EBUS-TBNA

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Disclosures

- None

Objectives

- Provide an introduction to:
  - The anatomy of the EBUS-TBNA bronchoscope
  - Techniques of sampling
  - Indications, contraindications and complications

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Endobronchial Ultrasound

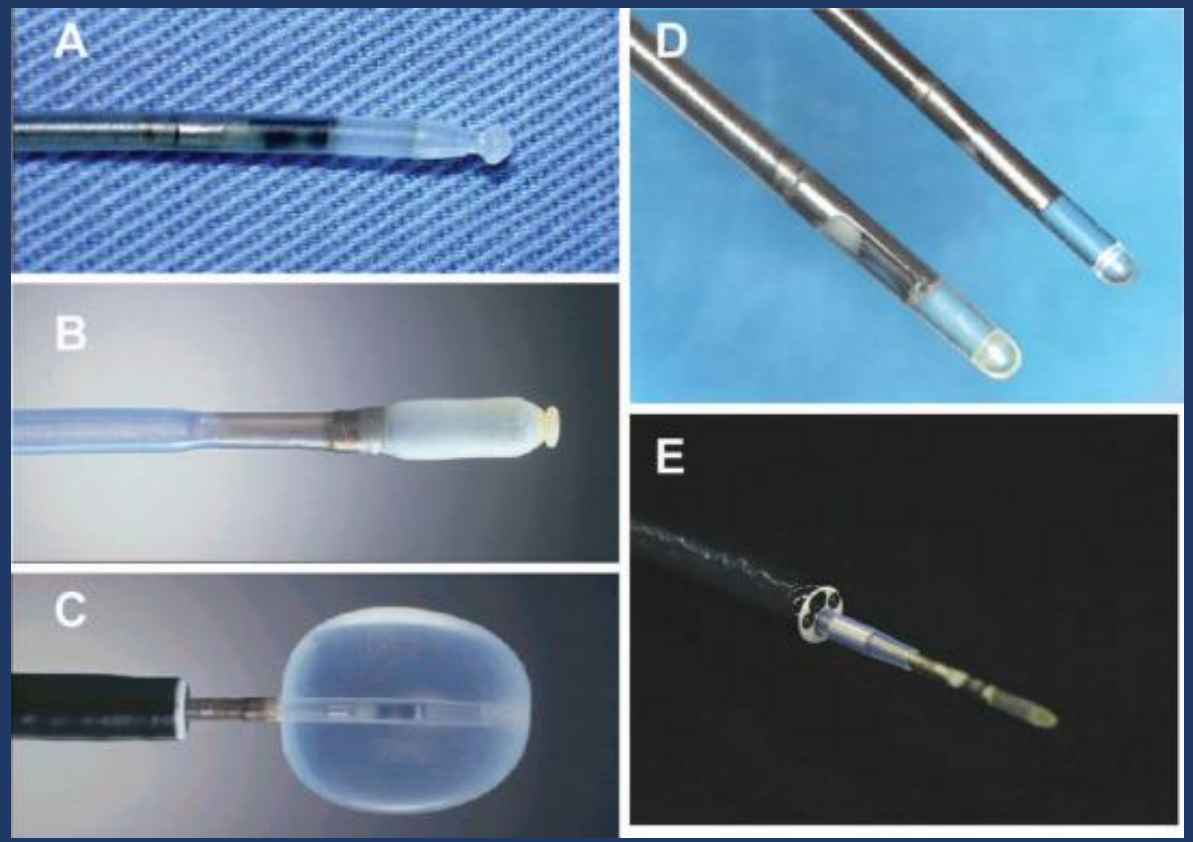
- Endobronchial Ultrasound (EBUS) is a bronchoscopic technique that uses ultrasound to visualize structures within and around the airway wall as well as the lung.

- EBUS-TBNA (Endobronchial ultrasound – transbronchial needle aspiration)
  - Minimally-invasive procedure
  - Performed on an outpatient basis
  - May be performed under moderate sedation or general anesthesia

Endobronchial Ultrasound

Convex

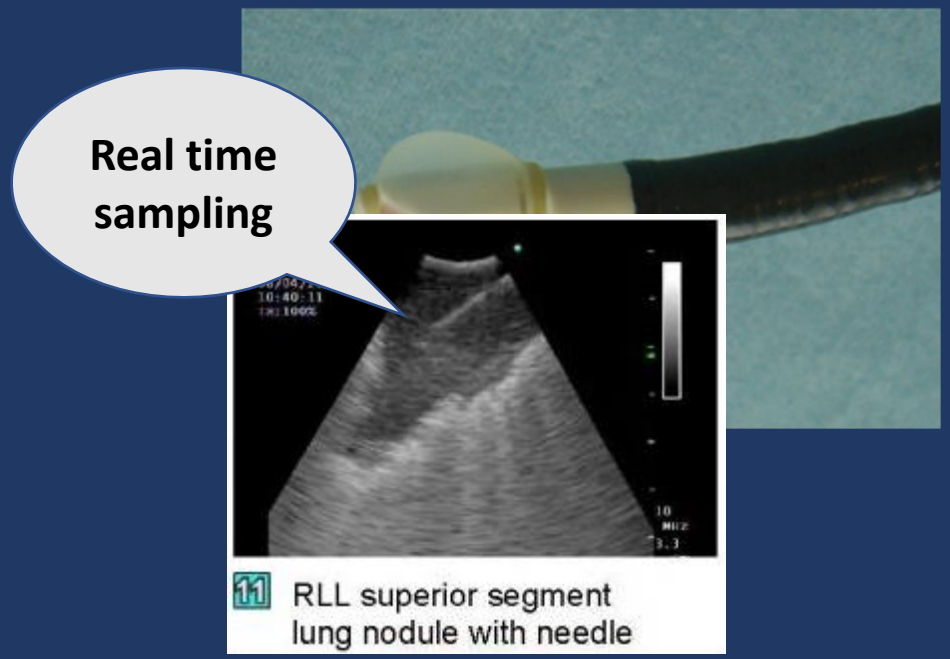
Radial



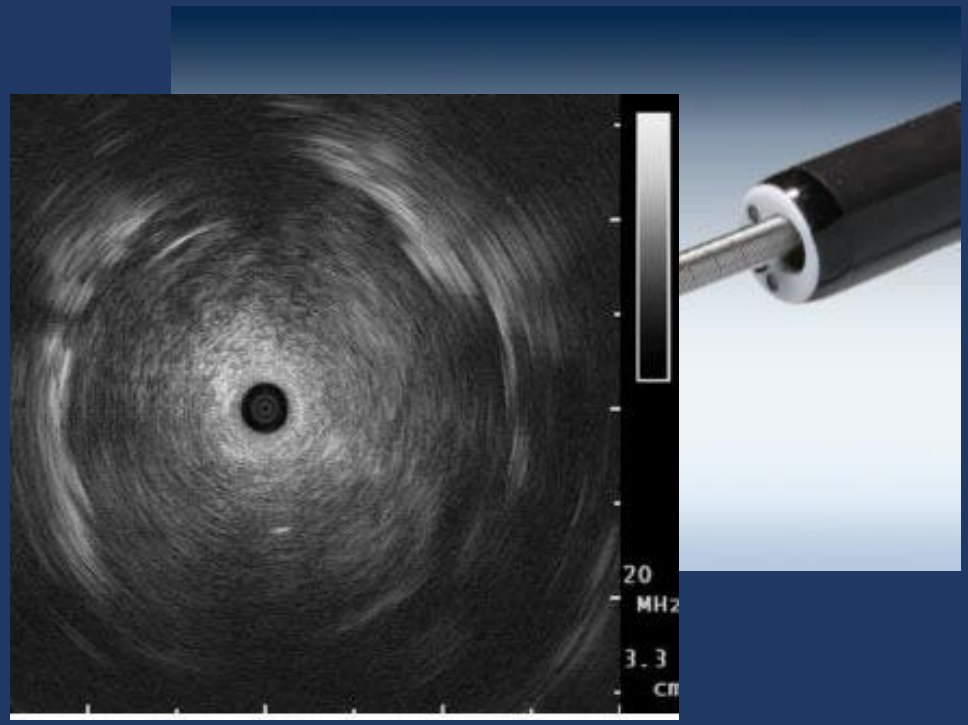
Yasufuku, K. et al. Journal of Thoracic Oncology, Volume 2, Issue 10, 2007, 970–97
Kurimoto, N. J Med Ultrasound 2009;17(1):31–439

