

LUNGCANCER

endoskopisk utredning

Marija Kotevska
SUS
231120

Agenda

Historien om bronkoskopi

Rigid och flexibel bronkoskopi

Planering av bronkoskopi, indikationer och kontraindikationer

Utredning av lungcancer – patientfall

TNM 8

EBUS

The history of bronchoscopy

Porter 1838: "There is perhaps no disease covered by greater darkness or posing more difficulties to the practitioner than those of the larynx and the trachea."

The pre-endoscopic era

Hipocretes (460-370 BC) var först att introducera ett rör in i larynx hos patientesr som kvävdes

Desault (1744-1795) utförde nasotracheal intubation för extraktion av främmende kropp, kvävning

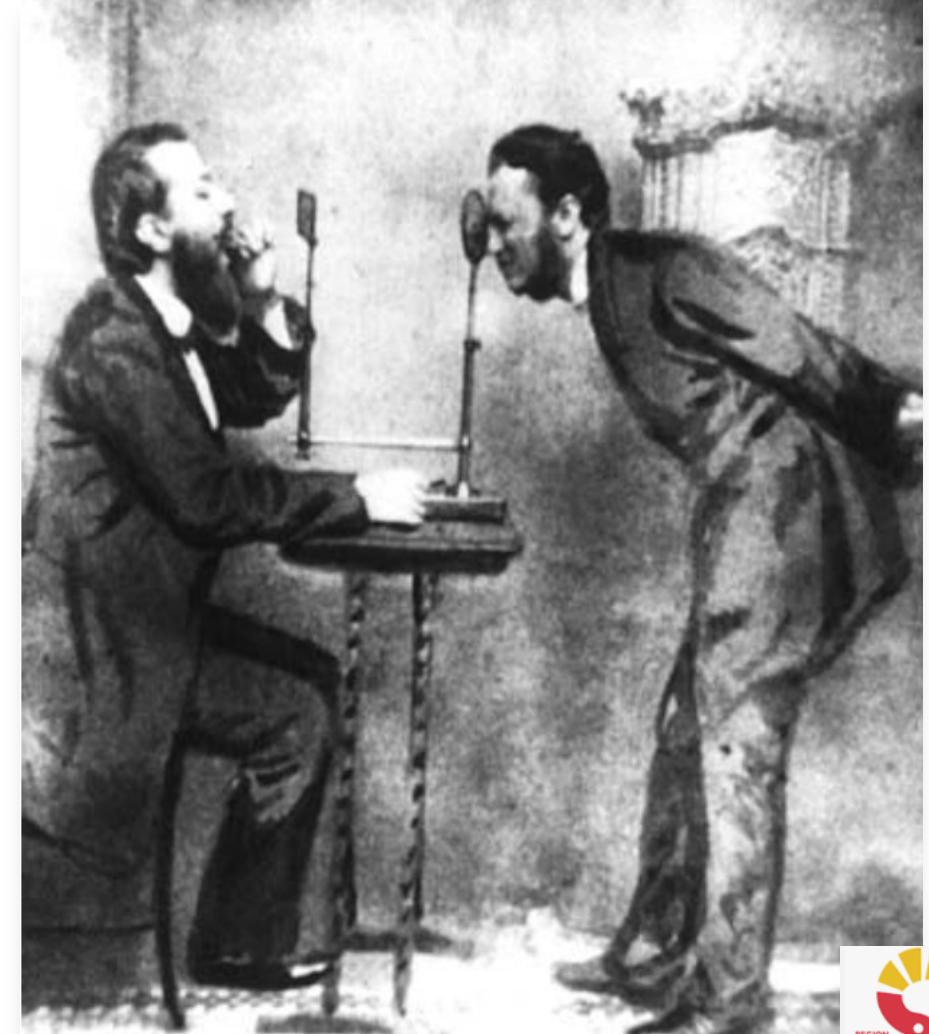
Laryngeal spegel fysiolog Czermak, Budapest

