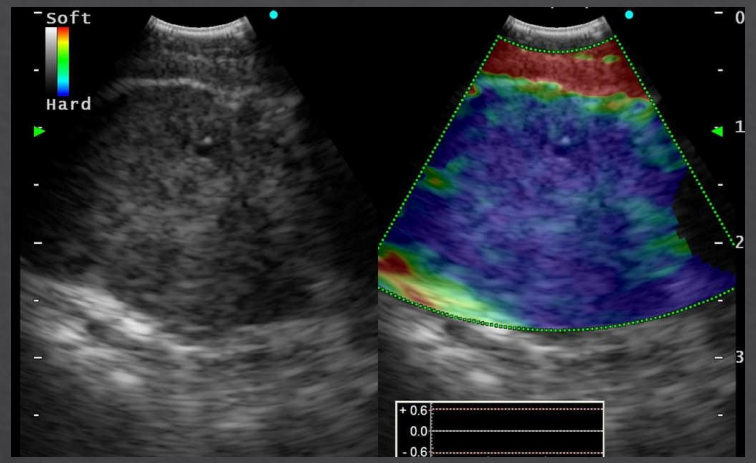
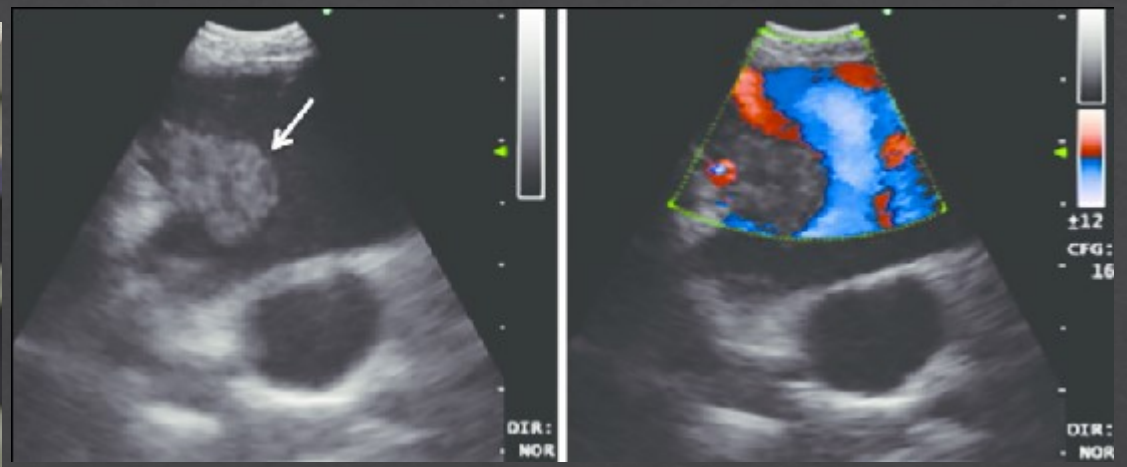




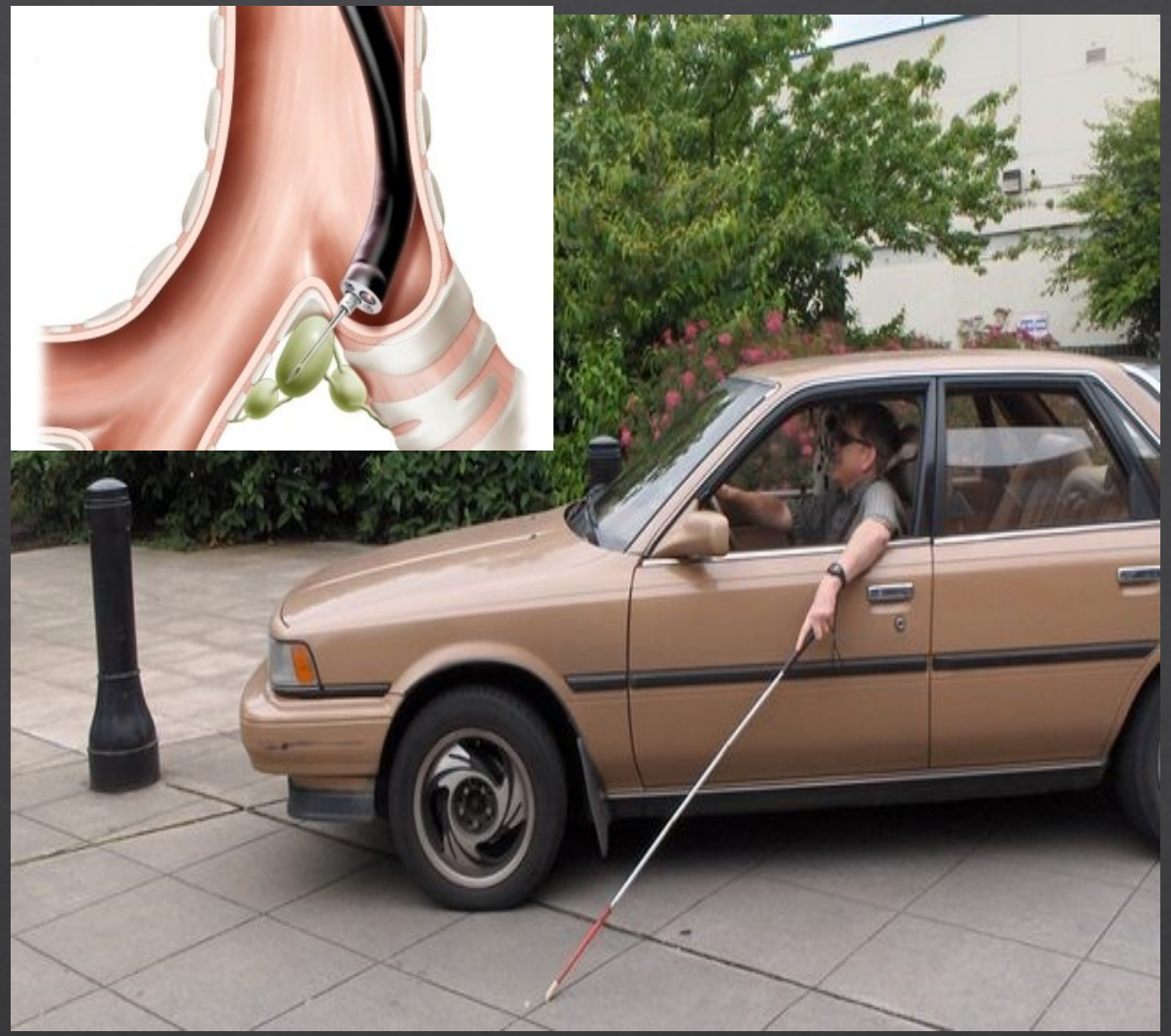
EBUS INDICATIONS

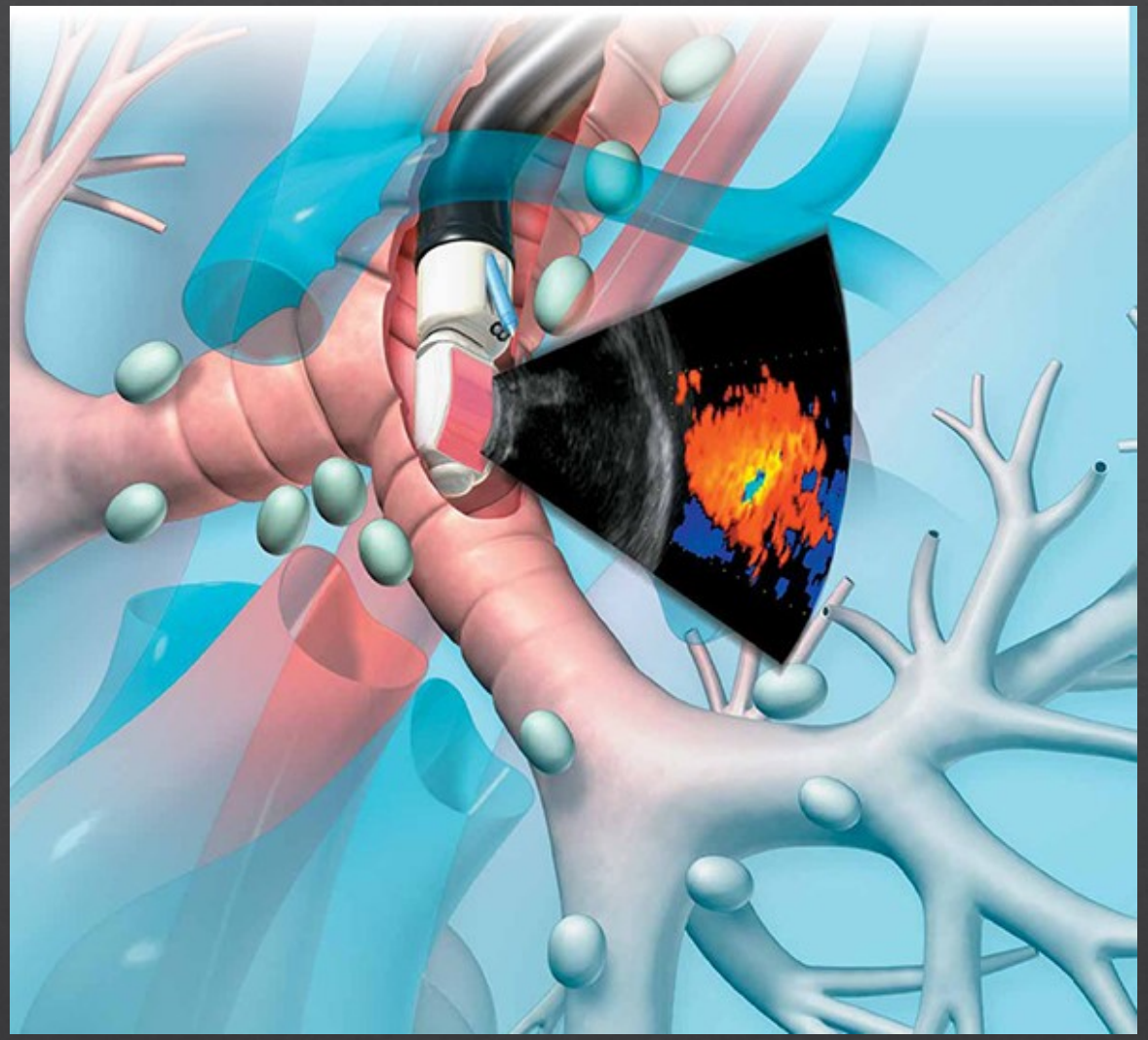
CASE DISCUSSION

Ersin GÜNAY, MD
Ankara Etlik City Hospital

Contents

- Types of EBUS (Radial Probe & Convex Probe)
- Lymph node stations (could be sampled via EBUS)
- EBUS indications (case samples)
- Disadvantages and Complications
- Future tech for EBUS





Conventional TBNA (Wang TBNA)

Sensitivity: 78%,
Specificity: 100%

EBUS TBNA

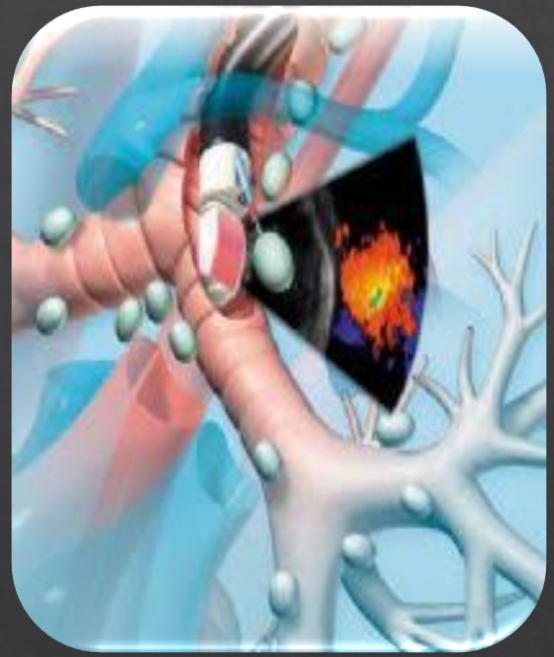
Sensitivity: 89%
Specificity: 100%

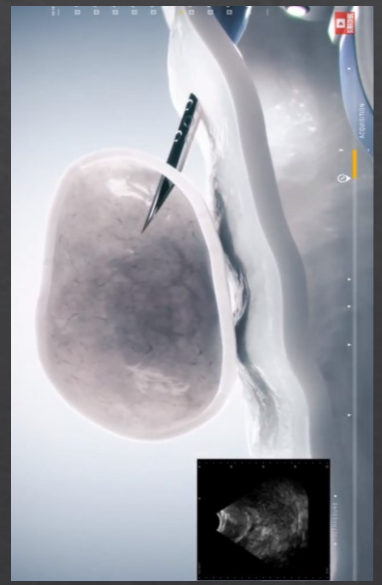
CHEST 2013; 143(5)(Suppl):e211S-e250S

Types of EBUS

RADIAL PROBE EBUS

CONVEX PROBE EBUS

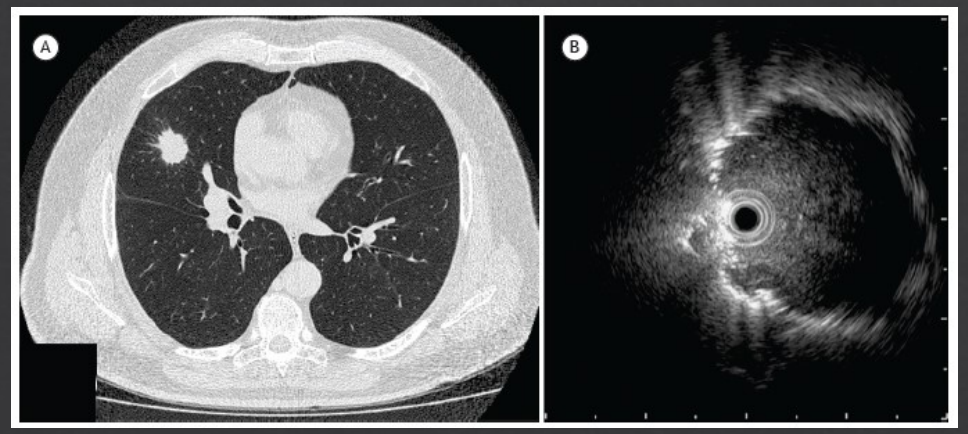


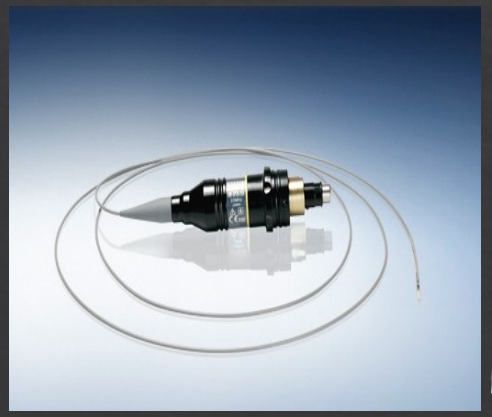


Endobronchial Ultrasound (EBUS)

1-Radial probe EBUS (rp-EBUS) (Miniprobe) (early 1990's)

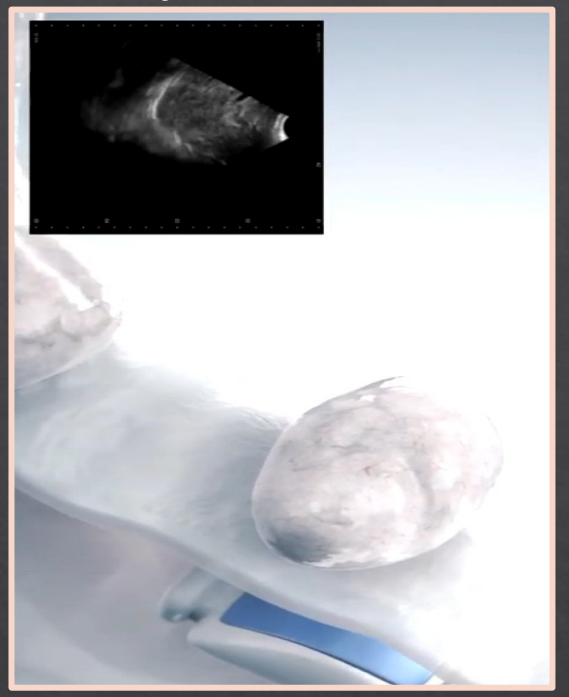
- 2 mm (ultraminiature) or 2.8 mm (miniature) US prob (used through FOB)
- 360° ultrasound view angle
  - Visualization of peripheral mass/nodules, and lymph nodes
  - Guidance for TBNA/biopsy (via catheter guide)
  - Differentiation vascular lesions from nonvascular
  - Evaluation for tumoral invasion (early tumoral stage)
  - Guidance for endobronchial treatment options





Hürter T, Thorax 1992;47:565-7

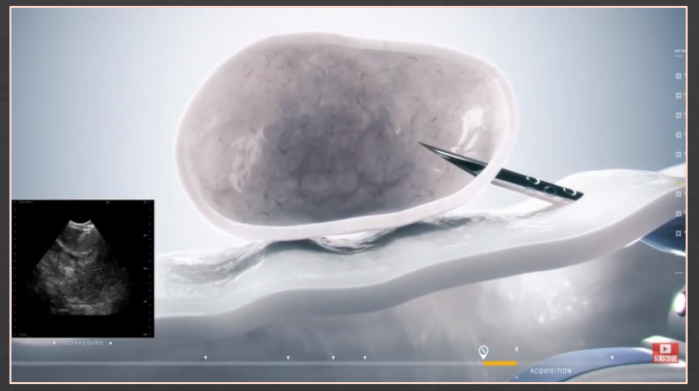
Endobronchial Ultrasound (EBUS)



2- Konveks Prob-EBUS (cp-EBUS)- TBİA

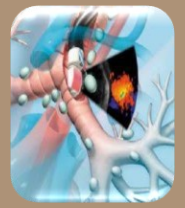
- Produced in 2000's.
- Minimally invasive
- Hibrid device used for
  - Visualization for lesions located mediastinal and hilar region
  - Sampling (simultaneously)
- Doppler feature

