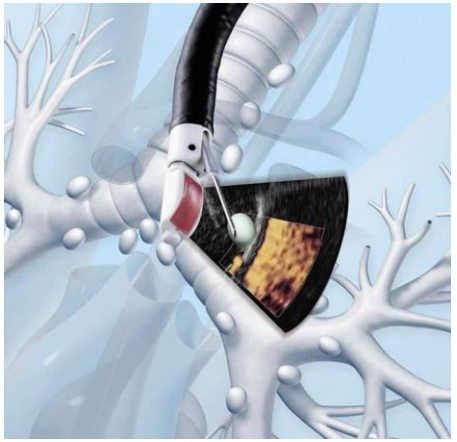
Νεότερα δεδομένα στη διάγνωση, σταδιοποίηση και θεραπεία του καρκίνου πνεύμονα

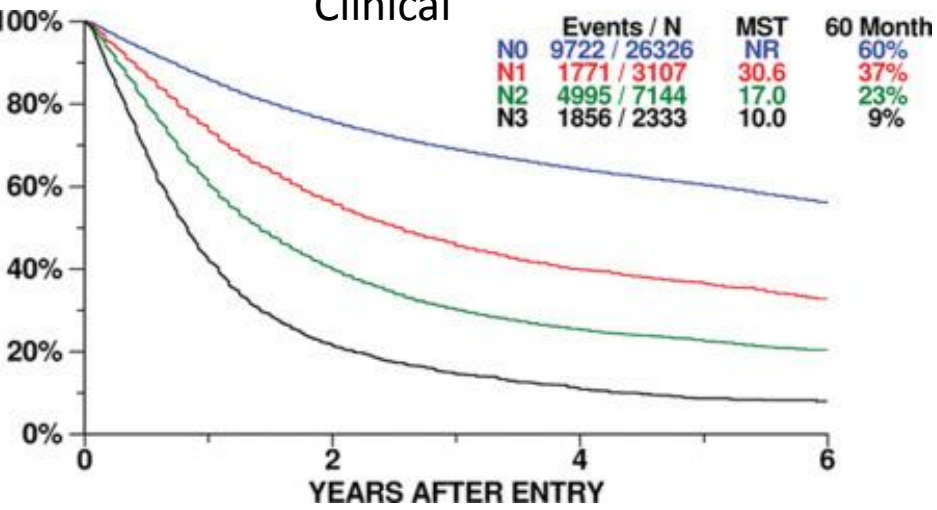
Θωρακική υπερηχογραφία (EBUS, b EUS) και σταδιοποίηση του μεσοθωρακίου

Ελένη Καρέτση, MD, PhD
Επιμ. Α΄ Πνευμονολογικής Κλινικής
Πανεπιστημίου Θεσσαλίας

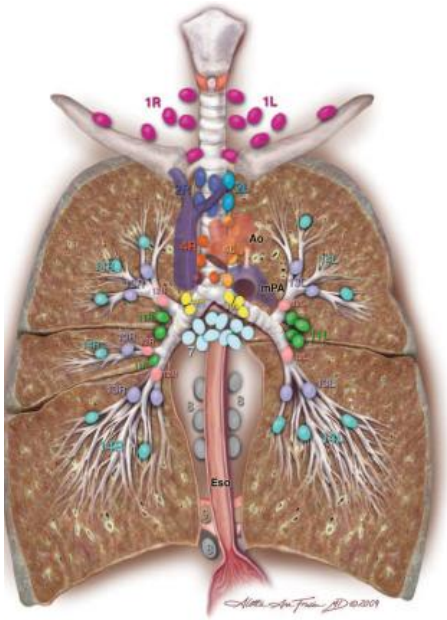


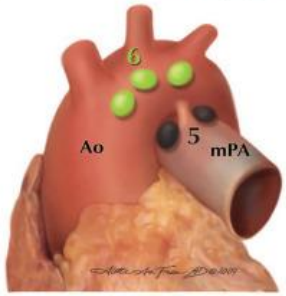
International Association for the Study of Lung Cancer

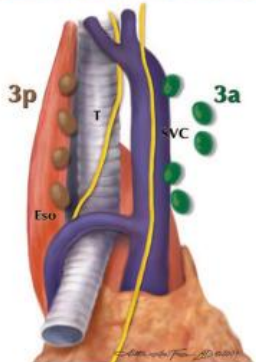
Clinical



Asamura, J Thorac Oncol 2015







Supraclavicular zone
1 Low cervical, supraclavicular, and sternal notch nodes

SUPERIOR MEDIASTINAL NODES

Upper zone
2R Upper Paratracheal (right)
2L Upper Paratracheal (left)
3a Prevascular
3p Retrotracheal
4R Lower Paratracheal (right)
4L Lower Paratracheal (left)

AORTIC NODES

AP zone
5 Subaortic
6 Para-aortic (ascending aorta or phrenic)

INFERIOR MEDIASTINAL NODES

Subcarinal zone
7 Subcarinal

Lower zone
8 Paraesophageal (below carina)
9 Pulmonary ligament

N1 NODES

Hilar/Interlobar zone
10 Hilar
11 Interlobar

Peripheral zone
12 Lobar
13 Segmental
14 Subsegmental

8th edition Lung Cancer Stage Classification

T/M	Label	N0	N1	N2	N3
T1	T1a *≤1*	IA1	IIB	IIIA	IIIB
	T1b *>1-2*	IA2	IIB	IIIA	IIIB
	T1c *>2-3*	IA3	IIB	IIIA	IIIB
T2	T2a *Cent, Visc Pl*	IB	IIB	IIIA	IIIB
	T2a *>3-4*	IB	IIB	IIIA	IIIB
	T2b *>4-5*	IIA	IIB	IIIA	IIIB
T3	T3 *>5-7*	IIB	IIIA	IIIB	IIIC
	T3 *Inv*	IIB	IIIA	IIIB	IIIC
	T3 *Satell*	IIB	IIIA	IIIB	IIIC
T4	T4 *>7*	IIIA	IIIA	IIIB	IIIC
	T4 *Inv*	IIIA	IIIA	IIIB	IIIC
	T4 *Ipsi Nod*	IIIA	IIIA	IIIB	IIIC
M1	M1a *Contr Nod*	IVA	IVA	IVA	IVA
	M1a *Pl Dissem*	IVA	IVA	IVA	IVA
	M1b *Single*	IVA	IVA	IVA	IVA
	M1c *Multi*	IVB	IVB	IVB	IVB

Chest, 2017

8th edition Lung Cancer Stage Classification

T/M	Label	N0	N1	N2	N3
T1	T1a *≤1*	IA1	IIB	IIIA	IIIB
	T1b *>1-2*	IA2	IIB	IIIA	IIIB
	T1c *>2-3*	IA3	IIB	IIIA	IIIB
T2	T2a *Cent, Visc Pl*	IB	IIB	IIIA	IIIB
	T2a *>3-4*	IB	IIB	IIIA	IIIB
	T2b *>4-5*	IIA	IIB	IIIA	IIIB
T3	T3 *>5-7*	IIB	IIIA	IIIB	IIIC
	T3 *Inv*	IIB	IIIA	IIIB	IIIC
	T3 *Satell*	IIB	IIIA	IIIB	IIIC
T4	T4 *>7*	IIIA	IIIA	IIIB	IIIC
	T4 *Inv*	IIIA	IIIA	IIIB	IIIC
	T4 *Ipsi Nod*	IIIA	IIIA	IIIB	IIIC
M1	M1a *Contr Nod*	IVA	IVA	IVA	IVA
	M1a *Pl Dissem*	IVA	IVA	IVA	IVA
	M1b *Single*	IVA	IVA	IVA	IVA
	M1c *Multi*	IVB	IVB	IVB	IVB

Chest, 2017

8th edition Lung Cancer Stage Classification

T/M	Label	N0	N1	N2	N3
T1	T1a *≤1*	IA1	IIB	IIIA	IIIB
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T2	T2a *Cent, Visc Pl*	IB	IIB	IIIA	IIIB
	T2a *>3-4*	IB	IIB	IIIA	IIIB
	T2b *>4-5*	IIA	IIB	IIIA	IIIB
T3	T3 *>5-7*	IIB	IIIA	IIIB	IIIC
	T3 *Inv*	IIB	IIIA	IIIB	IIIC
	T3 *Satell*	IIB	IIIA	IIIB	IIIC
T4	T4 *>7*	IIIA	IIIA	IIIB	IIIC
	T4 *Inv*	IIIA	IIIA	IIIB	IIIC
	T4 *Ipsi Nod*	IIIA	IIIA	IIIB	IIIC
M1	M1a *Contr Nod*	IVA	IVA	IVA	IVA
	M1a *Pl Dissem*	IVA	IVA	IVA	IVA
	M1b *Single*	IVA	IVA	IVA	IVA
	M1c *Multi*	IVB	IVB	IVB	IVB

Chest, 2017

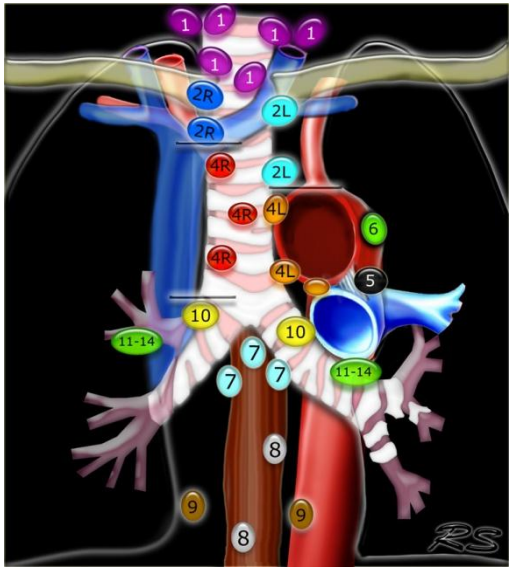
Types of Staging Assessments

Prefix	Name	Definition
c	Clinical	Before initiation of any treatment, using any and all information available (eg, including mediastinoscopy)
p	Pathologic	After resection, made on the basis of pathologic assessment
y	Restaging	After part or all of the treatment has been given
r	Recurrence	Stage at time of a recurrence
a	Autopsy	Stage as determined by autopsy

Goldstraw P et al. J Thorac Oncol 2016; 11: 39-51.

MEDIASTINAL LYMPH NODE STAGING

- Several techniques are available and their use depends on local availability and local expertise



- These techniques include:

  (i) imaging techniques (CT, PET-CT)

  (ii) endoscopic techniques (EBUS, EUS, EUB-B)

  (iii) surgical techniques (mediastinoscopy VATS, thoracotomy)

Mediastinoscopy vs Endosonography for Mediastinal Nodal Staging of Lung Cancer

A Randomized Trial

ASTER study

241 patients

- enlarged or FDG-avid mediastinal lymph nodes
- enlarged or FDG-avid hilar lymph nodes
- central lung lesion

Surgical group

118 patients (79% sensitivity, 86% NPV)