Development of endoscopy

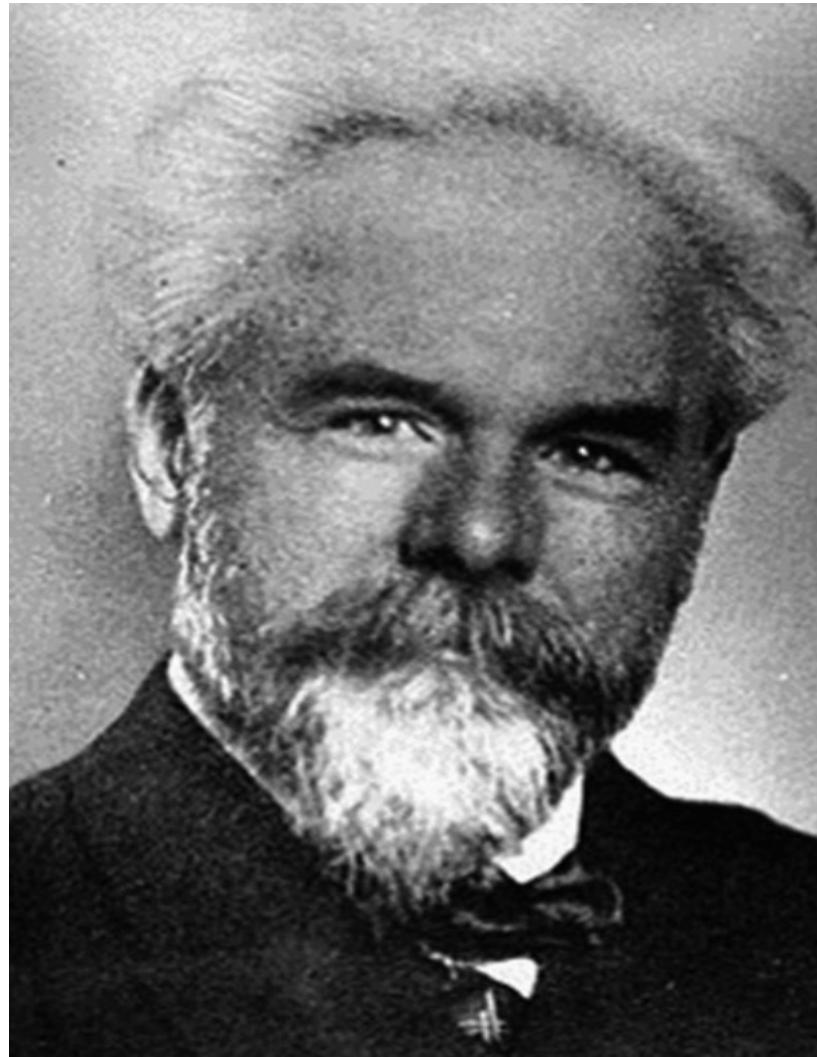
1875 Desormeaux, urolog – utvecklar ett instrument – endoskop

Uretroskop - belysning med alkohol, lins att fokusera ljuset

1895 Alfred Kirstein, laryngolog i Berlin modifierar esofagoskop till trakeoskop och utför den första direktlaryngoskopin



Czermak demonstrerar laryngeal spegel



Dr. **Gustav Killian**, tysk otorhinolaryngolog
och grundare av bronkoskopi

Bronchoscopy - The Pioneers



Trakea är flexibel och instrumentet kan lätt
vinklas och nedföras till lobärnvå

Historien om ett fläskben

1897 Killian använde ett styvt instrument (rak bronkoskop) för att ta bort främmande kropp från den högra huvudbronken utan trakeotomi