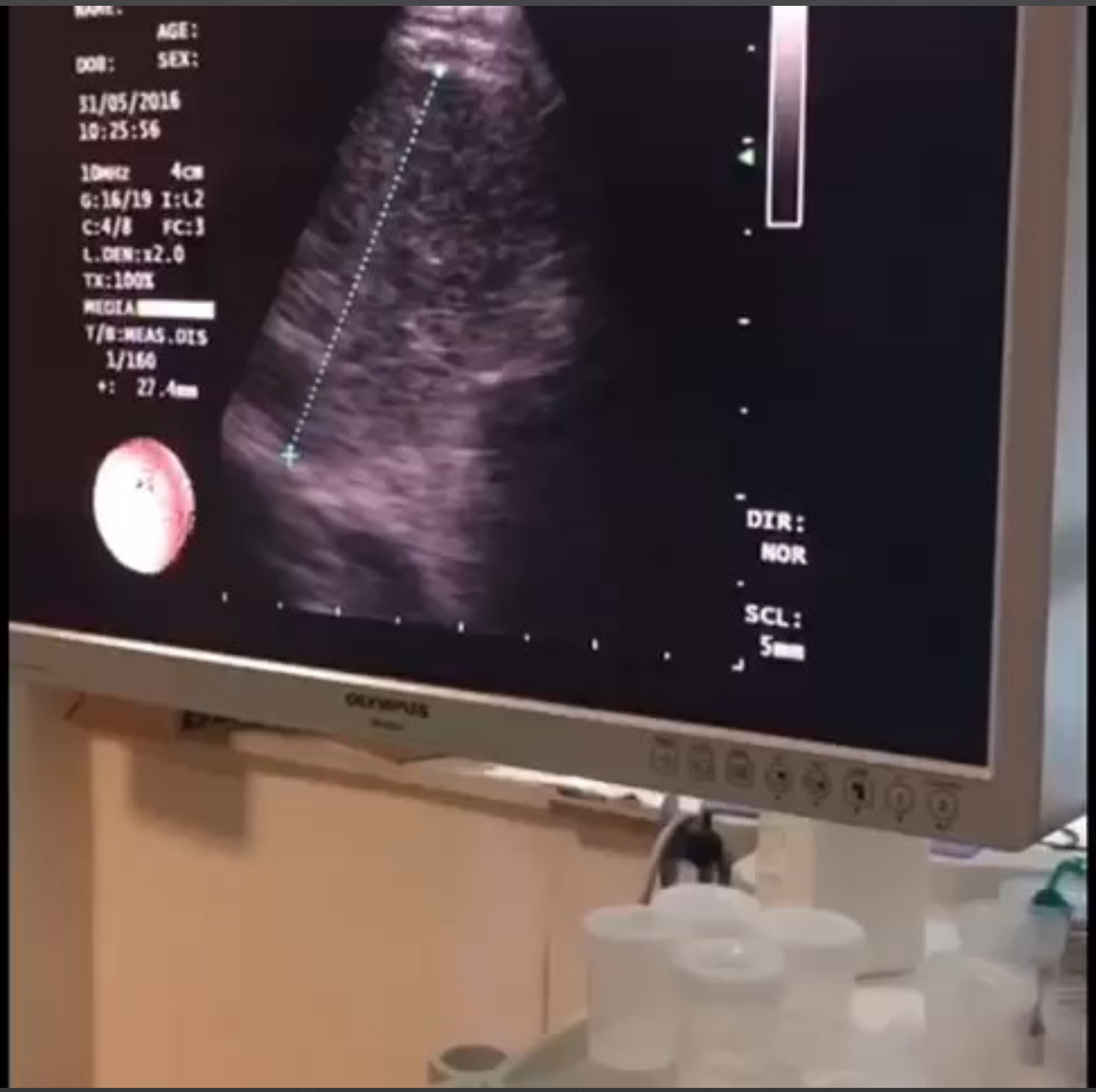
- Lymph Nodes
- Mass lesions
- Main vasculature

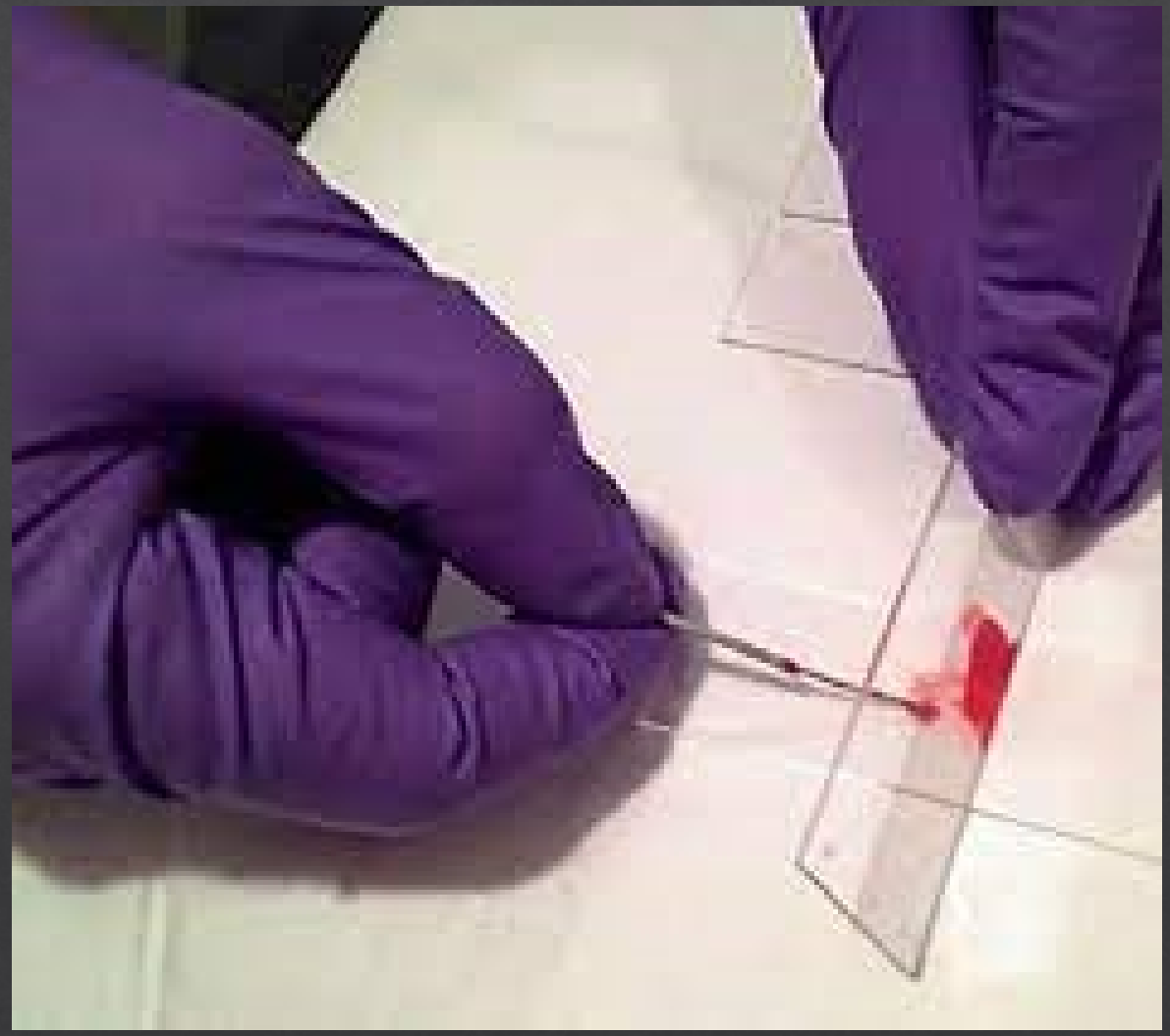


Yasufuki K, Oncol Rep 2004;11:293-6.
Yasufuki K, Chest 2004;126:122-8.

rp-EBUS vs cp-EBUS

Features	rp-EBUS 	cp-EBUS 
View angle	360°	80-120°
Penetration	4-5 cm	>5 cm
Resolution	Relatively worse	Better
Color Doppler	Not present	Present
Real Time Sampling	Not present	Present
Elastography	Not present	Present


AGE:
DOB: SEX:
31/05/2016
10:25:56
4cm
G:16/19 I:L2
C:4/8 FC:3
L.DEN:x2.0
TX:100%
MEDIA
T/B:MEAS.DIS
1/166
+: 27.4mm
DIR:
NOR
SCL:
5mm
OLYMPUS

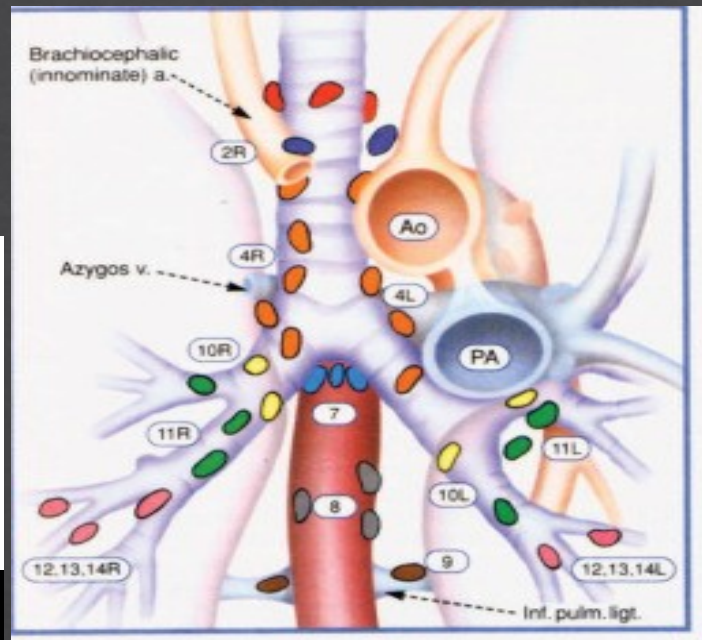


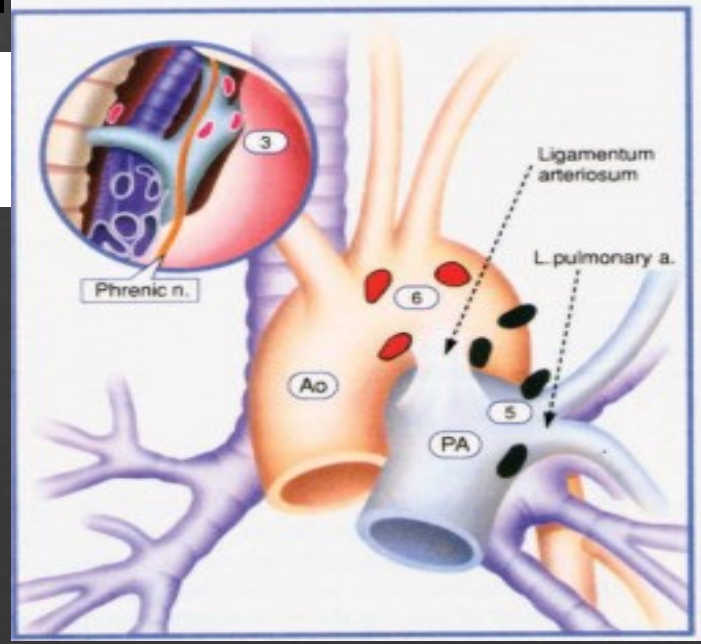
MEDIASTINAL LYMPH NODES

IASLC

The **International Association for the Study of Lung Cancer (IASLC)**

Lymph Node Map





Superior Mediastinal Nodes

- 1 Highest Mediastinal
- 2 Upper Paratracheal
- 3 Pre-vascular and Retrotracheal
- 4 Lower Paratracheal (including Azygos Nodes)

Upper zone (R)

N_2 = single digit, ipsilateral
N_3 = single digit, contralateral or supraclavicular

Aortic Nodes

- 5 Subaortic (A-P window)
- 6 Para-aortic (ascending aorta or phrenic)

AP zone (L)

Inferior Mediastinal Nodes

- 7 Subcarinal

Subcarinal zone

- 8 Paraesophageal (below carina)
- 9 Pulmonary Ligament

Lower zone

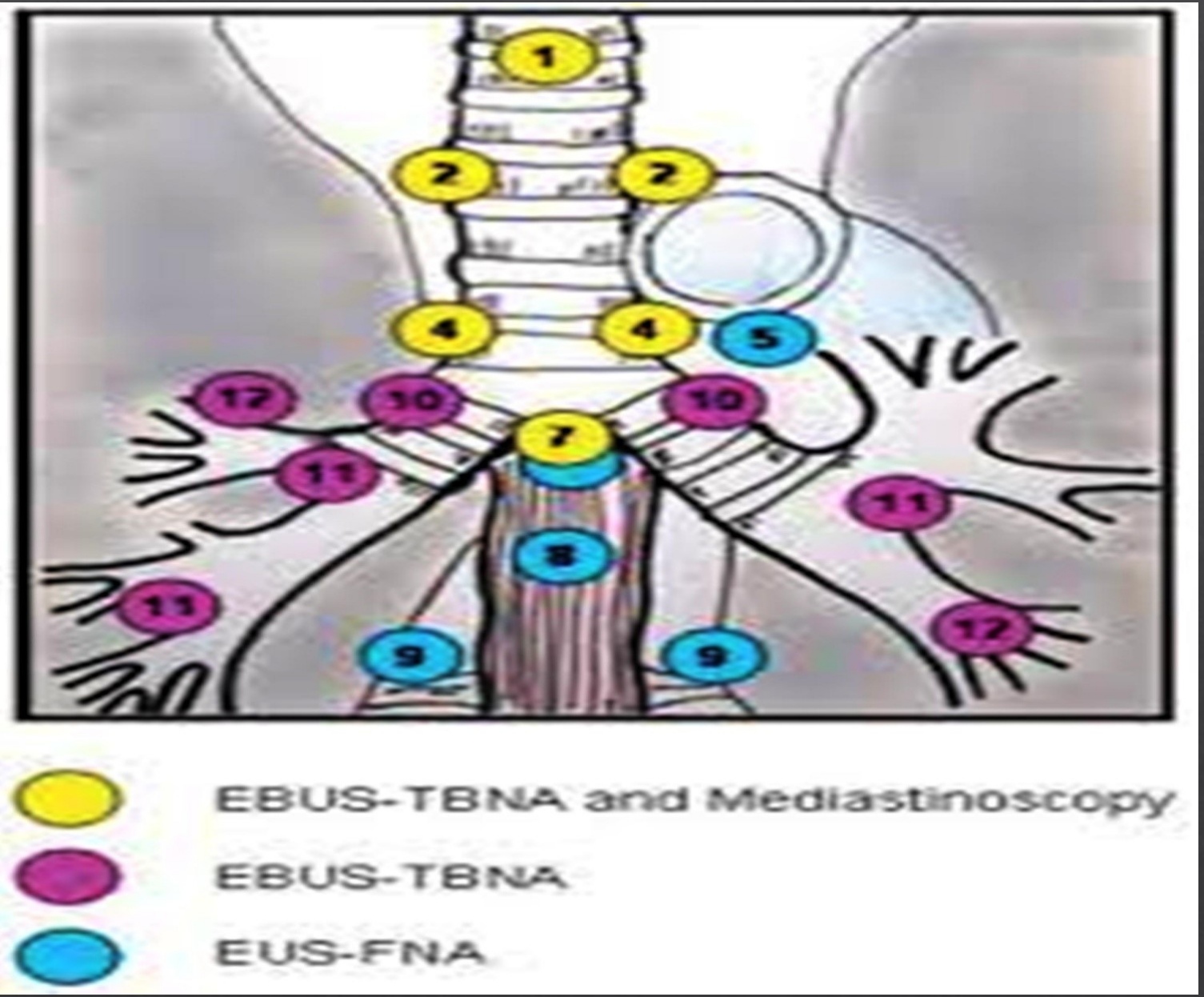
N_1 Nodes

- 10 Hilar
- 11 Interlobar

Hilar zone

- 12 Lobar
- 13 Segmental
- 14 Subsegmental

Peripheral zone


1
2
2
4
4
5
12
10
10
7
11
11
8
13
12
9
9
EBUS-TBNA and Mediastinoscopy
EBUS-TBNA
EUS-FNA

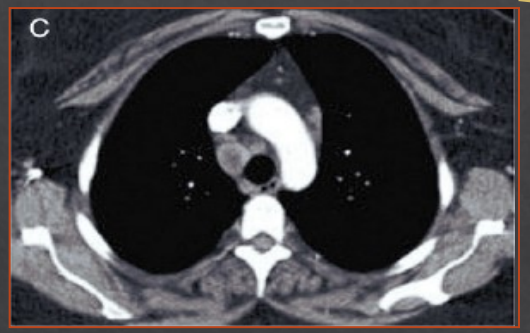
cp-EBUS Indications

- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging

Mediastinal Staging

Non-invasive Methods:

CT



PET-CT

Invasive Methods:

Needle biopsies

Surgical:
Mediastinoscopy, VAM, VATS

Minimally Invasive:

cTBNA (Wang), EBUS, EUS, Tru-cut Bx

If a cancer patient is a candidate for surgery

HISTOPATHOLOGICAL SAMPLING

of mediastinal lymph nodes

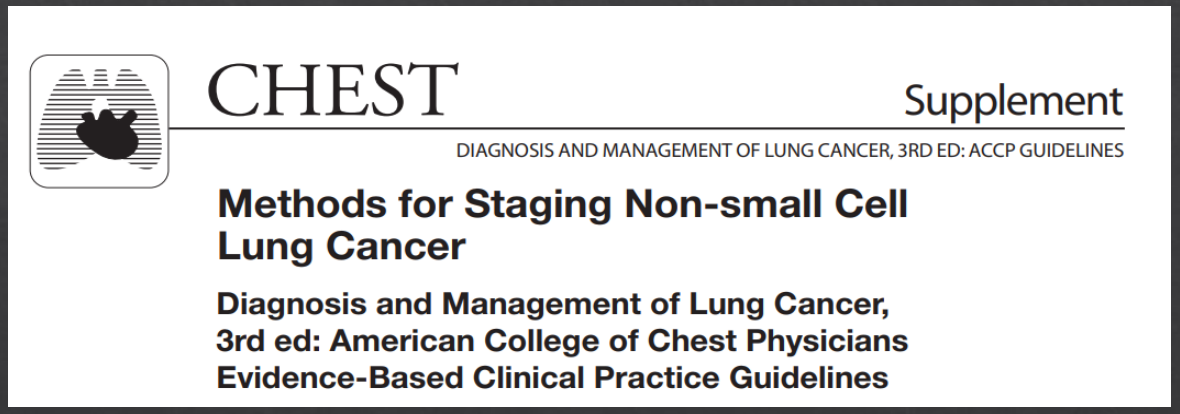
is essential

FOR STAGING.

Cancer 1992; 70: 1102
Ann Thorac Surg 1991; 51: 253
Am J Respir Crit Care Med 1997; 156: 320

NSCLC
MEDIASTINAL INVASIVE STAGING

WHEN?