Endobronchial Ultrasound

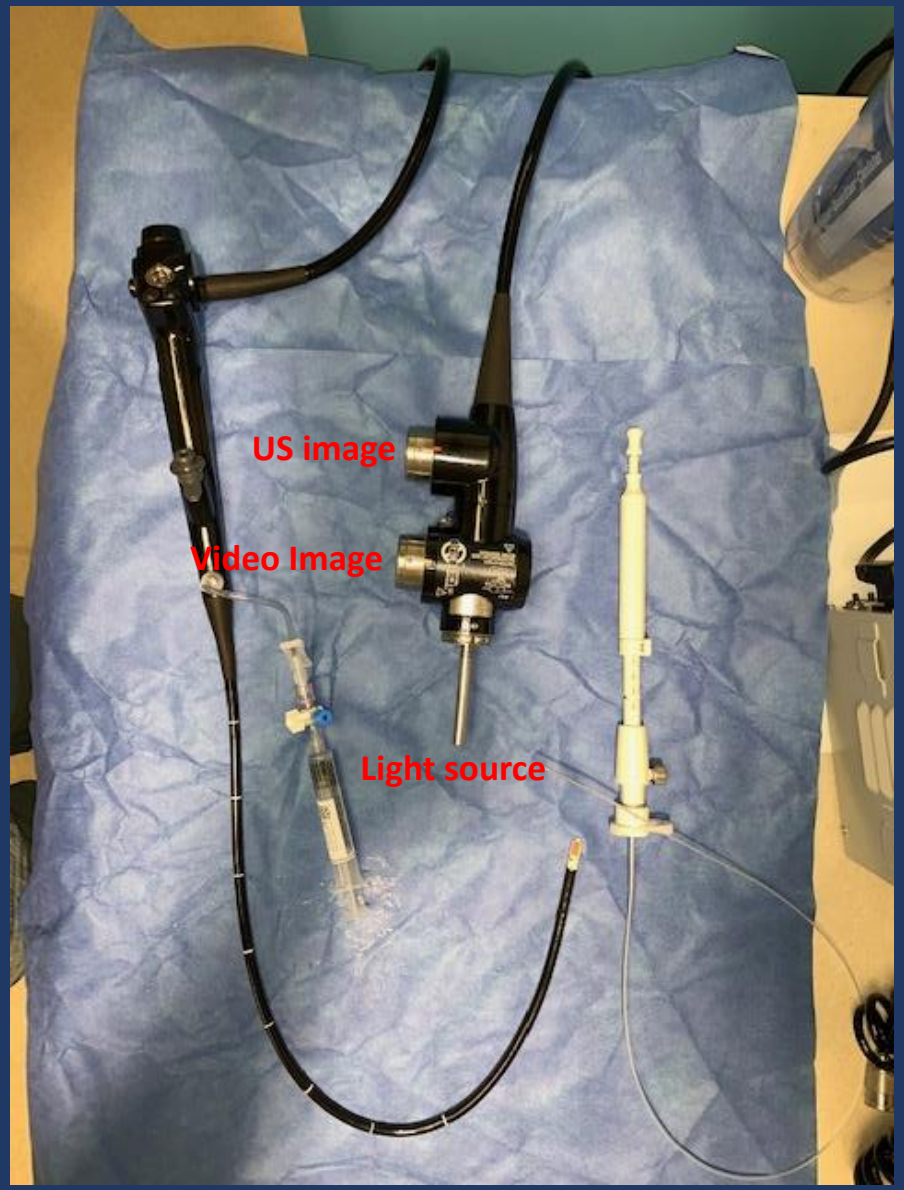
Convex

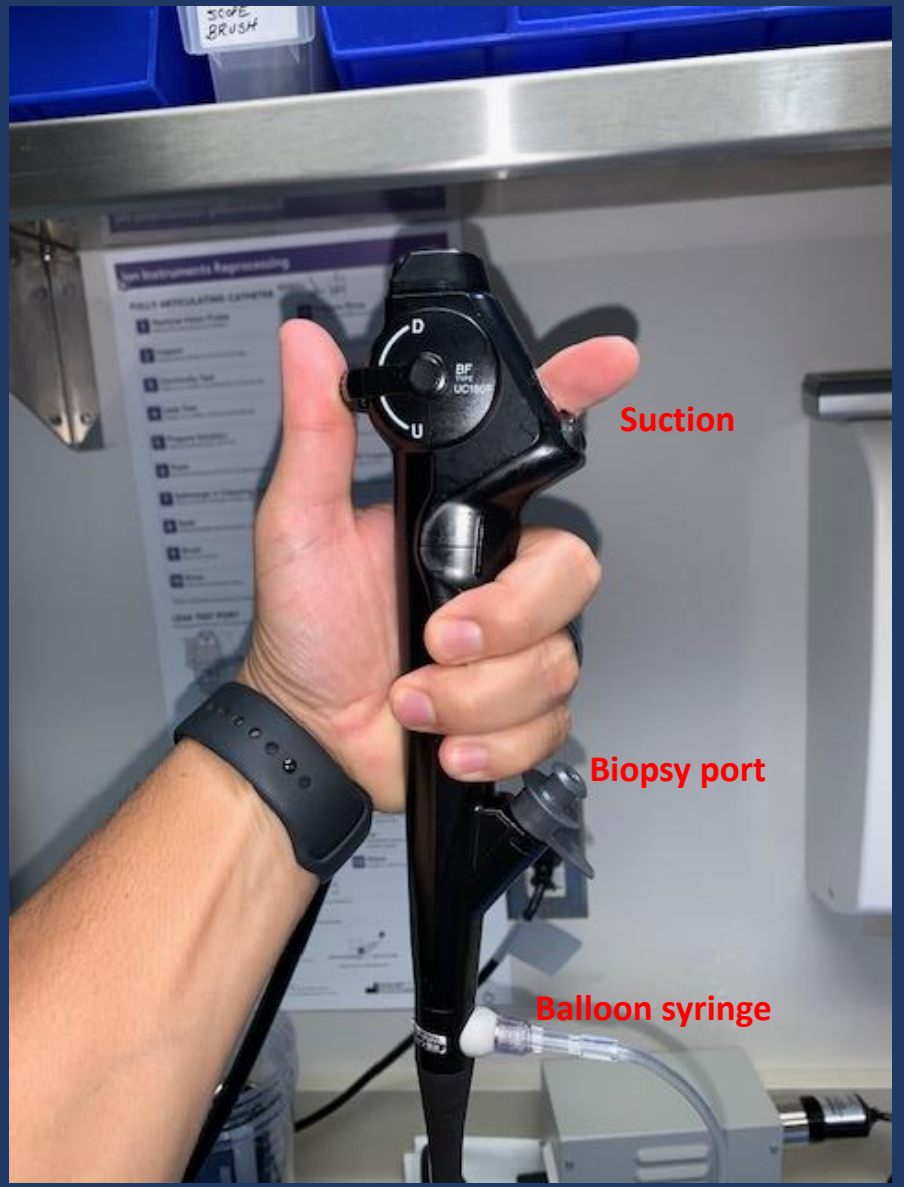


Radial

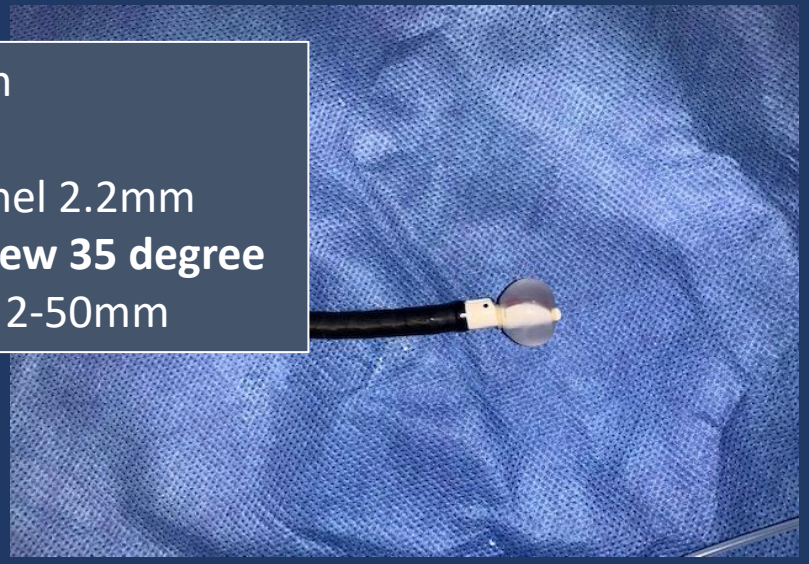


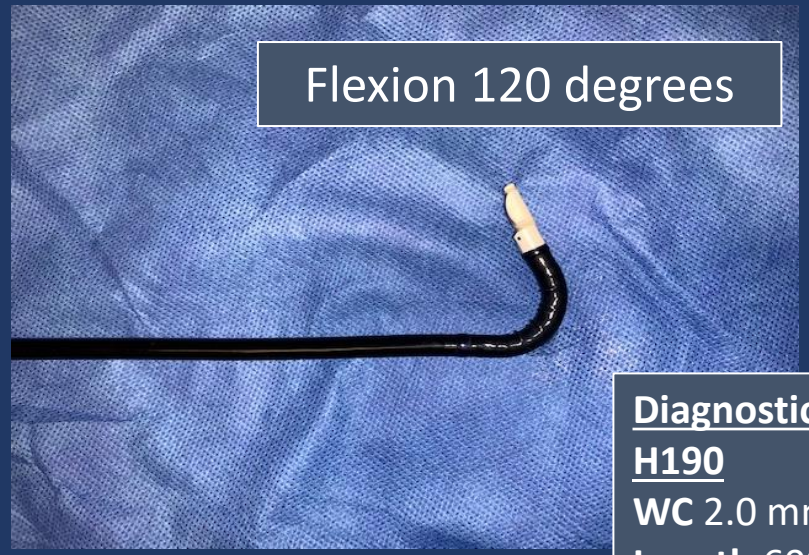
Yasufuku, K. et al. Journal of Thoracic Oncology, Volume 2, Issue 10, 2007, 970–97
Image courtesy of Olympus Medical Corporation


US image
Video Image
Light source


Suction
Biopsy port
Balloon syringe

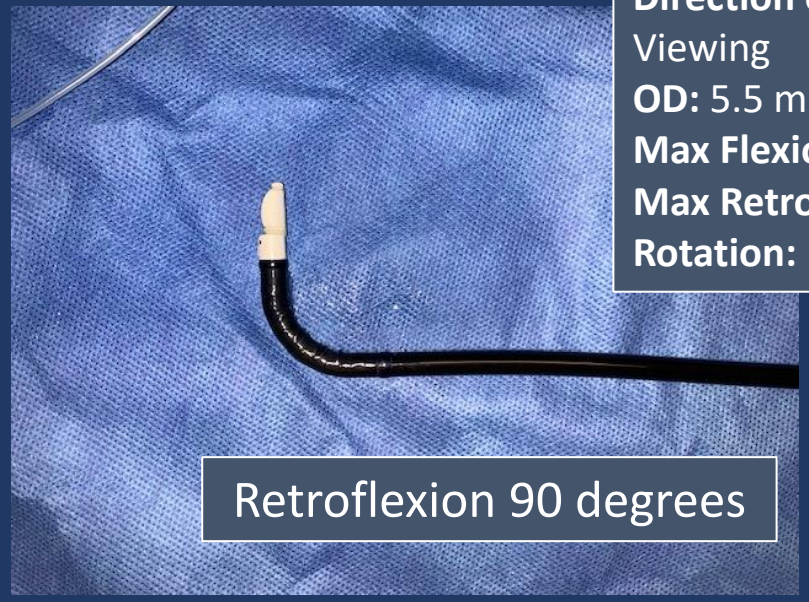
Length 600mm
OD 6.9mm
Working channel 2.2mm
Direction of view 35 degree
Depth of Field 2-50mm



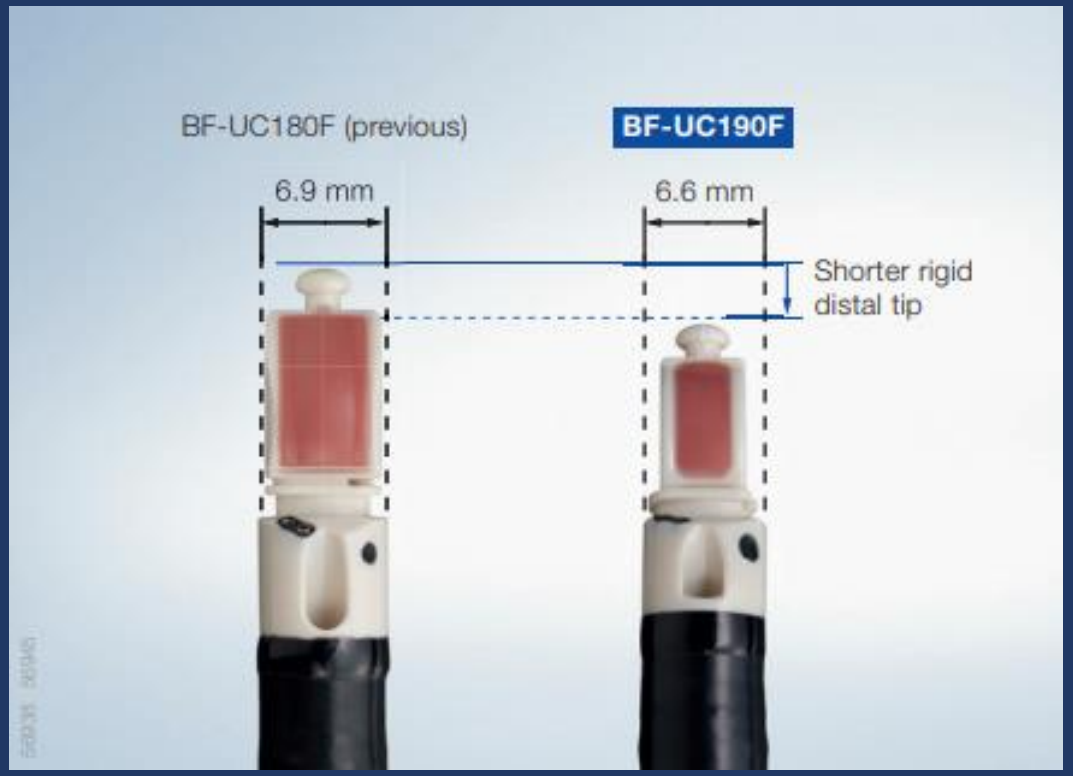


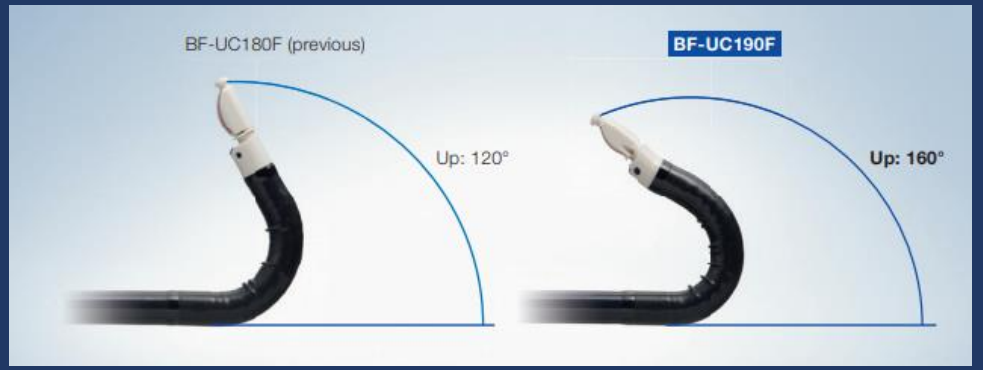
Flexion 120 degrees

<u>Diagnostic bronchoscope BF-H190</u>
WC 2.0 mm
Length 600 mm
Direction of View 0° Forward Viewing
OD: 5.5 mm Distal End
Max Flexion: 210°
Max Retroflexion: 130°
Rotation: 120°



Retroflexion 90 degrees





https://www.olympus-europa.com/medical/en/Products-and-Solutions/Products/Product/EBUS-TBNA.html