Endosonography group

123 patients 85% sensitivity –EBUS/EUS

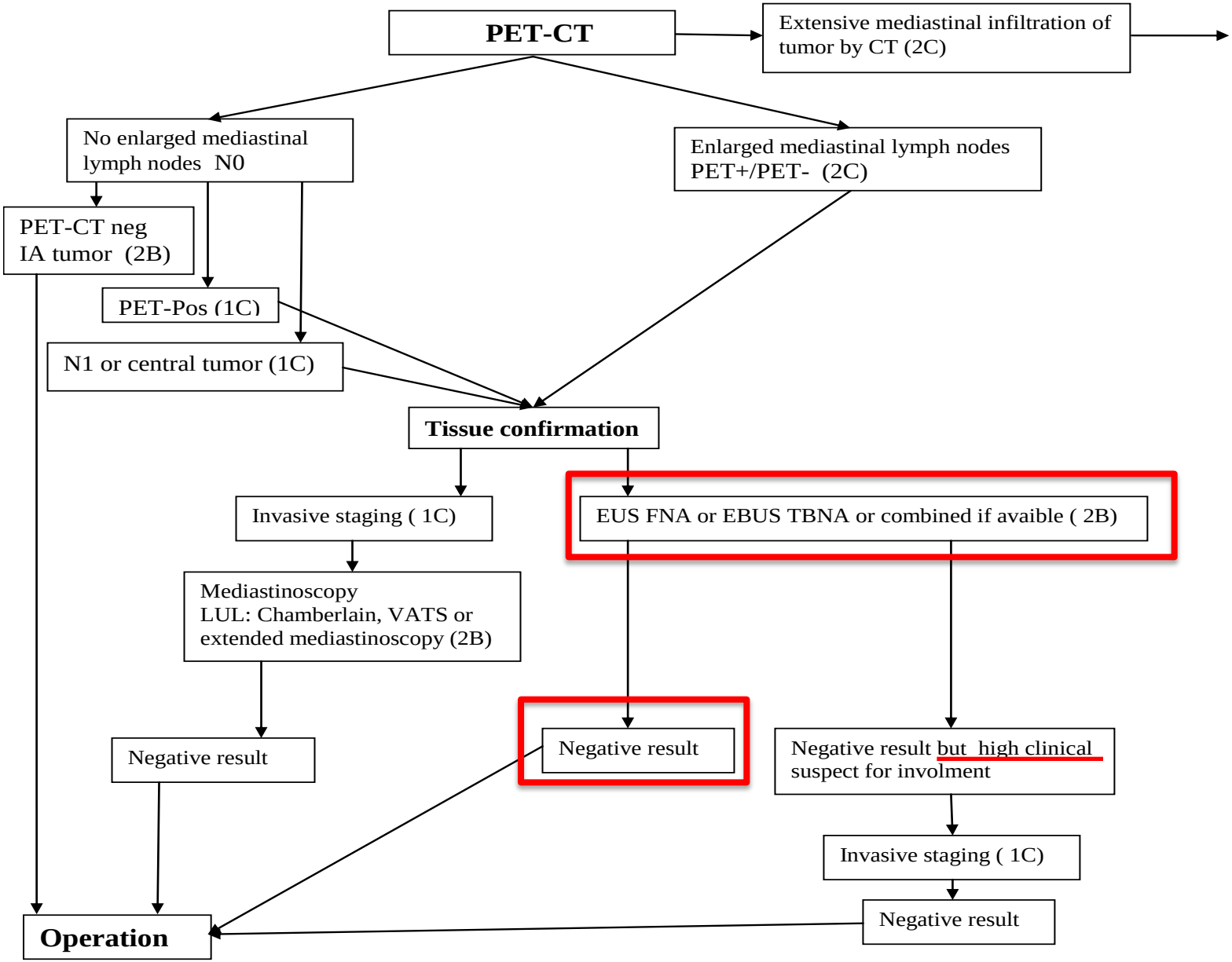
94% sensitivity when followed by surgical staging, 93%NPV

However, to detect one case of single level N2 disease, 11 patients need to undergo additional surgical staging

Endosonography and surgical staging versus immediate surgical staging reduced the percentage of unnecessary thoracotomies from 18% to 7%.

Annema JT, JAMA 2010

Staging of the mediastinum
(no distal metastases)



Chest 2013; 13 (5 supl)

Το μέλλον θα (απο)δείξει….

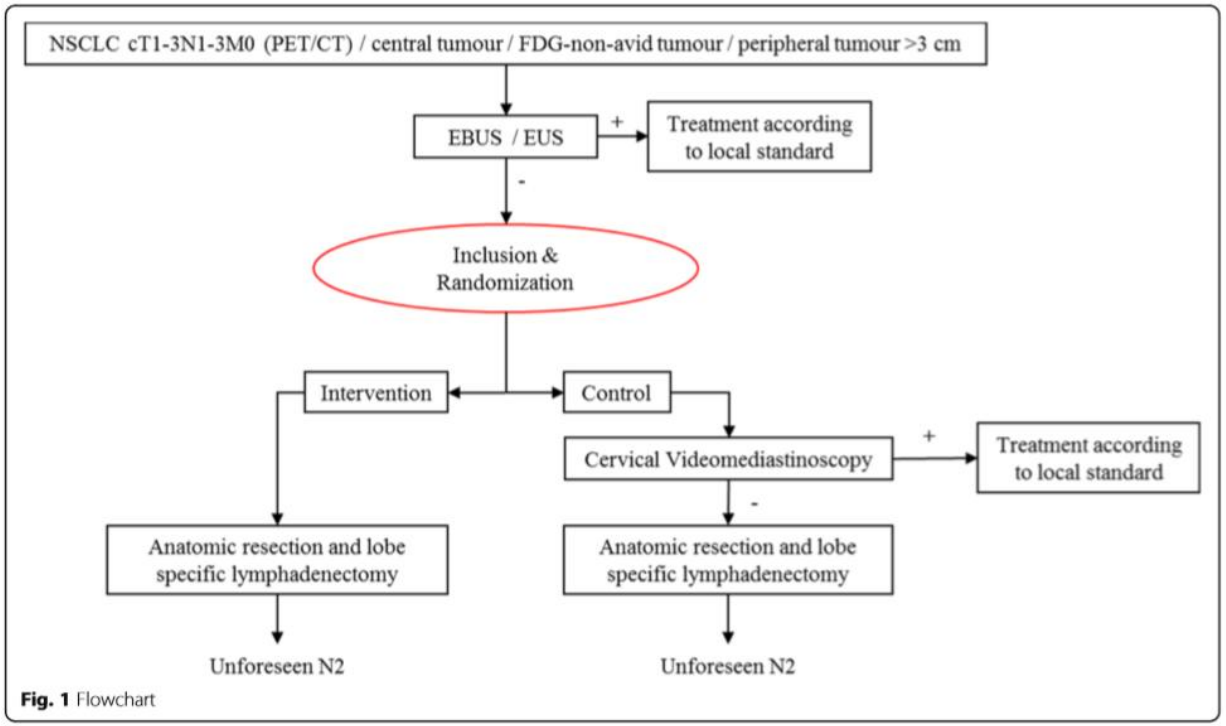


Fig. 1 Flowchart

Main objective: to compare the **cost-effectiveness** and **cost-utility of mediastinal staging strategies** including and excluding mediastinoscopy, provided that non-inferiority of excluding mediastinoscopy regarding unforeseen N2 disease can be demonstrated.

Bousema, BMC 2018

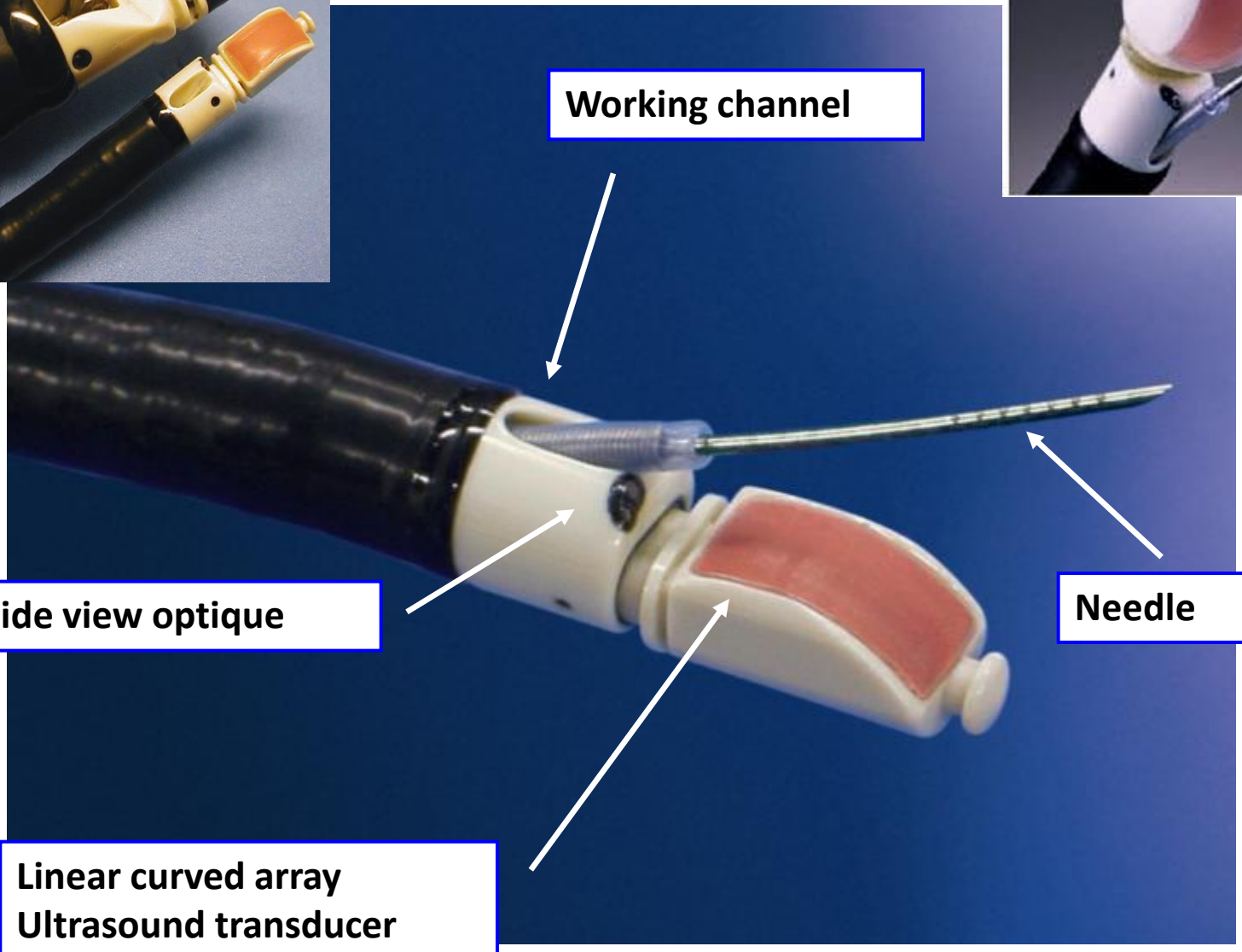
CHEST Supplement
DIAGNOSIS AND MANAGEMENT OF LUNG CANCER, 3RD ED: ACCP GUIDELINES

Methods for Staging Non-small Cell Lung Cancer

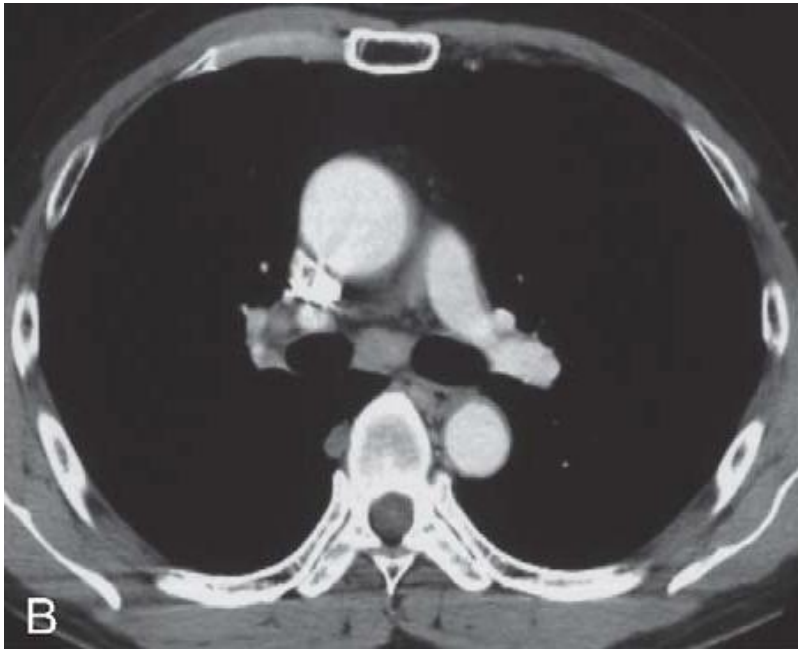
Diagnosis and Management of Lung Cancer, 3rd ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines

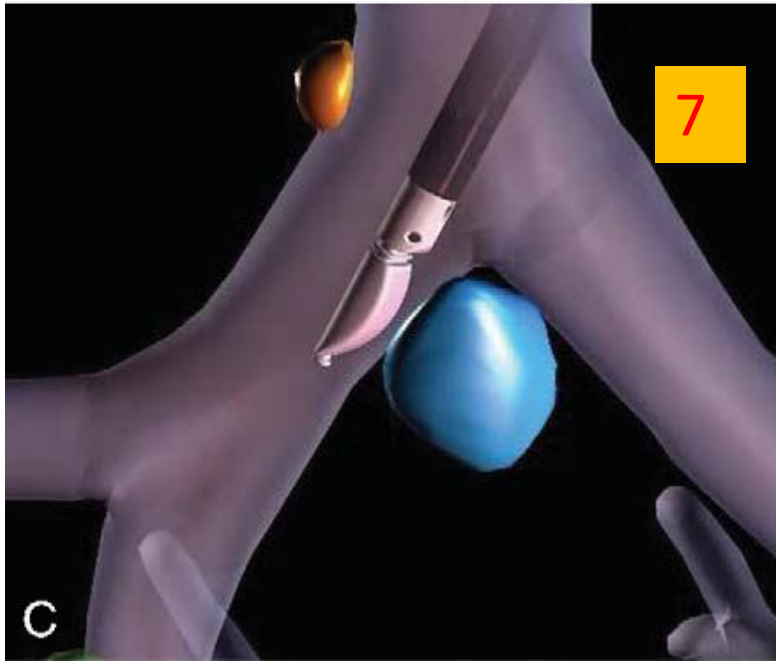
Method	N	Sensitivity (%)	Specificity (%)	NPV
CT	7368	55	81	83
PET-CT	2014	62	90	90
MES	10648	81	100	91
EUS	2756	89	100	86
EBUS	2347	89	100	91
EBUS/EUS	811	91	100	96