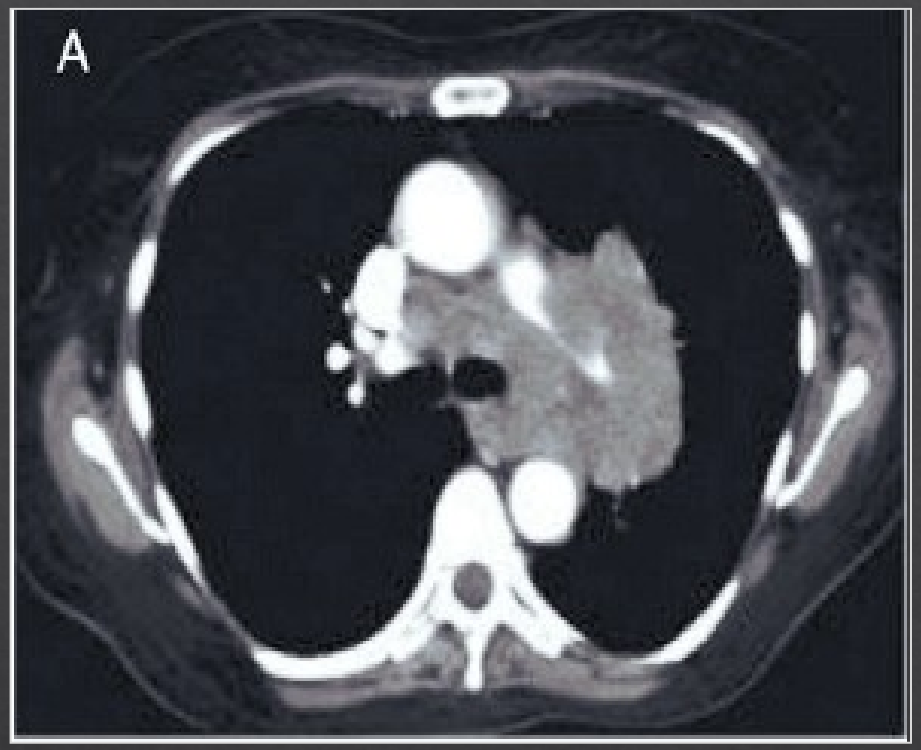


WHICH METHOD ?

EBUS

WHEN?

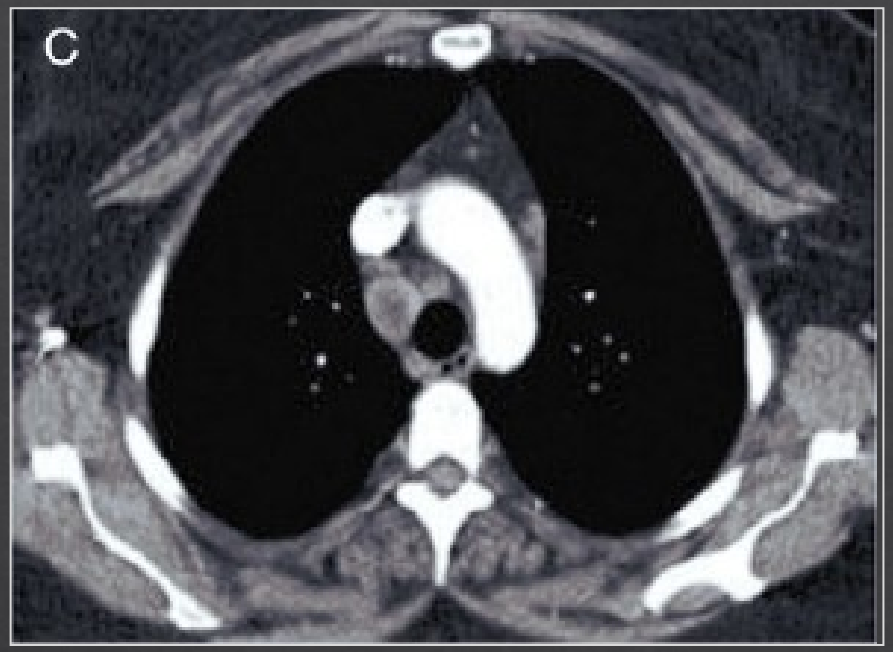
WHICH CASES?



- In cases where the tumor has caused extensive mediastinal infiltration and there is no distant metastasis
  - For mediastinal staging, evaluation with CT is usually sufficient without the need for invasive confirmation.

(Grade 2C)

Chest 2013;143: :e211S–e250S



- In cases with significant mediastinal lymph node enlargement (and no distant metastasis),
  - Invasive staging of the mediastinum is recommended for mediastinal lymph nodes, regardless of whether there is PET uptake.

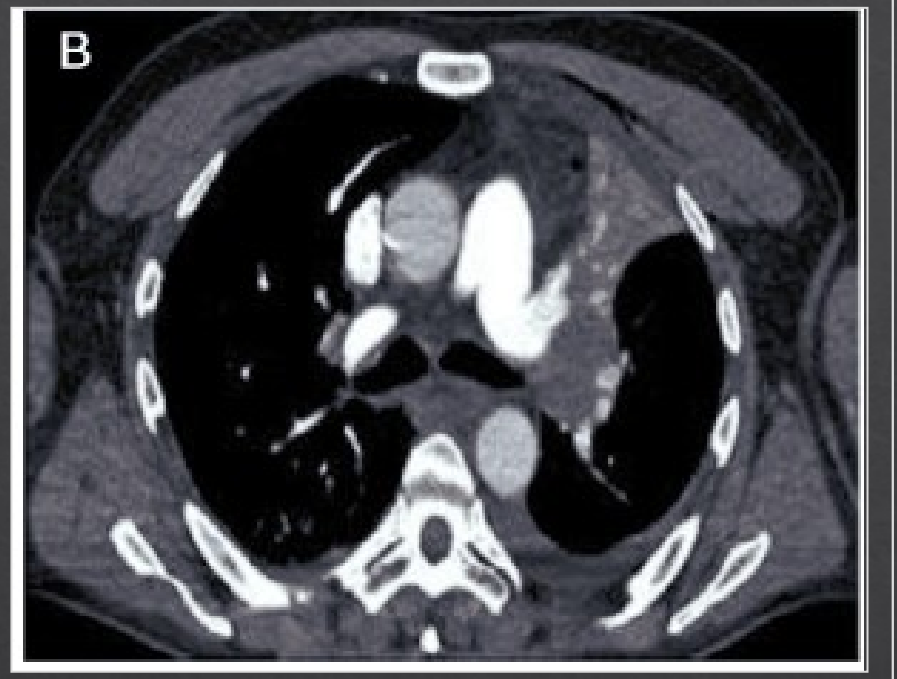
(Grade 1C)

Chest 2013;143: :e211S–e250S

- For mediastinal lymph nodes that show **activity on PET-CT but appear normal on CT (and without distant metastasis)**
  - Invasive mediastinal staging should be preferred over imaging alone.

(Grade 1C)

Chest 2013;143: :e211S–e250S



- Central tumor or enlarged N1 lymph node,
- The mediastinum is normal (based on CT and PET scan findings),
- No distant metastases,
- N2 or N3 involvement is moderately suspicious,
  - Invasive mediastinal staging should be performed.

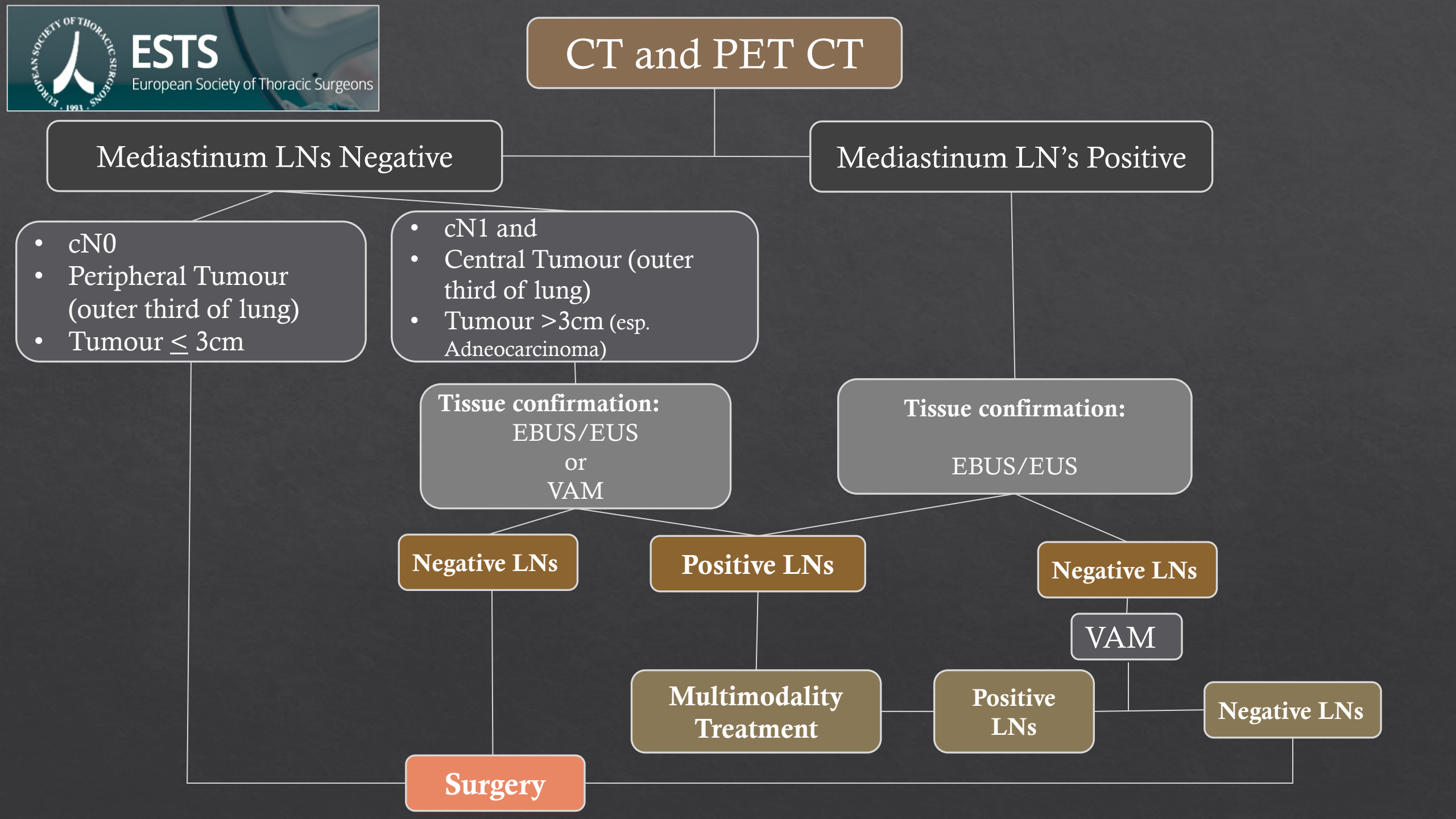
(Grade 1C)

Chest 2013;143: :e211S–e250S

- In this patient group, it is recommended to prefer needle techniques (such as EBUS-TBNA, EUS-FNA, or combined EBUS/EUS-FNA) as the best initial test for surgical staging (Grade 2B).

- If staging with needle techniques is negative but clinical suspicion remains high, surgical staging should be performed.

Chest 2013;143: :e211S–e250S


ESTS
European Society of Thoracic Surgeons
CT and PET CT
Mediastinum LNs Negative
Mediastinum LN's Positive
• cN0
• Peripheral Tumour (outer third of lung)
• Tumour ≤ 3cm
• cN1 and
• Central Tumour (outer third of lung)
• Tumour >3cm (esp. Adneocarcinoma)
Tissue confirmation: EBUS/EUS or VAM
Tissue confirmation: EBUS/EUS
Negative LNs
Positive LNs
Negative LNs
VAM
Multimodality Treatment
Positive LNs
Negative LNs
Surgery

cp-EBUS Indications

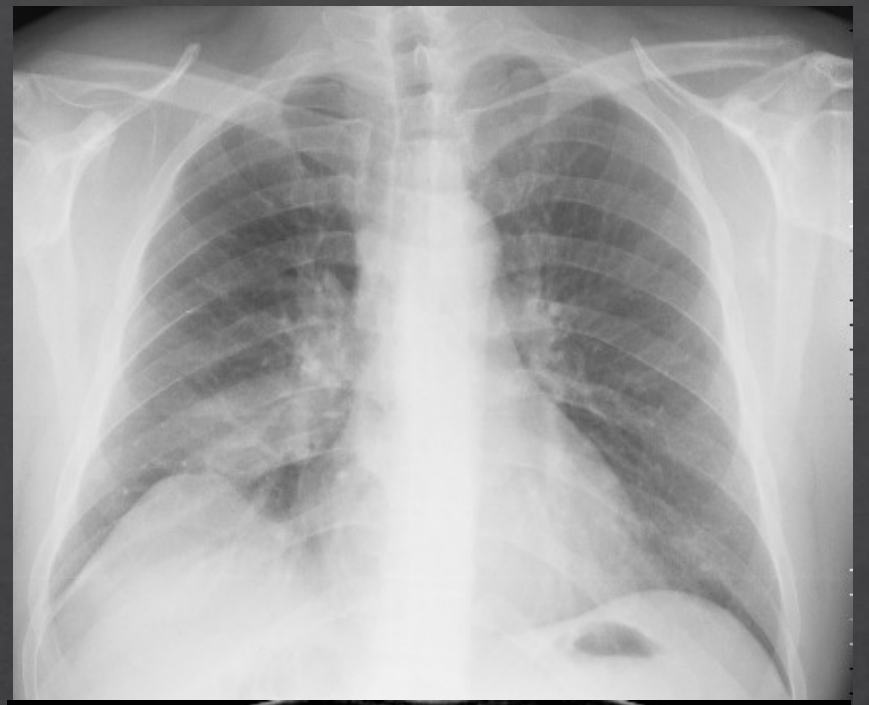
- Staging
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging

- >5mm and at least 3 different lymph node stations are suggested to be sampled
  - N3→N2→N1
- «Cortex to cortex» aspiration
- Move the needle back and forth inside 15-20 times through the LNs
- How many time puncturing is enough for a lymph node st.
  - At least 3 times sampling (sens.:%95,sps.:%100) for diagnosis
  - At least 4 times for molecular analysis (mutations)

https://youtu.be/4J8ZwYXuTLA?si=0mbrDXZxk9bUKSrL

CASE 1

- 42 yoa, ♂
- Dry cough, dyspnea
- Smoker (20 pack-years)
- Right hilar mass



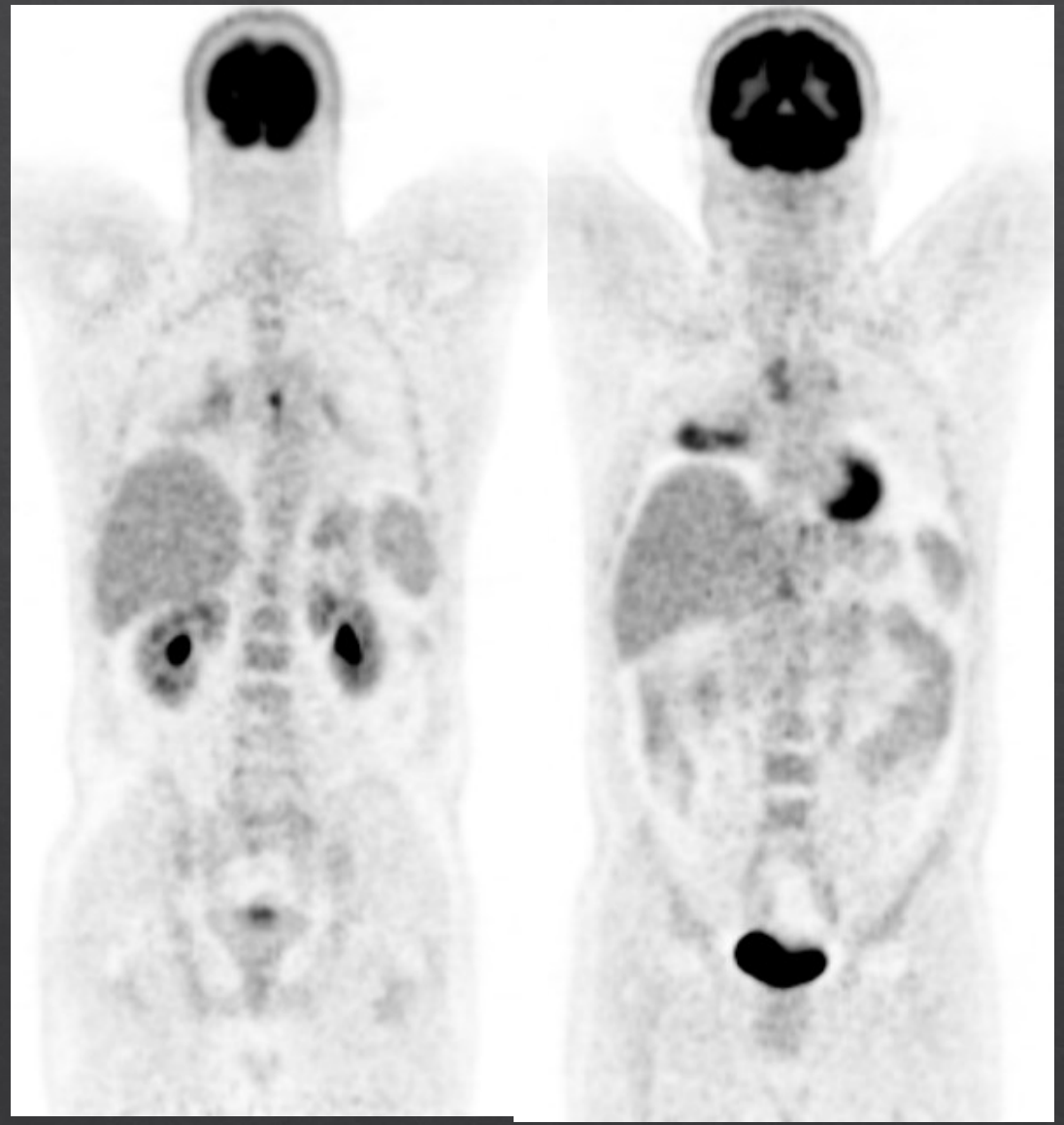
FOB: Tatally obliterating necrotizing endobronchial lesion at middle lobe orifice.