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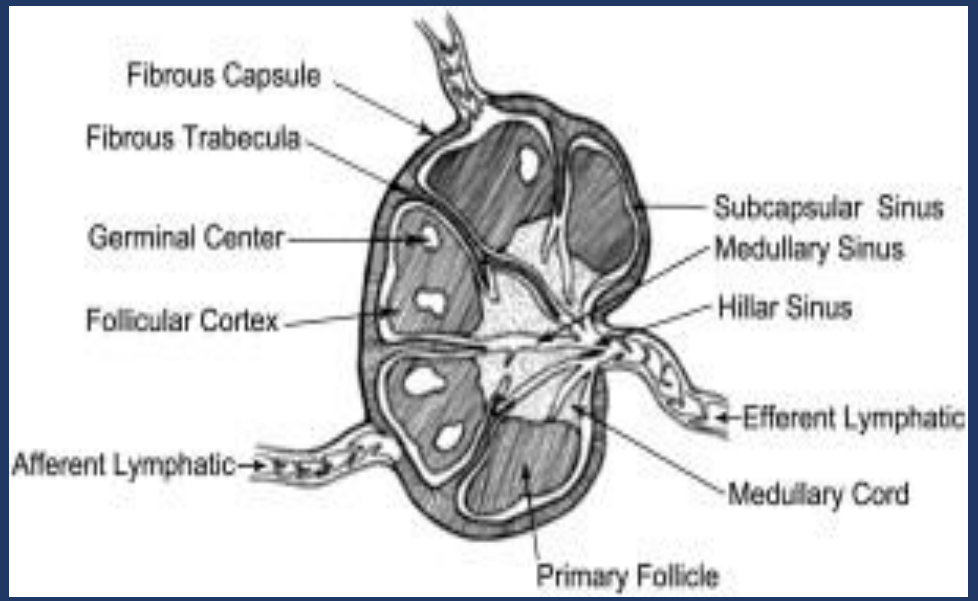
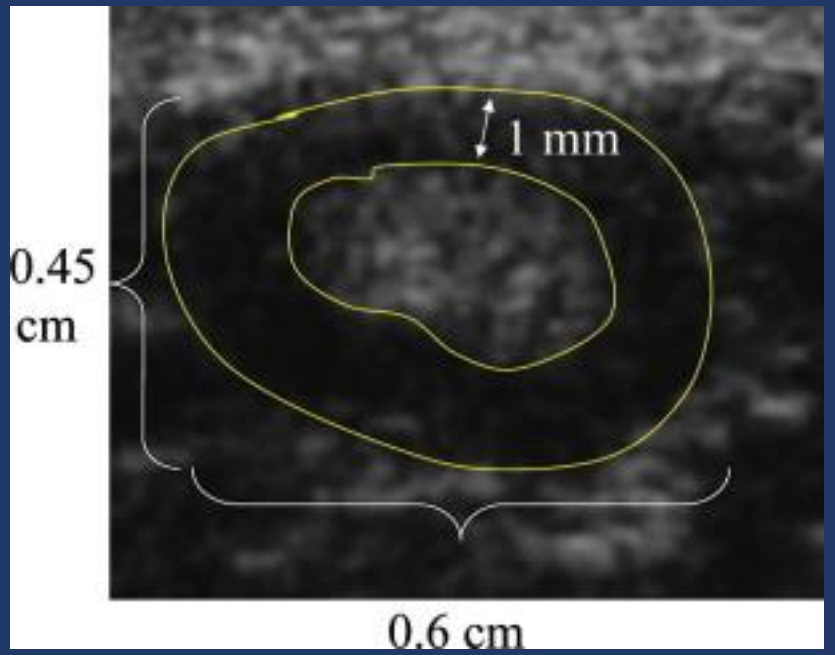
Lymph Node





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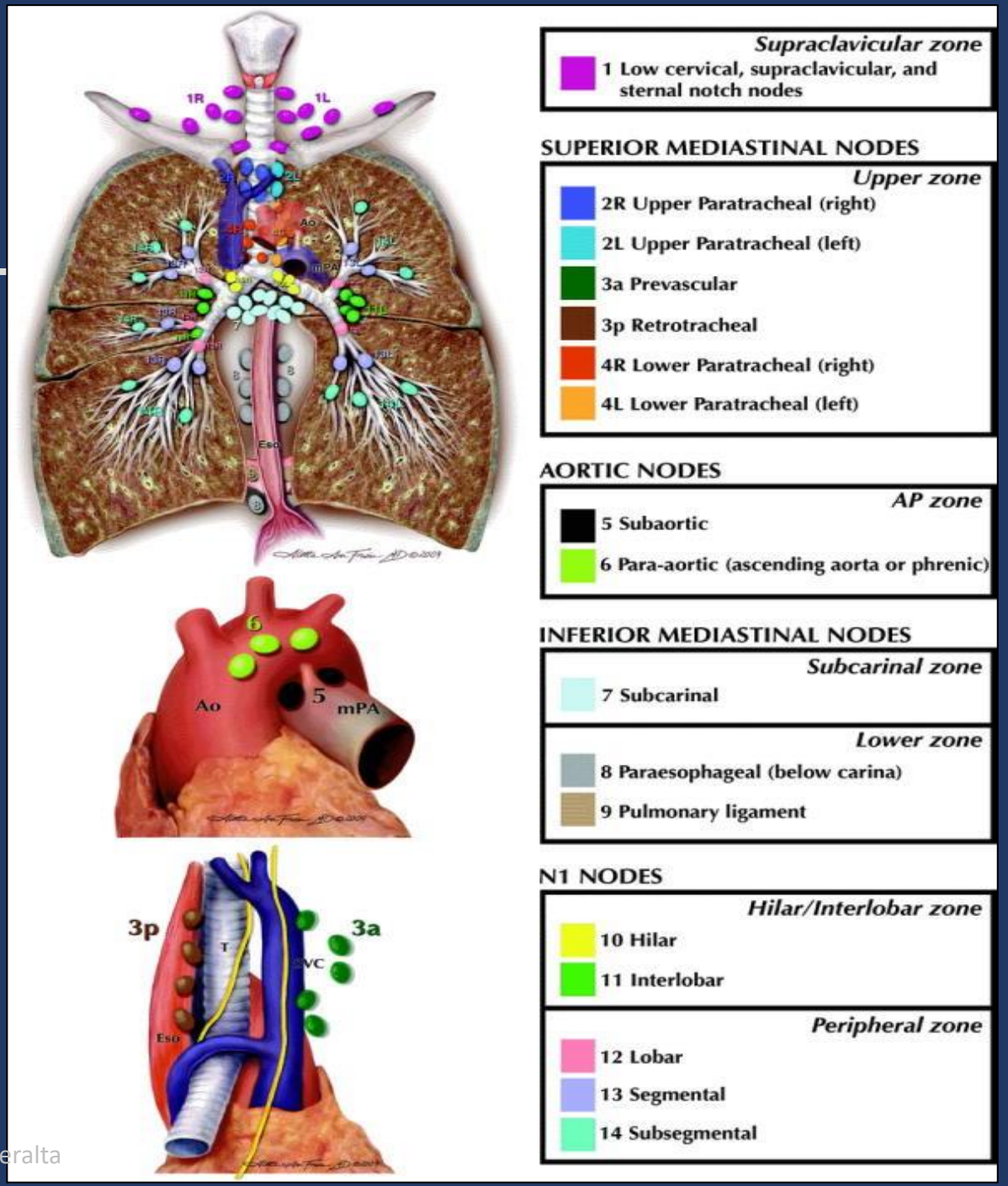
Whitman GJ. **Lymph Node Sonography.** Ultrasound Clinics, Volume 6, Issue 3, 2011, 369–380

Lymph Node Stations



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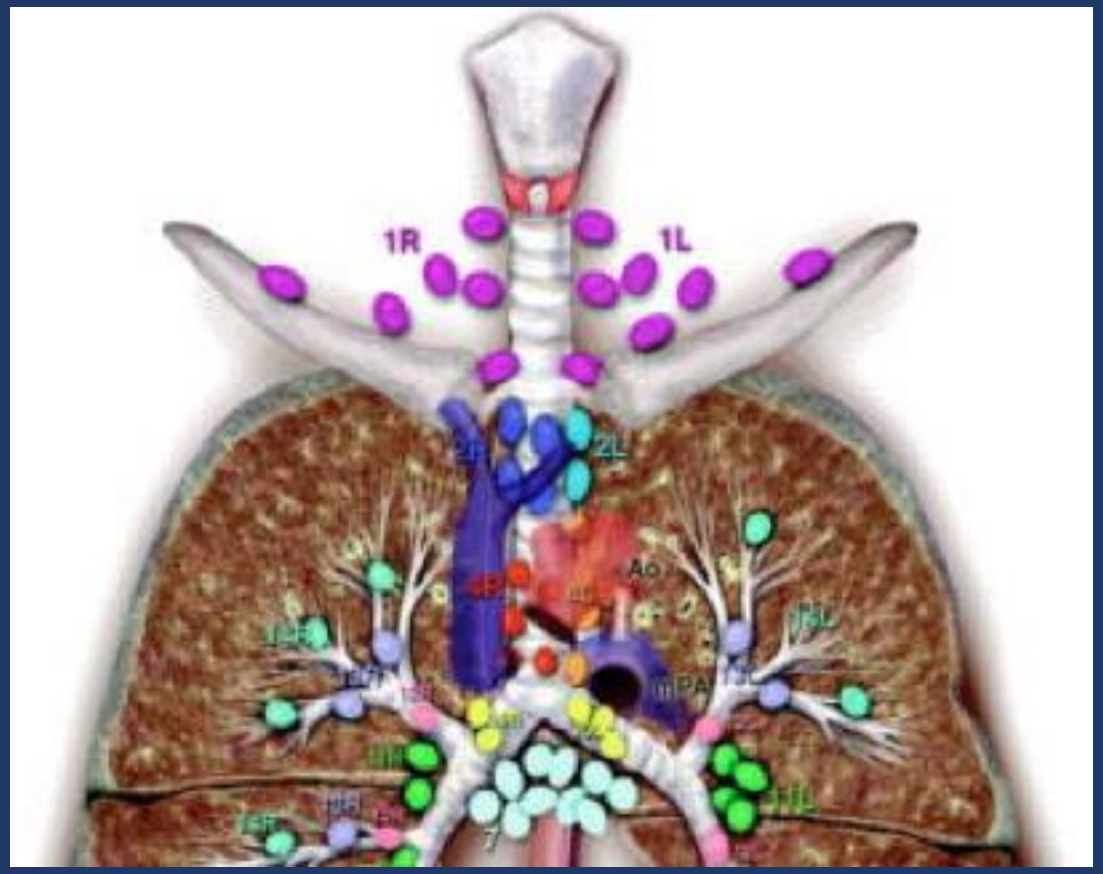
Journal of Thoracic Oncology. 4(5):568-577, May 2009. DOI: 10.1097/JTO.0b013e3181a0d82e

Supraclavicular Zone (1R and 1L)



- Upper border
  - Lower margin of the cricoid cartilage
- Lower border
  - Clavicles bilaterally and in the midline, the upper border of the manubrium
- Midline serves as the border between 1R and 1L

Supraclavicular Zone (1R and 1L)

Endobronchial ultrasound : an atlas and practical guide (0-387-09436-9, 978-0-387-09436-6), Ernst, Armin. Start Journal/Book Specific Information Springer, 2009

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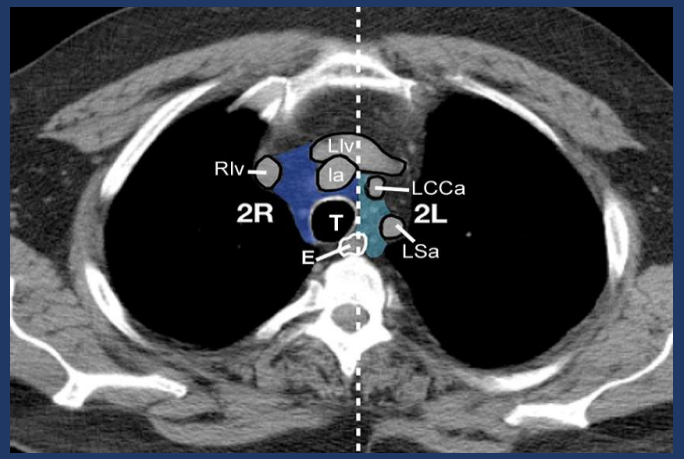
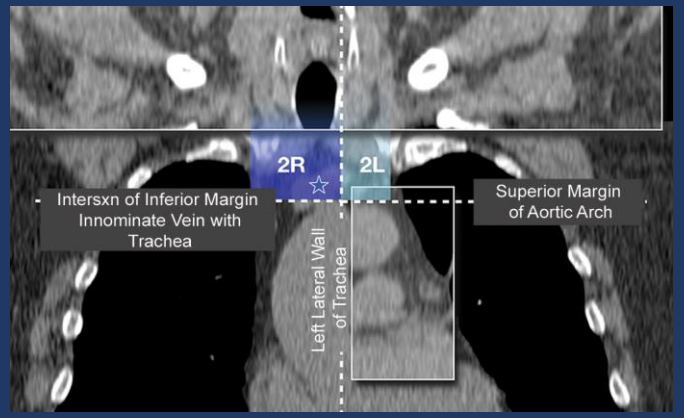
Superior Mediastinal Zone (2R and 2L)





Upper border
- Apex of the lung and pleural space, upper border of the manubrium (midline)
- Lower border

2R: Intersection of the caudal margin of the innominate v. with the trachea

2L: Superior border of the aortic arch

The left lateral wall of the trachea (not the midline) serves as the boundary between stations 2R and 2L

Ahmed H. El-Sherief; Charles T. Lau; Carol C. Wu; Richard L. Drake; Gerald F. Abbott; Thomas W. Rice; *RadioGraphics* **2014,** 34, 1680-1691. DOI: 10.1148/rg.346130097

