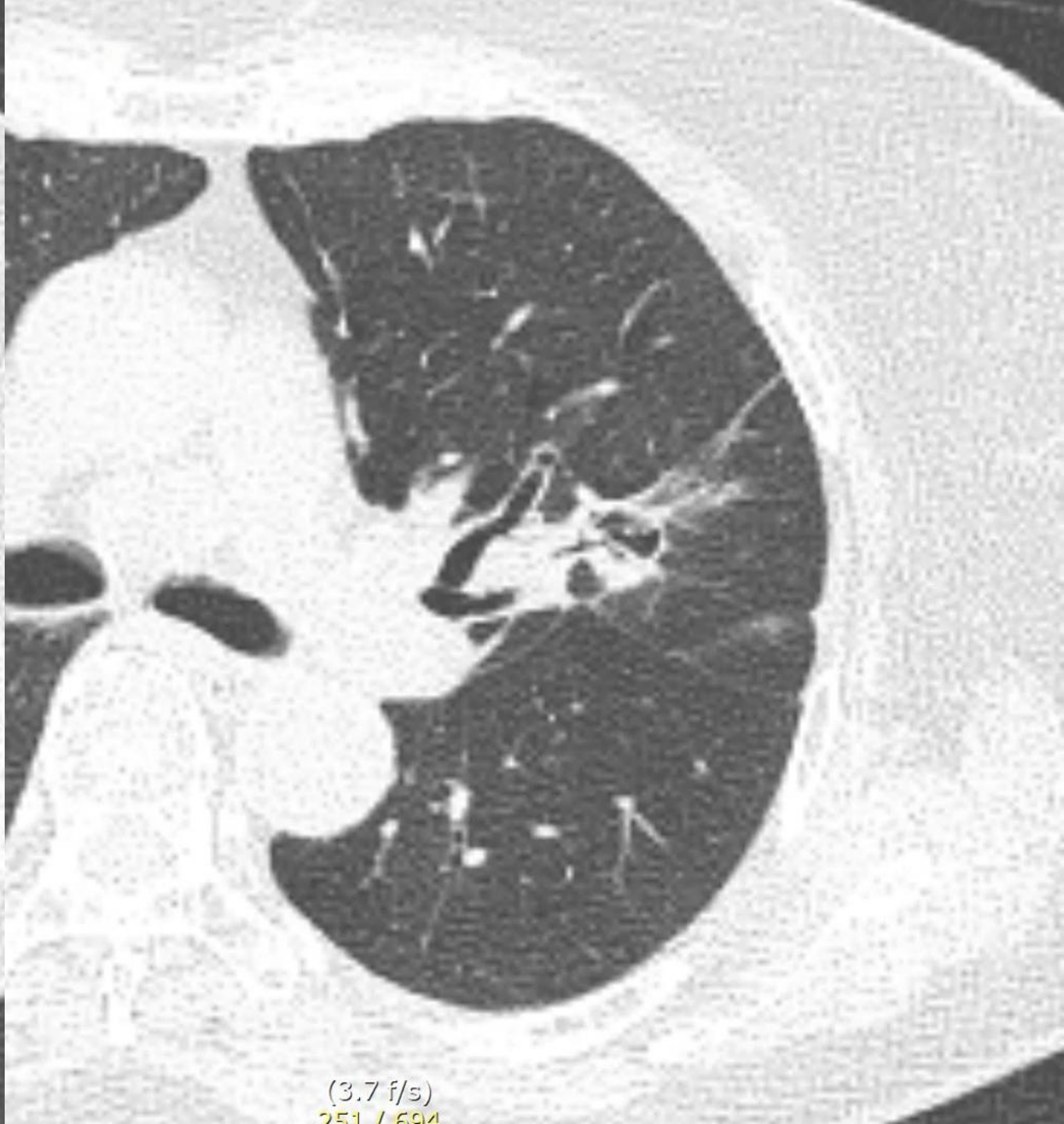
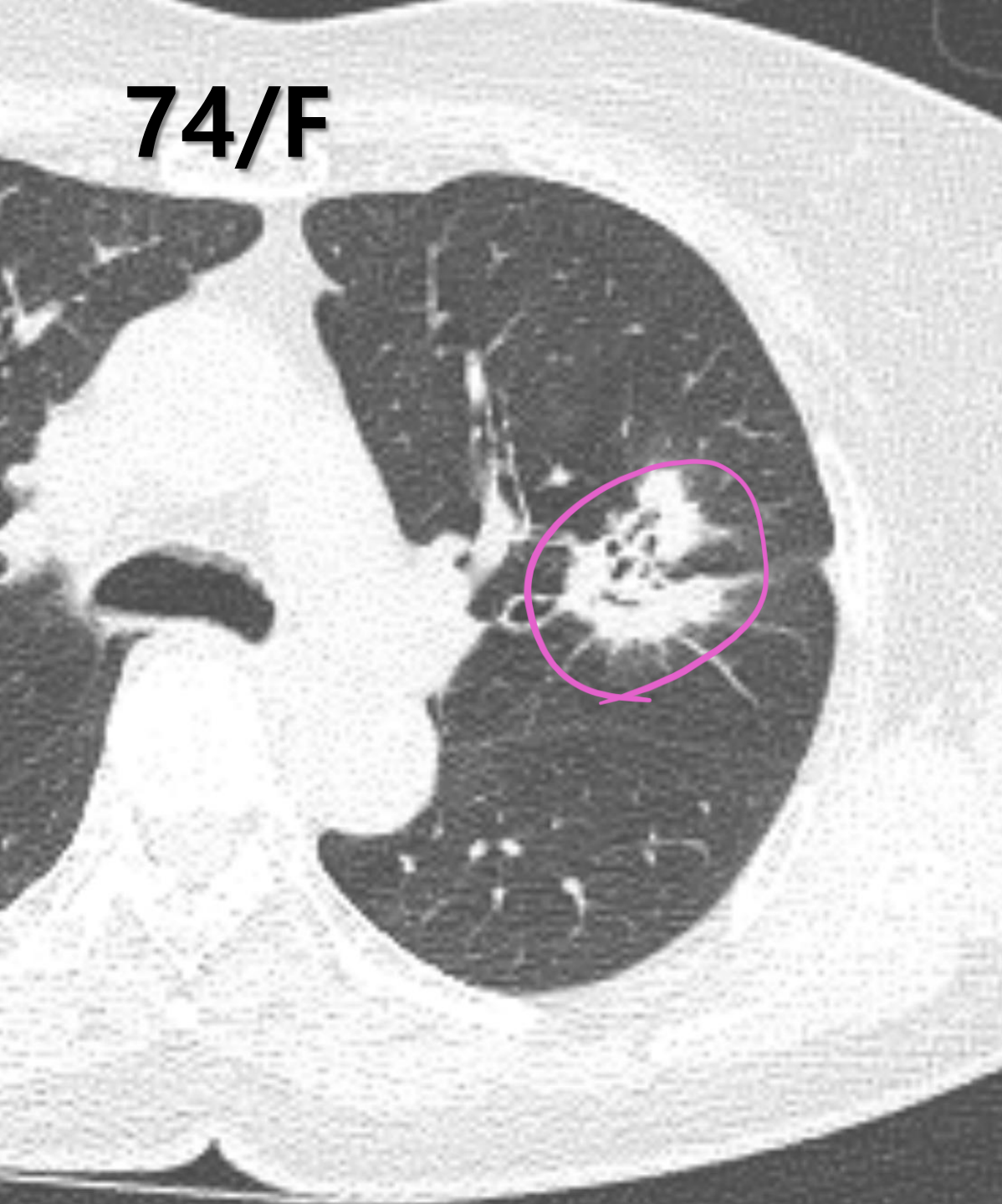