Pathology:

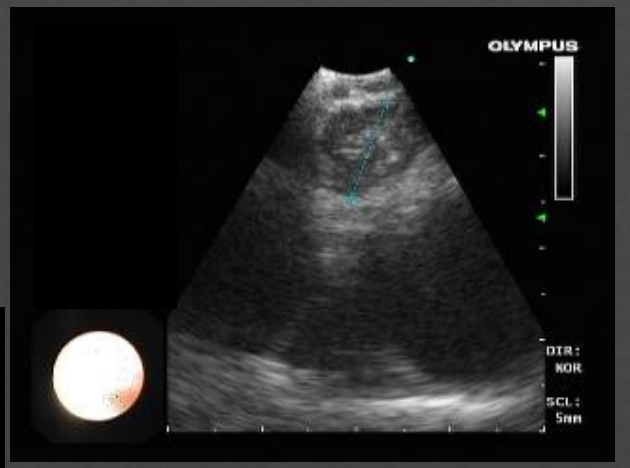
«ADENOCARCINOMA»

FDG PET-CT

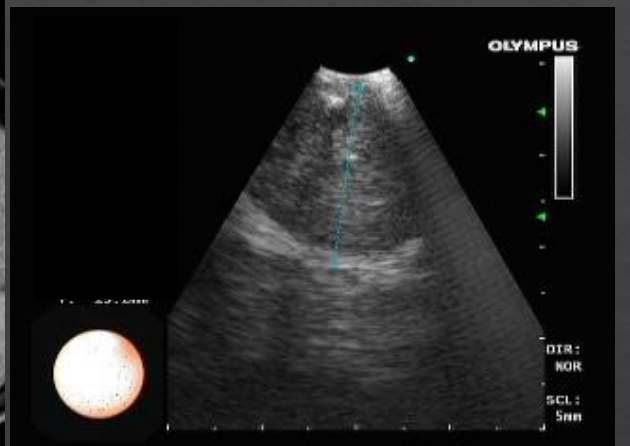
- Right hilar mass at the level of middle lobe (2.5x3 cm in diameter) (SUVmax:6.75)
- In mediastinum;
  - Left lower paratracheal (SUVmax:4.64),
  - Paraaortic (SUVmax:5.10),
  - Aorticopulmonary (SUVmax:4.15),
  - Subcarinal (SUVmax:4.10),
  - Paraesophageal (SUVmax:4.94),
  - Right hilar (SUVmax:4.12)



4L: 11.2 mm, distinct margin, heterogenous, hypoechogenic, round shaped



7: 19.2 mm, distinct margin, heterogenous, hypoechogenic, round shaped



11R: 13.9 mm, distinct margin, heterogenous, hypoechogenic, round shaped and central necrosis

EBUS PATHOLOGY

Metastatic Lymph Nodes (4L, 7 & 11R)

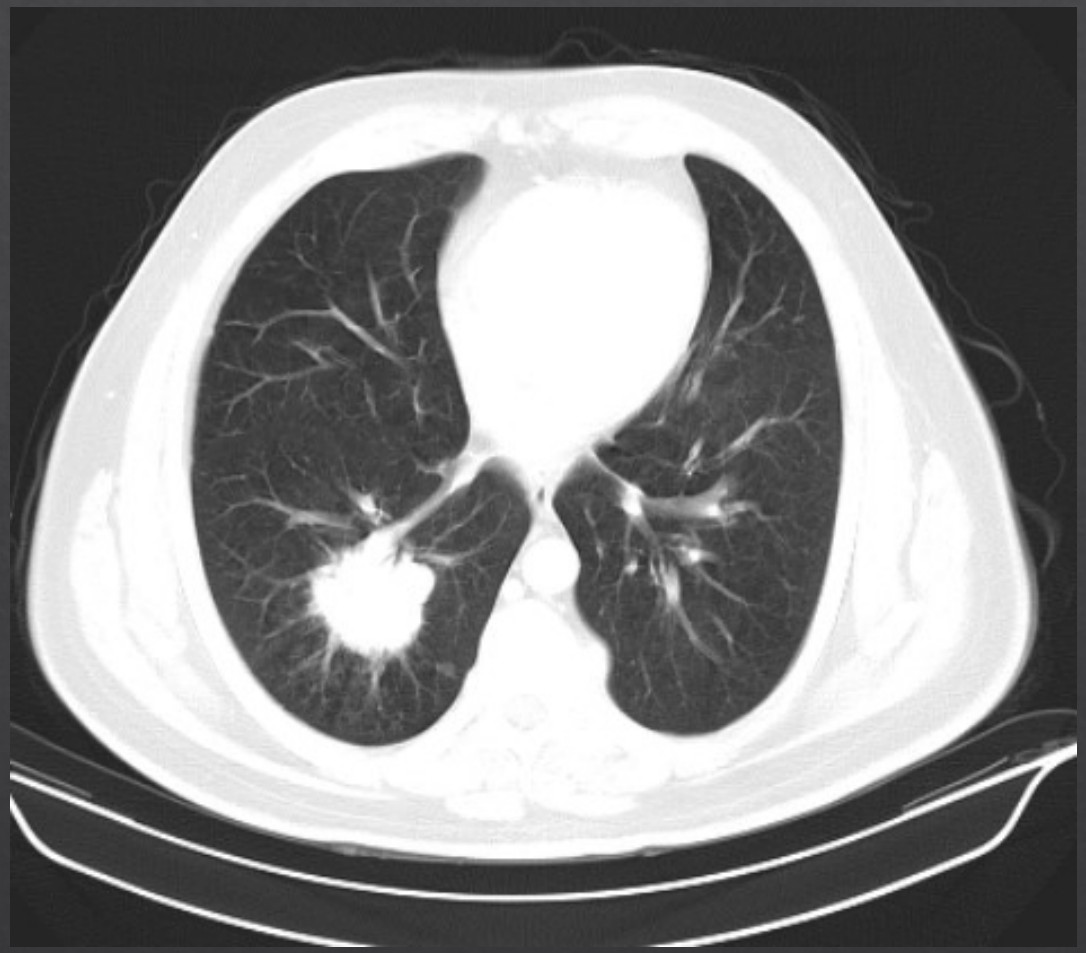
cT1c pN3 M0 Stage-3B

Molecular Investigation:

ALK, EGFR, K-RAS and ROS (Negative)

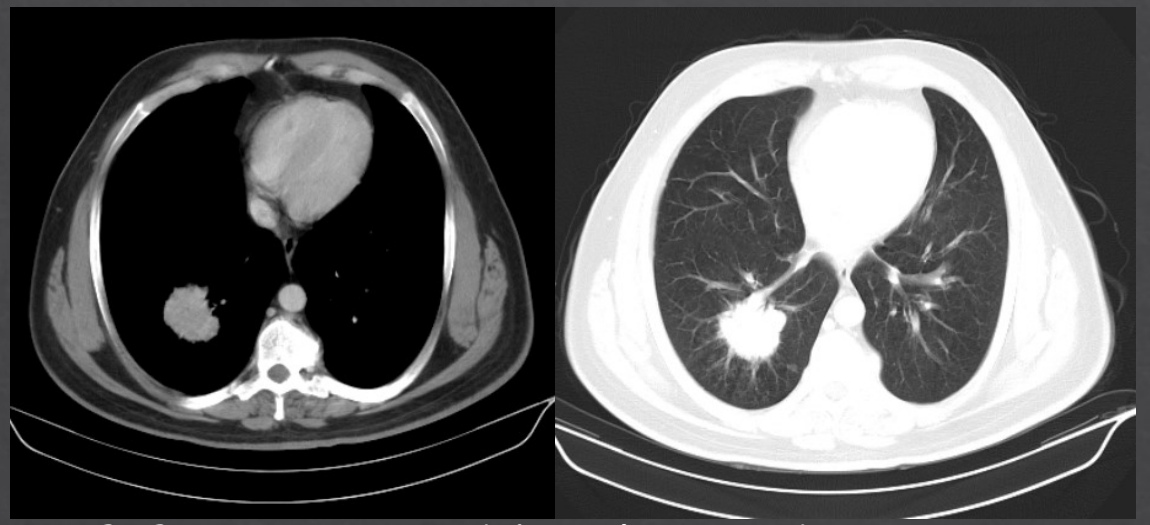
CASE 2

- 52 yoa, ♂
- Coughing with sputum
- No haemopytisis
- 35 pack-years
- Asbest exposure (+)



Bronchoscopy:

Normal



Tru-cut bx:

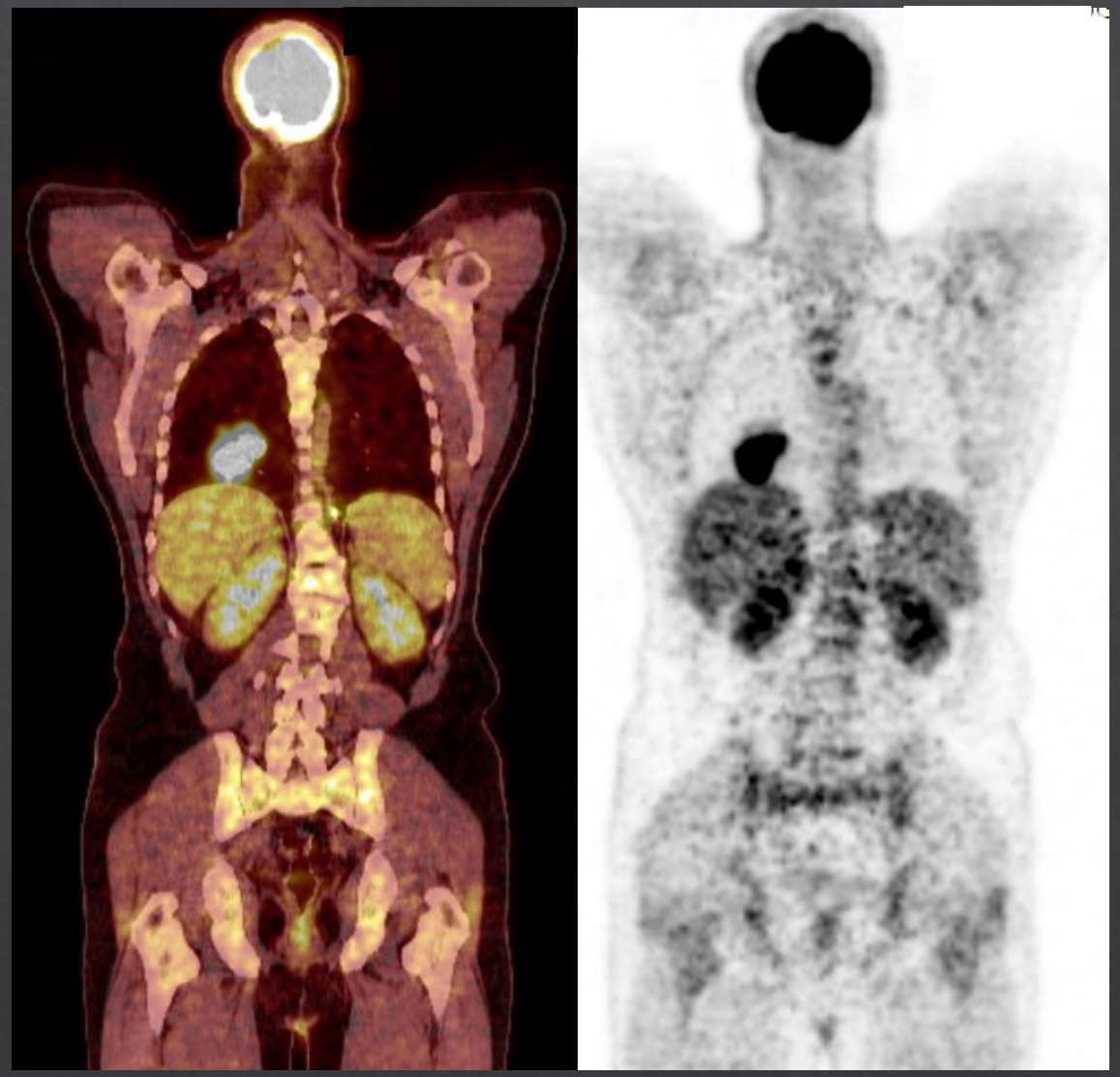
In the examined sections, there are areas of fibrotic and hyalinized tissue infiltrated with dense mononuclear inflammatory cells. A few large, hyperchromatic nuclei are observed at the edges of these tissues..

IHC: pansitokeratin (+), P63 (+), TTF-1 (-)

**Due to the reduction in these areas on serial sections, further interpretation for diagnosis could not be performed.*

FDG PET-CT

- ✓ 44x45x40 mm in diameter mass lesion on right lower lobe (SUVmax:16.38)
- ✓ Right hilar (SUVmax:4.96) and subcarinal (SUVmax:4.41) metabolically active lymph nodes



EBUS

11L: 9.9 mm, distinct margin, heterogenous, hypoechogenic, oval shaped

7: 17.2 mm, irregular border, heterogenous, hypoechogenic, round shaped

11R: 14.4 mm distinct margin, heterogenous, hypoechogenic, oval shaped

PATHOLOGY

All lymph nodes exhibit antracotic feature

PATHOLOGY for SURGICAL SAMPLING

Tanı : - SKUAMÖZ HÜCRELİ KARSİNOMA / ORTA DERECEDE DİFERANSİYE; sağ alt lobektomi
- METASTATİK LENF NODLARI, 1 adet peribronşial
- REAKTİF ANTRAKOTİK LENF NODLARI, 2 - 4 - 7 - 8 ve 9 nolu
- Sağ torakotomi

NOT:
- Bronş cerrahi sınırında tümör yoktur.
- Plevral tutulum yoktur.
- 10 nolu lenf nodu kayıtlı dokuda lenf nodu yapısı yoktur. Bu örnekler tümör içermeyen akciğer parankiminden oluşmaktadır.
- Tümörün büyük çapı 5,5 cm7dir.
- Tümör dışı akciğer parankiminde kalsifiye nodüler lezyonlar izlenmektedir.

Squamous Cell Carcinoma with metastatic peribronchial lymph node.

pT3 pN1 M0 → Stage IIIA

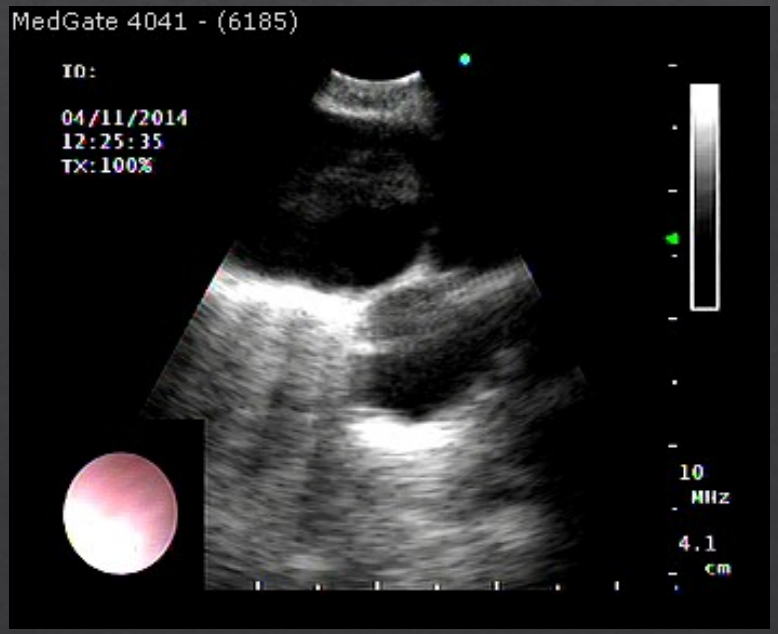
cp-EBUS Indications

- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging

- Pulmonar Embolism

  (embolism in main pulmonary artery)
  - Contraindication for contrast media
  - Pregnancy
  - Patients followed in ICU
  - Diagnostic accuracy 96%

    (lower diagnostic accuracy for lower and middle pulmonary artery)



Sariaydin M, Günay S, Günay E, et al. Am J Emerg Med. 2016; 34(3):684.e1-2

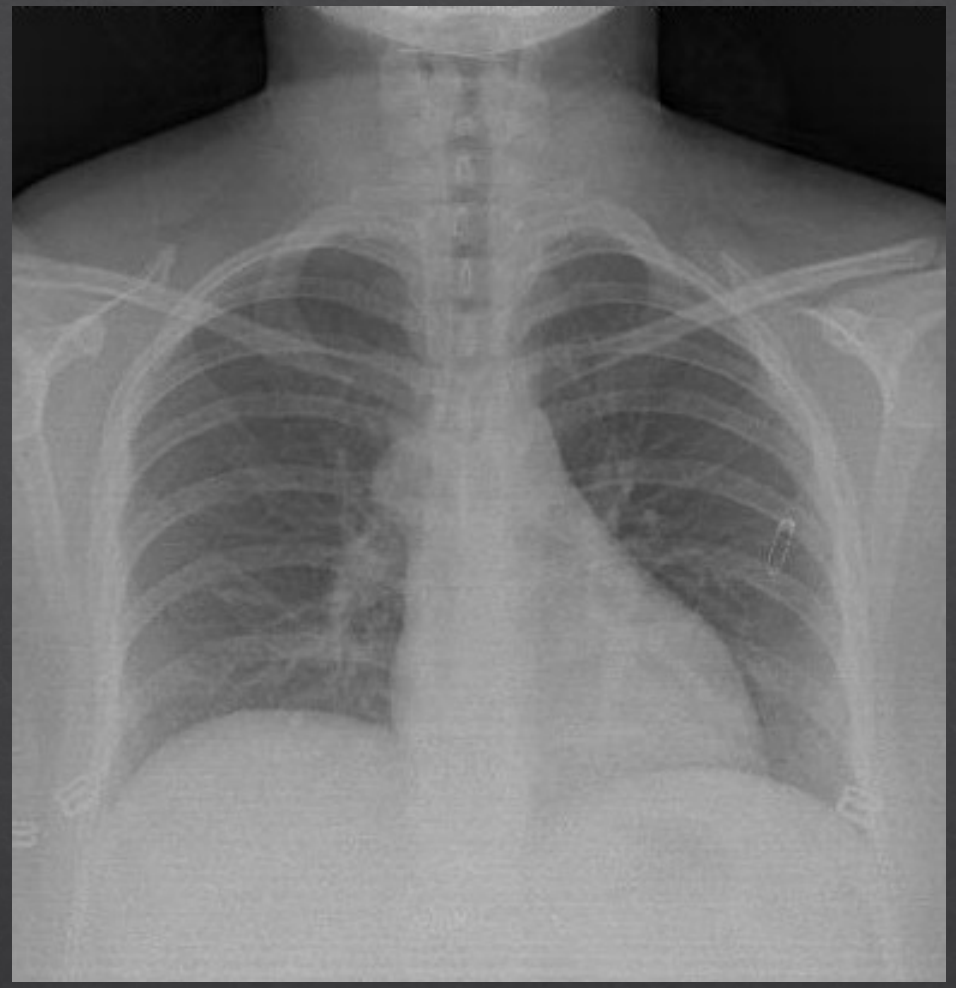
cp-EBUS Indications

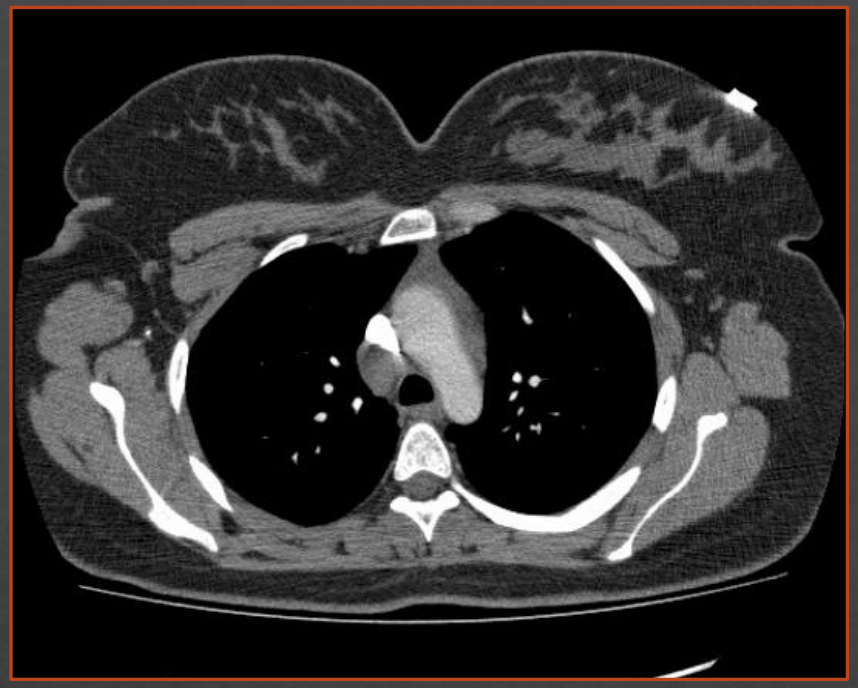
- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging
- Pulmonar Embolism