Vaken patient med kokain som lokalbedövning

703 patienter med främmande kroppar i bronkerna 1911–1921



Gustav Killian's Bronchoscope , external light source



Bronchoscopy - The Pioneers



"Looking into the living lungs"
Chevalier Jackson 1928



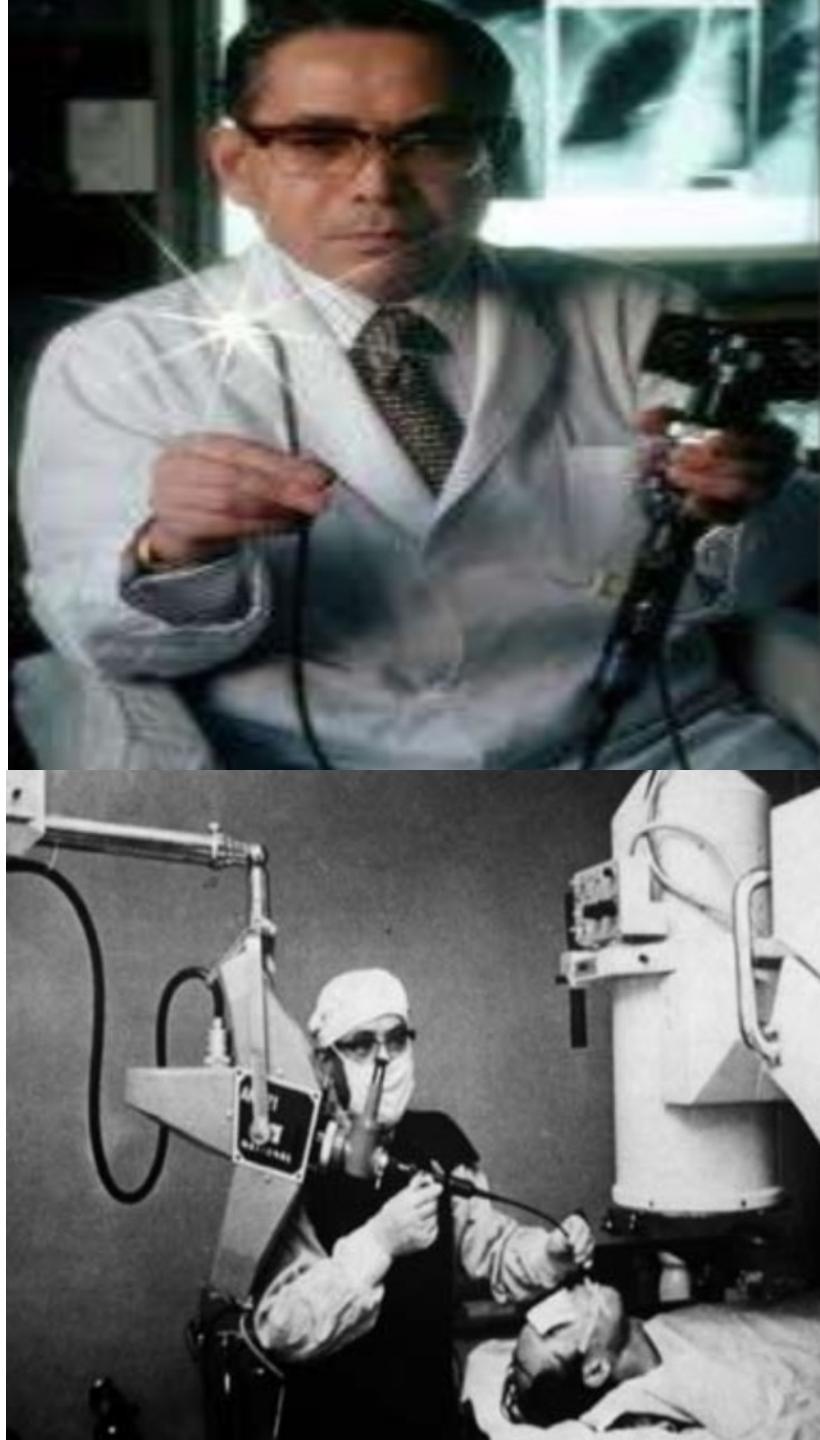
Chevalier Jackson's Bronchoscope with a
small distal bulb & built –in suction tube

Bronchoscopy - The Pioneers

1960 - **Shigeto Ikeda** ersätter den lilla elektriska glödlampan med glasfibrer som kan sända starkare ljus från en extern källa

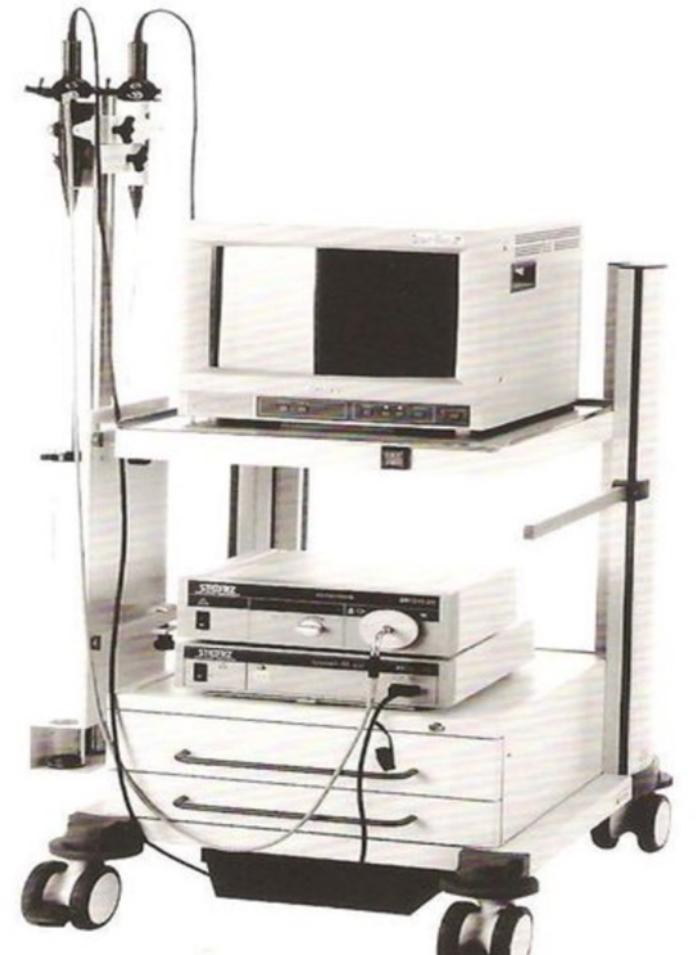
1966 - International Congress on Diseases of the Chest in Copenhagen - Ikeda presenterar det första flexibla bronkoskopet