◎ 병 리 진 단

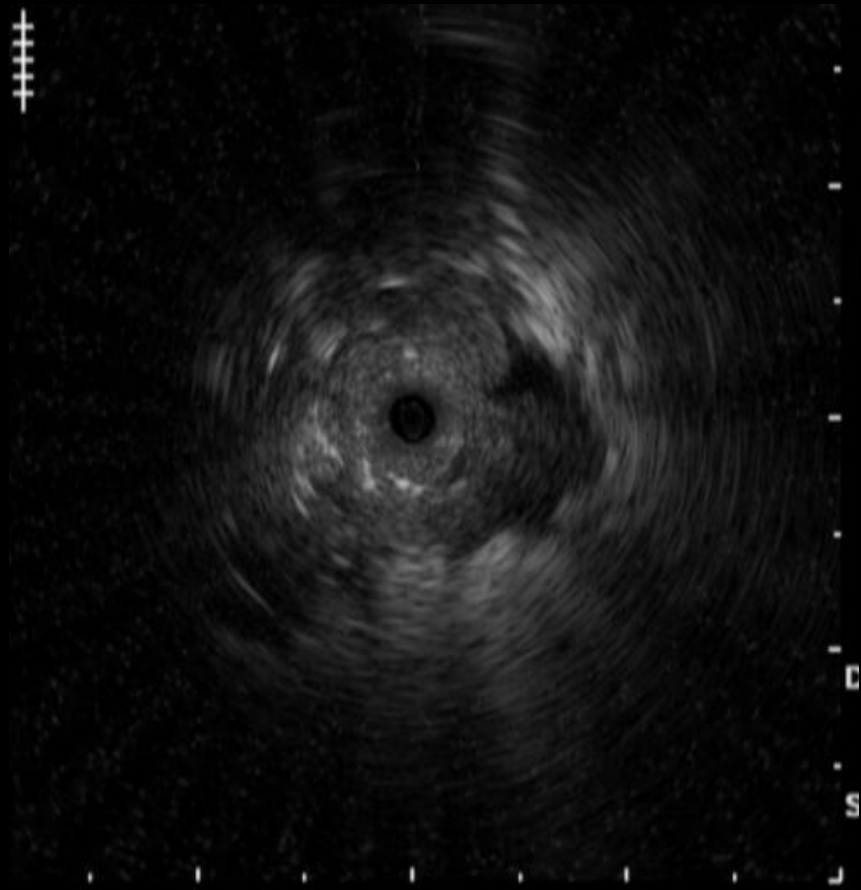
Lung, left upper lobe, superior lingular segment, "A", "B" and "C", EBUS-GS-TBLB;

1. Anthracofibrosis (A)
2. Mainly anthracofibrosis
with a few atypical cells (B,C)

74/F



(3.7 f/s)
251 / 694



◎ 병리 진단

Lung, left upper lobe, posterior segment, "A", "B", "C", "D" and "E", EBUS-GS-TBLB:

Non-neoplastic bronchial mucosa (A,B,C,D,E)

Diagnostic yield of TBLC for PPLs

- Diagnostic yield (2021~2023): 89.9-91.5%
- Additional diagnostic yield (DY)
 - Matsumoto Y, et al. (2021) (n = 257)
 - 8.6% (81.3% → 89.9%)
 - 'Adjacent to' / 'Within': 14.9% / 14.9% (p = 0.001)
 - Bronchus sign (-) / (+): 15.4% / 6.3% (p = 0.011)
 - Nakai T, et al. (2022) (n = 139)
 - 76.3% (FB) / 81.3% (TBLC) / 89.9% (Total)
 - 'Adjacent to': conventional biopsy 67.4% vs. cryobiopsy 81.9% (p = 0.019)
 - 'Within': FB 94.2% (49/52) vs. cryobiopsy 84.6% (44/52) (p = 0.18)
 - Chaeuk Chung, et al. (2024) (n = 199)
 - 65.3% (FB) / 84.4% (TBLC) / 91.5% (Total)
 - 'Adjacent to' / 'Within': 29.9% / 25.2% (p = 0.003)