- Non-thrombotic endovasculary lesions (NELs)
  - Pulmonary hydatid cyst embolism
  - Pulmonary arterial sarcoma,
  - Pulmonary arterial aneurysm
  - Tumors of the vena cava

Case 3

- 30 years old female
- Cough (very rare)
- Treated 14 days for pneumonia
- No smoking
- Housewife (not working)
- No medical history
- Control chest X-ray (14th day of treatment)





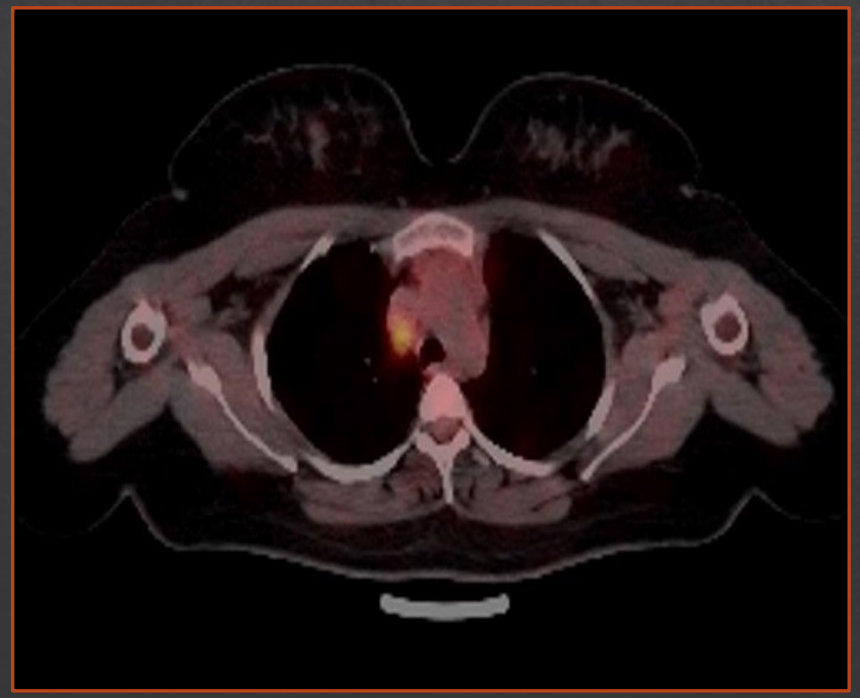
- **Thorax CT**

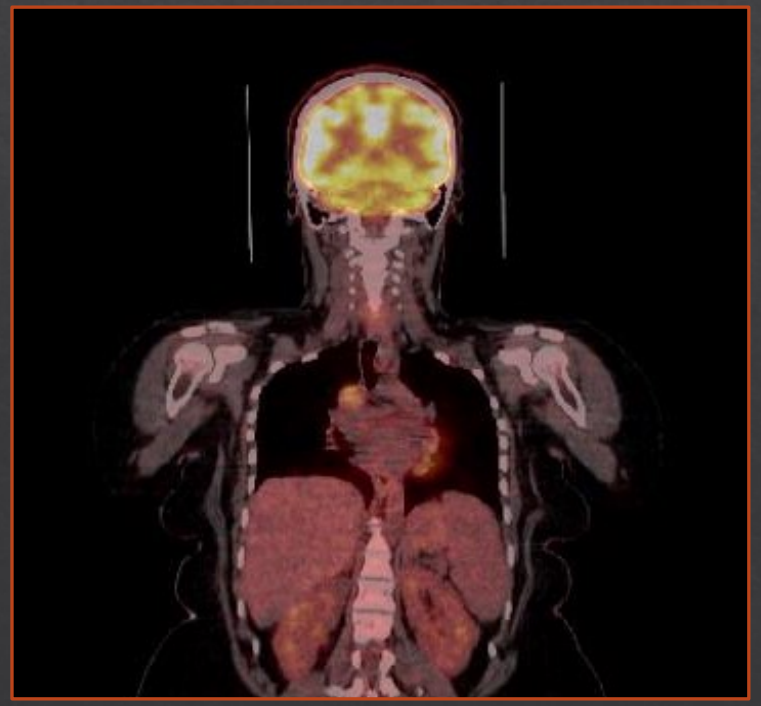
Right paratracheal lymph node (20X15 mm)

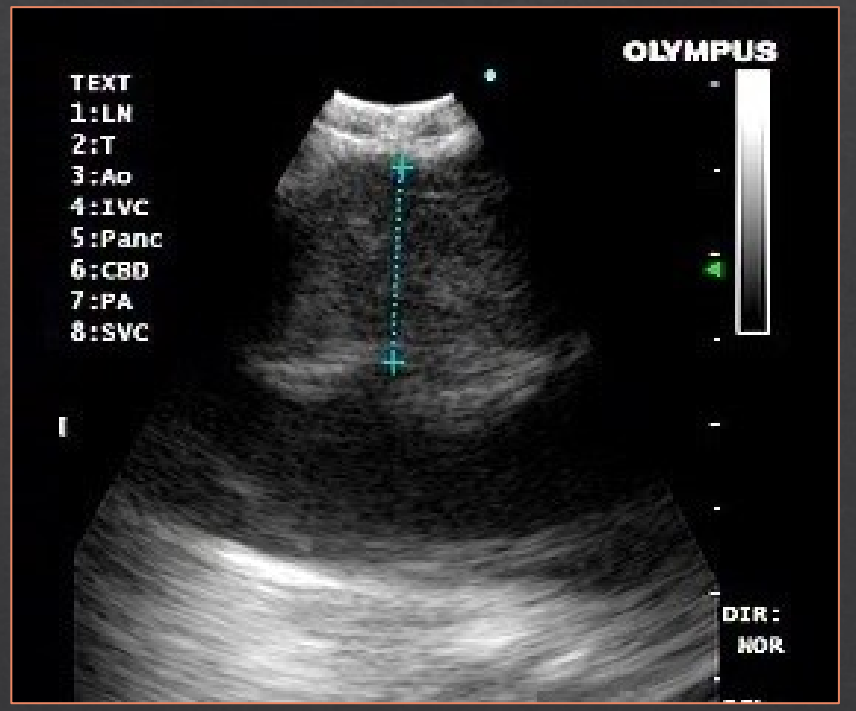
- PET-CT:

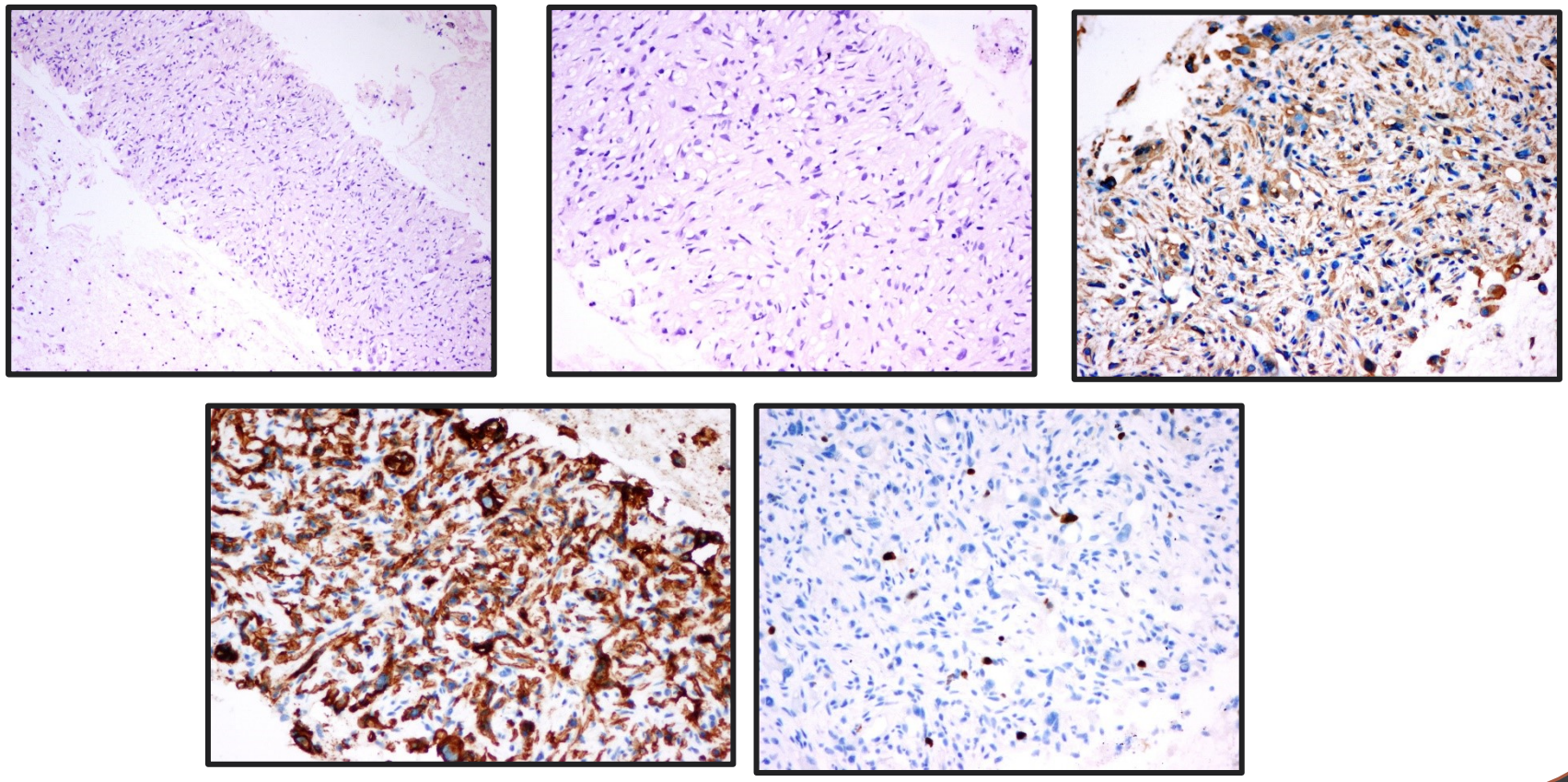
4R , SUVmax: 8.7

- EBUS performed









Strongly (+) with Vimentin and CD34
Ki67 proliferation index is 5 %
«Epithelioid Hemangioendothelioma»

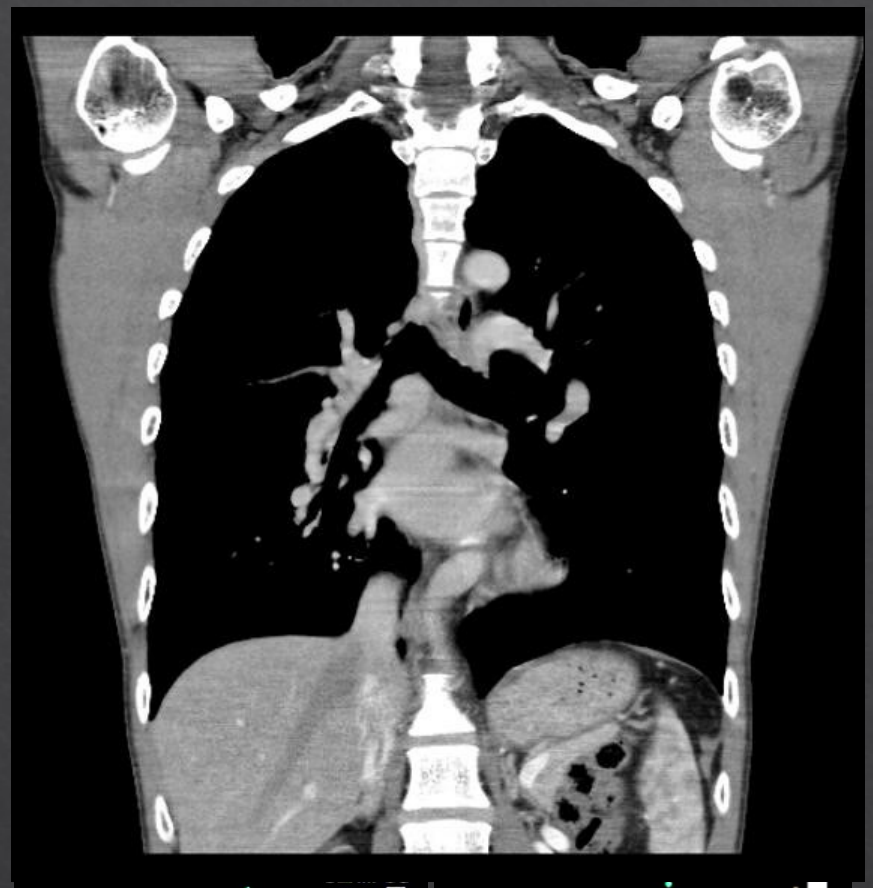
Günay E, Günay S, Demirciler Yavas B. Arch Bronconeumol. 2022;58(1):84.

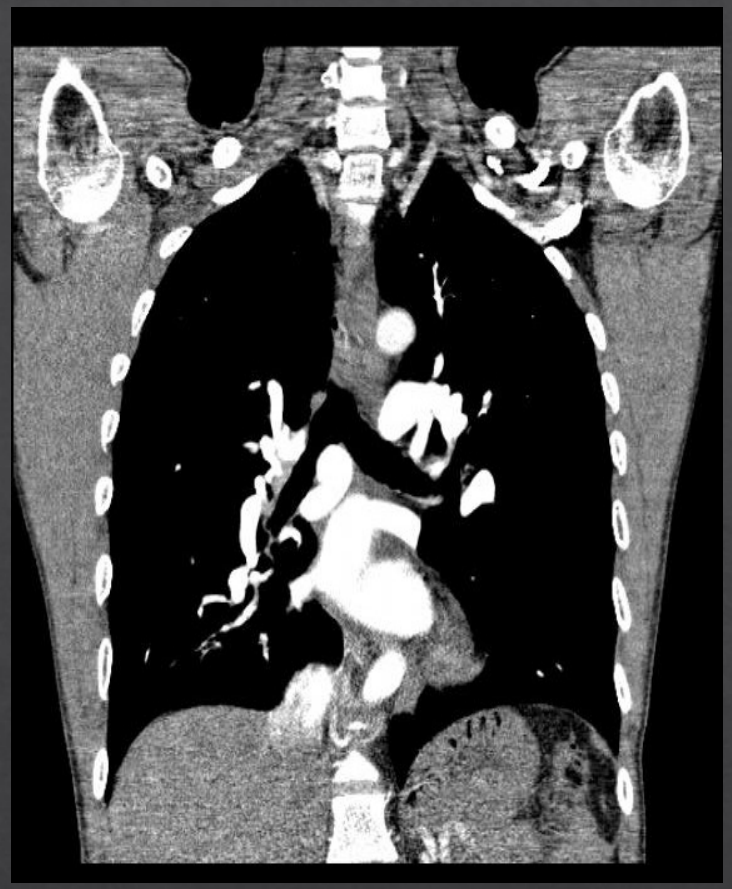
Case 4

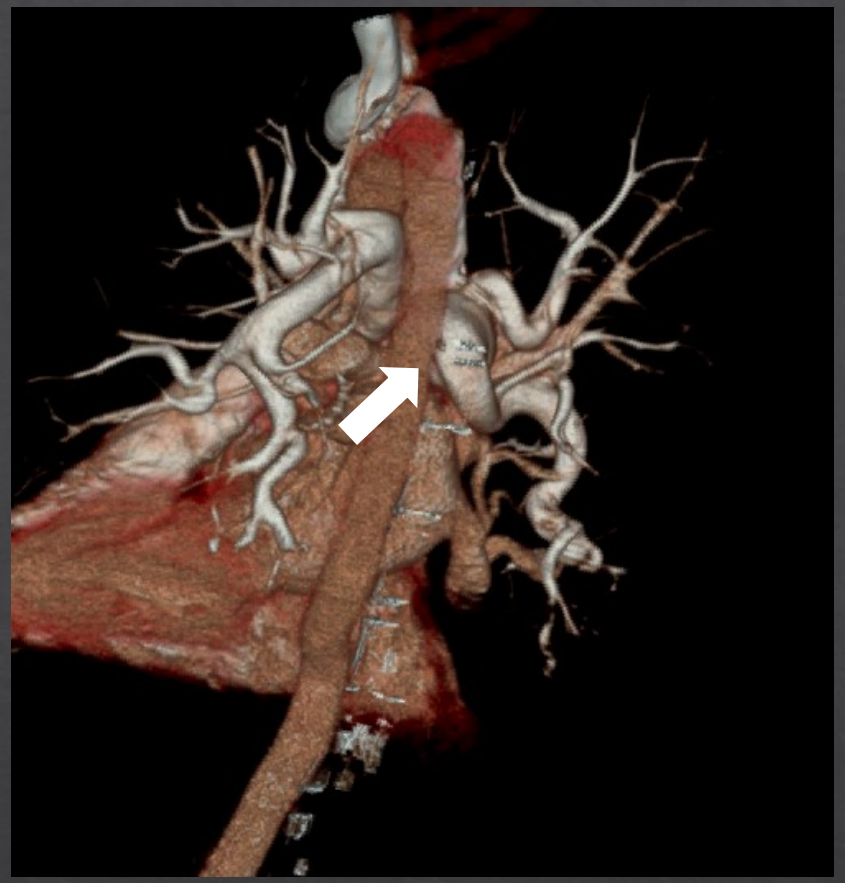
- 45 year old male
- Productive cough for 2 weeks
- Chst X-ray: Right hilar enlargement