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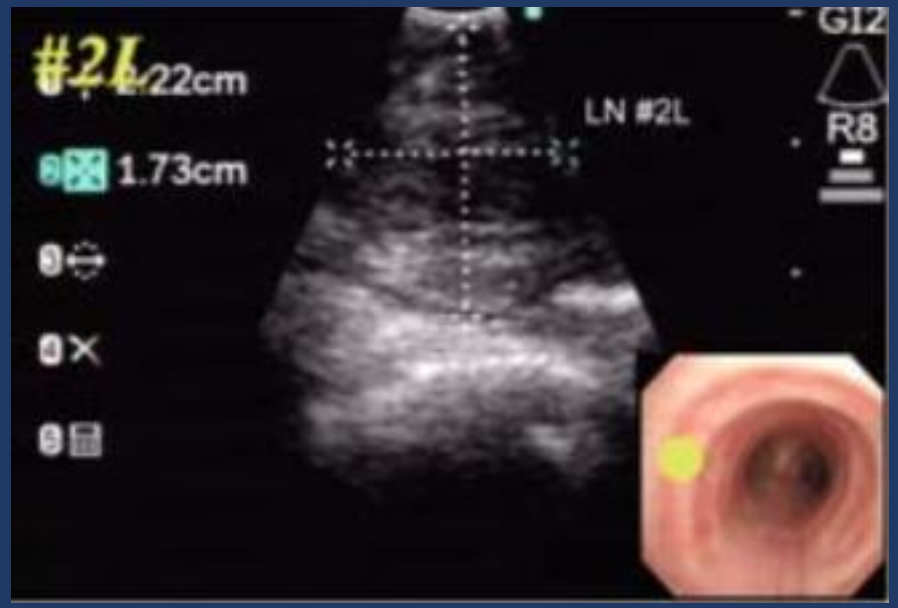
Superior Mediastinal Zone (2R and 2L)



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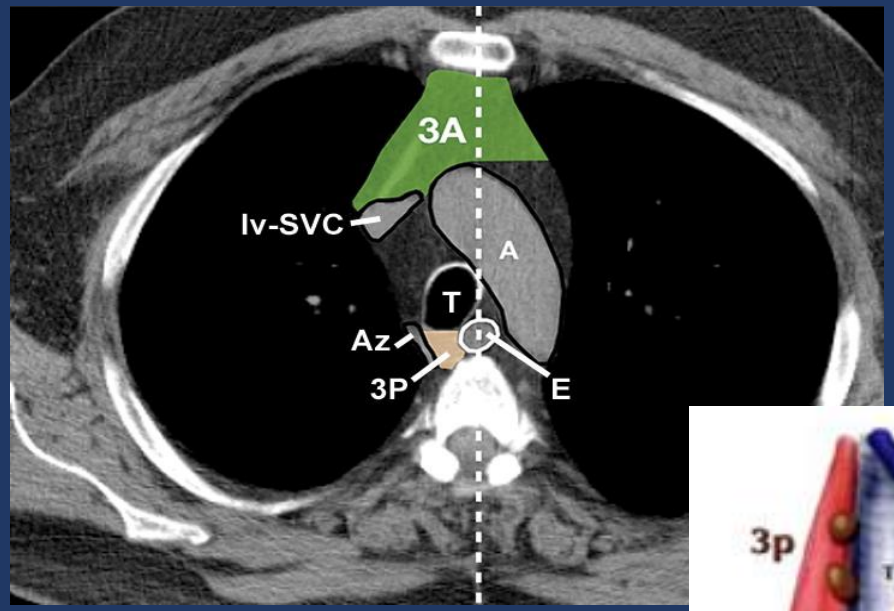
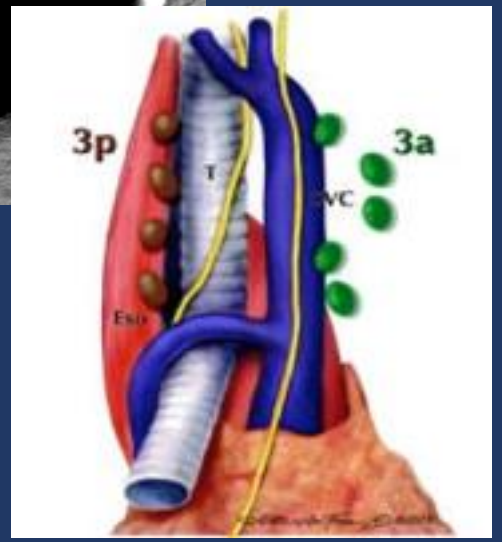
Superior Mediastinal Zone (3A and 3P)





- Upper border
  - Apex of chest
- Lower border
  - Level of carina
- Anterior border
  - Posterior aspect of sternum
- Posterior border (3a)
  - R: anterior border of SVC
  - L: L carotid artery

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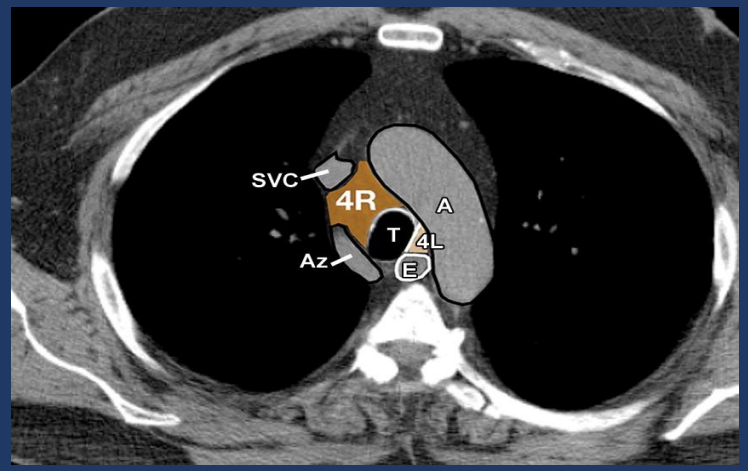
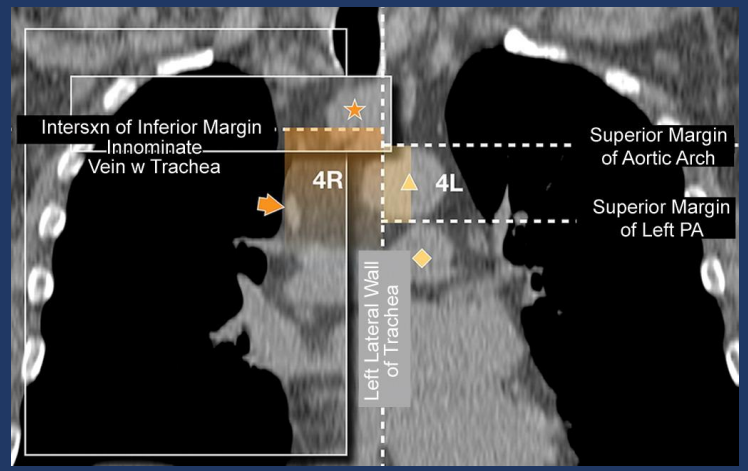
W. Rice; *RadioGraphics* **2014,** 34, 1680-1691. DOI: 10.1148/rg.346130097

Superior Mediastinal Zone (4R and 4L)





Upper border

- 4R: Intersection of the caudal margin of the innominate v. with the trachea
- 4L: Superior border of the aortic arch

Lower border

- 4R: Lower border of the azygos
- 4L: Upper rim of the Lt main PA

The left lateral border of the trachea (not the midline) serves as the boundary between stations 4R and 4L

Ahmed H. El-Sherief; Charles T. Lau; Carol C. Wu; Richard L. Drake; Gerald F. Abbott; Thomas
W. Rice; *RadioGraphics* **2014,** 34, 1680-1691. DOI: 10.1148/rg.346130097

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Superior Mediastinal Zone (4R and 4L)

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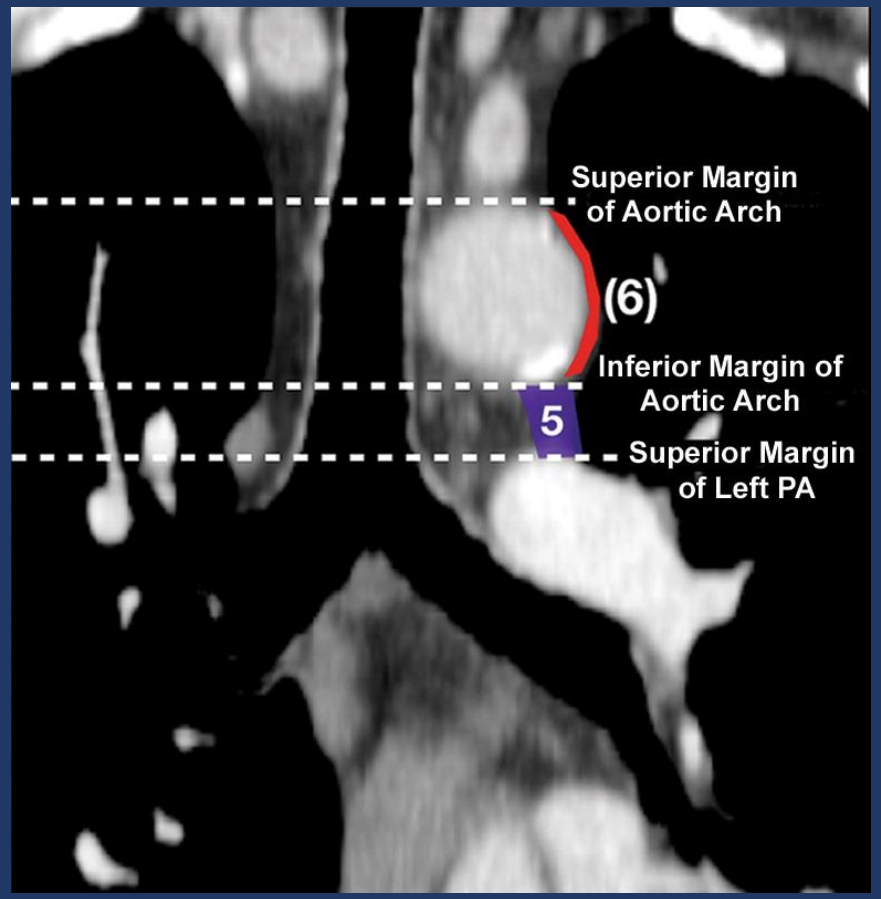
Aortic Nodes (5 and 6)



5 Aortopulmonary

- Lateral to the ligamentum arteriosum
- Upper border: Lower border of the aortic arch
- Lower border: Upper rim of the left main pulmonary artery

6 Paraaortic

- Anterior and lateral to the ascending aorta and aortic arch
- Upper border: Line tangential to the upper border of the aortic arch
- Lower border: Lower border of the aortic arch

Ahmed H. El-Sherief; Charles T. Lau; Carol C. Wu; Richard L. Drake; Gerald F. Abbott; Thomas W. Rice; *RadioGraphics* **2014,** 34, 1680-1691. DOI: 10.1148/rg.346130097