Silvestri, CHEST 2013


Working channel
30° side view optique
Needle
Linear curved array
Ultrasound transducer


A

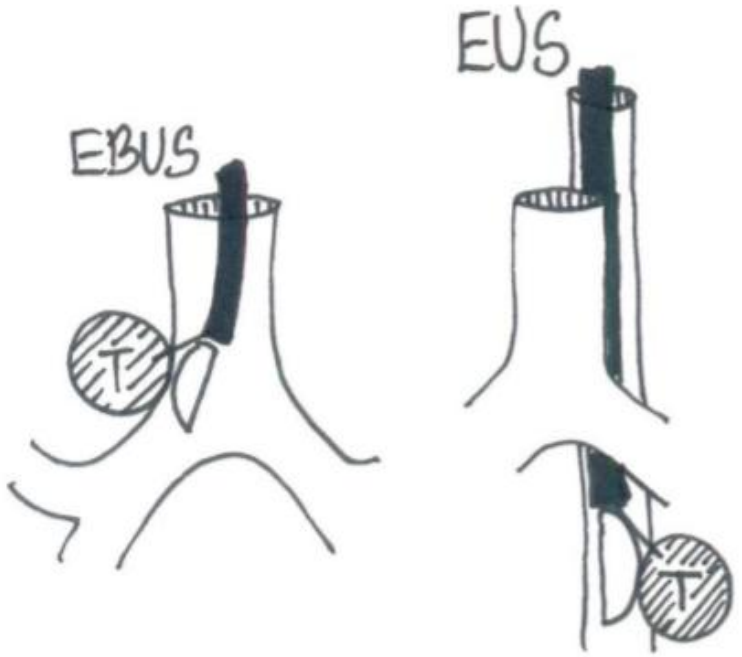

B


7
C


ID:1/30-5-1
2
30/05/2012
08:11:54
TX: 60%
±12
10
MHz
3.3
cm

Endosonographic nodal staging

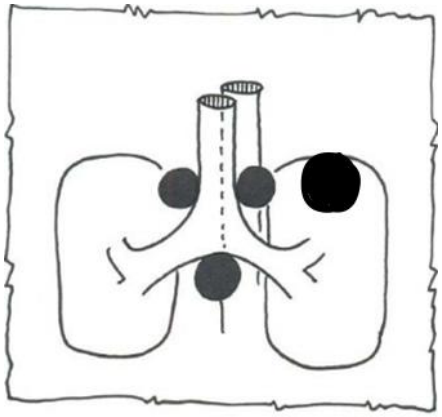
- 1991: EUS-FNA
- 2003: Endobronchial ultrasound (EBUS)
- 2007: Esophageal ultrasound (EUS) with EBUS scope (EUS-B)



This combined EBUS scope approach can be performed in one endoscopy session by a single operator which facilitates staging.

Herth FJ, Chest 2010
Hwangbo B, Chest 2010

Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)

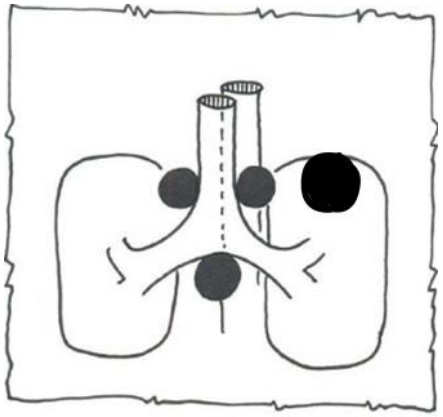


For mediastinal nodal staging in patients with suspected or proven NSCLC with abnormal mediastinal and/or hilar nodes at CT and/or PET, **endosonography** is recommended over surgical staging as the initial procedure

(Recommendation grade A).

Vilmann, Endoscopy 2015

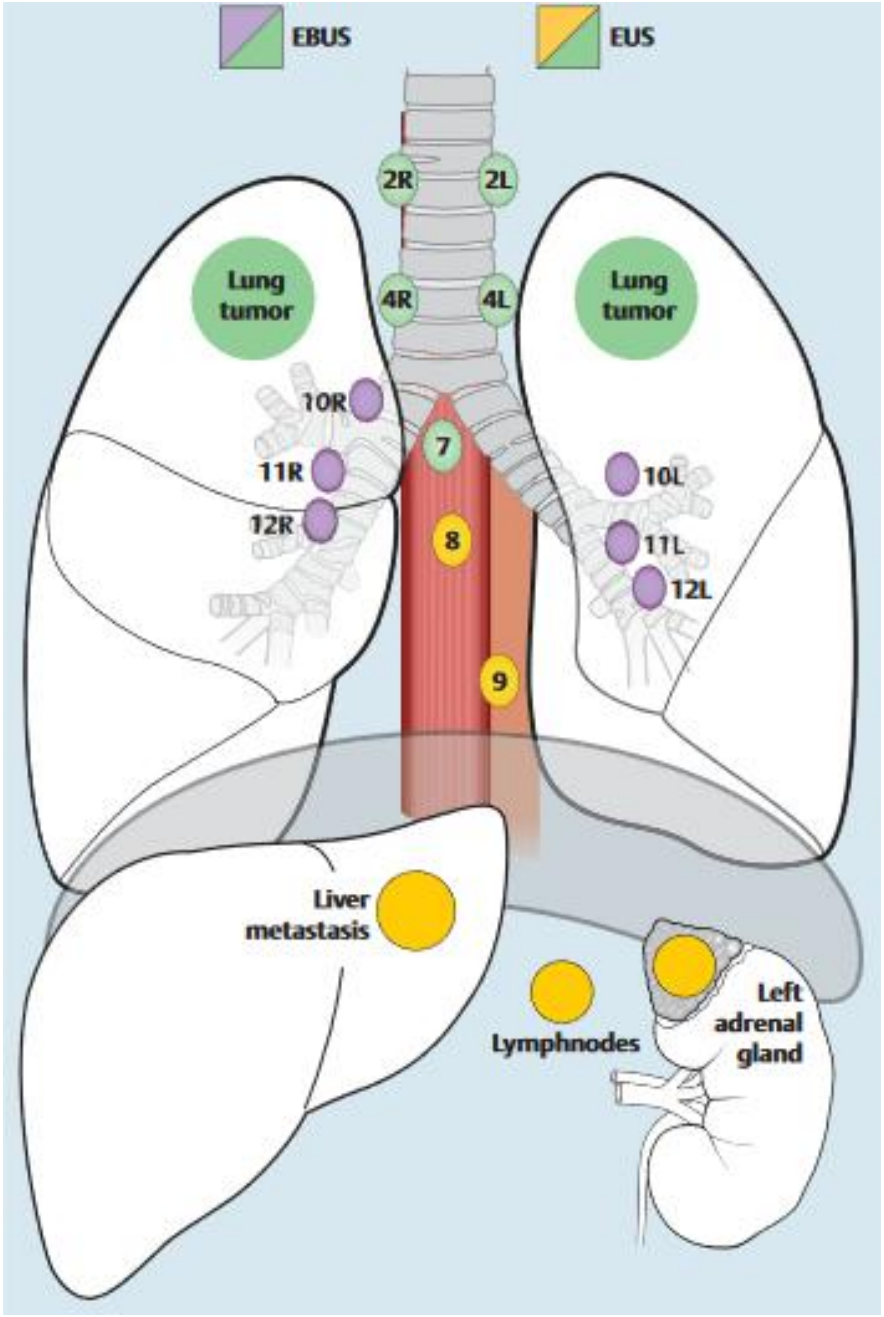
Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)



The **combination of EBUS-TBNA and EUS-FNA or EBUS (EUS-B-FNA)** scope is preferred over either test alone (Recommendation grade C).

If the combination of EBUS and EUS-(B) is not available, we suggest that **EBUS alone** is acceptable (Recommendation grade C).

Vilmann, Endoscopy 2015



EBUS alone:

- 10R, 11R
- 10L, 11L

EUS alone

- 5, 8, 9, left adrenal

EBUS/EUS

- 2L, 4L, 7, (2R, 4R)

VATS for 5, 6 LN

Vilmann, Endoscopy International Open 2015

Utility and Safety of Endoscopic Ultrasound With Bronchoscope-Guided Fine-Needle Aspiration in Mediastinal Lymph Node Sampling: Systematic Review and Meta-Analysis

- 10 studies
- 1,080 subjects with mediastinal lymphadenopathy
- The same echobronchoscope

Table 6. Summary Characteristics of EBUS-TBNA and the Combined Procedure (EBUS-TBNA and EUS-B-FNA)

Characteristic	EBUS-TBNA Alone	Combined Procedure
Sensitivity (%)	80.3 (73.7–85.9)	91 (85.8–94.8)
Specificity (%)	100 (98.7–100)	100 (98.7–100)
Positive likelihood ratio	74.9 (18.9–296.8)	88.9 (22.5–351.2)
Negative likelihood ratio	0.21 (0.09–0.49)	0.095 (0.03–0.28)
Diagnostic odds ratio	388.5 (90.9–1659.9)	1323.5 (278.3–6293.6)

All values are pooled values with 95% confidence intervals in parentheses.
EBUS-TBNA = endobronchial ultrasound-guided transbronchial needle aspiration
EUS-B-FNA = endoscopic ultrasound with bronchoscope-guided fine-needle aspiration

The additional diagnostic gain of EUS-B-FNA over EBUS-TBNA was 7.6% in the diagnosis of mediastinal adenopathy.

No serious complication of EUS-B-FNA procedure was reported.

Dhooria S, Respir Care 2015

Utility and Safety of Endoscopic Ultrasound With Bronchoscope-Guided Fine-Needle Aspiration in Mediastinal Lymph Node Sampling: Systematic Review and Meta-Analysis

Table 7. Individual Studies Reporting the Reasons for Performing EUS-B-FNA

First Author	Reasons for Performing EUS-B-FNA
Hwangbo[11]	Inaccessible by EBUS-TBNA, technical difficulty of EBUS-TBNA, intolerance of bronchoscopy due to cough or dyspnea, brain metastasis with mass effect, medical condition precluding bronchoscopy (ischemic heart disease)
Hwangbo[24]	Inaccessible by EBUS-TBNA, well visualized areas by EUS-B-FNA, technical difficulty of EBUS-TBNA
Herth[25]	Inaccessible by EBUS-TBNA
Szulobowski[26]	Inaccessible by EBUS-TBNA, patient comfort
Bugalho[27]	Inaccessible by EBUS-TBNA
Araya[28]	Inaccessible by EBUS-TBNA, poor performance status, poor respiratory condition
Oki[29]	Not reported
Szlubowski[30]	Not reported
Lee[31]	Inaccessible by EBUS-TBNA
Oki[32]	Inaccessible by EBUS-TBNA, technical difficulty of EBUS-TBNA

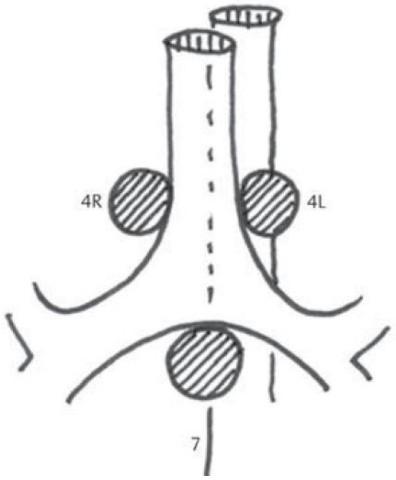
- LN: 9, 8, 7, 4L, 5
- No cough
- No cartilage to hit during FNA
- Preferred by patients?
- More time for ROSE

Dhooria S, Respir Care 2015

Από ποιους λεμφαδένες θα πάρω υλικό;

- complete sampling (all visible lymph nodes)
- systematic sampling (each nodal station)
- selective sampling (‘hit-and-run’ suspicious nodes only)
- limited or no sampling