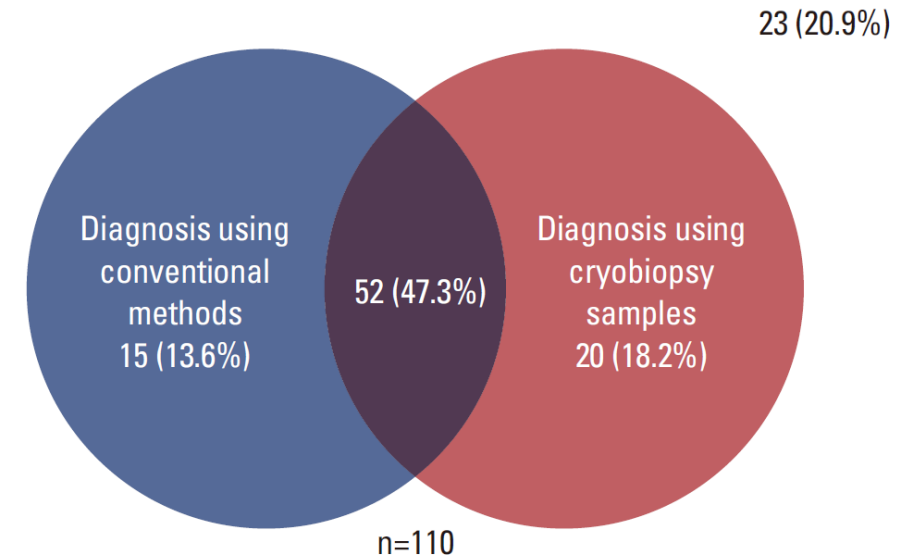
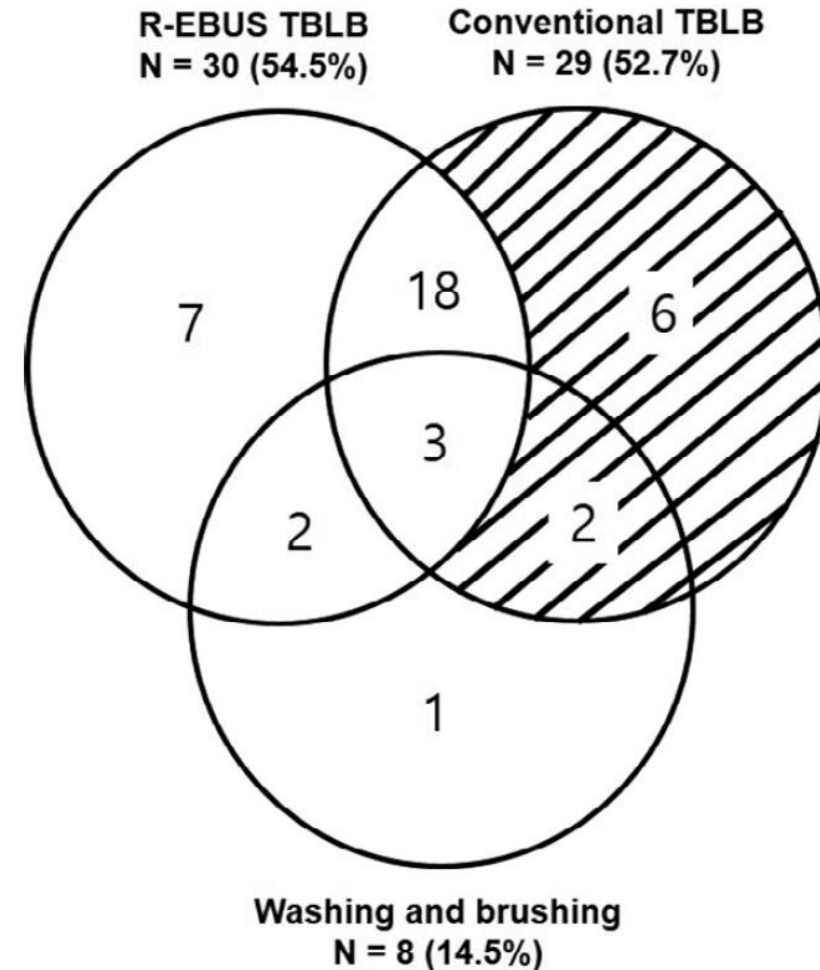


Fig. 2. Venn diagram of results