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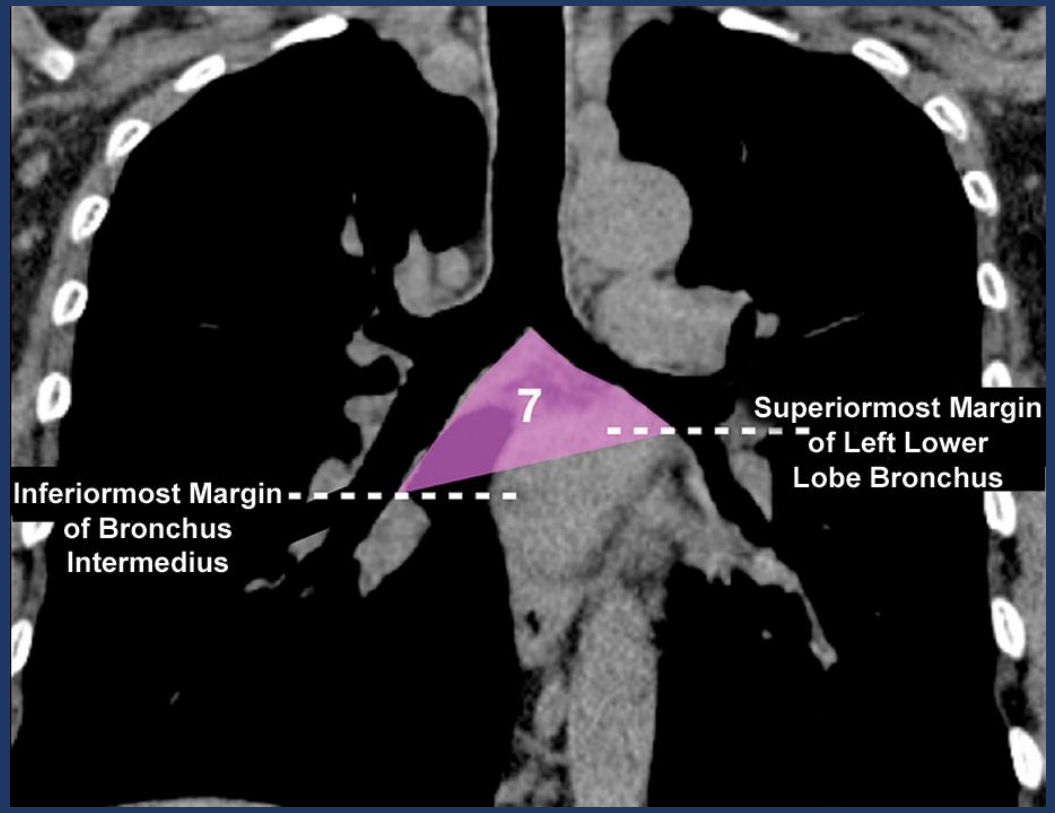
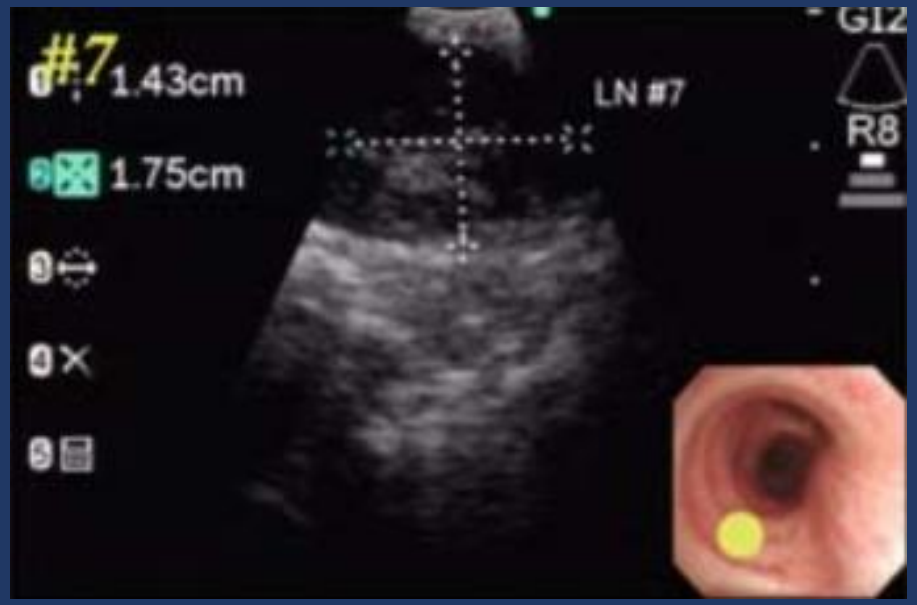
Inferior Mediastinal (Subcarinal 7, Lower Zone 8 & 9)





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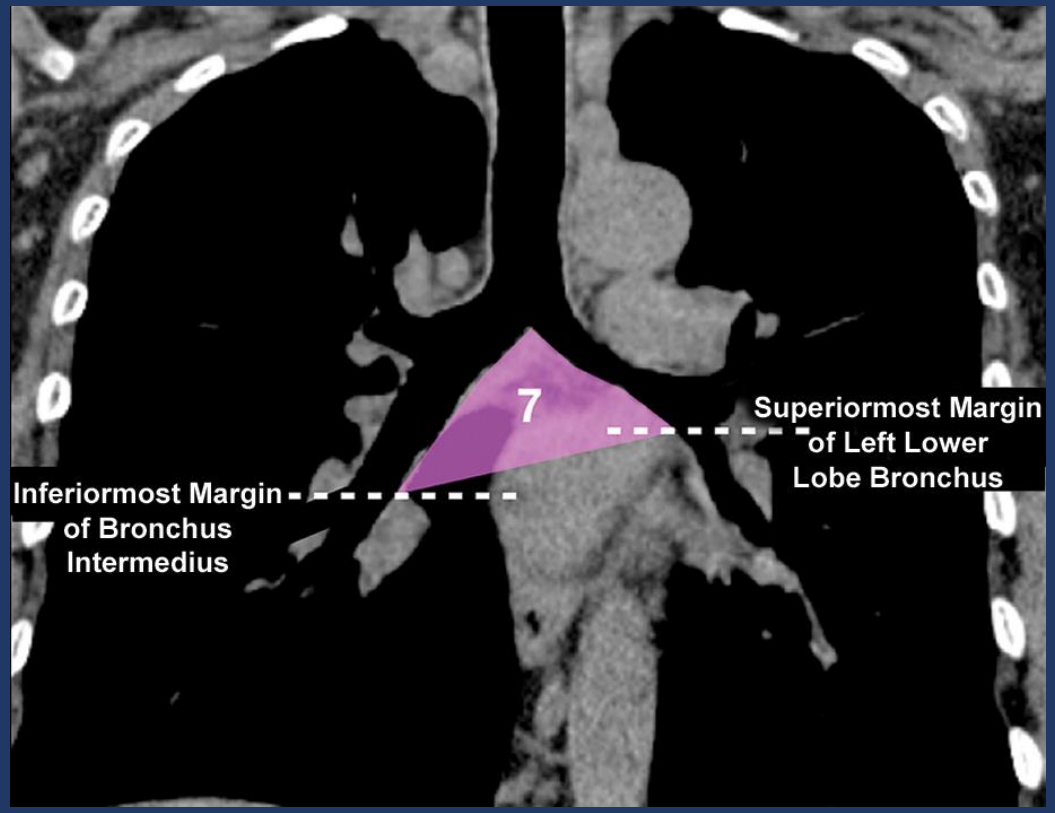

8 Paraesophageal

- Adjacent to the wall of the esophagus
- Upper border
  - R: Lower border of the bronchus intermedius
  - L: Upper border of the lower lobe bronchus
- Lower border: Diaphragm

9 Pulmonary Ligament Nodes

- Nodes within the pulmonary ligament
- Upper border: Inferior pulmonary vein
- Lower border: Diaphragm

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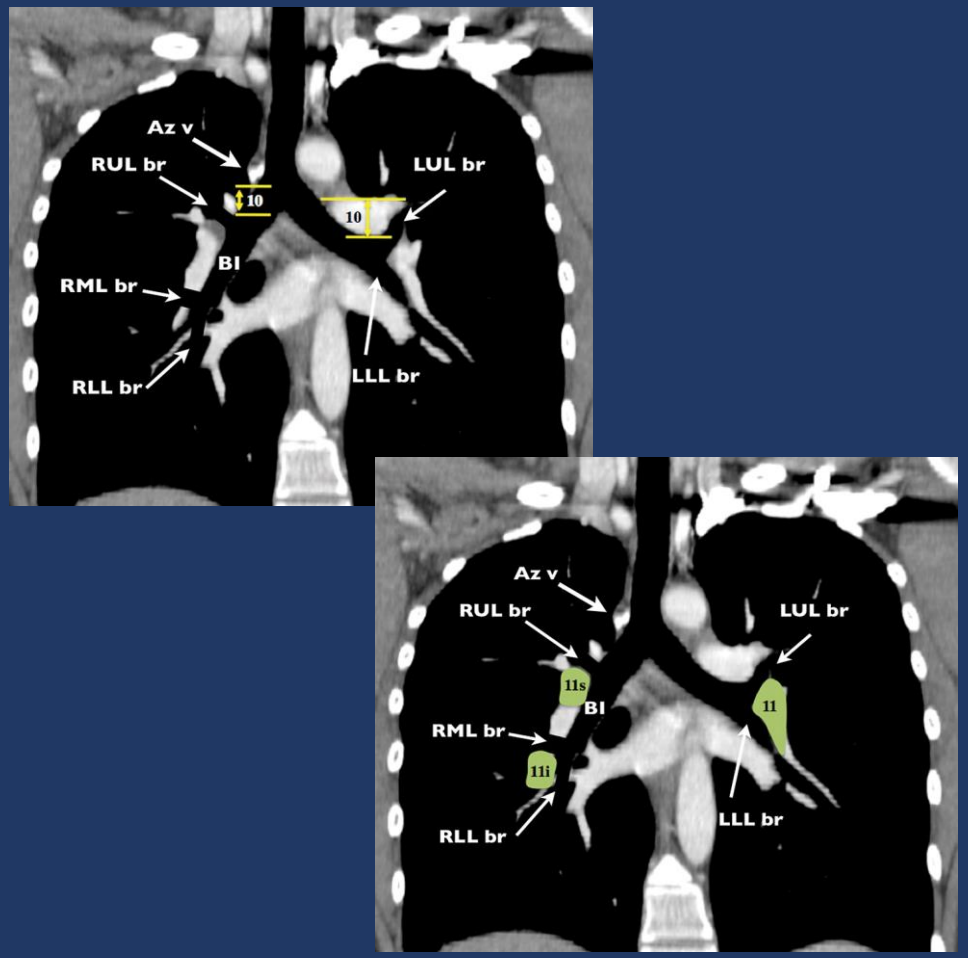
Hilar / Interlobar Zone (10, 11)



10 Hilar

- Includes nodes immediately adjacent to the mainstem br and hilar vessels
- Upper border
  - R: Lower rim of azygos
  - L: Upper rim of the Lt main PA
- Lower border: Interlobar region

11 Interlobar Zone

- Between the origin of the lobar bronchi
- 11s: Between upper lobe bronchus and bronchus intermedius
- 11i: Between the middle and lower lobe bronchi

Ahmed H. El-Sherief; Charles T. Lau; Carol C. Wu; Richard L. Drake; Gerald F. Abbott; Thomas W. Rice; *RadioGraphics* **2014,** 34, 1680-1691. DOI: 10.1148/rg.346130097

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Hilar / Interlobar Zone (10, 11)

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Peripheral Zone (12, 13, 14)