1979 - grundar WAB - World Association of Bronchology





80-talet - videobronkoskop



Bronchoscopy - The Pioneers

Sveriges pionjär – dr **Rune Lundgren**

1975 i Umeå introducerade den nya tekniken,
rak bronkoskopi för cancerdiagnostik och
utredning av andra lungsjukdomar



Typer av bronkoskopier

Rigid bronkoskopi



Flexibel bronkoskopi

Konventionell bronkoskopi

Bronkoskopi med EBUS-TBNA

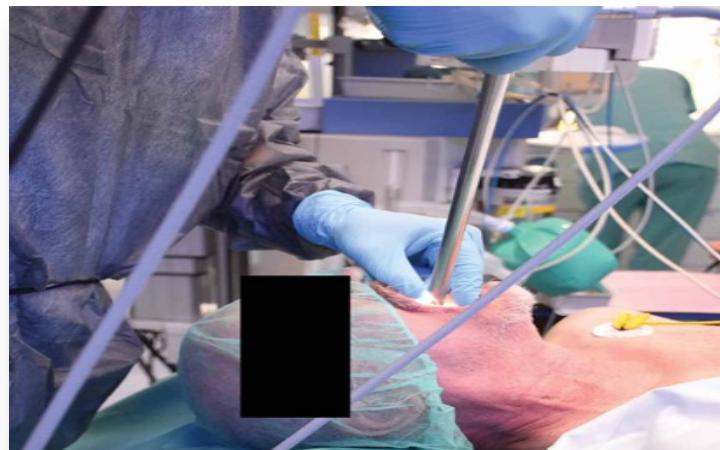
Avancerad flexibel bronkoskopi med radiellt ultraljud och genomlysning

Elektromagnetisk navigationsbronkoskopi

Robot assisterad bronkoskopi



Terapeutisk bronkoskopi - Indikationer



Central luftvägsobstruktion – vid neoplastisk eller benign
Extrahering av främmmande kropp
Endobronkiell rekanalisering av luftväg
Inläggning av stent i centrala luftvägar
Behandling av massiv hemoptys

Flexibel bronkoskopi - indikationer

Utreda pulmonella symtom (hemoptys, prolongerad och kronisk hosta, återkommande infektioner)

Infektion (mikrobiologisk agens). Rensugning av luftvägar

Suspekt neopla

- heshet och förlamning av stämband utan känd genes

- unilateral ronki

- segmentell eller lobär kollaps

- lunginfiltrat och noduli

- unilateral diafragmapares av oklar genes

- bedömning av mediastinala förändringar

- lung cancer staging

Bronkoskopisk lung volymen reduktion – heterogen emfysem – ventiler

Bronkiell termoplasti för astma

Diagnostik och behandling av bronchopleural fistel

Bronkoskopi - kontrandikationer

Grav hypoxi – inte kan korrigeras med syrgas

Koagulopatier

Instabil koronarischemi - hjärtinfarkt < 4 veckor

Patienten kan inte samtycka till ingrepp – demens

Akutvagn ska finnas tillgänglig på bronkoskopiavdelningen och personalen ska ha kompetens och erfarenhet att utföra HLR och hantera eventuella komplikationer som kan uppstå i samband med bronkoskopi – andningssvikt, hjärtarytmier, blödningar, pneumothorax

Planera och utföra bronkoskopi

Bedöma DT thorax bilder - alla projektioner

Välja vilken typ av bronkoskopi ska utföras och instrument

Kontraindikationer? Antikoagulantia?