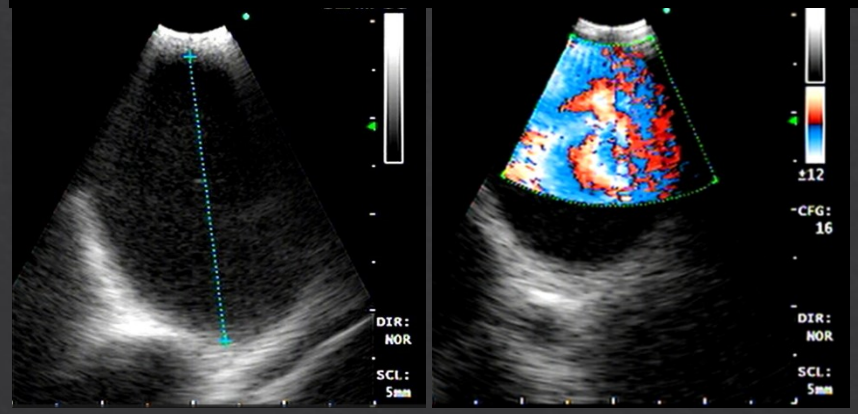
- **Bronchoscopy:**

Enlargement at the level of main carina and visible pulsation









Günay E, Kaya F, Günay S. Tuberk Toraks. 2018 ;66(3):268-270.

cp-EBUS Indications

- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging
- Pulmonar Embolism
- Non-thrombotic endovasculary lesions (NELs)
- **Thyroid nodule needle aspiration (substernal localization)**

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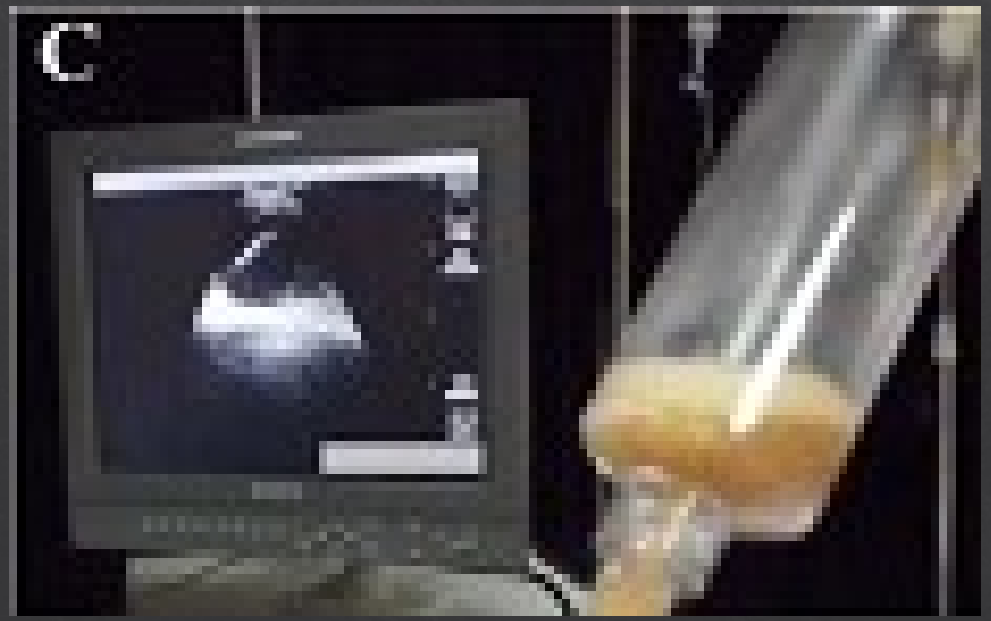


- Therapeutic applications
  - **Drainage** (Mediastinal cyst, abscess and lymphangioma)
  - **Transbronchial needle injection (TBNI)**

cp-EBUS Indications

- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging
- Pulmonary Embolism

- Cardiac indications
  - Aspiration for pericardial effusion
  - Diagnosis of atrial mass lesions (Cardiac tumors)

Maturu VN,et al . BMJ Case Rep. 2022;15(7):e249279.

cp-EBUS Indications

- Staging/Diagnosis
  - NSCLC / Extrapulmonary tumors with mediastinal metastasis
  - Restaging
- Pulmonar Embolism
- Non-thrombotic endovasculary lesions (NELs)
- Thyroid nodüle needle aspiration (substernal localization)
- Therapeutic applications,
- Cardiac indications

- Diagnosis of other mediastinal lesions
  - Lymphoma
  - Granulomatous diseases
    - Sarcoidosis
    - Tuberculosis

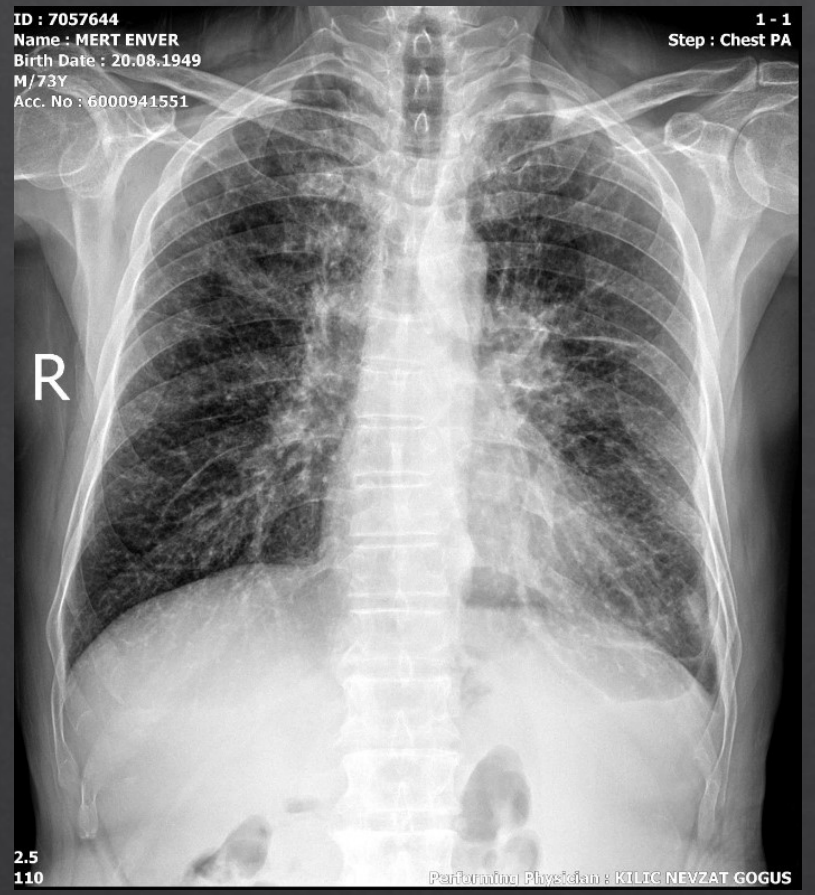
Case 5

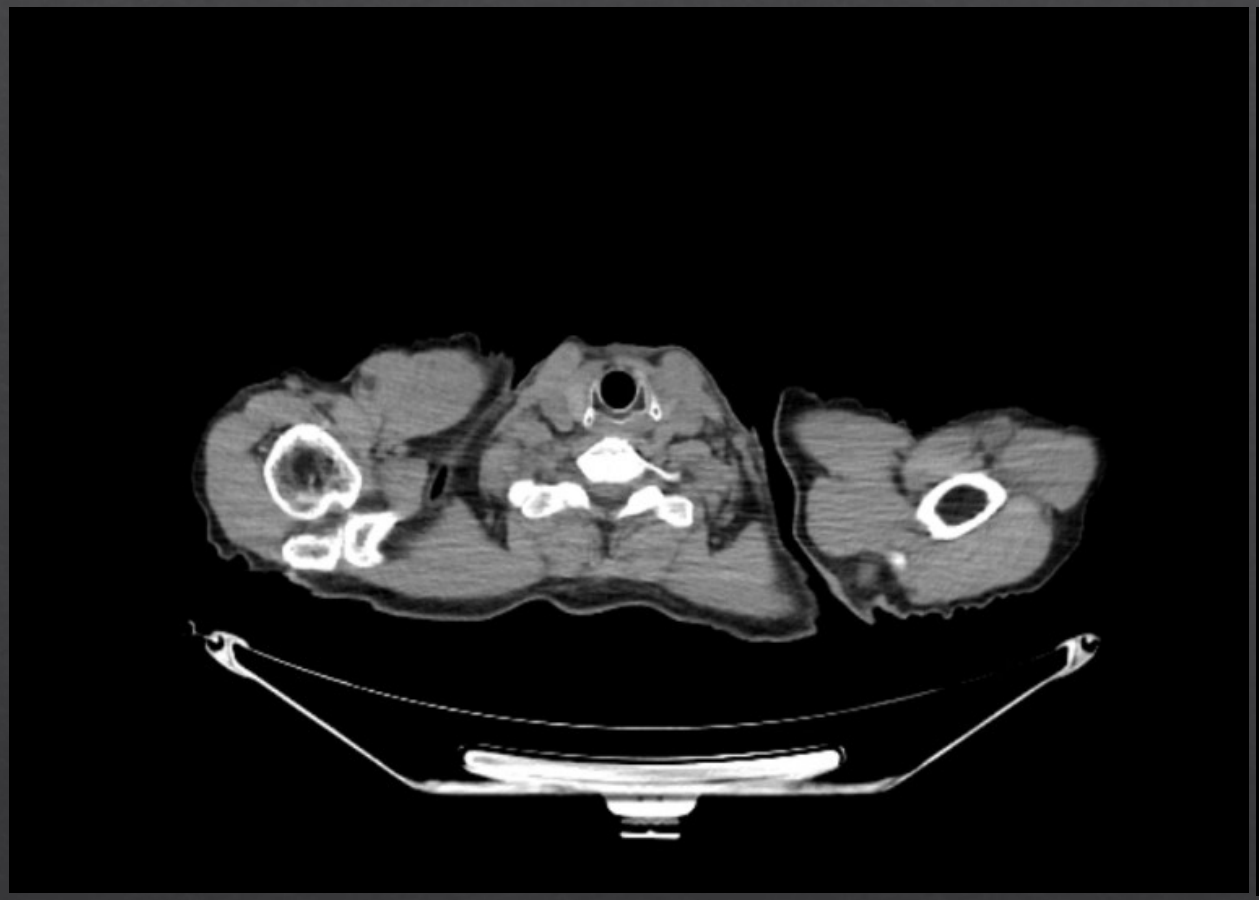
- 75 yoa, Male
- Back pain for 3 months
- Cough with phlegm
- Dyspnea
- Weight loss (6 kg per/ 3 months)
- Night sweeting
- No fever

Case 5

Medical History

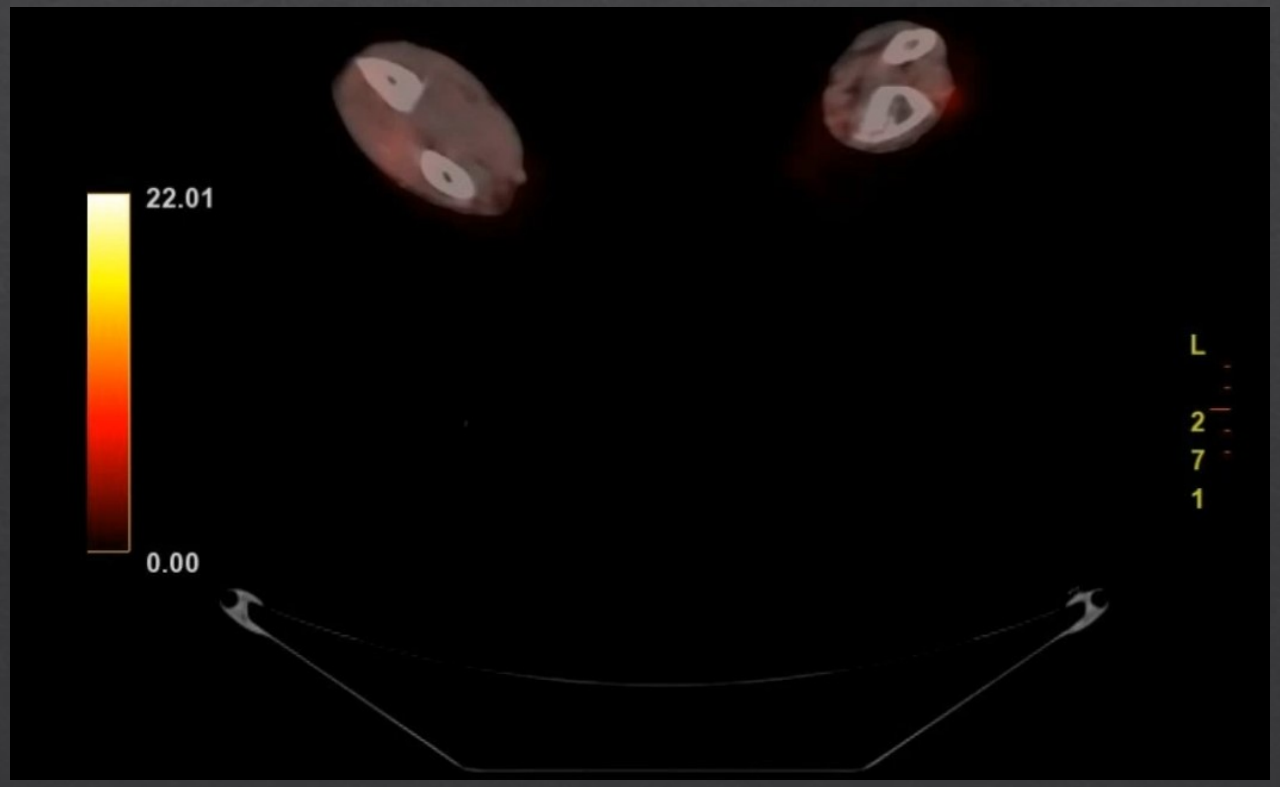
- Smoking (+)
  - ex-smoker; 25 pack-years
- Farmer
- CAD (+) (angiography, baloon tx)
- Hyperlipidemia (+)





PET CT

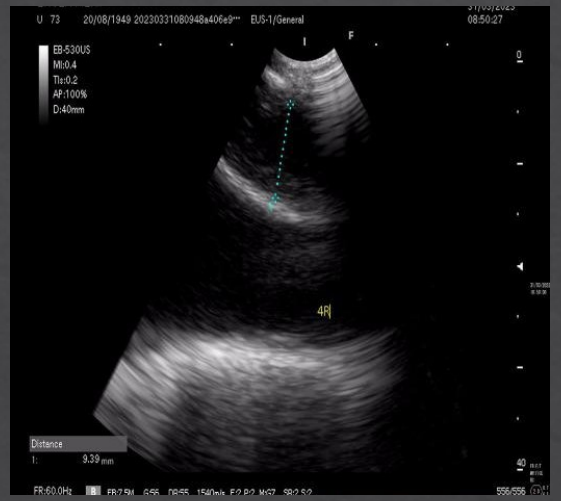
- Extensive mediastinal lymphadenopathy, with the largest lymph node measuring 1.5 x 1.5 cm (SUVmax: 7.47).

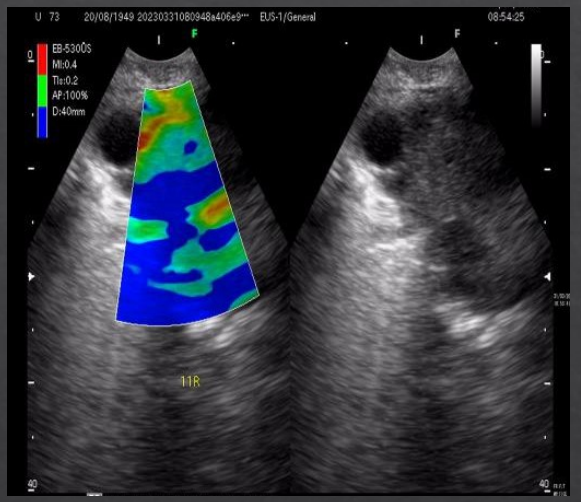


EBUS

- 4R and 4L; 9 mm, heterogenous, partial blue
- 7; 23 mm, partial blue
- 11R; 17 mm and partial blue
- 11L; 17 mm heterogenous, round