- 12
  - Adjacent to lobar bronchi
- 13
  - Adjacent to segmental bronchi

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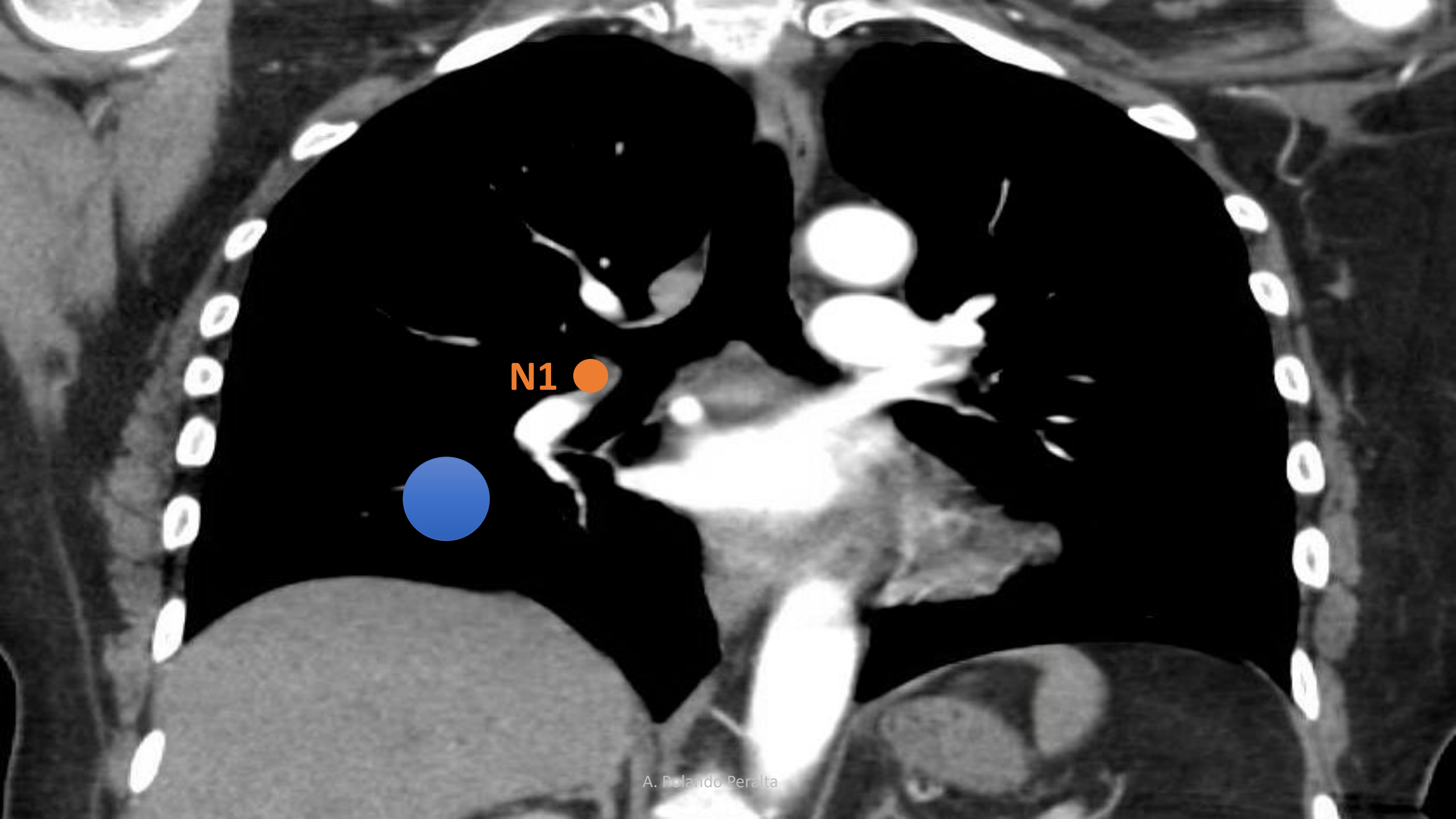
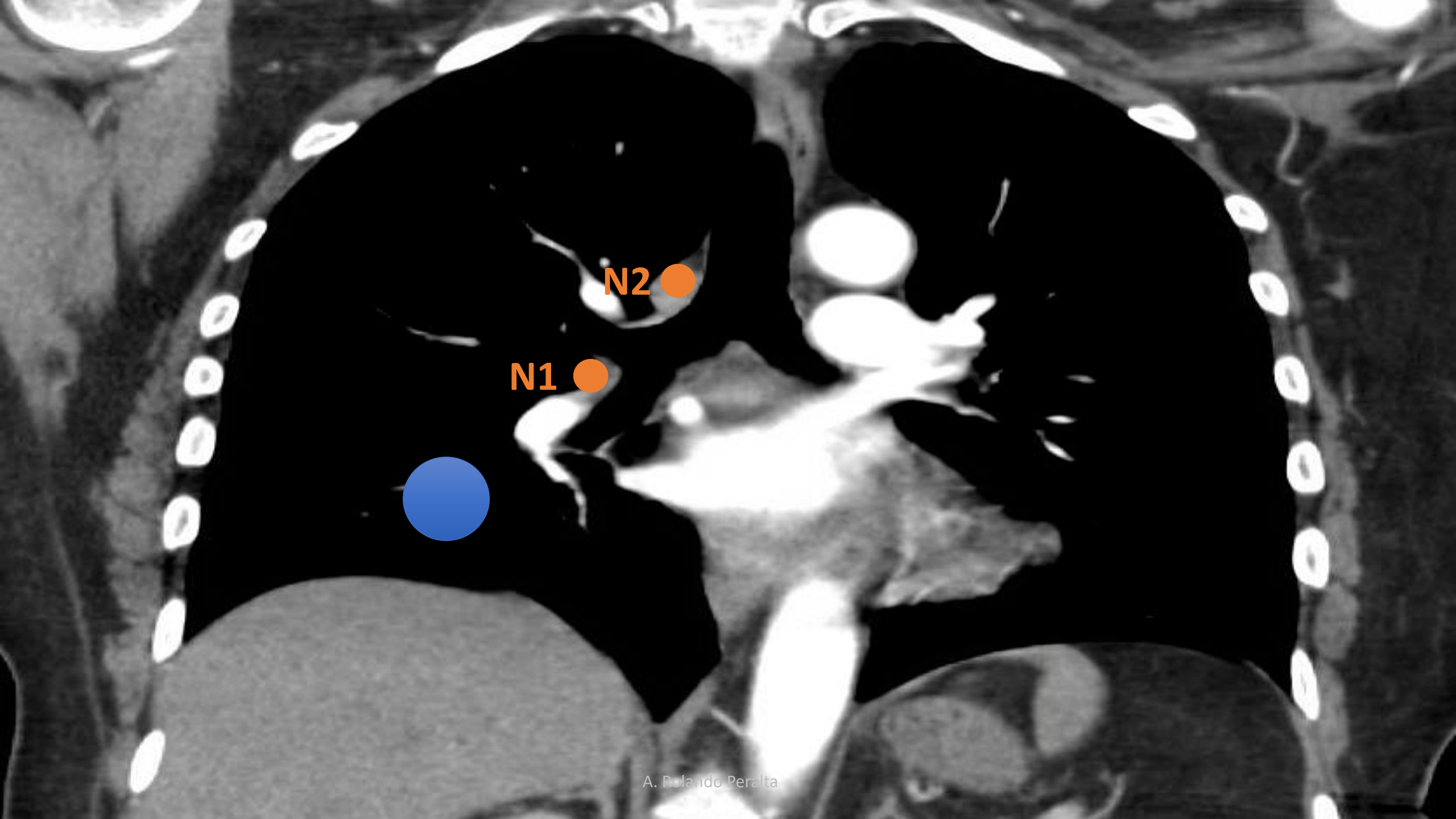
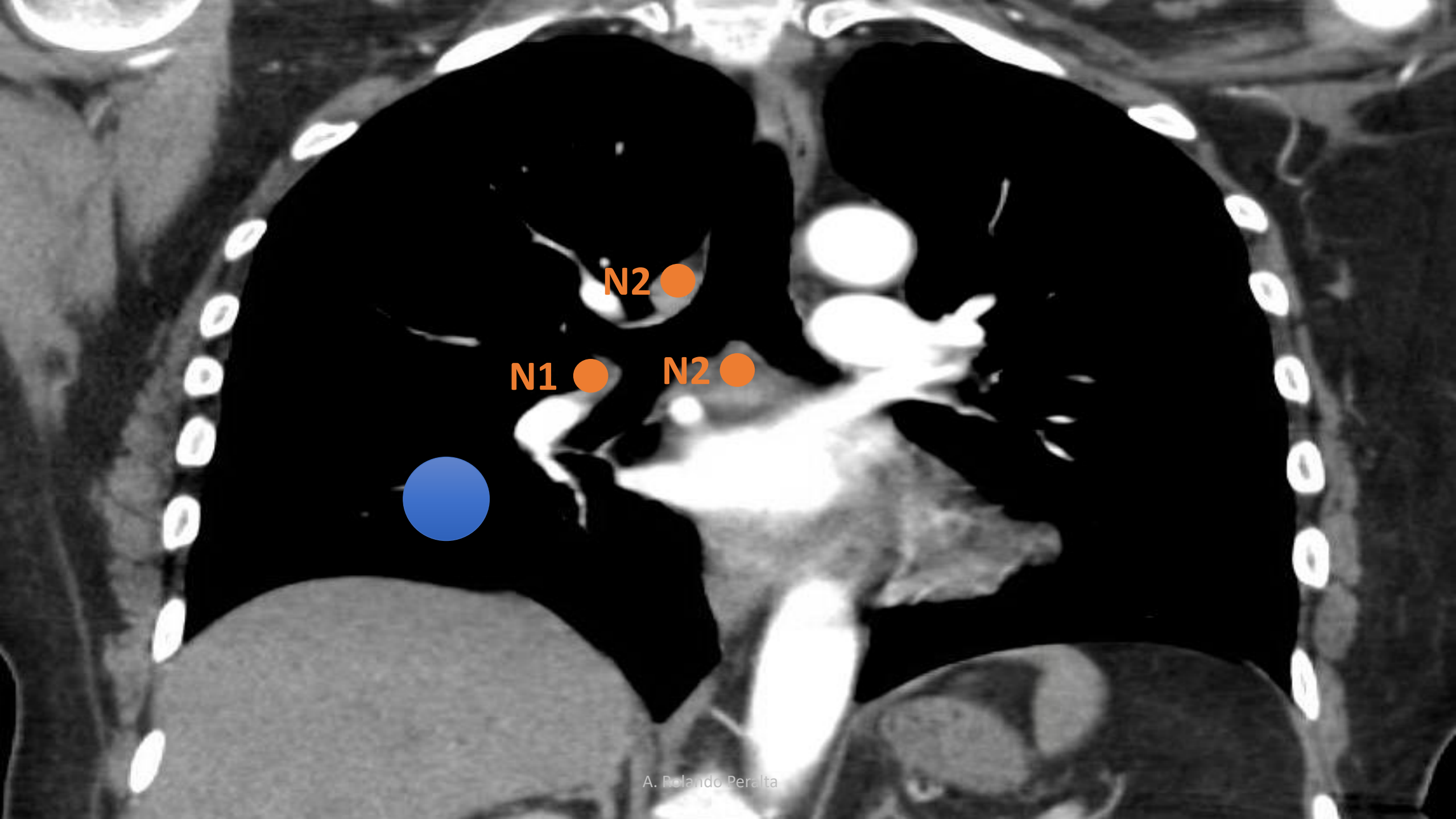
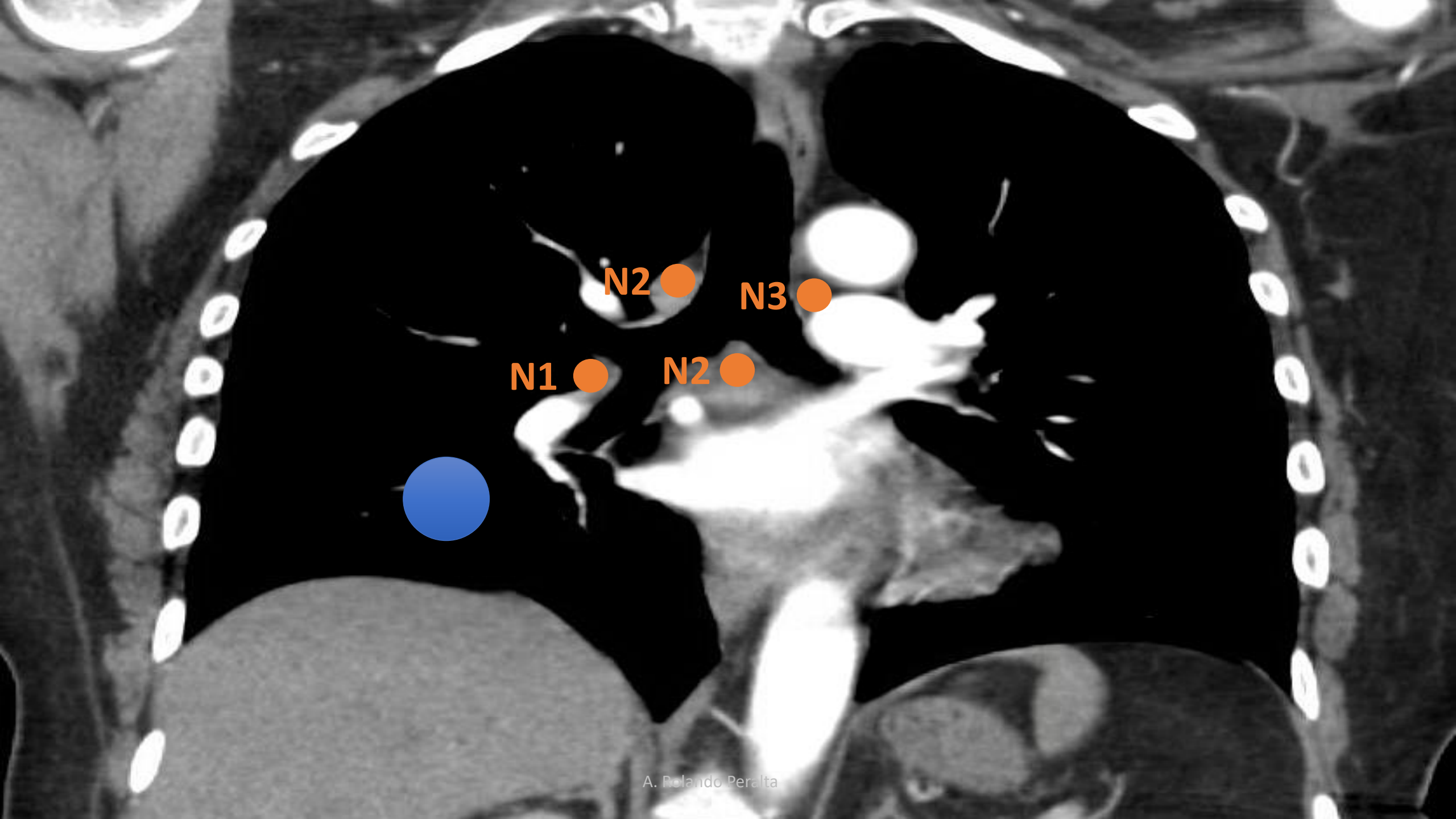
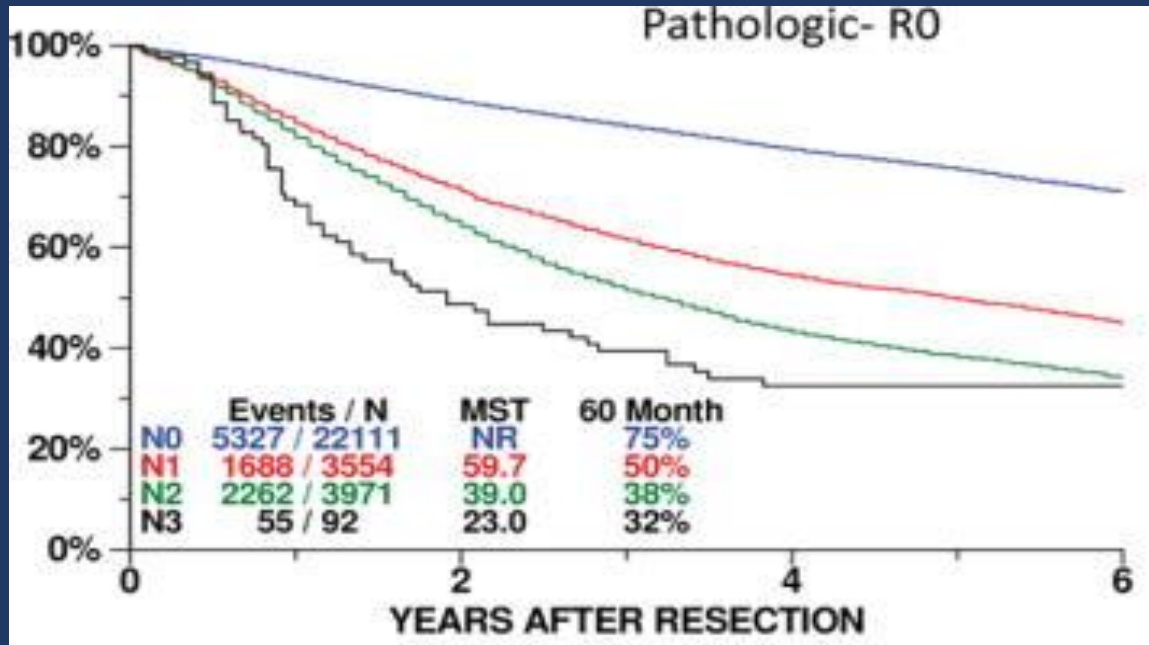