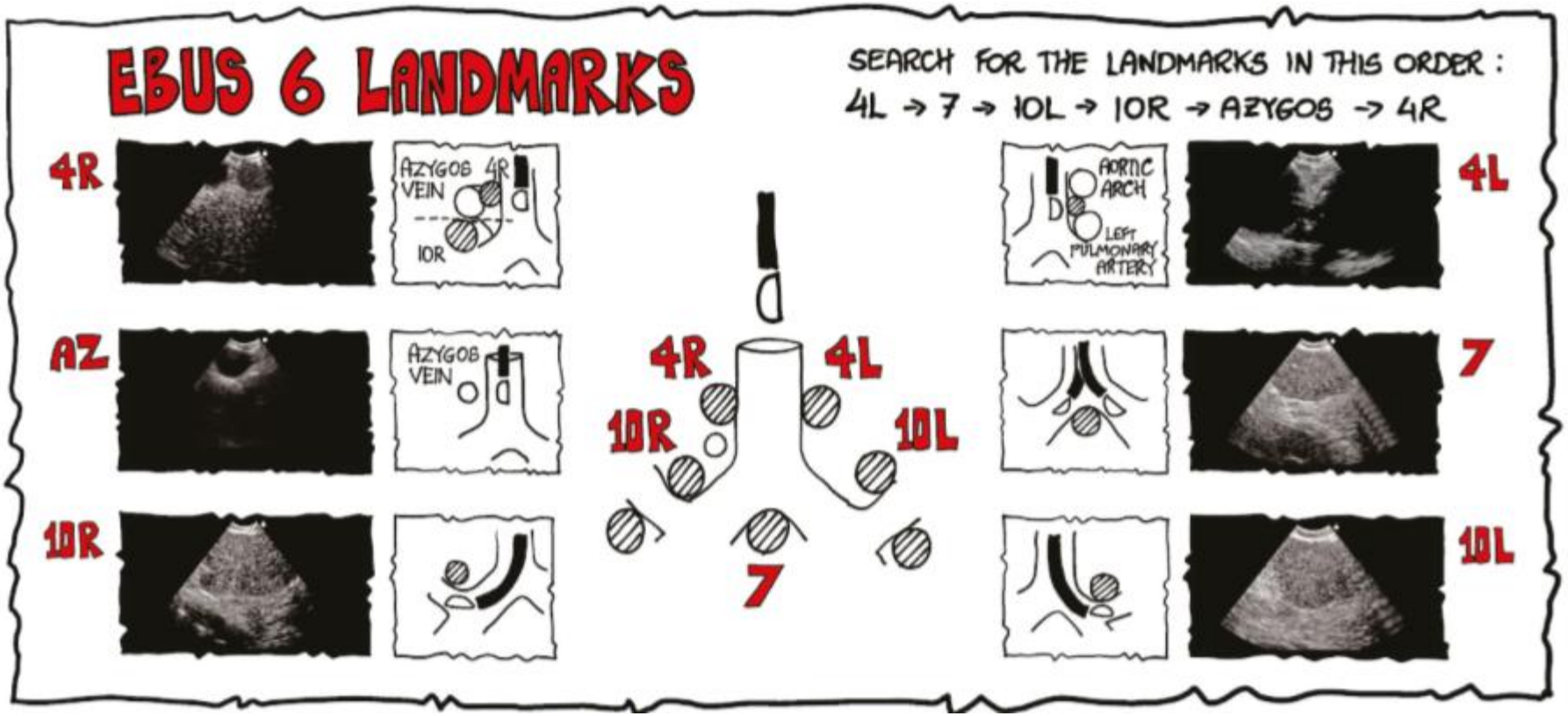
Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)



A complete assessment of mediastinal and hilar nodal stations, and sampling **of at least three different mediastinal nodal stations** (4R, 4L, 7) is suggested in patients with NSCLC and an abnormal mediastinum by CT or CT-PET (Recommendation grade D).

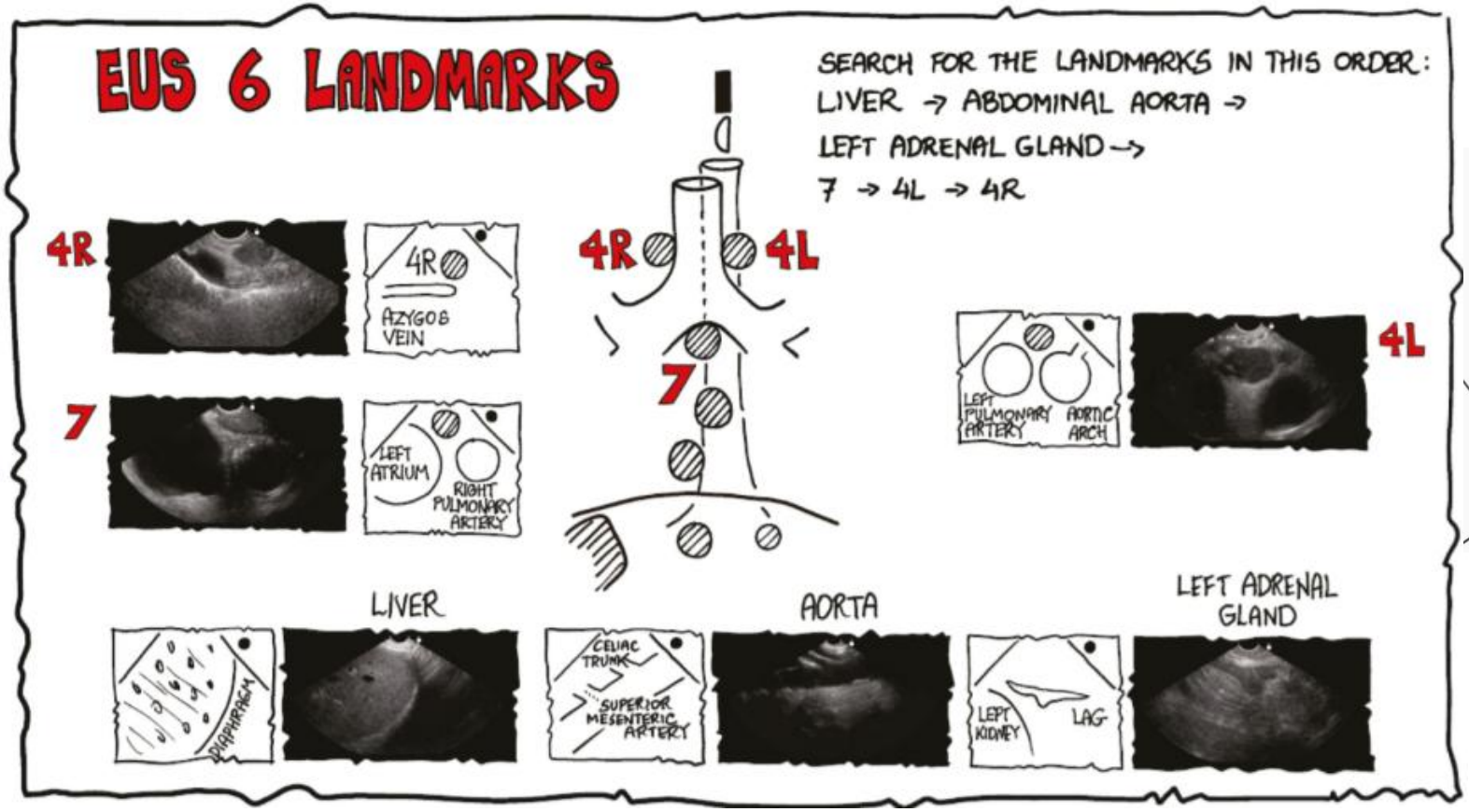
Vilmann, Endoscopy 2015

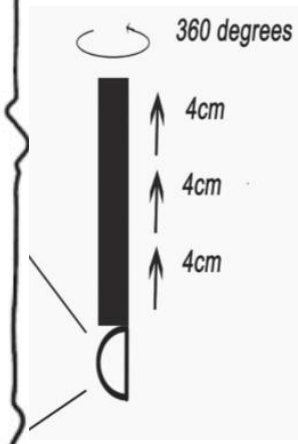
Συστηματικός έλεγχος των λεμφαδένων



Paul Frost Clementsen 2015

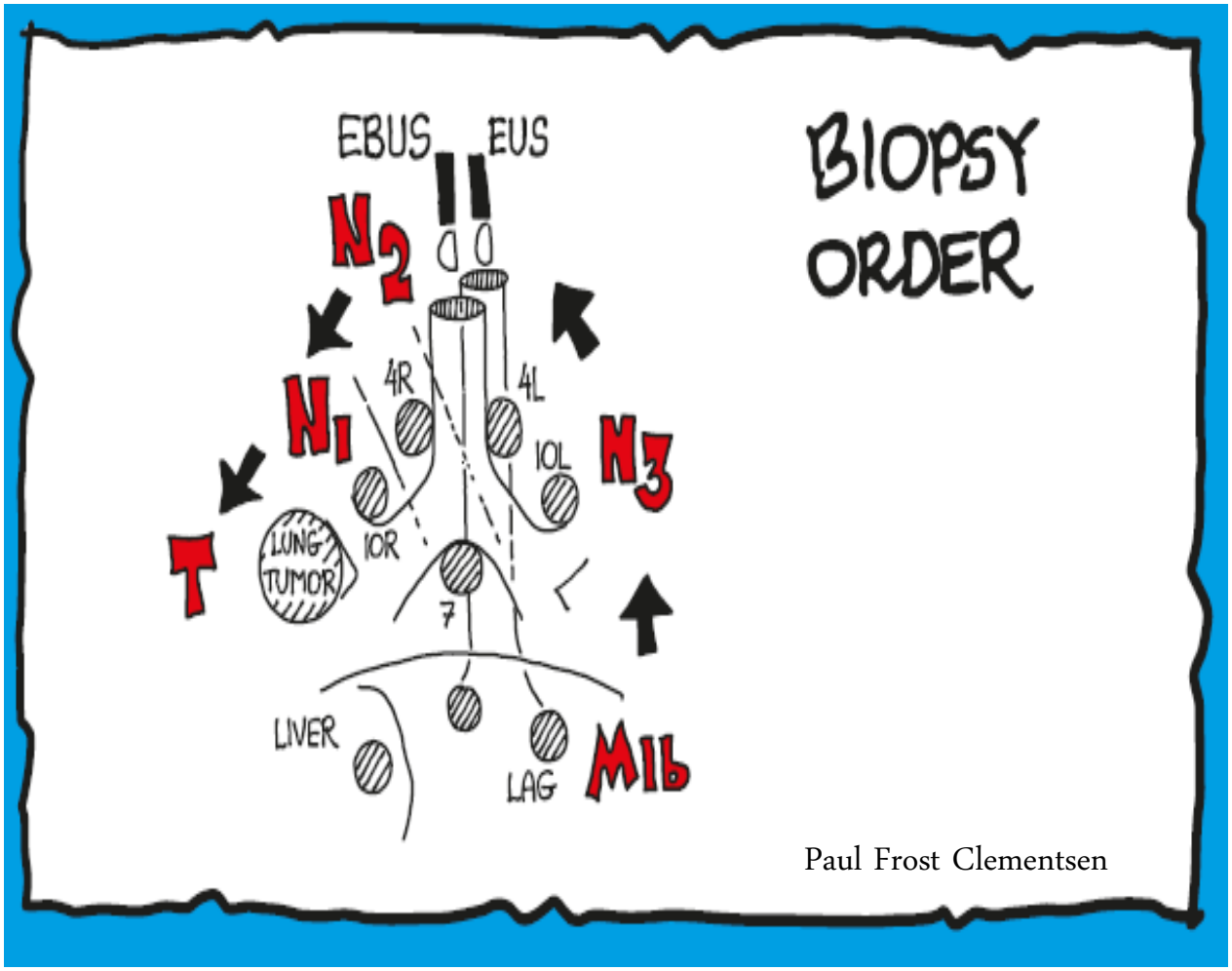
Συστηματικός έλεγχος των λεμφαδένων





Paul Frost Clementsen 2015

Sampling order: N3- N2- N1



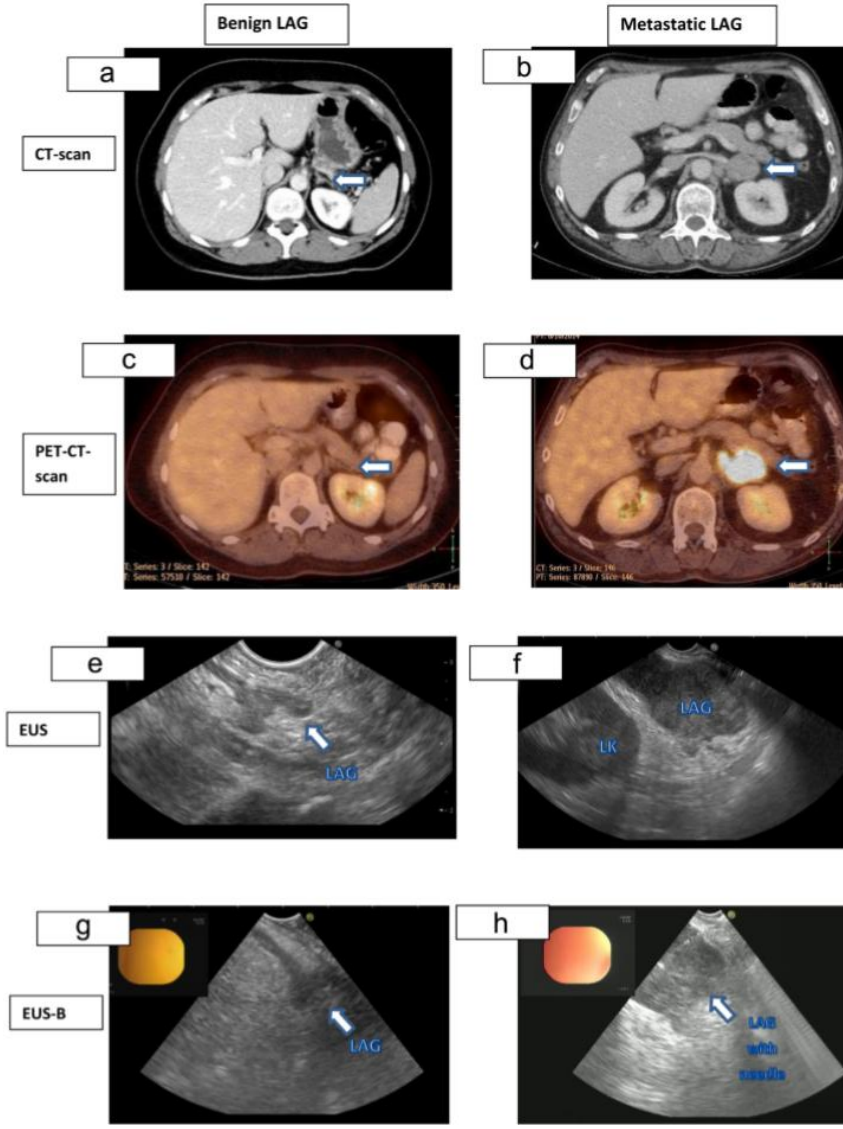
Endosonography for left adrenal gland staging of lung cancer

Prospective trial (44 patients with (suspected) lung cancer and suspected mediastinal and LAG metastases.