of the bronchoscopy procedure.

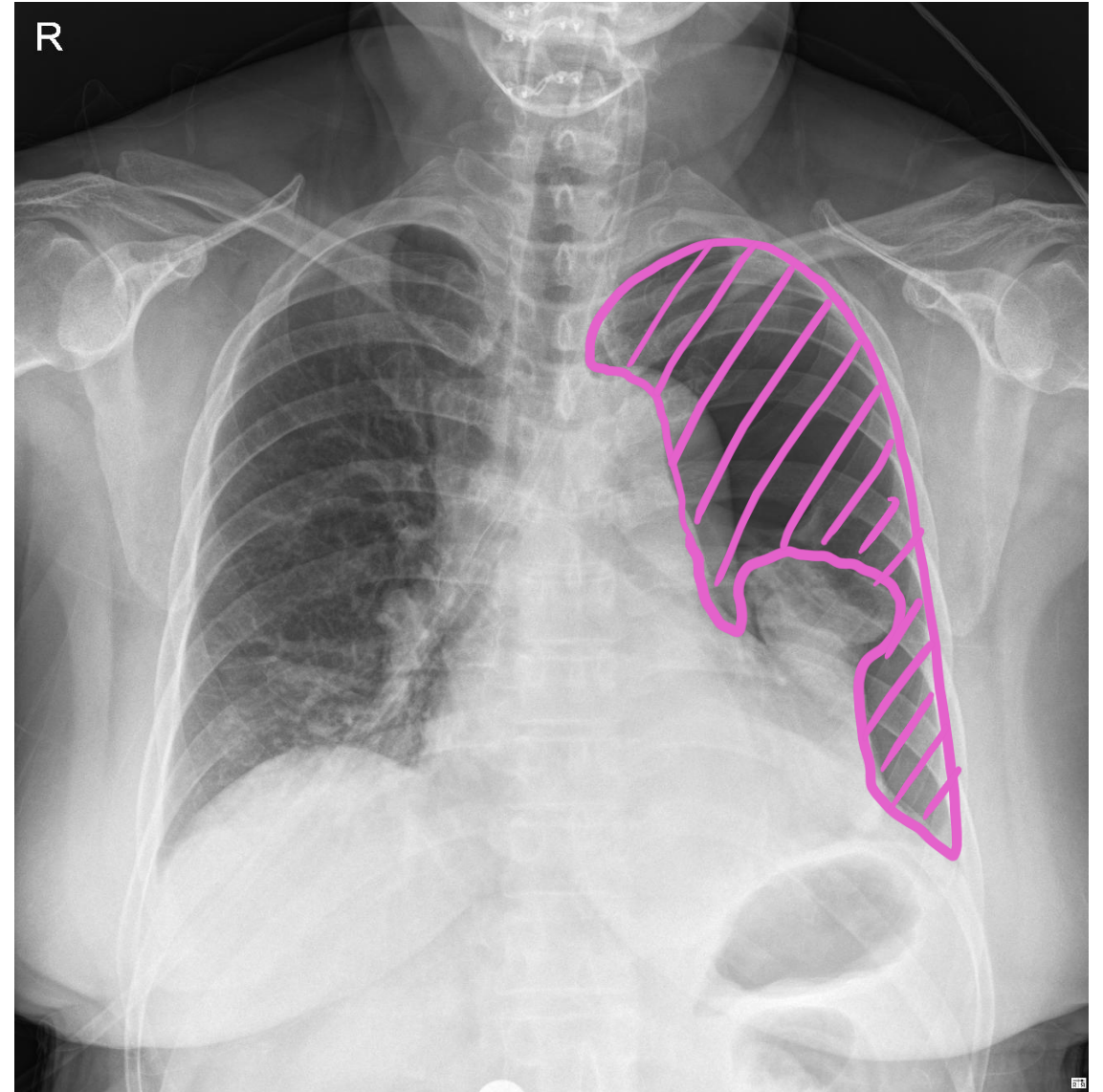
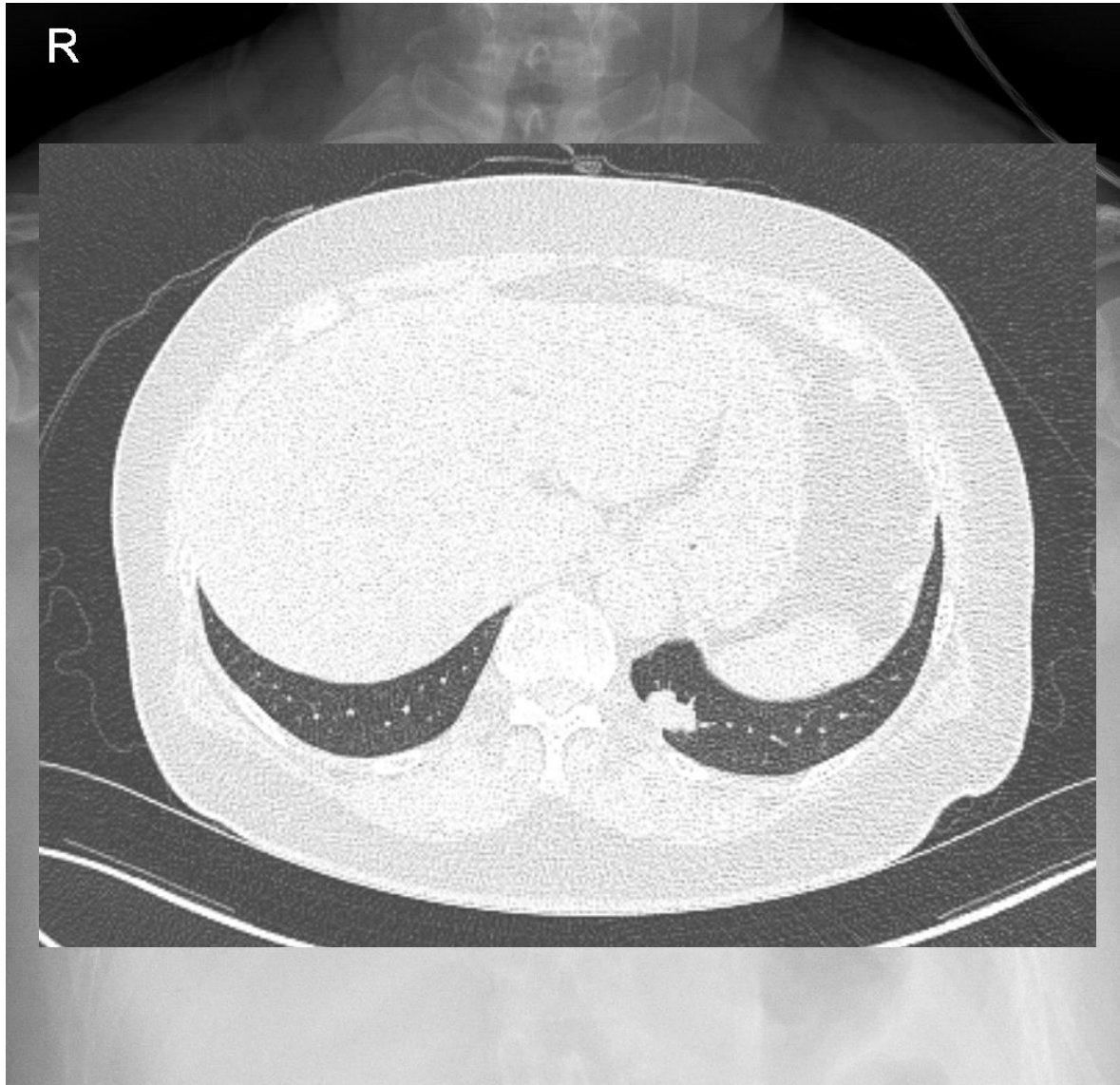
25%