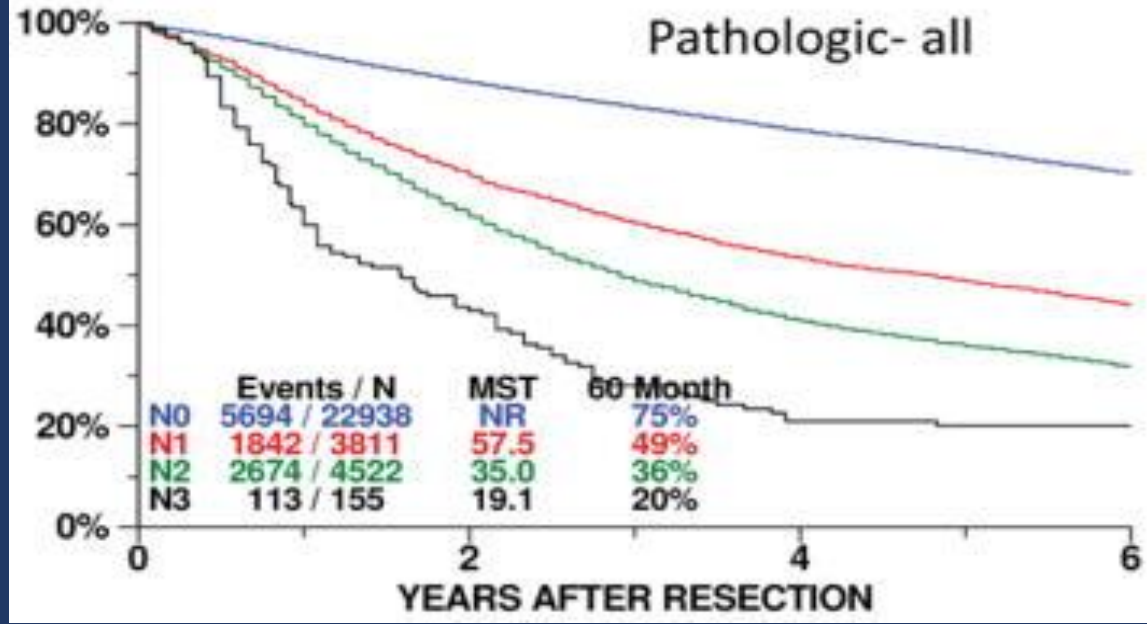








N0 vs N1 vs N2 vs N3 Comparisons Adjusted for Histology (adeno vs others), Sex, Age 60+ , and Region. (Cox PH regression on R0 cases)		
comparison	HR	P
N1 vs N0	2.13	<0.0001
N2 vs N1	1.65	<0.0001
N3 vs N2	1.56	.0012



N0 vs N1 vs N2 vs N3 Comparisons Adjusted for Histology (adeno vs others), Sex, Age 60+ , R0 resection, and Region. (Cox PH regression on all cases)		
comparison	HR	P
N1 vs N0	2.10	<0.0001
N2 vs N1	1.63	<0.0001
N3 vs N2	1.66	<0.0001

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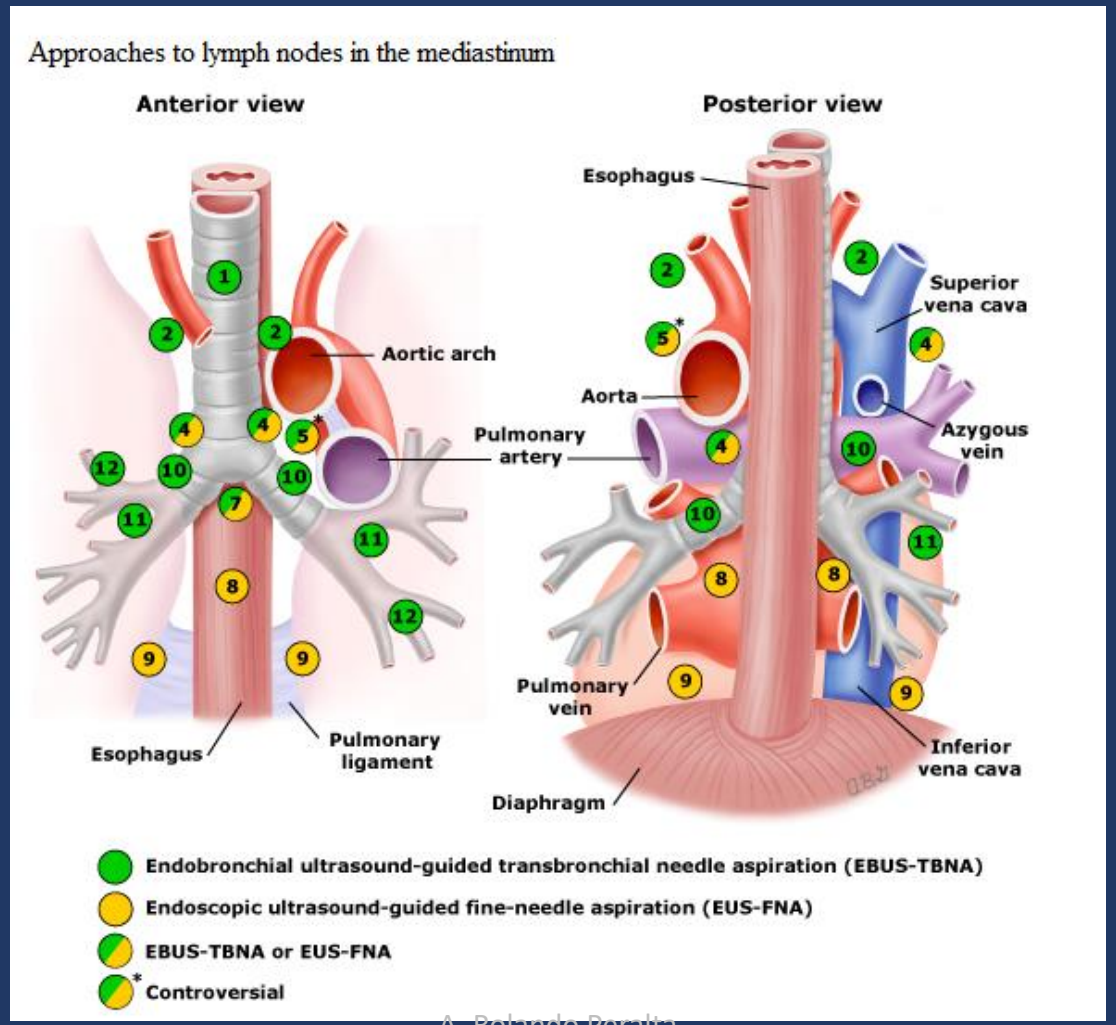
Asamura et al Journal of Thoracic Oncology. 10(12):1675-1684, December 2015.

EBUS-TBNA – Accessible Stations



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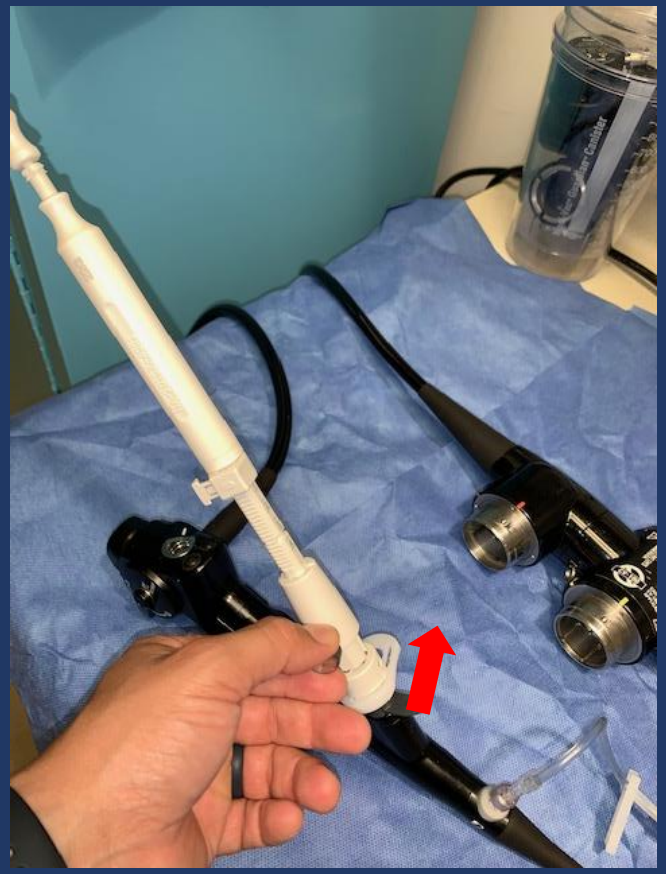
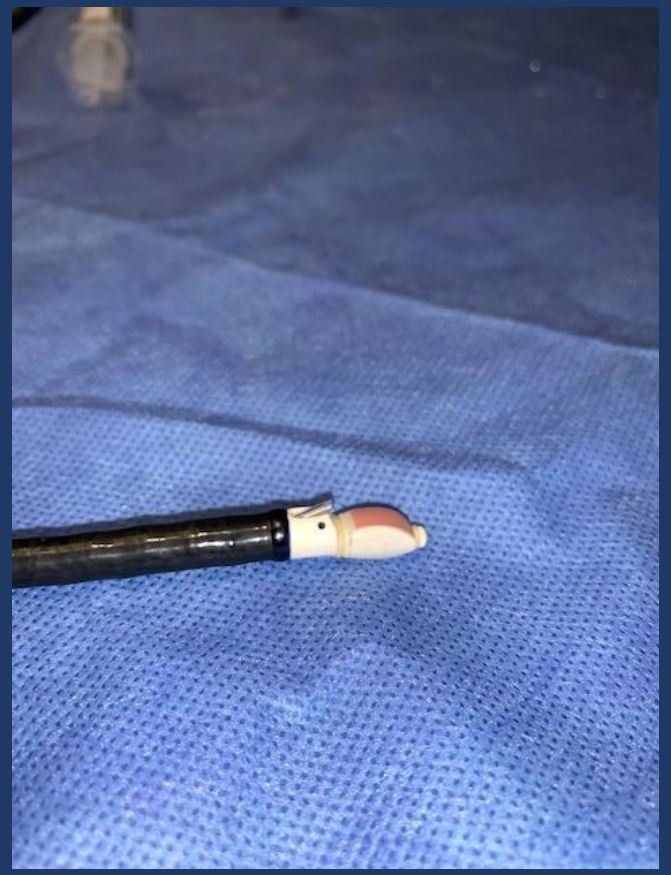
Uptodate image

Insertion of the needle into the scope (done in neutral position)