Following complete mediastinal staging using the EBUS scope (EBUS+EUS-B), the LAG was evaluated and sampled by both EUS-B (experimental procedure) and conventional EUS (current standard of care).

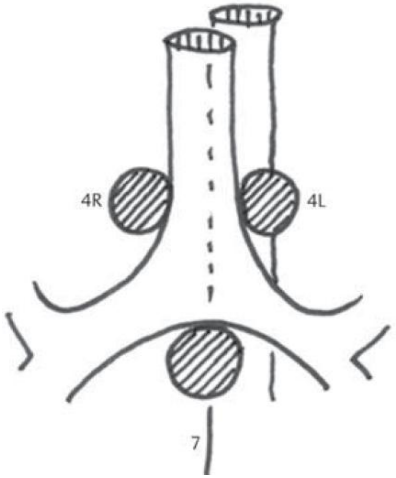
RESULTS:

- The success rate for LAG analysis (visualized, sampled and adequate tissue obtained)
- 89% for EUS-B-FNA
- 93% for EUS-FNA



Crombag, Lung Cancer , 2017

Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)



For optimal endosonographic staging of lung cancer, we suggest that individual endoscopists should be trained in **both EBUS and EUS-B** in order to perform **complete endoscopic staging in one session** (Recommendation grade D).

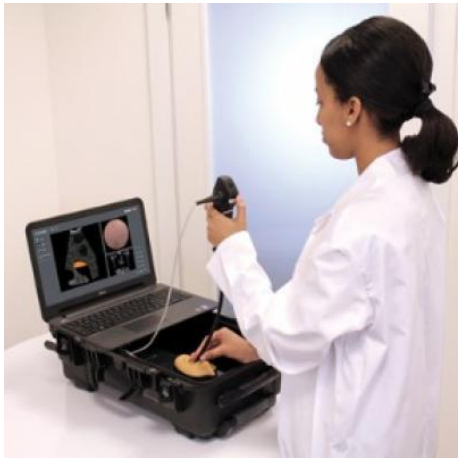
Complete E(B)US staging

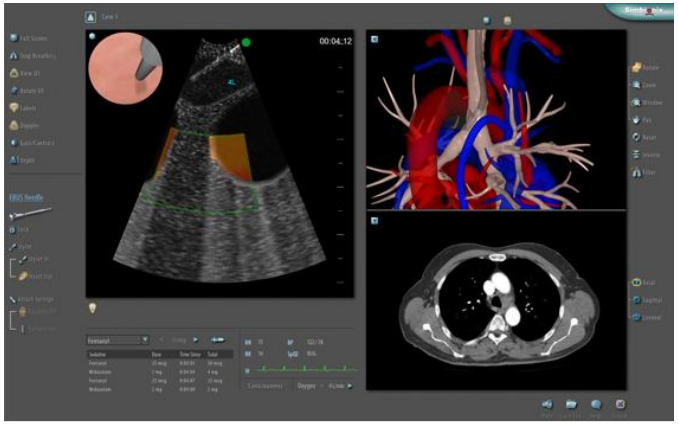
Vilmann, Endoscopy 2015

Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)

ESGE ERS EUROPEAN RESPIRATORY SOCIETY every breath counts

- We suggest that new trainees in endosonography should follow a structured training curriculum consisting of **simulation-based training** followed by **supervised practice** on patients (Recommendation grade D).
- We suggest that competency in EBUS-TBNA and EUS-(B)FNA for staging lung cancer be assessed using available **validated assessment tools** (Recommendation Grade D).

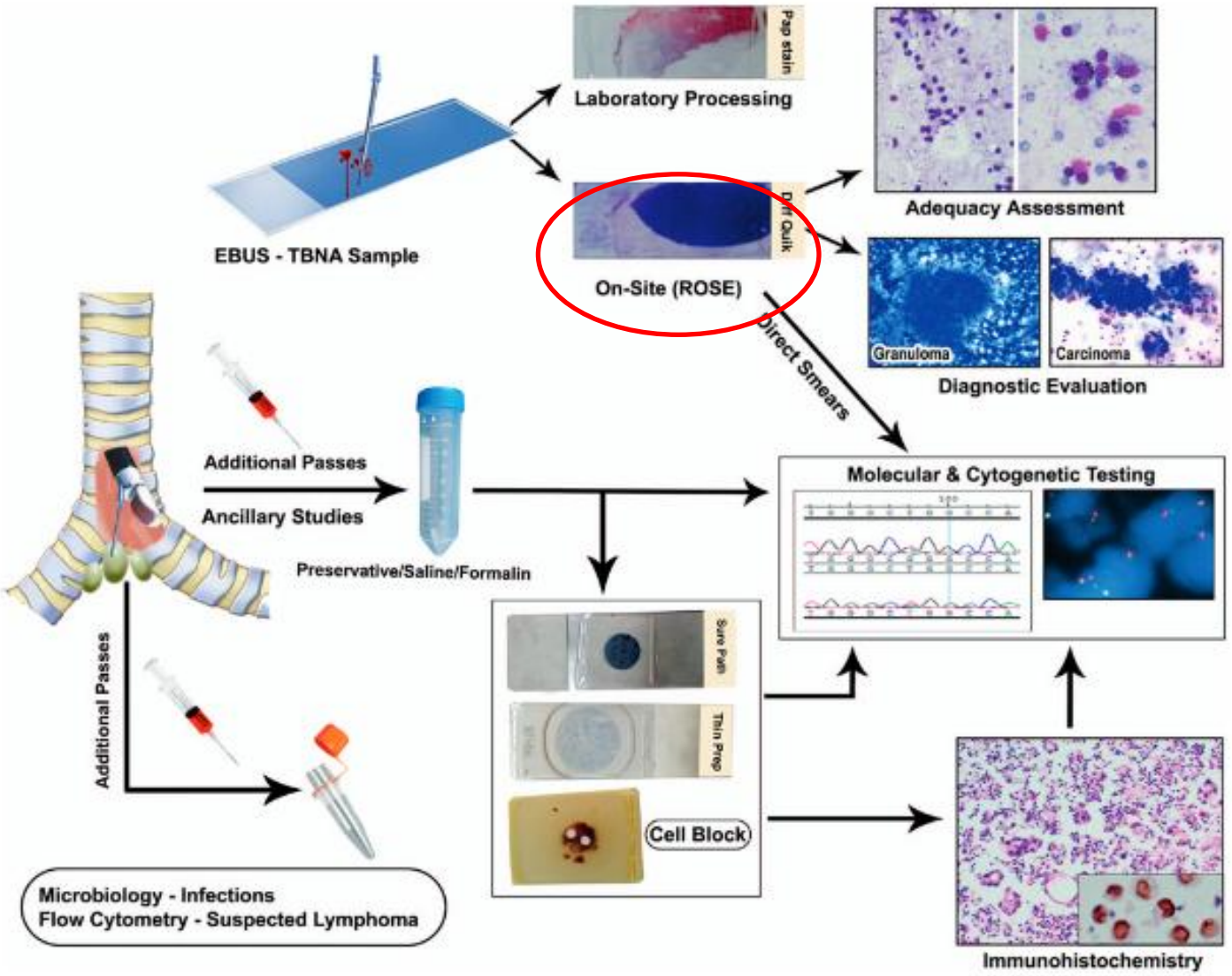




Comprehensive hands-on training of EBUS-TBNA procedure

Vilmann, Endoscopy 2015

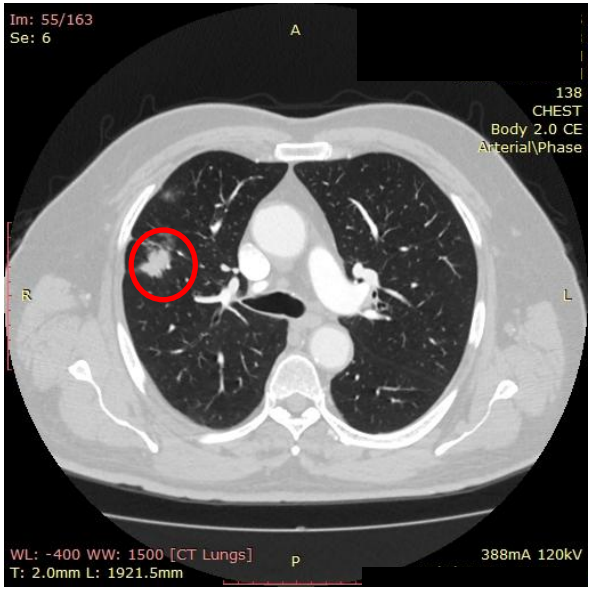
Διαχείριση υλικού (EBUS-TBNA)