EBUS-GS-TBLB + conventional FB

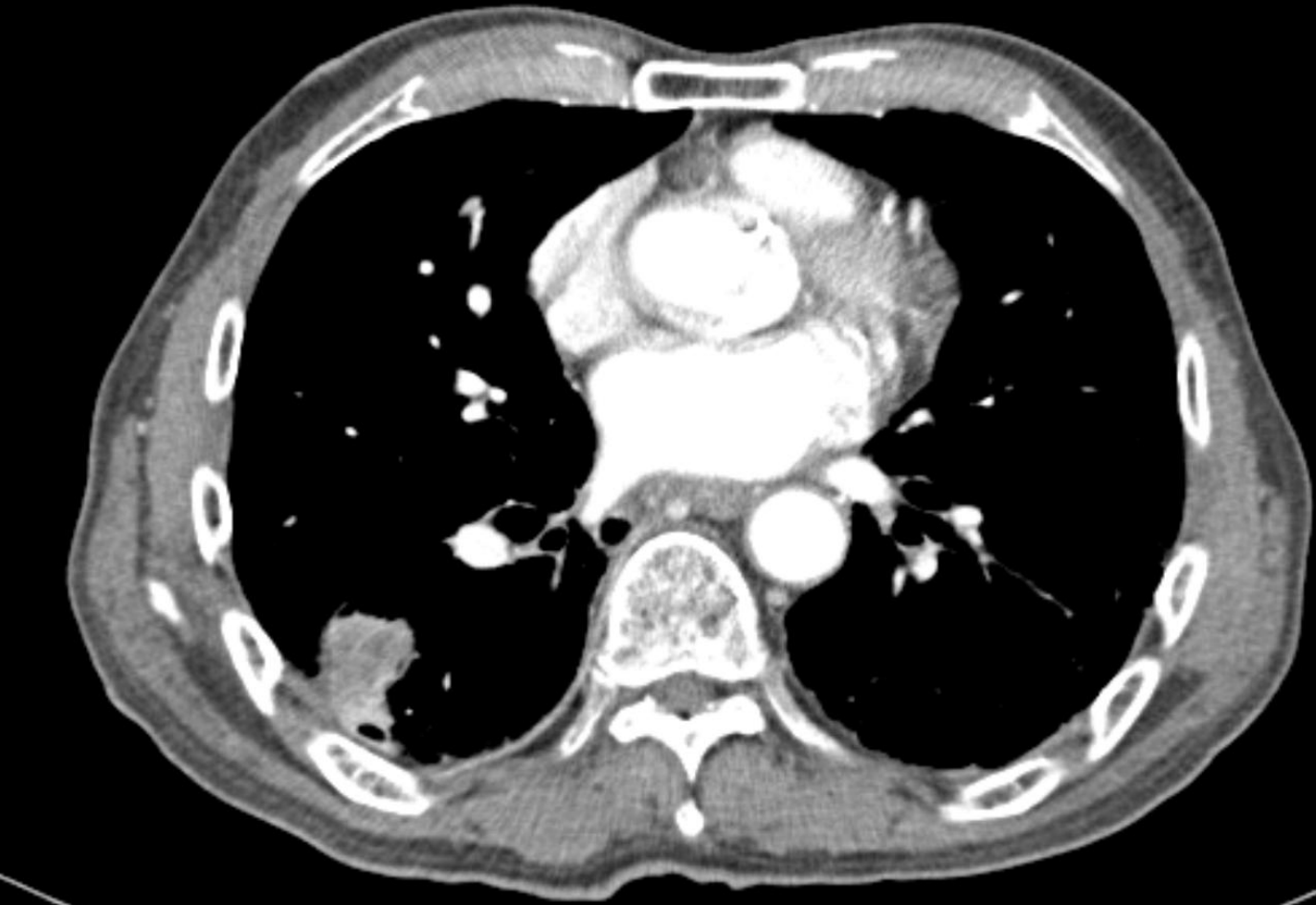
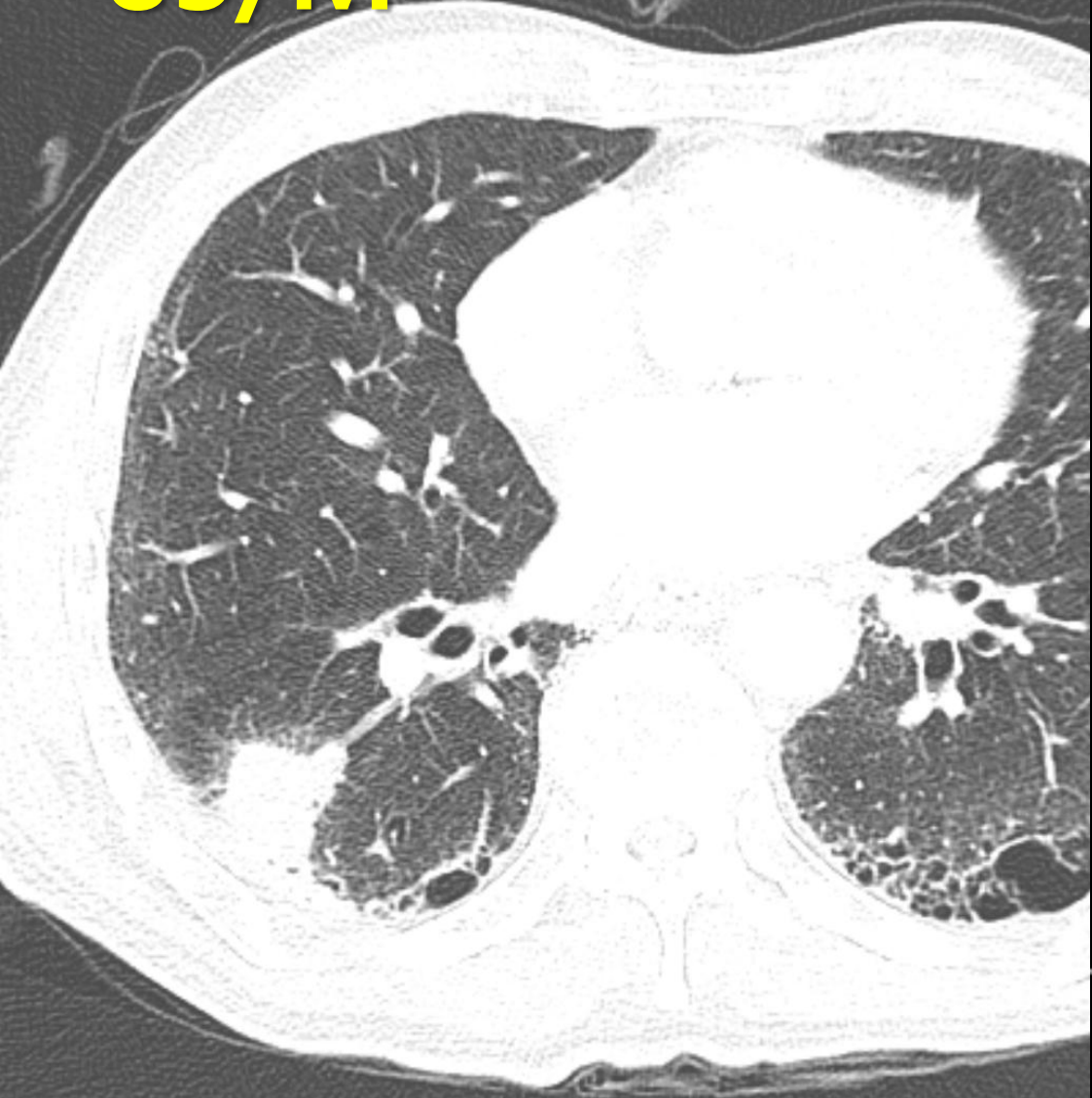
- Additional diagnostic yield: 14.5% (8/55)
- Fluoroscopy-guided TBLB
- 4.8 mm bronchoscope (BF-Q290; Olympus)
- Lesion size: 28 mm
- Solid nodule: 81.8% (45/55)
- 'Within': 32 (58.2%)