- 11L→4L→7→4R→11R





PATHOLOGY

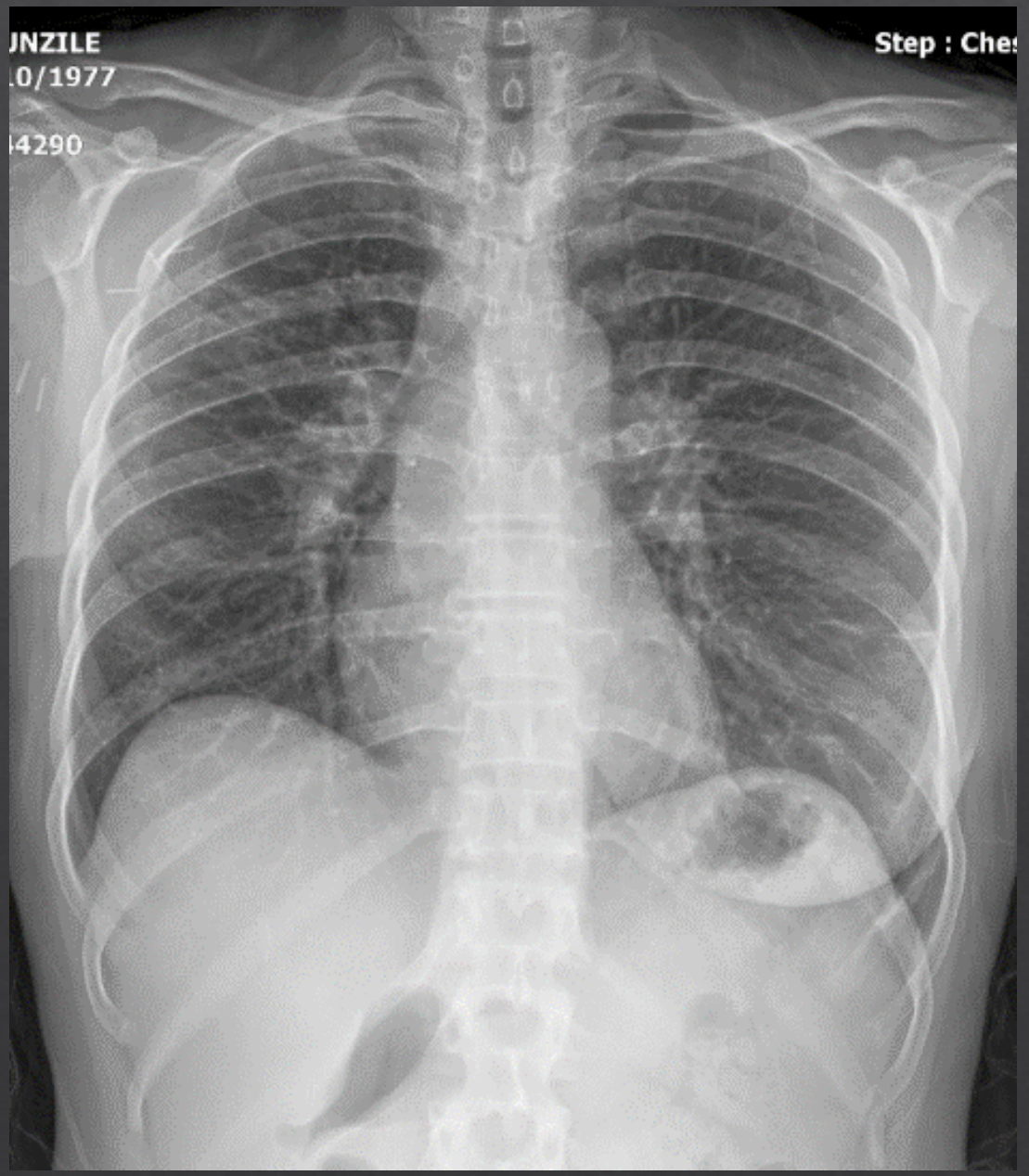
- All sampled lymph node stations revealed;
  - Diffusse positive CD20, CD5, Bcl-2 and Bcl-1
  - CD-21 reveals immune reaction representing FDRC (+) (follicular dendritic reticulum cells- Reed Sternberg cells)
  - Ki-67 proliferation index 20-25%,

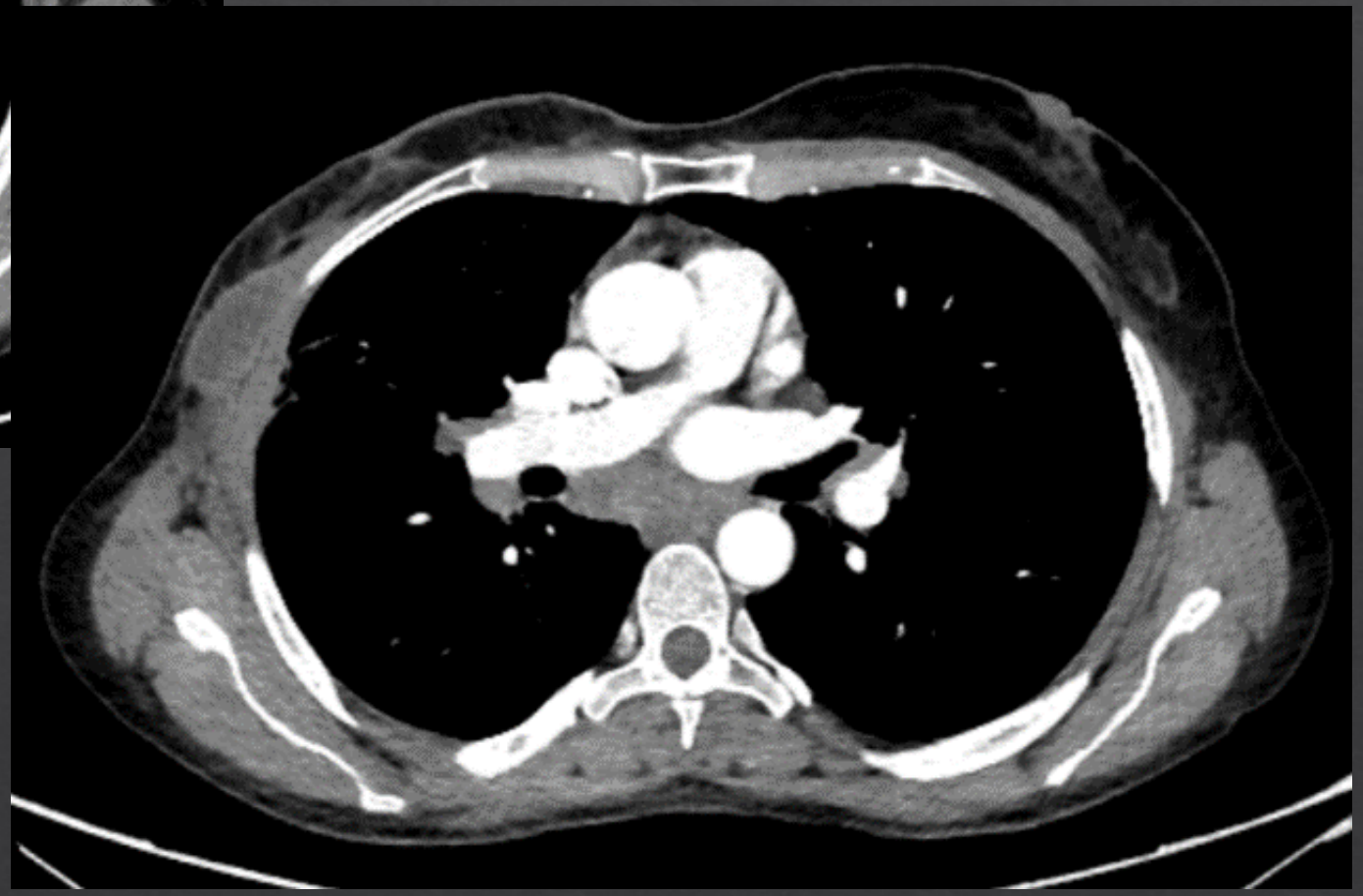
FINAL DIAGNOSIS:

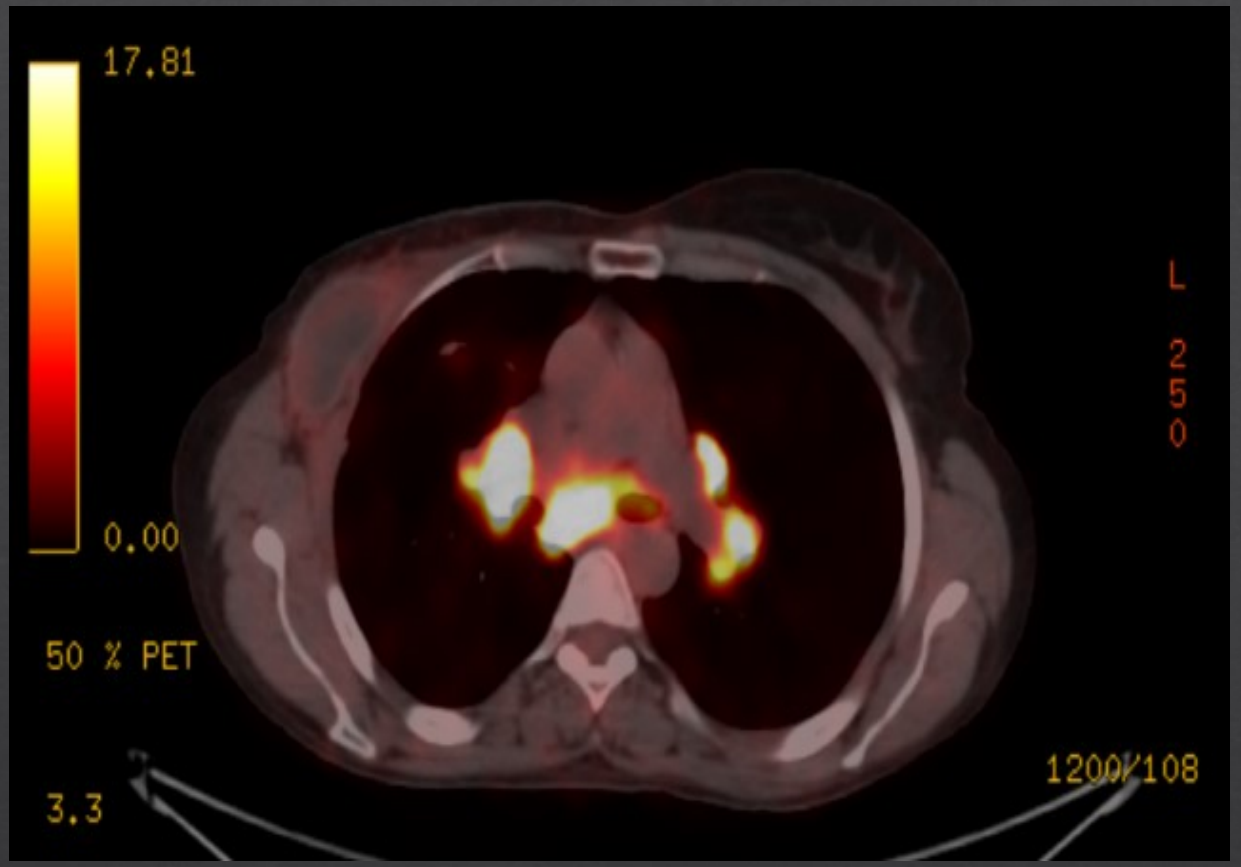
MANTLE CELL LYMPHOMA

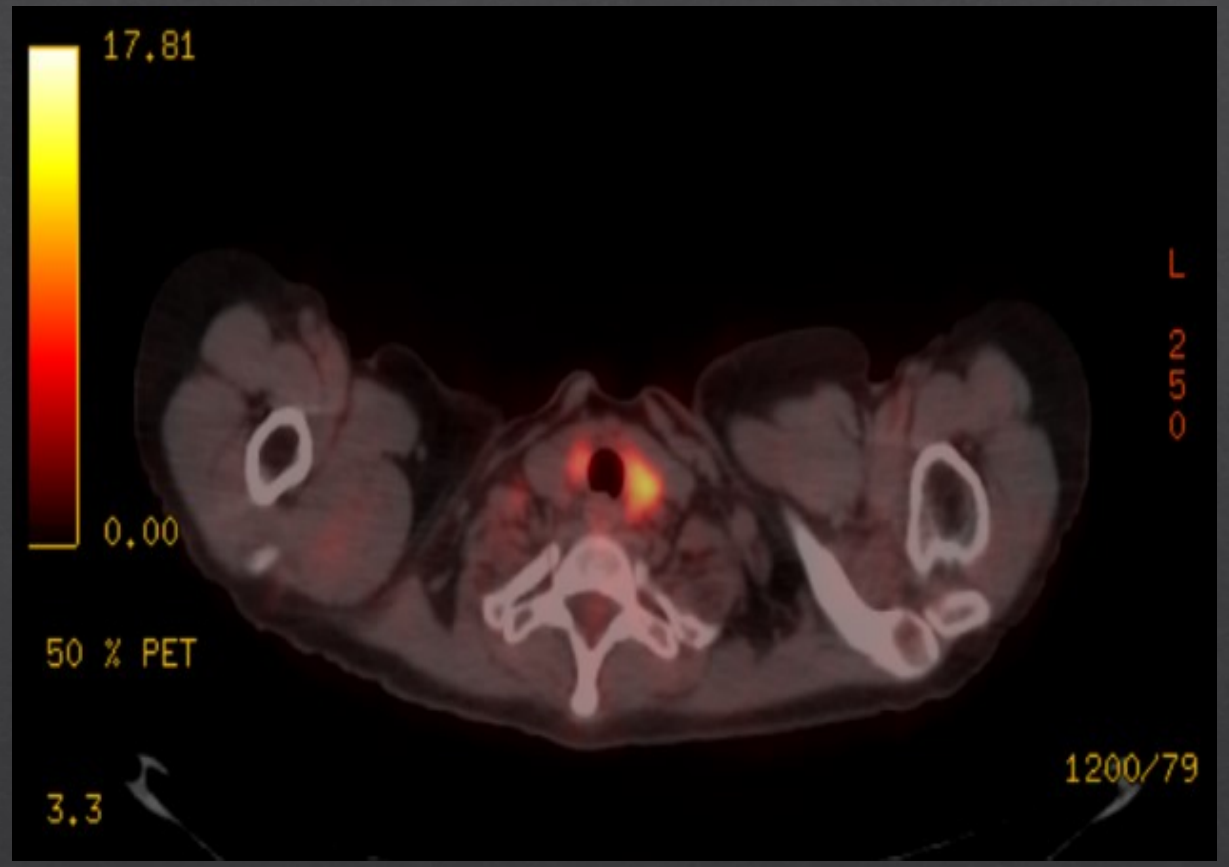
Case 6

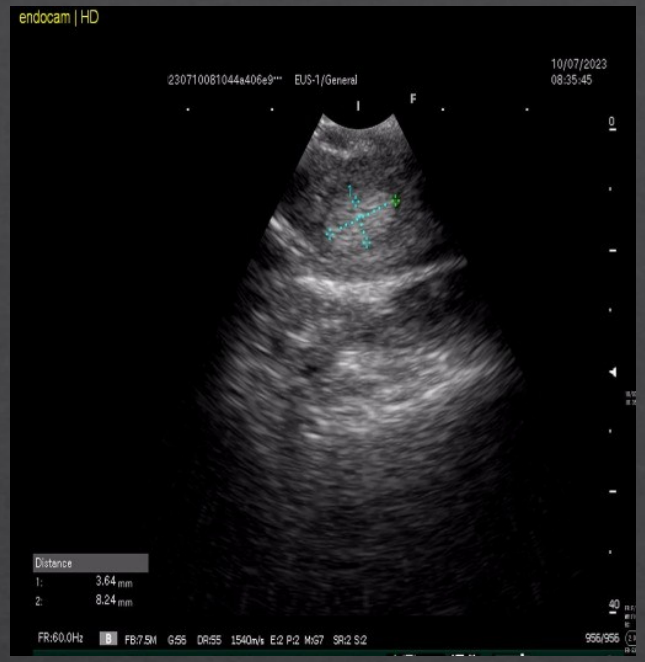
- 46 years old
- Female
- No pulmonary symptom
- Mastectomized 2 years before for breast cancer
- Mediastinal pathological lymph nodes during follow-up

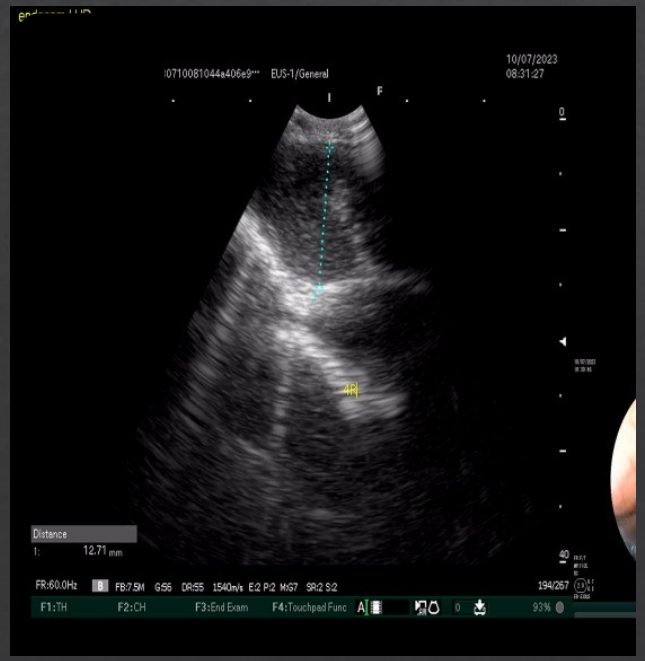


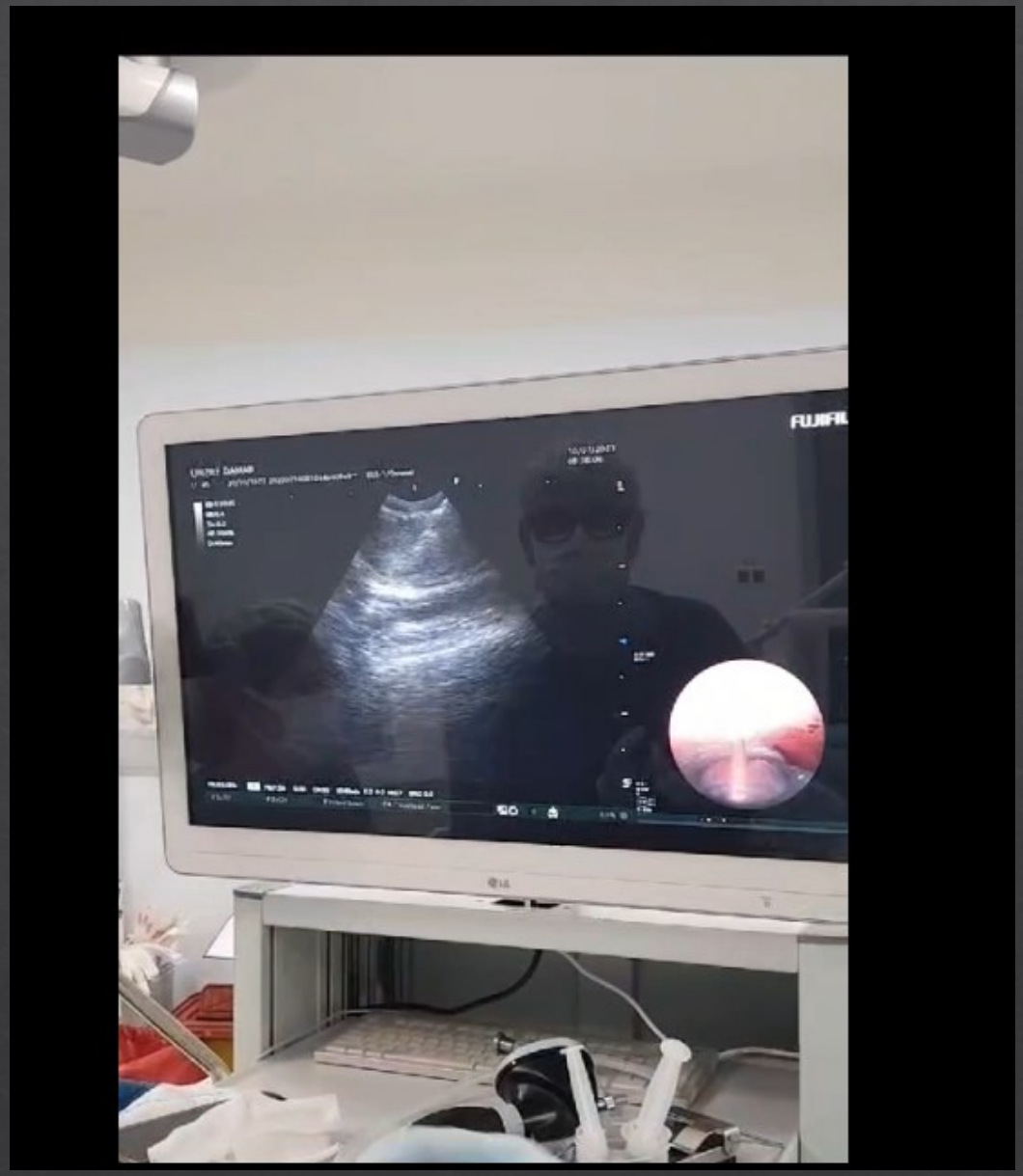



17.81
0.00
50 % PET
3.3
L
250
1200/108


17.81
0.00
50 % PET
3.3
L
250
1200/79

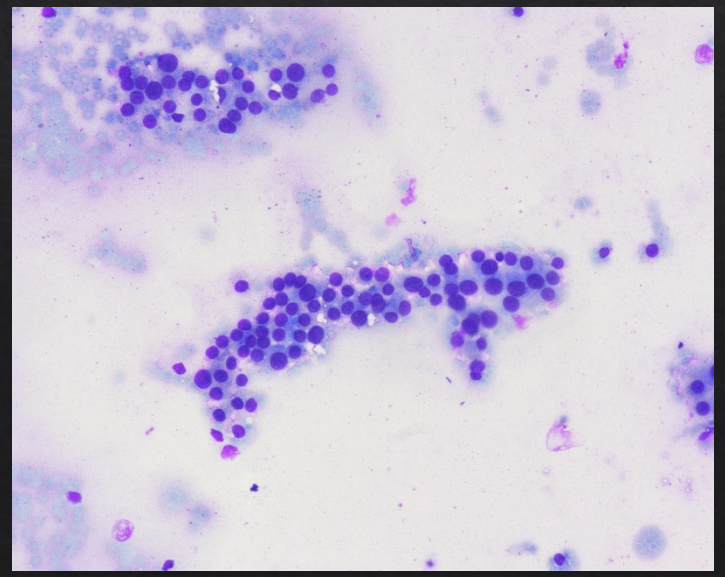

endocam | HD
10/07/2023
08:35:45
EUS-1/General
Distance
1: 3.64 mm
2: 8.24 mm
FR:60.0Hz
956/956