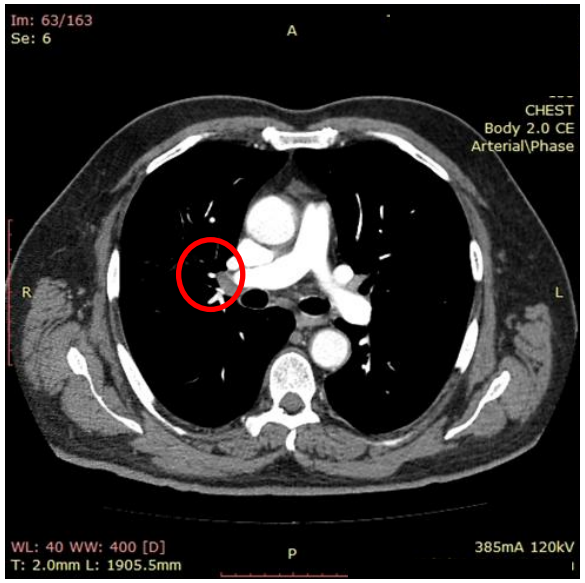


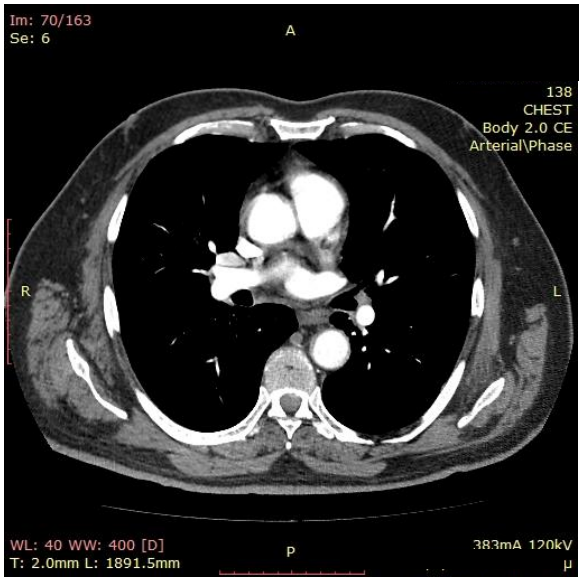
Jain D, Arch Pathol Lab Med 2018

Πιθανό Ca πνεύμονα – σταδιοποίηση μεσοθωρακίου

64 ετών, καπνιστής (60pys), όζος 1,8cm ΔΑΛ – τυχαίο εύρημα

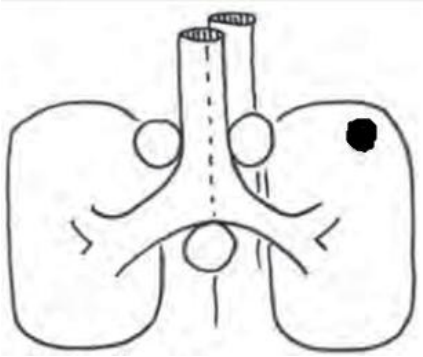






PET-CT όζος ΔΑΛ SUVmax=6.8, Πυλαίοι άμφω SUV=3.2

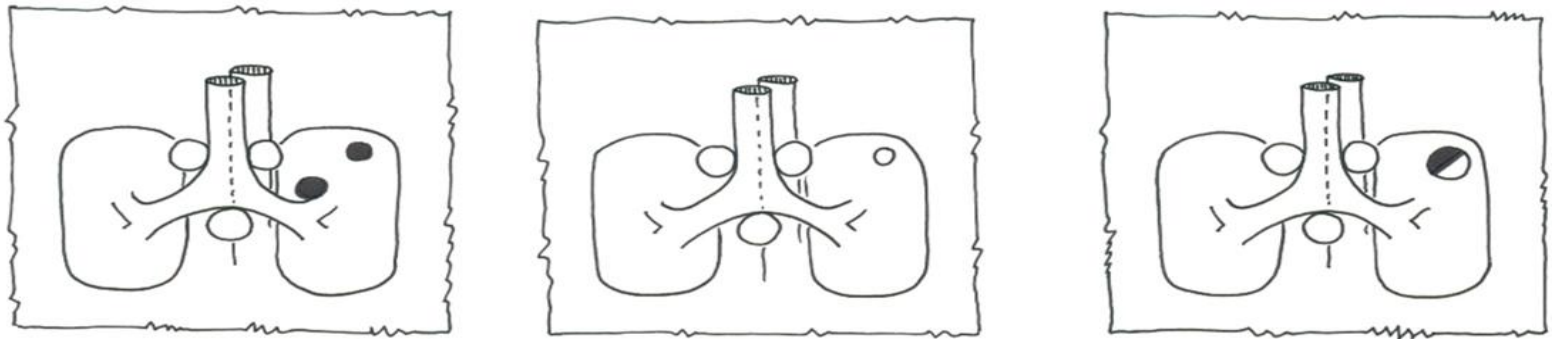
Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)



In patients with suspected or proven <3cm peripheral NSCLC with normal mediastinal and hilar nodes at CT and/or PET, we suggest initiation of therapy without further mediastinal staging (Recommendation grade C).

Vilmann, Endoscopy 2015

Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)



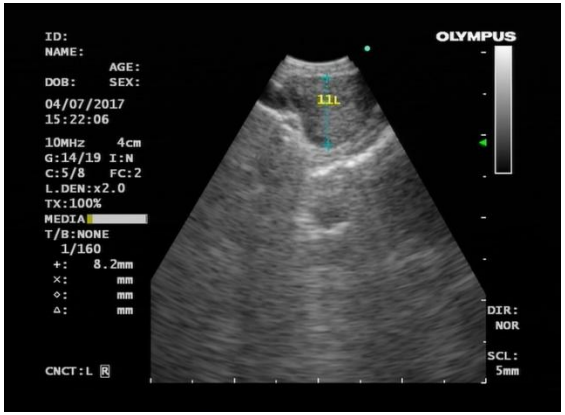
For mediastinal nodal staging in patients with suspected or proven peripheral NSCLC without mediastinal involvement at CT or CTPET, we suggest that **EBUS-TBNA and/or EUS-(B)-FNA** should be performed before therapy, provided that one or more of the following conditions is present:

(i) enlarged or (FDG)-PET-avid ipsilateral hilar nodes

(ii) primary tumor without FDG uptake;

(iii) tumor size ≥3 cm (grade C)

Vilmann, Endoscopy 2015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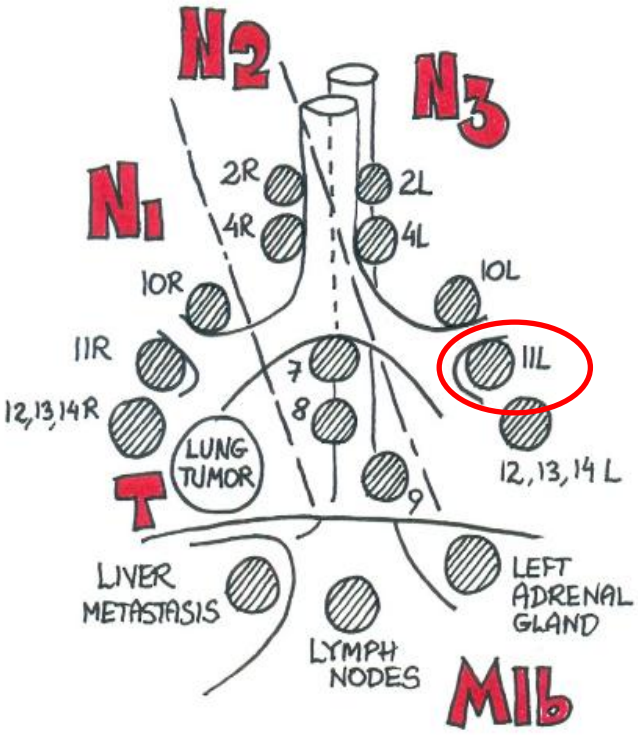
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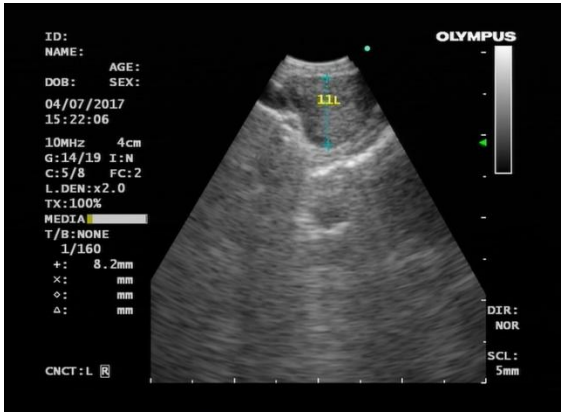
LUNG TUMOR
T
LIVER METASTASIS
LYMPH NODES
LEFT ADRENAL GLAND
M1b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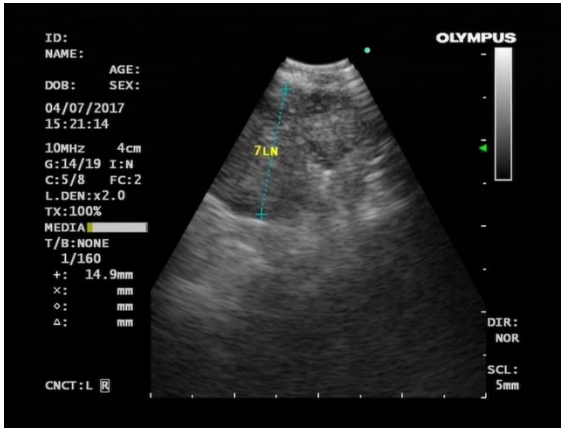
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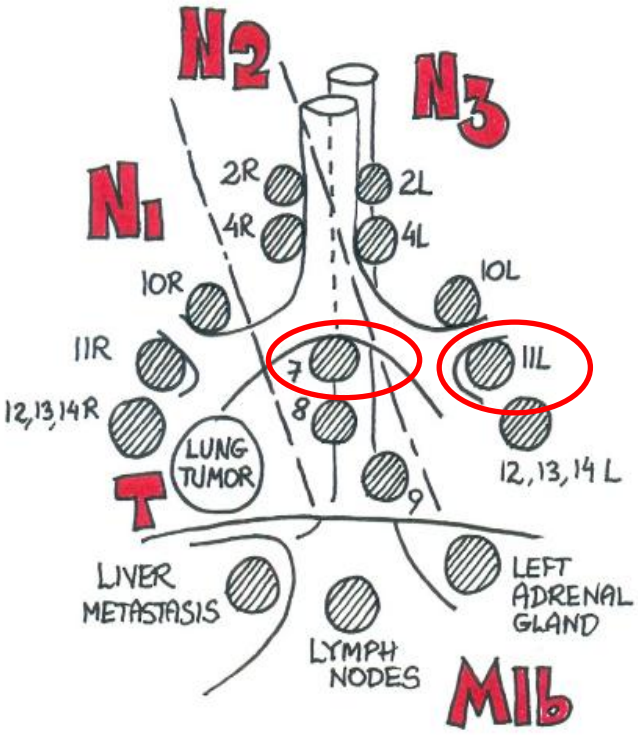
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LYMPH NODES
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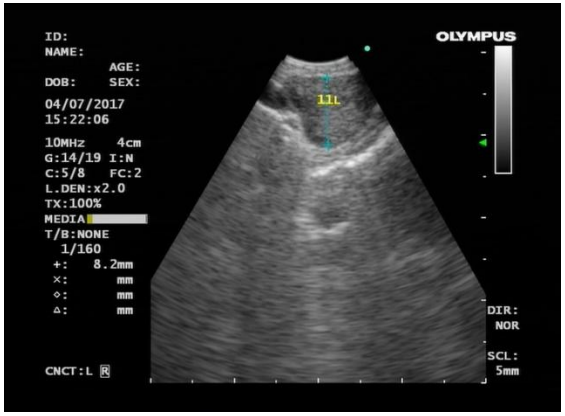
M1b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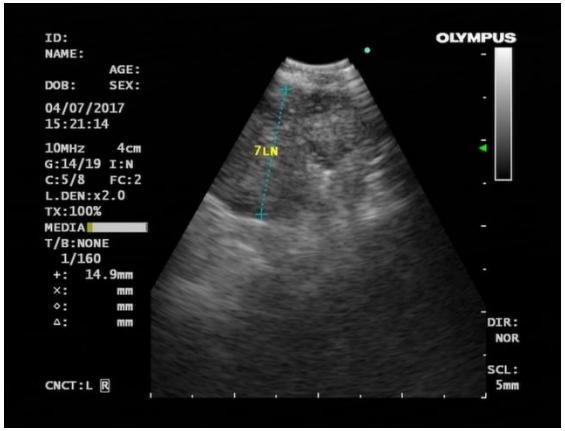
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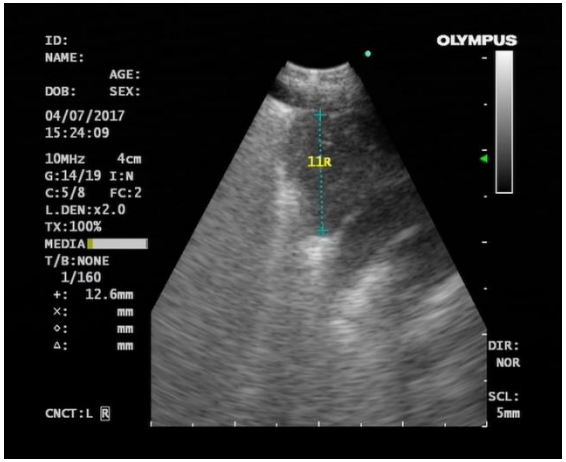
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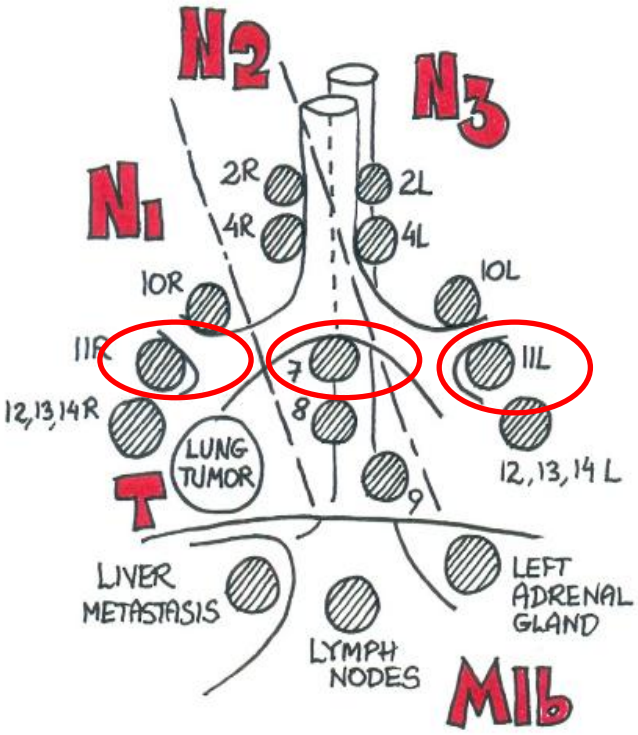
N2
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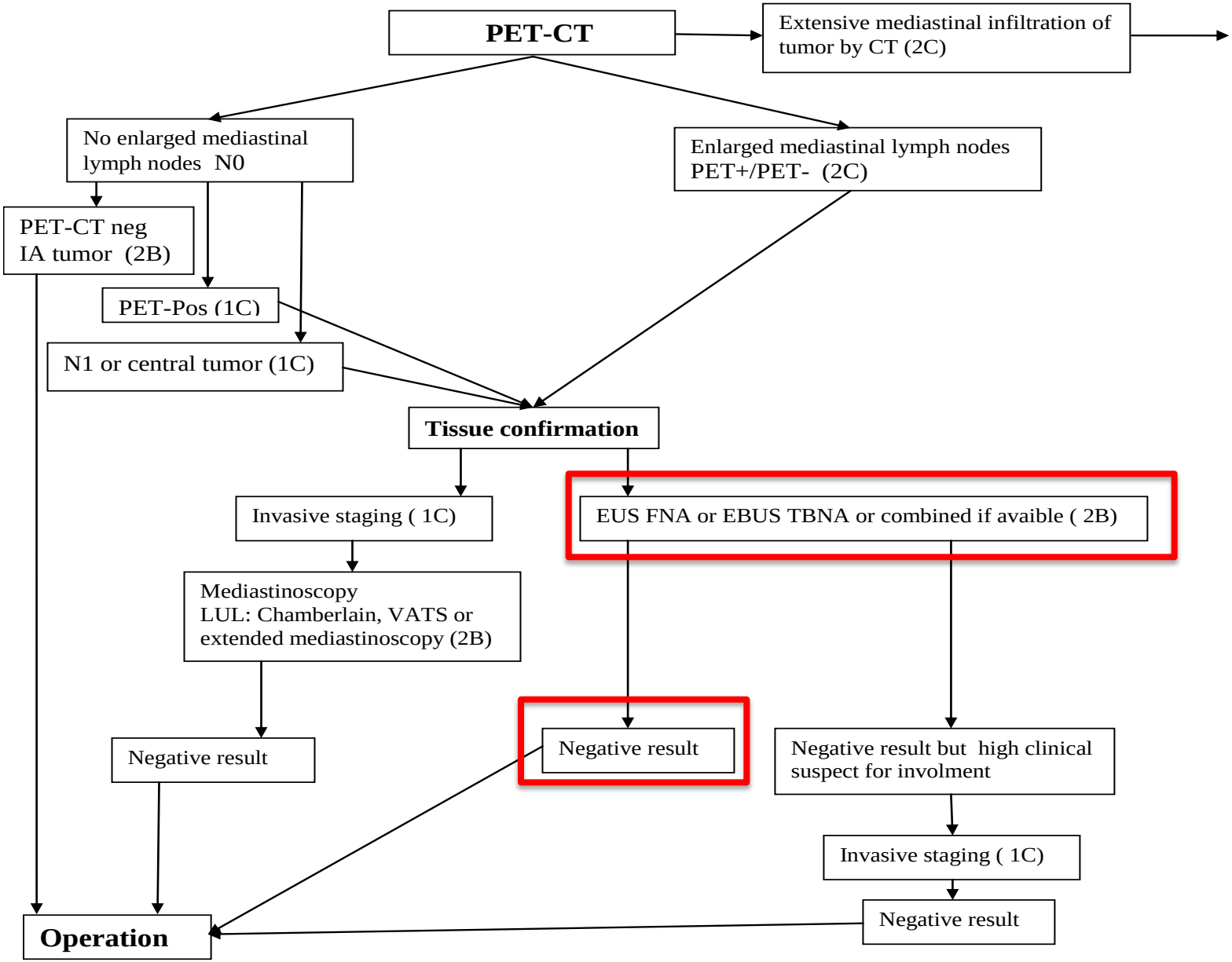
11L
12,13,14R
8
LUNG TUMOR
T
9
12,13,14 L
LIVER METASTASIS
LYMPH NODES
LEFT ADRENAL GLAND
M1b