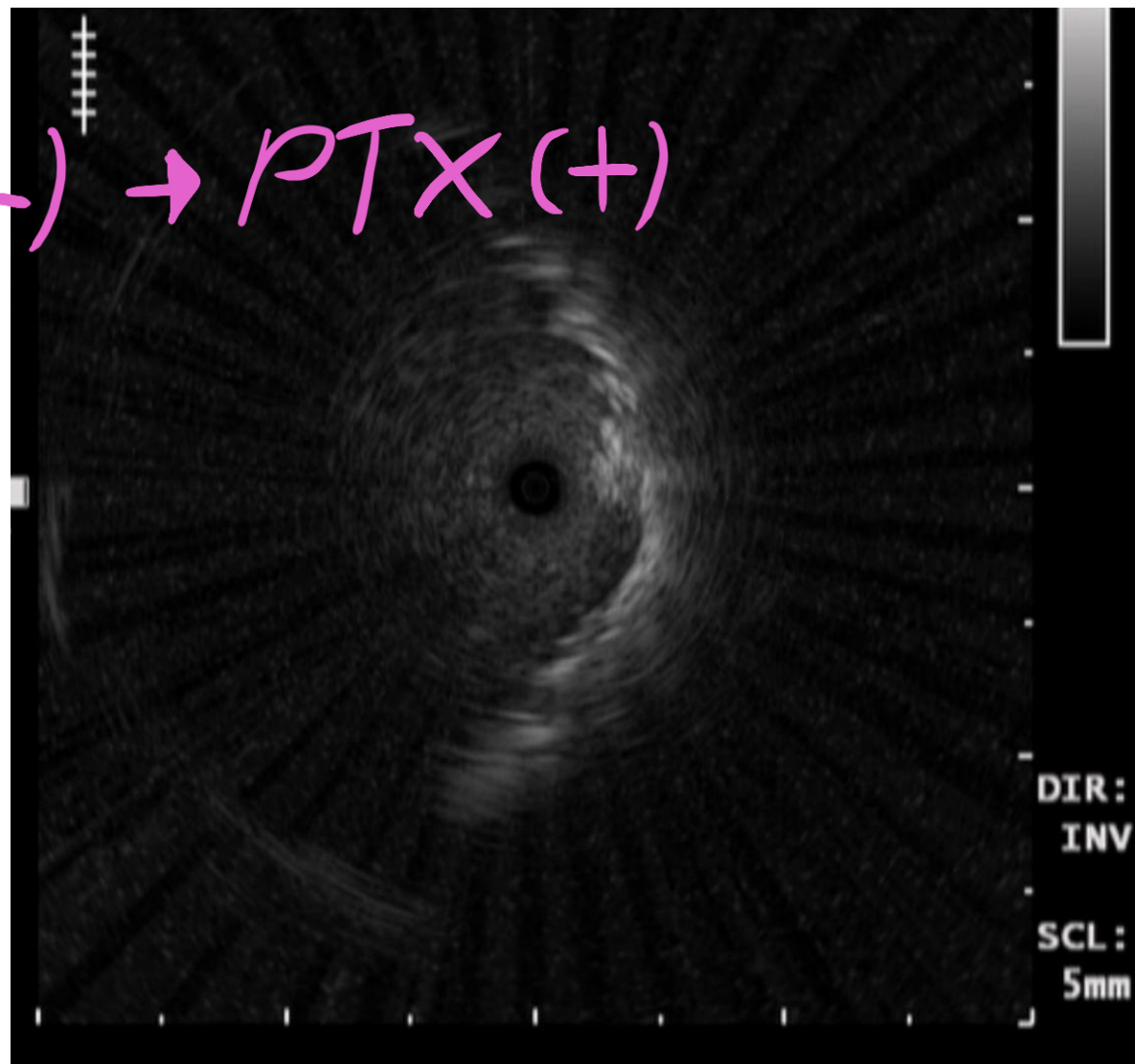
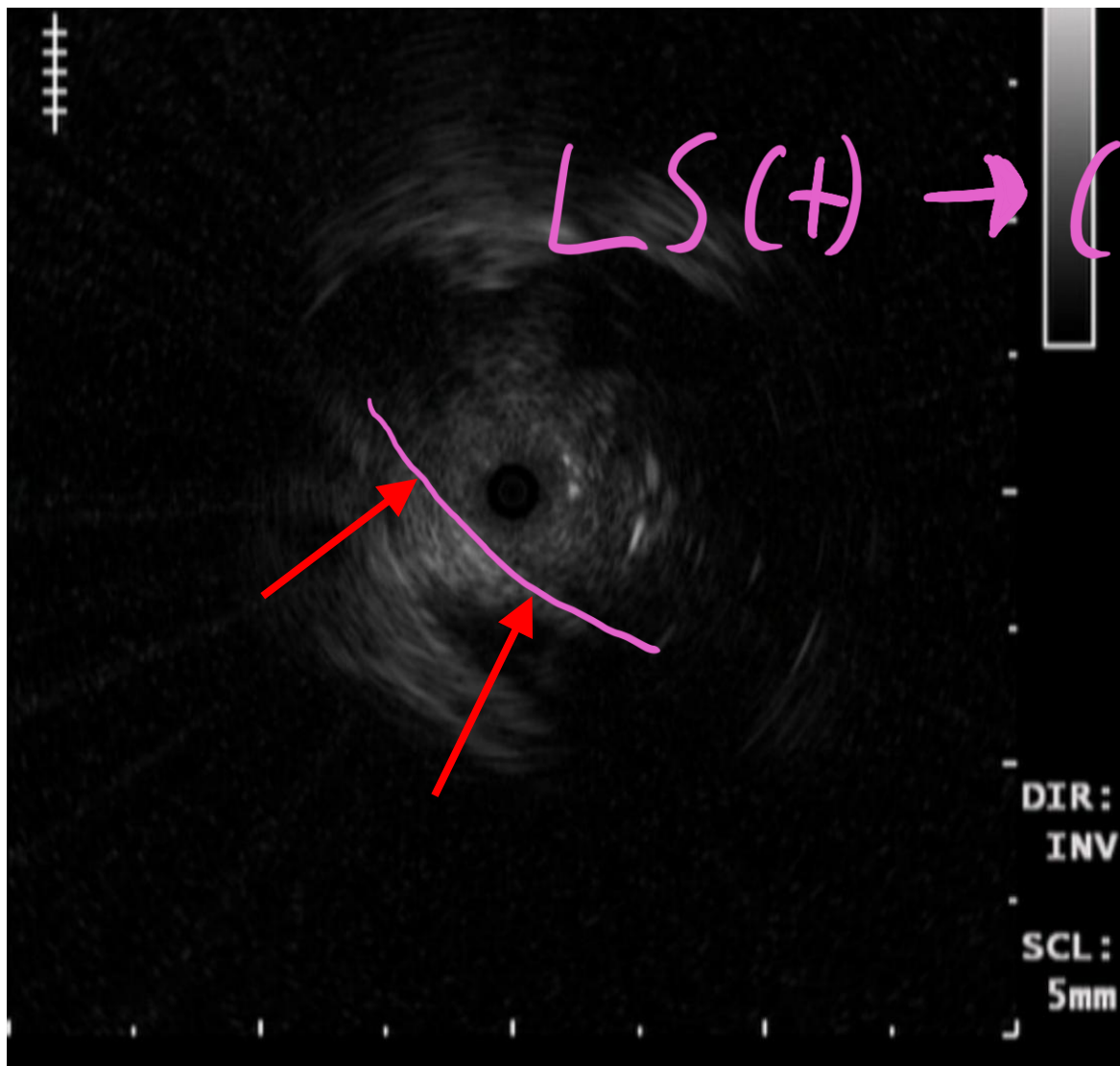