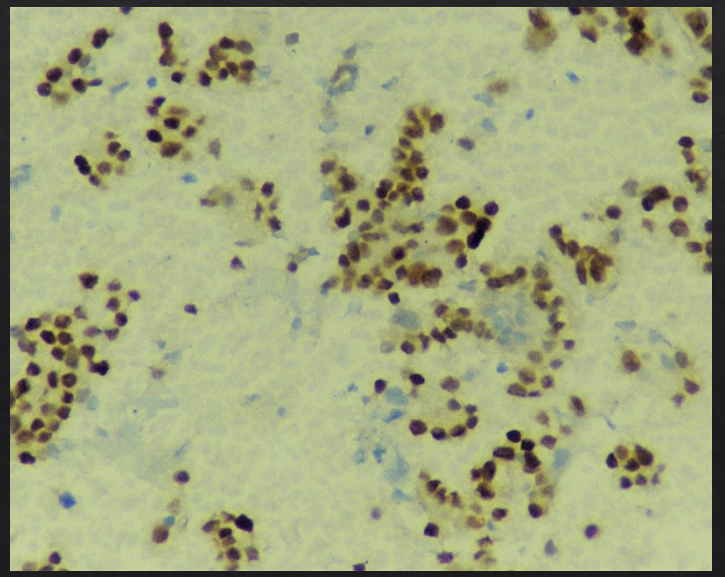

10/07/2023
08:31:27
EUS-1/General
Distance
1: 12.71 mm
FR:60.0Hz
194/267
F1:TH
F2:CH
F3:End Exam
F4:Touchpad Func

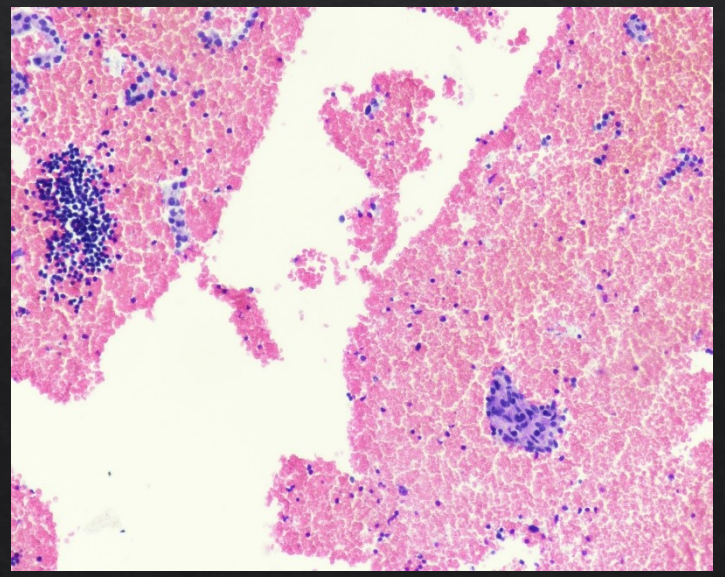

FUJIFILM

PATHOLOGY

- Noncaseating granuloma, THYROID, 4R, 7, 11R,
- EZN (-) for all specimens







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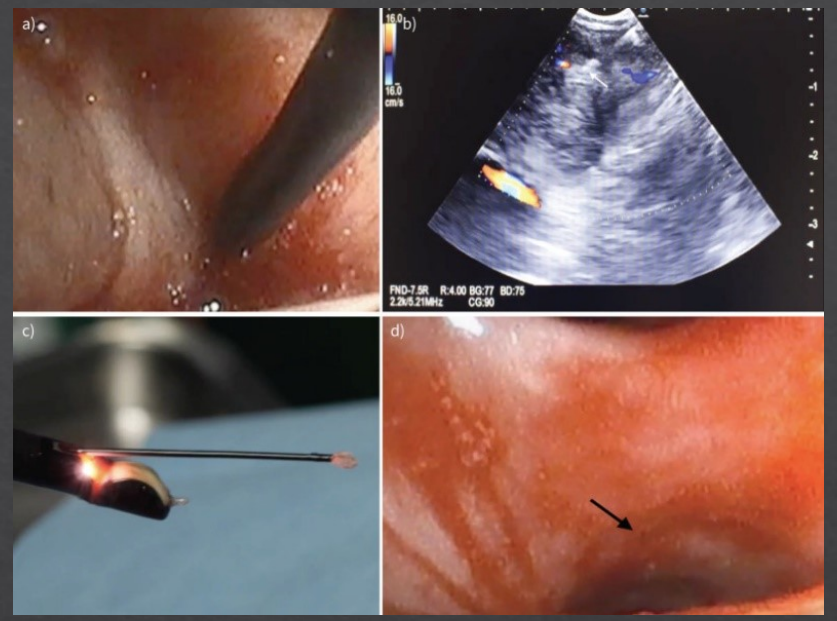
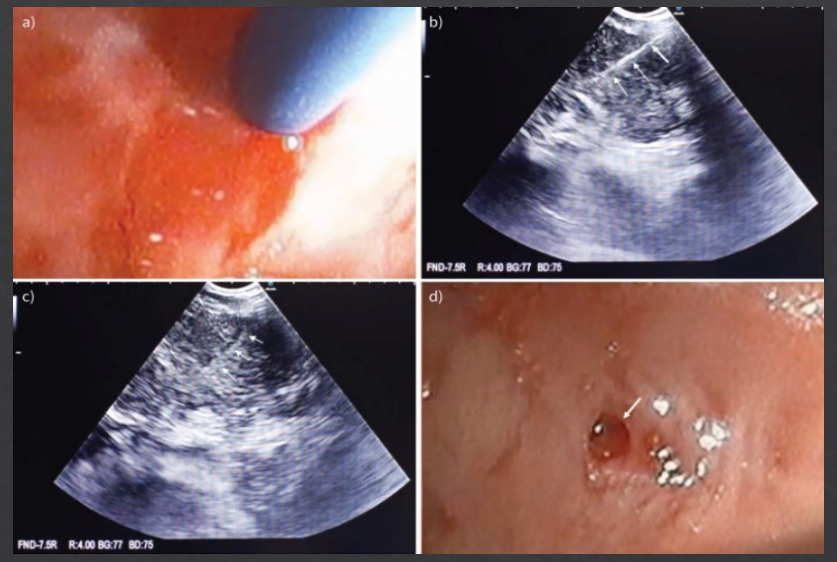
- Therapeutic applications,
- Cardiac indications
- Diagnosis of other mediastinal lesions

EBUS-Mediastinal cryobiopsy

- Negative EBUS-TBNA
- Suspicion for lymphoma





Disadvantages

- Require an supervised training period
  - 50 case with supervised practical training (ACCP)
  - At least 5-10 case / year

Ernst A. , Chest 2003; 123: 1693-1717

- Station 5,6,8 and 9 could not be sampled
- Standard fiberoptic/video bronchoscopy is required for whole airway examination and biopsies if needed.

Contraindications

Absolute	Relative
Absence of signed informed consent	Refractory hypoxemia (under 6lt/min nasal oxygen; SO2<90%, PaO2 <60 mmHg) (EUS-B FNA may be alternative)
Severe/uncontroled bleeding diathesis	Severe hypertension (Systolic >180, diastolic >110 mmHg)
Unstable arythmia Acute MI within the past 4 weeks	Airway narrowing with a lumen wide enough to permit the passage of a bronchoscope. (EUS-B FNA may be alternative)
Supraglottic/glottic stenosis (benign/malignant)	

Complications

- Most complications described as 'case reports'
- No death was reported
- 0.07% complication rate reported in a meta-analysis with 1299 patients
- 0.016% complication rate in a study with 3123 cases

TABLE 5 Complication rates following EBUS bronchoscopy.

Complication	Performance target: Rate of complication	Referenc
Hospitalization	<1%	
Bleeding		
Grade 1–2	<2%	
Grade 3–4	<1%	
Pneumothorax		
Linear EBUS	<1%	
Radial EBUS	<3%	
Pneumomediastinum	<1%	
Respiratory failure	<1%	

Other Complications

- Pericarditis,
- Mediastinal infections
- Vocal cord injury
- Hemapneumomediastinum
- Ultramural hematoma (p. artery)

What does the future hold for EBUS technology?

- Pulmonary Hypertension
  - Diagnosis
  - Follow-up

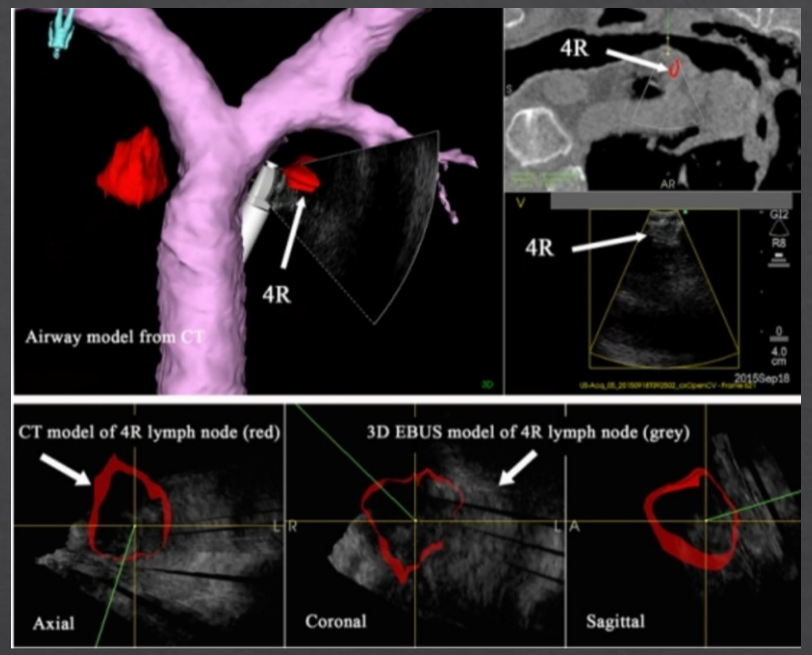
Endobronchial ultrasound: A novel screening test for pulmonary hypertension prior to major pulmonary surgery

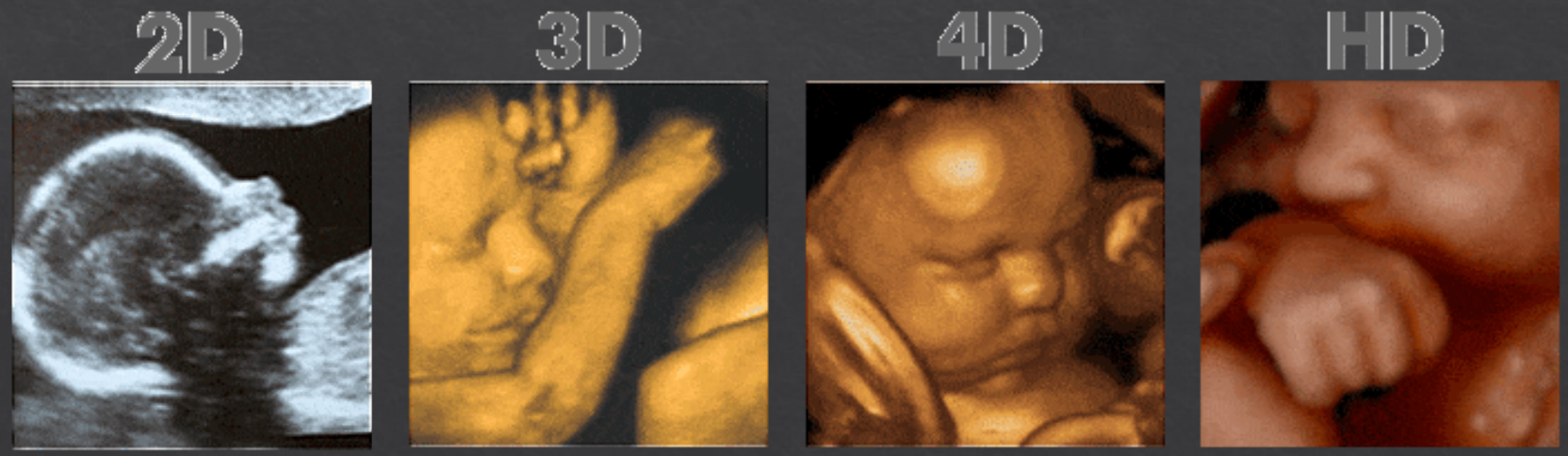
Check for updates

Nathaniel Deboever, MD, MSc,[a] George A. Eapen, MD,[b] Roberto F. Casal, MD,[b] Jean-Bernard Durand, MD,[c] Michael A. Eisenberg, MD,[a] Hope Feldman, MD, MSc,[a] Celestino May, MD, MAEd,[a] Zohra Ali, APRN, MSc,[a] David C. Rice, MB, BCh,[a] and Reza J. Mehran, MDCM, MSc[a]

What does the future hold for EBUS technology?

- Pulmonary Hypertension
- 3D- 4D technology in EBUS



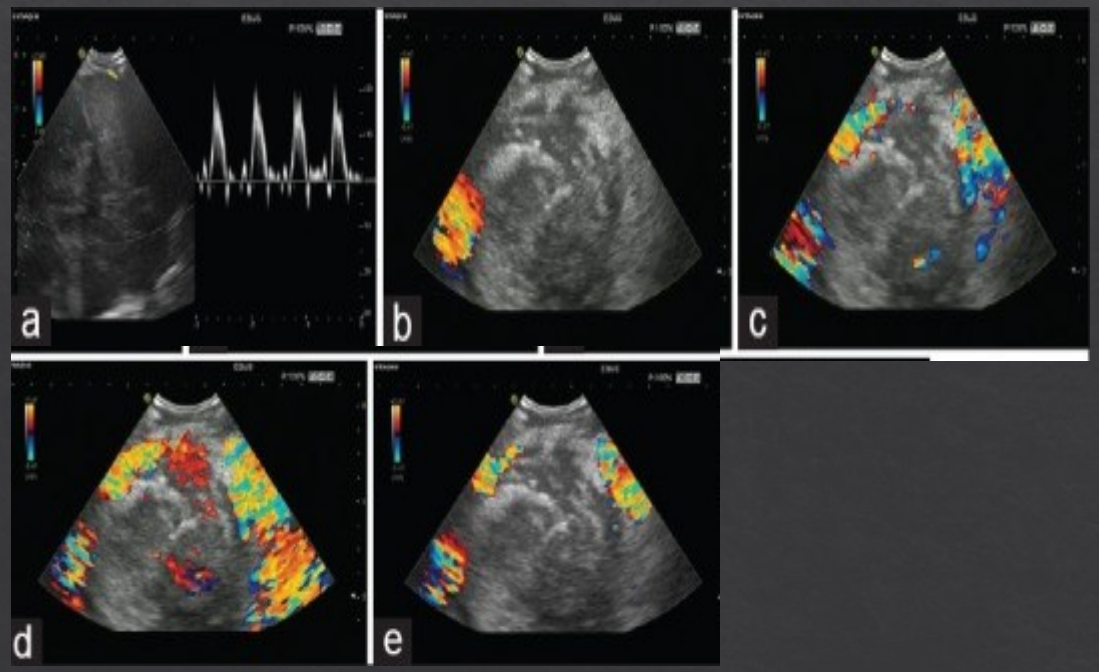


What does the future hold for EBUS technology?

- Pulmonary Hypertension
- 3D-4D technology in EBUS
- High resolution- ultrathin convex EBUS probes

What does the future hold for EBUS technology?

- Pulmonary Hypertension
- 3D-4D technology in EBUS
- High resolution- ultrathin convex EBUS probes
- Tissue Harmonic Contrast Imaging (HCI)
  - Comparing nectrotic vs normal perfusion
  - Determination of the correct sampling site



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- Pulmonary Hypertension
- 3D-4D technology in EBUS
- High resolution- ultrathin convex EBUS probes
- Tissue Harmonic Contrast Imaging (HCI)
- AI assisted EBUS-TBNA and robotic bronchoscopy
- Disposable/Single Use EBUS

Thank you for listening...

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