- Διάγνωση: λεμφαδένες χωρίς στοιχεία κακοήθειας

T/M	Label	N0	N1	N2	N3
T1	T1a ≤1	IA1	IIB	IIIA	IIIB
	T1b >1-2	IA2	IIB	IIIA	IIIB
	T1c >2-3	IA3	IIB	IIIA	IIIB
T2	T2a Cent, Yisc Pl	IB	IIB	IIIA	IIIB
	T2a >3-4	IB	IIB	IIIA	IIIB
	T2b >4-5	IIA	IIB	IIIA	IIIB
T3	T3 >5-7	IIB	IIIA	IIIB	IIIC
	T3 Inv	IIB	IIIA	IIIB	IIIC
	T3 Satell	IIB	IIIA	IIIB	IIIC
T4	T4 >7	IIIA	IIIA	IIIB	IIIC
	T4 Inv	IIIA	IIIA	IIIB	IIIC
	T4 Ipsi Nod	IIIA	IIIA	IIIB	IIIC
M1	M1a Contr Nod	IVA	IVA	IVA	IVA
	M1a Pl Dissem	IVA	IVA	IVA	IVA
	M1b Single	IVA	IVA	IVA	IVA
	M1c Multi	IVB	IVB	IVB	IVB

Lung Cancer Stage Classification 8th edition

Staging of the mediastinum
(no distal metastases)



Chest 2013; 13 (5 supl)

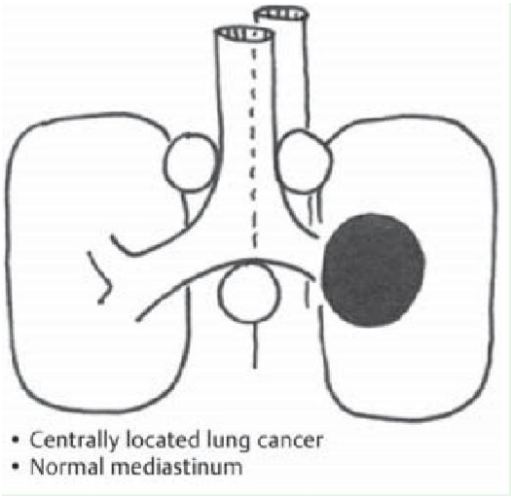
Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)

Centrally located tumor

False-negative rates:

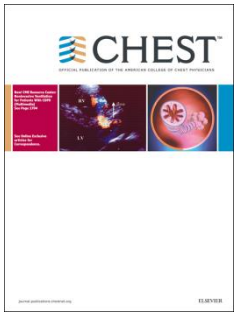
CT 20%–25%

PET 24%–83%



For mediastinal staging in patients with centrally located suspected or proven NSCLC without mediastinal or hilar involvement at CT and/or CT-PET, we suggest performance of EBUS-TBNA, with or without EUS-(B)-FNA, in preference to surgical staging

Vilmann, Endoscopy 2015



Επανασταδιοποίηση NSCLC

Mediastinal re-staging can be performed with:

- imaging

  CT *false negative 33%, false positive 25%*

  PET *false negative 33%, false positive 33%*

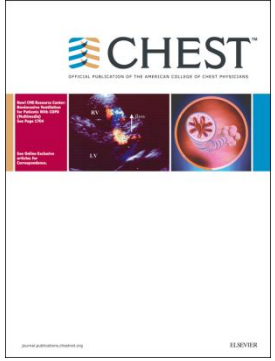
- invasive surgical procedures (mediastinoscopy, thoracotomy)

  false negative of repeat mediastinoscopy 22%

- minimally invasive endosonographic procedures
- or a combination of the above

Muthu, CHEST 2018

Efficacy of endosonographic procedures in mediastinal re-staging of lung cancer after neoadjuvant therapy: A systematic review and diagnostic accuracy meta-analysis



Citations found after initial search (n=285)

Studies excluded after initial review (n=202)
- Gastroenterology articles (n=162)
- Duplicates (n=21)
- Unrelated (n=19)

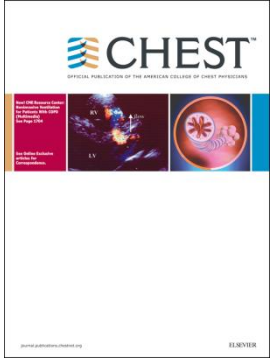
Studies assessed for eligibility (n=83)

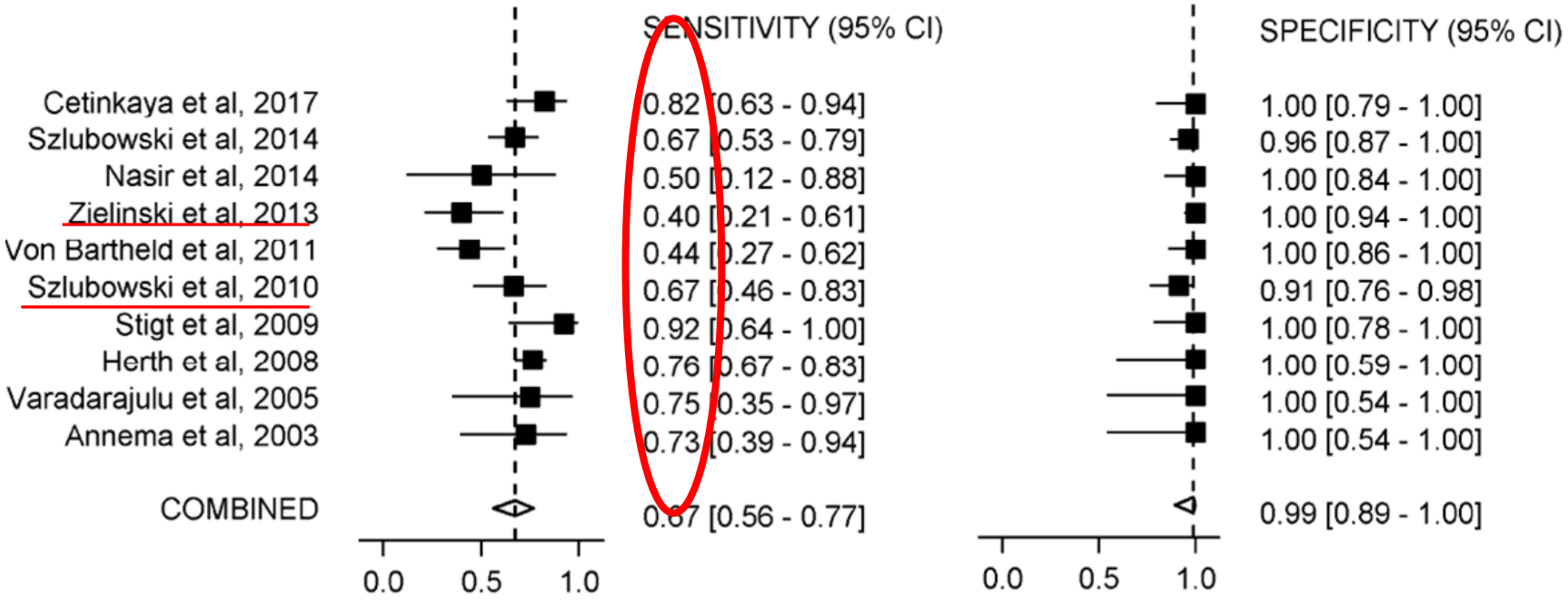
Studies excluded
- Review articles (n=24)
- Abstract/editorial/case reports/letter (n=23)
- Not about restaging (n=11)
- Restaging without EUS or EBUS (n=9)
- Guidelines (n=4)
- Non-English literature (n=1)
- Incomplete/overlap of data (n=1)

Studies included in the systematic review (n=10)
- EBUS in mediastinal restaging (n=4)
- EUS in mediastinal restaging (n=4)
- Combined EUS/EBUS in restaging (n=2)

Muthu, CHEST 2018

Efficacy of endosonographic procedures in mediastinal re-staging of lung cancer after neoadjuvant therapy: A systematic review and diagnostic accuracy meta-analysis





Conclusions: Endosonographic procedures are safe and highly specific in mediastinal re-staging of lung cancer.

Muthu, CHEST 2018

Combined endobronchial and esophageal endosonography for the diagnosis and staging of lung cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline, in cooperation with the European Respiratory Society (ERS) and the European Society of Thoracic Surgeons (ESTS)

Restaging

For mediastinal nodal restaging following neoadjuvant therapy, EBUS-TBNA and/or EUS-(B)-FNA is suggested for detection of persistent nodal disease, but, if this is negative, **subsequent surgical staging is indicated** (Recommendation grade C).

Vilmann, Endoscopy 2015

Συμπερασματικά…

- Το πρώτο βήμα στη σταδιοποίηση του NSCLC είναι ο ενδοσκοπικός υπέρηχος (έναντι του χ/ου)

- Η συστηματική προσέγγιση των λεμφαδένων με EBUS-TBNA σε συνδυασμό με EUS-(B)-FNA αυξάνει τη διαγνωστική ακρίβεια (N3/ N2/N1) και έχει μεγαλύτερη αρνητική προγνωστική αξία από το EBUS μόνο του.