Pneumothorax

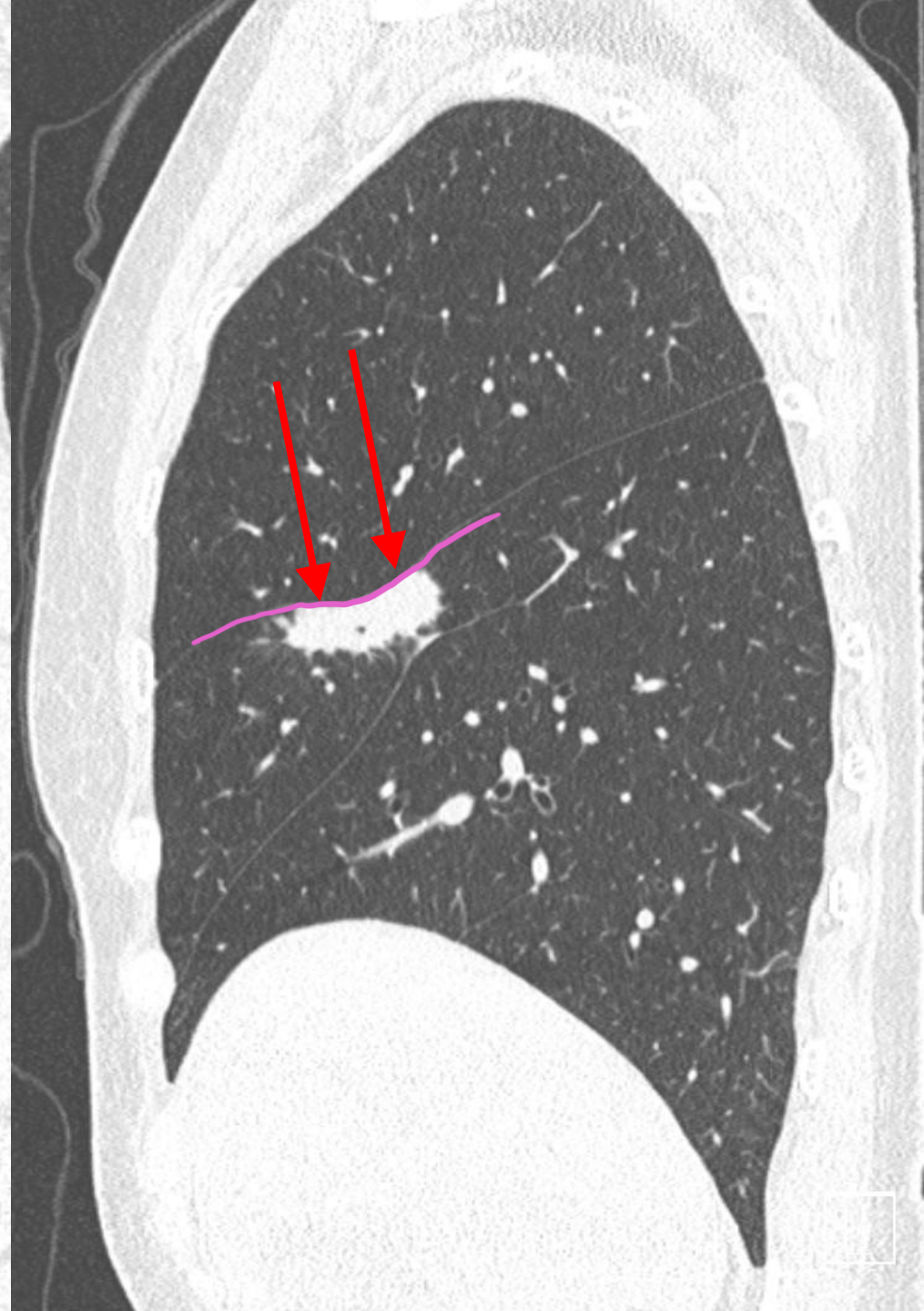
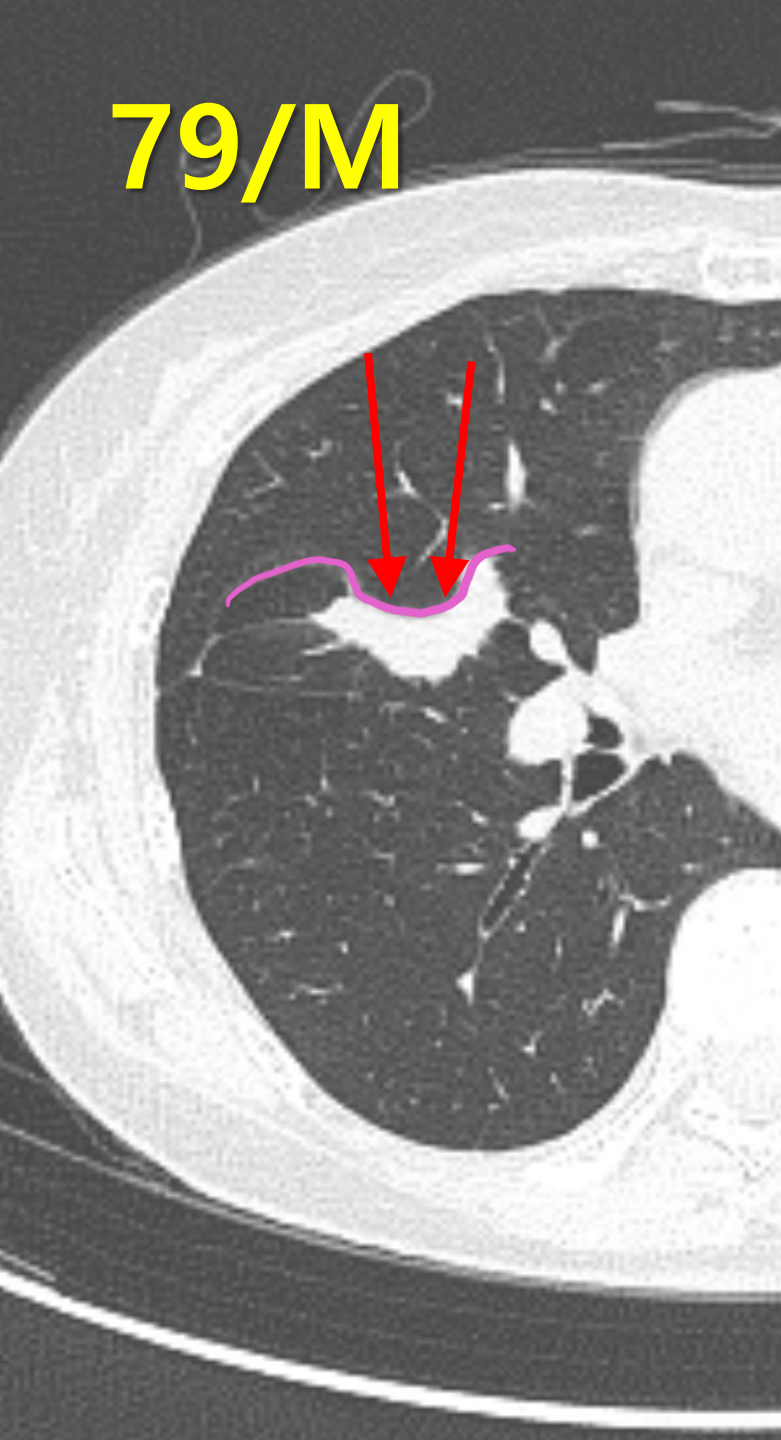