Locking and Setting the sheath



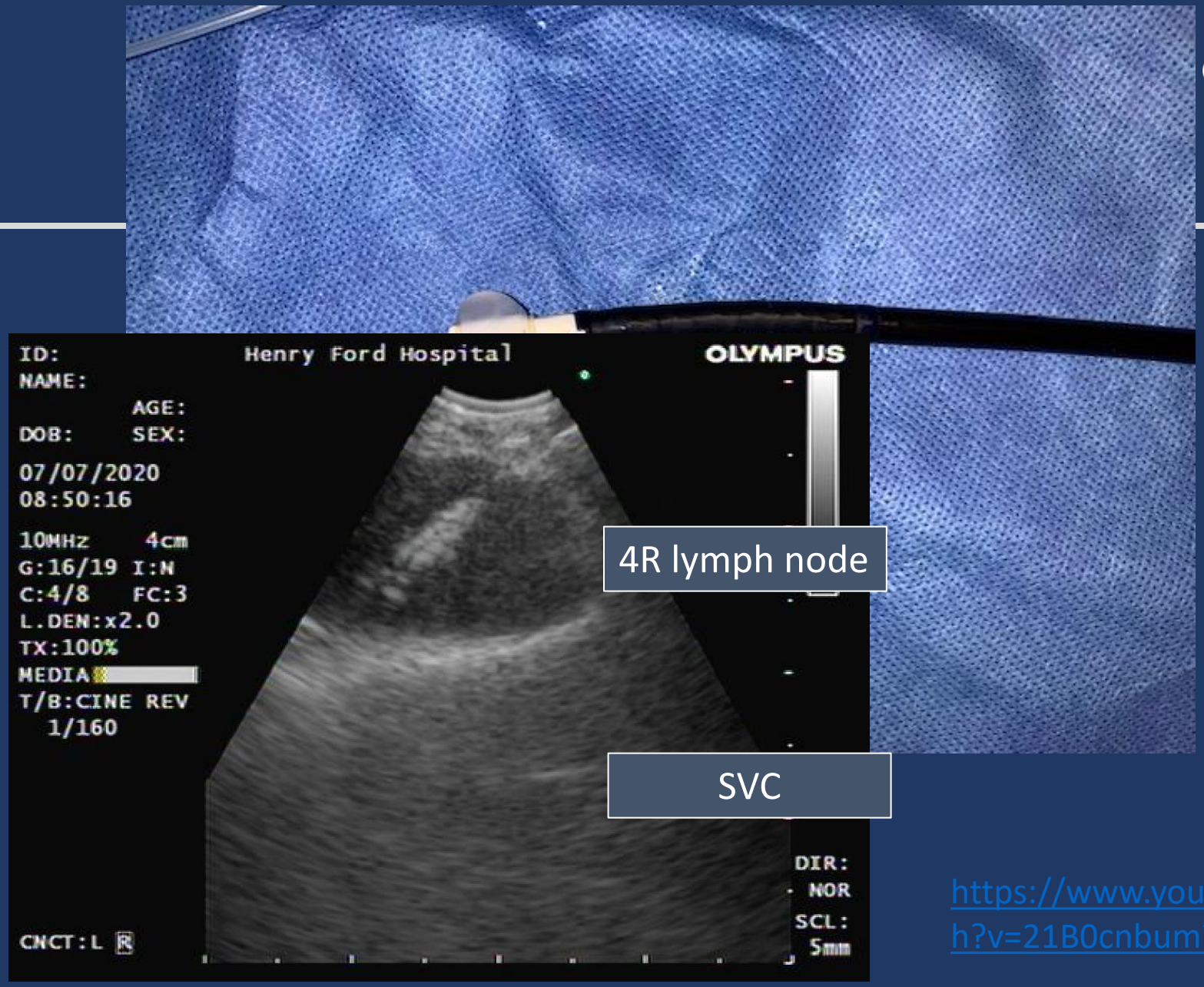
Sheath outside the working channel



Set the depth of the needle

Needle depth set at 2cm

Needle at full depth



https://www.youtube.com/watch?v=21B0cnbum7U

What needle and how many passes?

- 21 vs. 22 gauge needle
  - Aquire database (1235 patients)
  - No difference in adequacy or diagnostic yield
- Number of passes
  - Three passes maximized diagnostic yield for malignancy
  - Sensitivity 95%, NPV 97%
  - For molecular markers → Minimum 4 passes

Yarmus L. Chest 2013; 143(4)
Lee H. Chest 2008; 134: 36874
Yarmus L. Ann Am Thorac Soc 2013; 10:131622

Objectives

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  - Indications, contraindications and complications

EBUS-TBNA Indications

- Diagnosis, staging and restaging of NSCLC
- Sampling of:
  - Mediastinal / Hilar lymphadenopathy of unknown etiology
    - Sensitivity 92% -- Specificity 100% (1)
  - Mediastinal masses
  - Bronchogenic cysts
  - Pulmonary lesions adjacent to the airway

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Chandra S. Respir Care. 2012 Mar;57(3):384-91. Epub 2011 Oct 12.

EBUS-TBNA Contraindications

Same as contraindications to bronchoscopy and conventional TBNA

- Inability to tolerate sedation or anesthesia
- High risk for pulmonary and cardiac decompensation
  - Hypoxemia
  - Recent cardiac event
  - Uncontrolled CHF
  - Life-threatening arrhyt
  - Hemodynamic instabil
  - AE o Asthma
  - AE o COPD

Contraindications are all relative

- Inability to obtain consent
- High risk for bleeding
  - Antiplatelet agents
  - Therapeutic anticoagulation
  - Thrombocytopenia
  - for inspection
  - for procedures
  - pathy
- Unstable cervical spine
- Limited motion of TM joint

EBUS-TBNA Complications

Table 2—*Complications Following EBUS-TBNA*

Outcome	No. Events (N = 1,317)	Complication Rate, % (95% CI)
Any complication within 24 h	19	1.44 (0.87-2.24)
Bleeding requiring intervention[a]	3	0.2 (0.05-0.7)
Pneumothorax	7	0.53 (0.21-1.1)
Clinically significant airway injury	1	0.1 (0.002-0.4)
Sustained hypoxia	4	0.3 (0.08-0.8)
Hypotension	1	0.1 (0.002-0.4)
Cardiac arrest	0	…
Arrhythmia	0	…
Respiratory failure within 24 h	3	0.23 (0.05-0.7)

The only variable that affected the occurrence of complication was TBBx.

A. Rolando Peralta

Eapen G. CHEST 2013; 143(4):1044–1053

Thank you!

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1. In patients undergoing EBUS-TBNA, we suggest that either moderate or deep sedation is an acceptable approach(Grade 2C).

2. In patients undergoing EBUS-TBNA, we suggest that ultrasonographic features can be used to predict malignant and benign diagnoses, but tissue samples should still be obtained to confirm a diagnosis(Ungraded Consensus-Based Statement).

3. In patients undergoing EBUS-TBNA, we suggest that tissue sampling may be performed either with or without suction(Ungraded Consensus-Based Statement).

4. In patients undergoing EBUS-TBNA, we recommend that the use of either a 21- or 22-gaugeneedle is an acceptable option(Grade 1C).

5. In the absence of rapid on-site evaluation (ROSE) inpatients suspected of having lung cancer and undergoing EBUS-TBNA for diagnosis, we suggest that a minimum of 3 separate needle passes be performed per sampling site(Ungraded Consensus-Based Statement)

6. In patients undergoing EBUS-TBNA for diagnostic evaluation, we recommend that tissue sampling can be performed with or without rapid on-site evaluation(Grade 1C).

7. In patients undergoing EBUS-TBNA for the diagnosis and/or staging of suspected or known on-small cell lung cancer, we recommend that additional samples, beyond those needed to establish the diagnosis, be obtained for molecular analysis(Grade 1C).

8. In training EBUS-TBNA operators, we suggest that low- or high-fidelity simulation be incorporated in training(Grade 2C).

9. In evaluating EBUS-TBNA operators, we suggest that validated EBUS skills assessment tests be used to objectively assess skill level(Ungraded Consensus-Based Statement).

10. In patients with suspected sarcoidosis with mediastinal and/or hilar adenopathy, we recommend that EBUS-TBNA be used for diagnosis(Grade 1C).

11. In patients with suspected tuberculosis with mediastinal and/or hilar adenopathy who require lymph node sampling, we recommend that EBUS-TBNA be used for diagnosis(Grade 1C).

12. In patients with suspected lymphoma, we suggest that EBUS-TBNA is an acceptable initial, minimally invasive diagnostic test(Ungraded Consensus-Based Statement)

#1

- Which of the following factors are related to the diagnostic yield of EBUS-TBNA?

a) Hospital EBUS-TBNA procedural volume
b) Lymph node size
c) Number of lymph nodes sampled
d) Positive PET scan
e) Smoking status
f) All of the above

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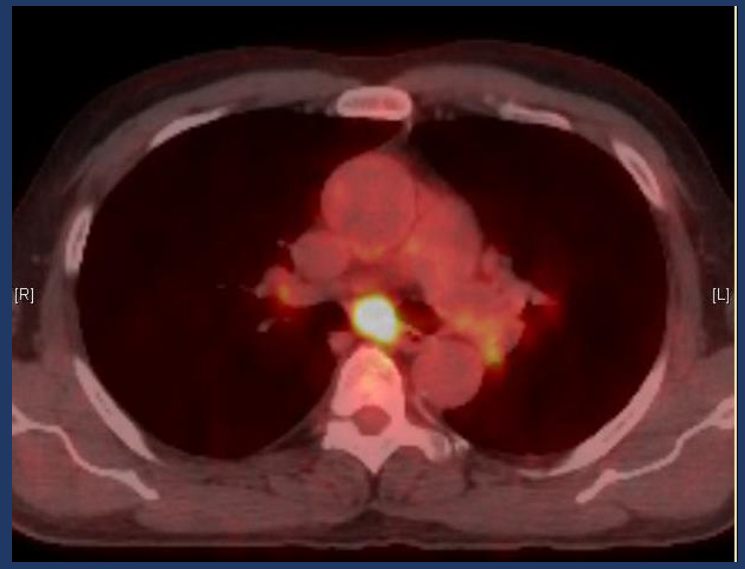
#2

68yo gentleman with 50PYH smoking has a RLL 3.8cm mass on Chest CT. Follow up PET-CT shows FDG uptake in RLL mass and the additional findings above, no other lesions found. Which of the following is correct about mediastinal staging of lung cancer?

a) Combination EBUS-TBNA and EUS-FNA has similar diagnostic accuracy than EBUS-TBNA alone
b) Diagnostic yield of EBUS-TBNA and video-assisted mediastinoscopy for lung cancer staging is similar
c) False positive rate of PET-CT for mediastinal lymph nodes is <5%
d) Sampling of mediastinal lymph nodes >1 cm is not needed



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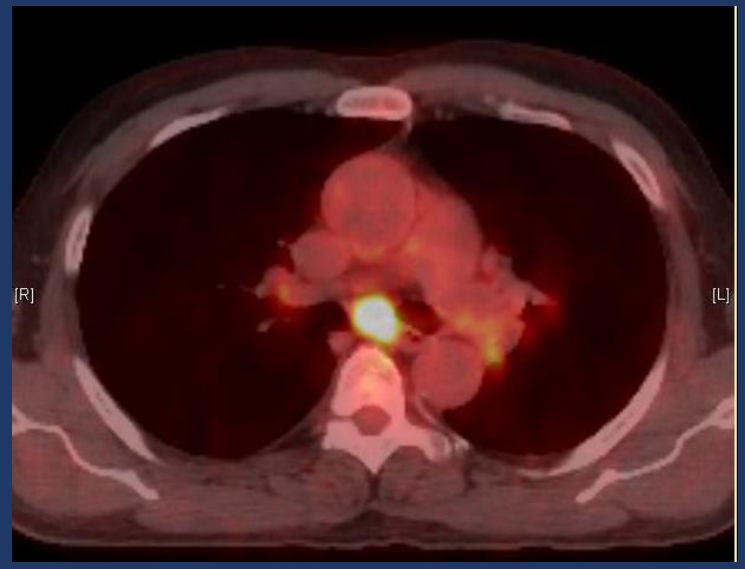

#3

A 74yo lady is referred to you for bronchoscopy after a lung cancer screening chest CT showed a RUL spiculated 2cm nodule. She has a 50PYH of cigarette smoking and liver cirrhosis due to NASH. Further imaging with a PET-CT showed FDG avidity in the RUL nodule and also in the right hilar and right paratracheal regions. You plan on performing EBUS-TBNA for mediastinal staging. Which of the following is true regarding EBUS-TBNA?

a) A minimum of 5 passes are required when sampling mediastinal lymph nodes
b) EBUS-TBNA has a complication rate of <1.5%
c) EBUS-TBNA is contraindicated due to bleeding risk secondary to NASH cirrhosis
d) Mediastinal staging is not needed in this case as the PET-CT shows FDG uptake in the lesion and lymph nodes

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