- Σε ασθενείς με περιφερική βλάβη και φυσιολογικό μεσοθωράκιο σε CT ή PET-CT, συστήνεται η χρήση **EBUS-TBNA και/ή EUS-(B)-FNA** πριν τη θεραπεία αν:

  1) υπάρχουν διογκωμένοι ή (FDG)-PET-avid σύστοιχοι πυλαίοι λεμφαδένες

  2) ο πρωτοπαθής όγκος δεν προσλαμβάνει FDG

  3) αν ο όγκος είναι ≥3 cm

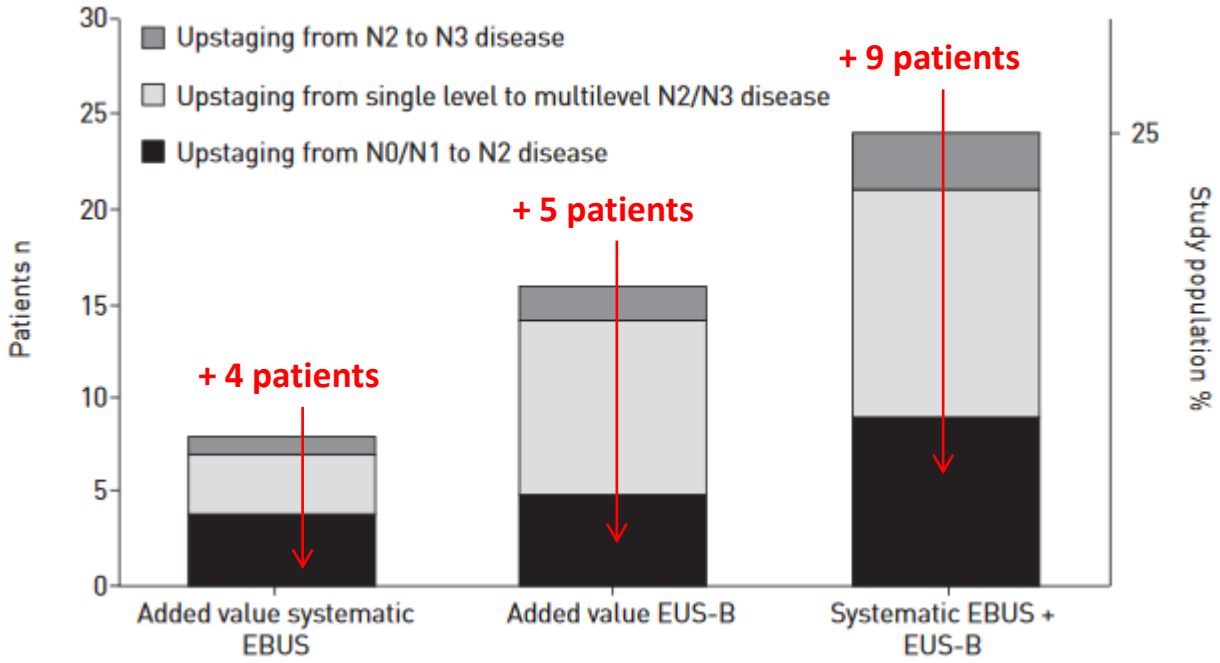

obrigado
Dank U
Merci
mahalo
Köszi
спасибо
Grazie
Thank you
mauruuru
Takk
Gracias
Dziękuję
Děkuju
danke
Kiitos

Systematic and combined endosonographic staging of lung cancer (SCORE study)

Eur Respir J 2019

Laurence M.M. Crombag[1], Christophe Dooms[2], Jos A. Stigt[3], Kurt G. Tournoy[4,5], Olga C.J. Schuurbiers[6], Maarten K. Ninaber[7], Wieneke A. Buikhuisen[8], Sayed M.S. Hashemi[9], Peter I. Bonta[1], Daniël A. Korevaar[10] and Jouke T. Annema[1]

229 patients



Systematic EBUS followed by EUS-B increased sensitivity for the detection of N2/N3 disease by 9% compared to PET-CT-targeted EBUS alone.

CHEST Original Research
PULMONARY PROCEDURES

The Role of the Pulmonologist in Rapid On-site Cytologic Evaluation of Transbronchial Needle Aspiration

A Prospective Study

Table 4—*Sensitivity, Specificity, and Accuracy of ROSE Performed by Cytopathologist and Pulmonologist (Final Diagnosis as Gold Standard)*

Physician	Sensitivity, % (95% CI)	Specificity, % (95% CI)	Accuracy, % (95% CI)
Pulmonologist	91 (86-94)	72 (65-78)	80 (77-90)
Cytopathologist	95 (88-95)	92 (87-95)	92 (85-94)

Conclusions: **Training pulmonologists to have a basic knowledge of cytopathology could obviate most difficulties related to the involvement of cytopathologists in routine diagnostic activities and may reduce the costs of the procedure.**

Bonifazi M, Chest 2014

Rapid On-Site Evaluation of Endobronchial Ultrasound–Guided Transbronchial Needle Aspirations for the Diagnosis of Lung Cancer

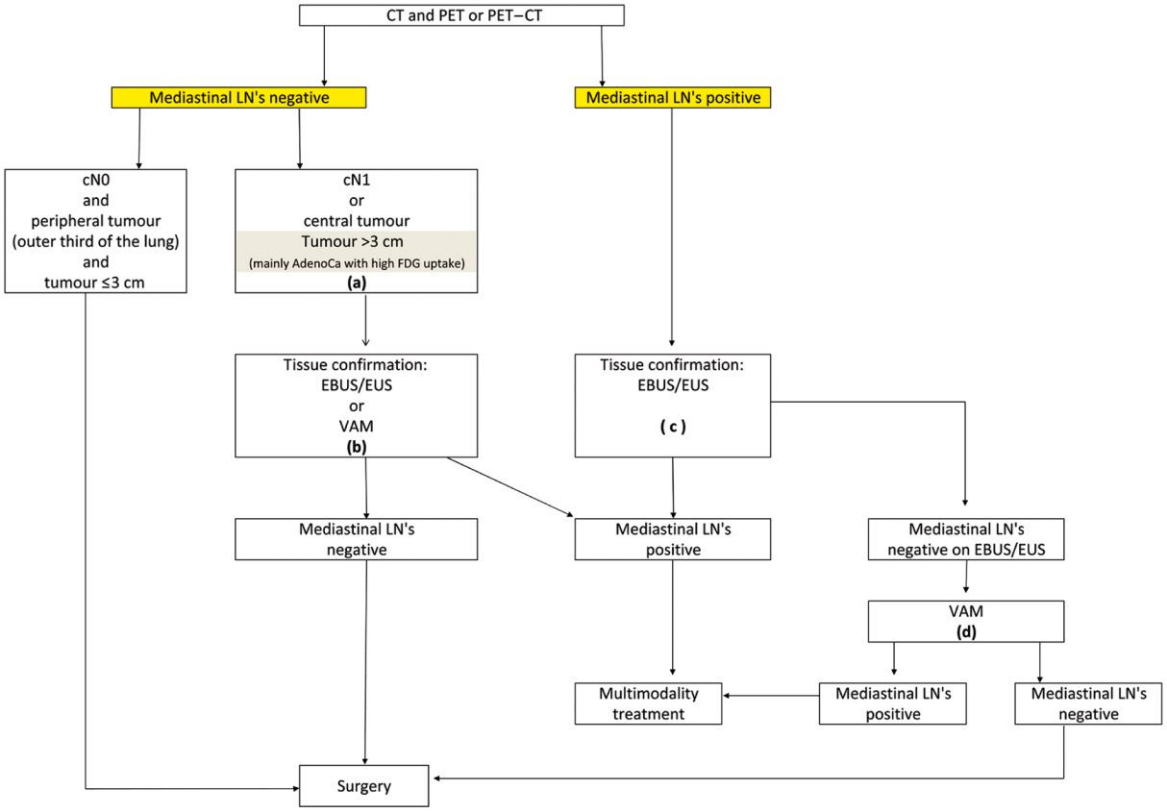
A Perspective From Members of the Pulmonary Pathology Society

Table 4. Advantages and Limitations of Rapid On-Site Evaluation (ROSE)

Advantages	Limitations
Adequacy assessment of the specimen	Needs an experienced cytopathologist or a dedicated trained cytotechnician
Improved diagnostic yield	Cost may not be reimbursed
Reduction of additional procedures	Time-consuming process (35–56 min)[67]
Obtain additional passes for molecular testing, microbiology cultures, and flow cytometry	At present, no statistically significant results for ROSE and increased diagnostic yield, fewer aspirations, decreased procedure time, and reduced rate of complications
Better use of laboratory resources and reduced laboratory effort because of the lower number of total slides	
Improved patient care	

Jain D, Arch Pathol Lab Med 2018

Figure 1. Suggested algorithm for locoregional lymph node staging in patients with non-metastatic NSCLC. CT, computed ...

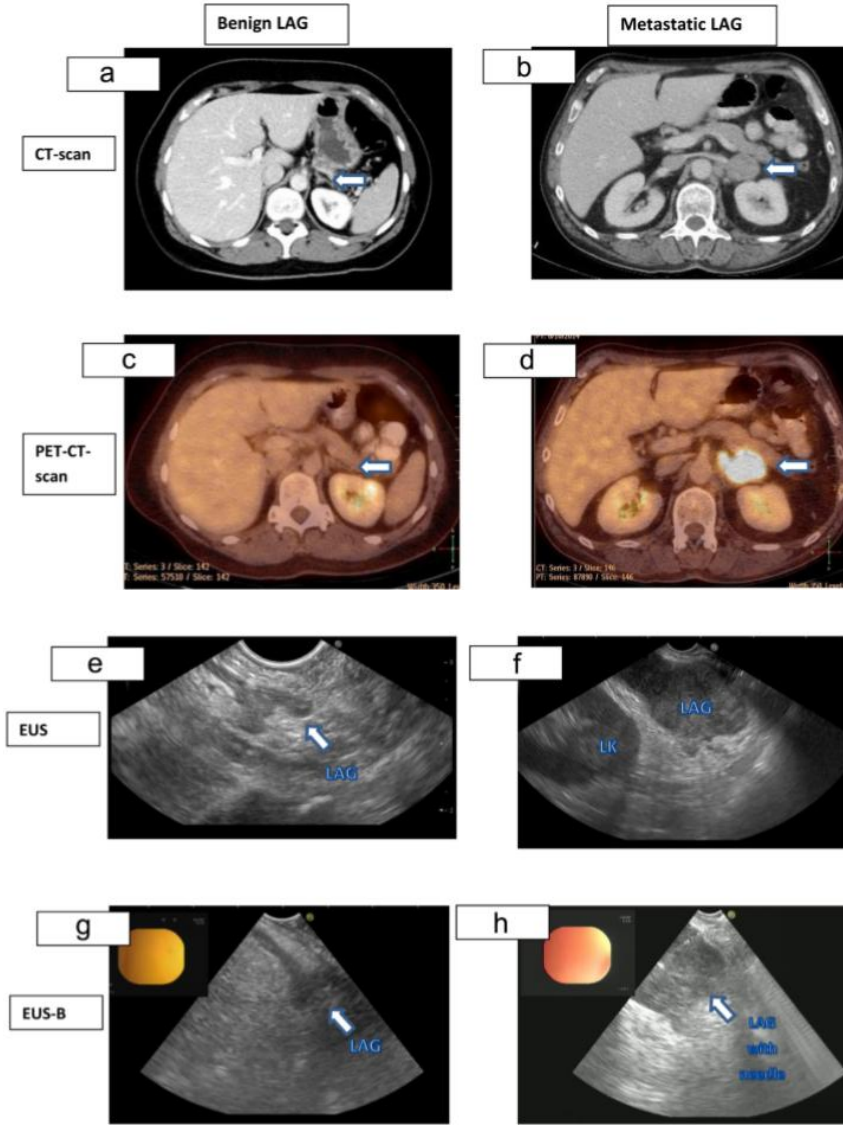


(a) : In tumours > 3 cm (mainly in adenocarcinoma with high FDG uptake) invasive staging should be considered
(b) : Depending on local expertise to adhere to minimal requirements for staging
(c) : Endoscopic techniques are minimally invasive and are the first choice if local expertise with EBUS/EUS needle aspiration is available
(d) : Due to its higher NPV, in case of PET positive or CT enlarged mediastinal LN's, videoassisted mediastinoscopy (VAM) with nodal dissection or biopsy remain indicated when endoscopic staging is negative. Nodal dissection has an increased accuracy over biopsy

Annals of Oncology, Volume 28, Issue suppl_4, July 2017, Pages iv1–iv21, https://doi.org/10.1093/annonc/mdx222

Endosonography for left adrenal gland staging of lung cancer

- Retrospective trial (143 parients)
- In **85%** of patients it was feasible to transgastrically detect the LAG with the EBUS scope.
- 9 patients punctured (6:benign adrenal tissue, 2:metastases of NSCLC, 1: pheochromocytoma)



Crombag, Respiration , 2016