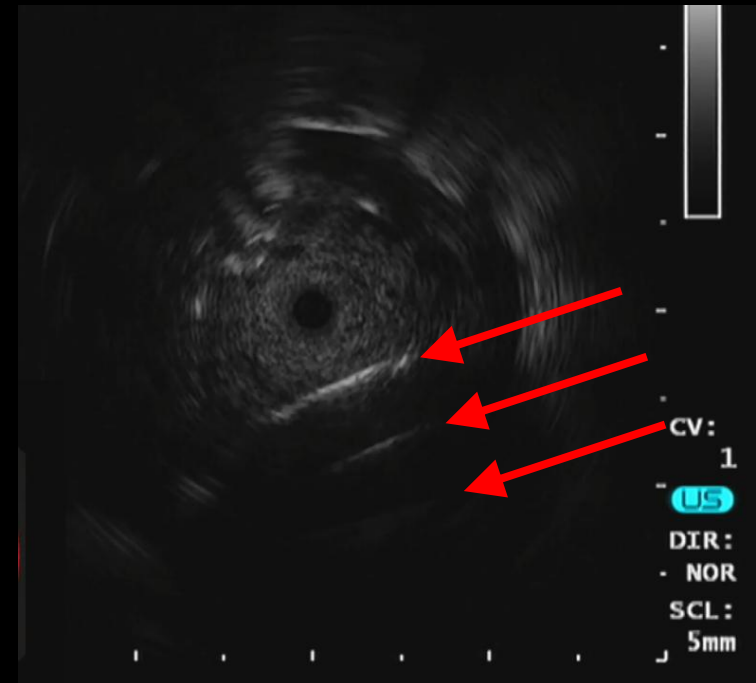
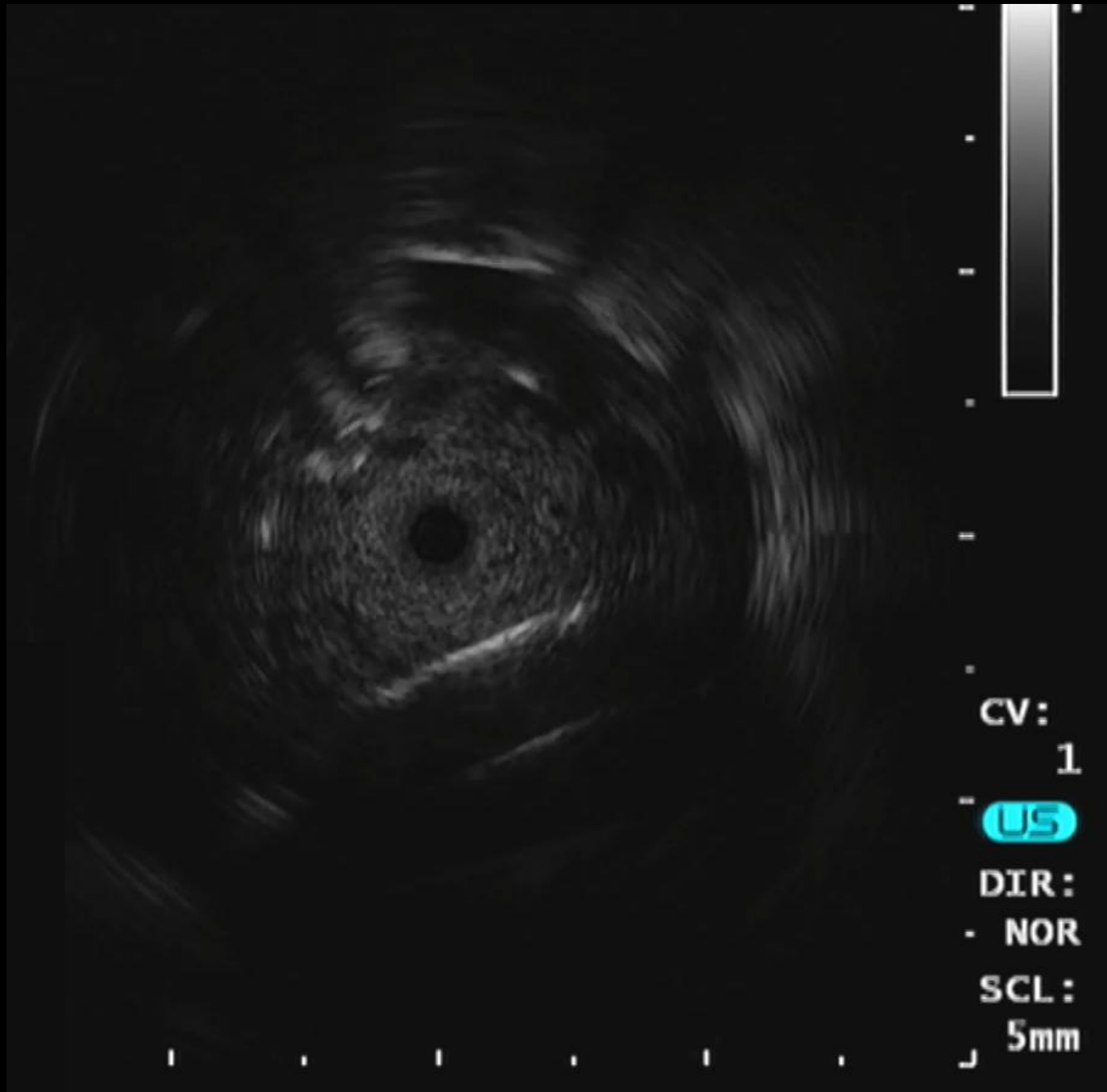
85/M



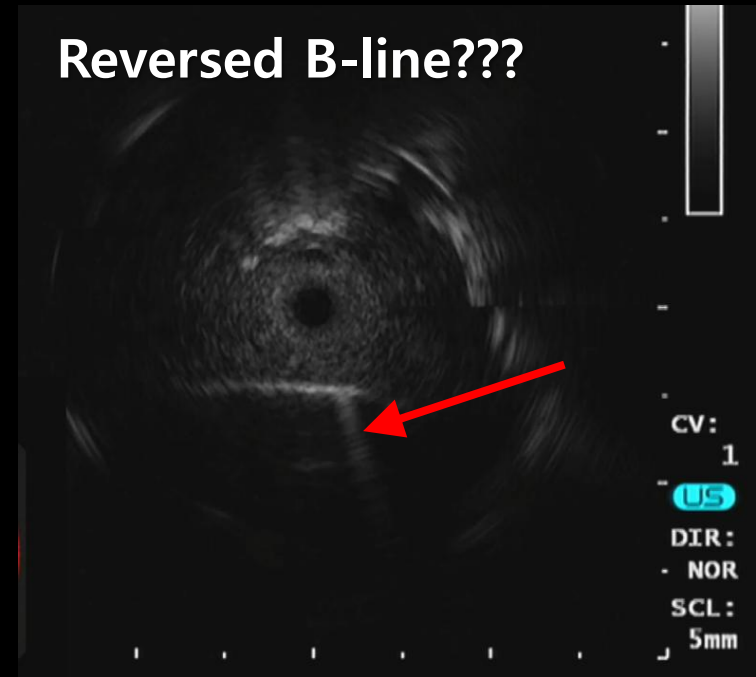


79/M





Reversed B-line???



Thank you for your attention



rahm3s@gmail.com