Lokal bedövning Xylokain och Lidokain 10mg/ml och 20mg/ml (maxdos ~ 8 mg/kg kroppsvikt)

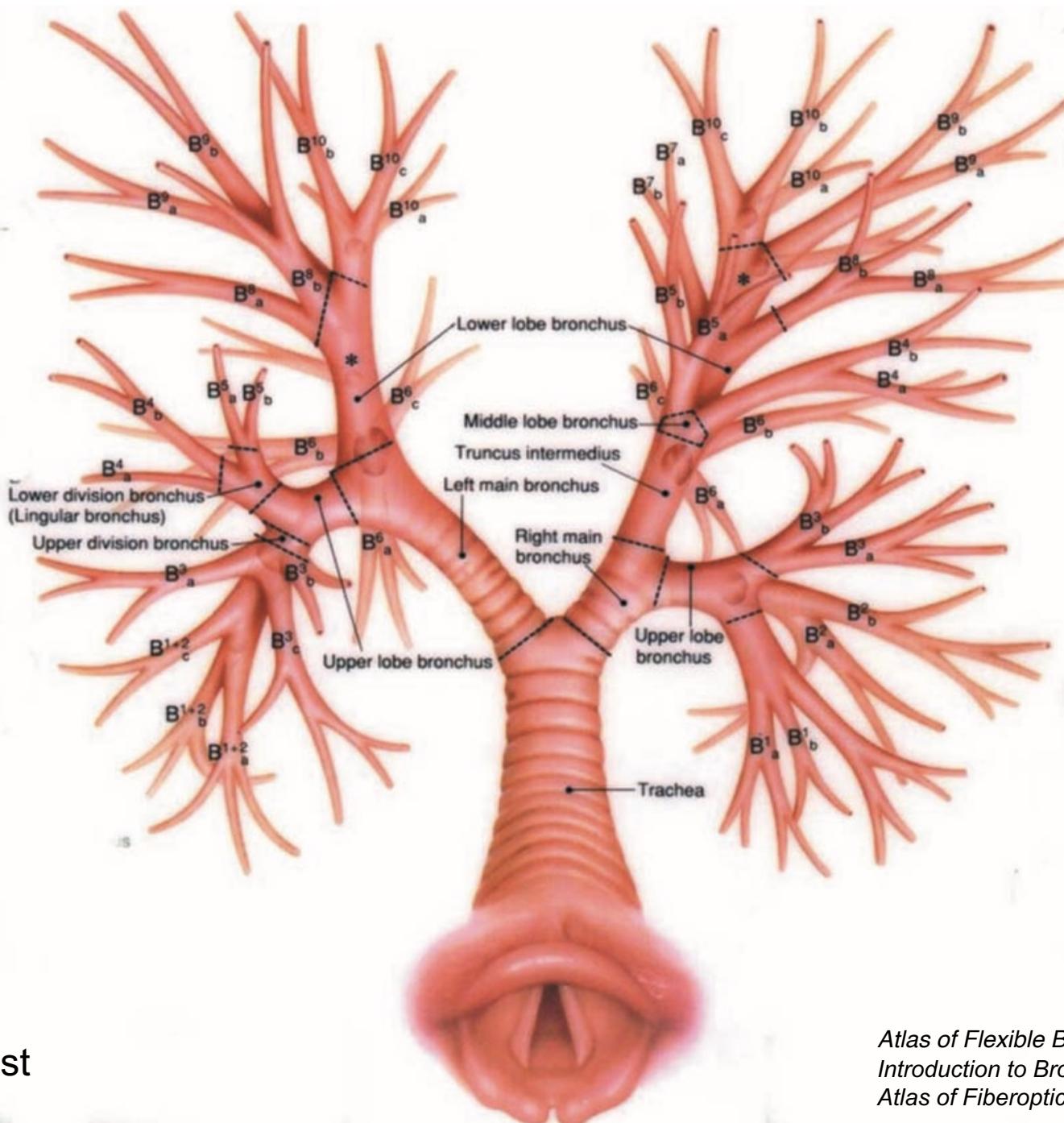
Lidokain: toxiska reaktioner - VT, cardiac arrest (höga doser eller nedsatt clearance – lever svikt och hjärtsvikt)

Case rapport: 19-årig student, bronkoskopi inom ramen av en studie, går hem, får kramper och dör. Vid obduktion s-konc av Lidokain 12 mikrogram/ml – fick 1200 mg Lidokain totalt under ingreppet

Sedering – moderate conscious sedation – Remimazolam (Byfavo) eller Midazolam och Alfentanyl

Propofol – propofol kurs

Generell anestesi?



Airway anatomy for the bronchoscopist

Atlas of Flexible Bronchoscopy, Shah 2012
Introduction to Bronchoscopy, Ernst 2009
Atlas of Fiberoptic bronchoscopy, Prasad 2014

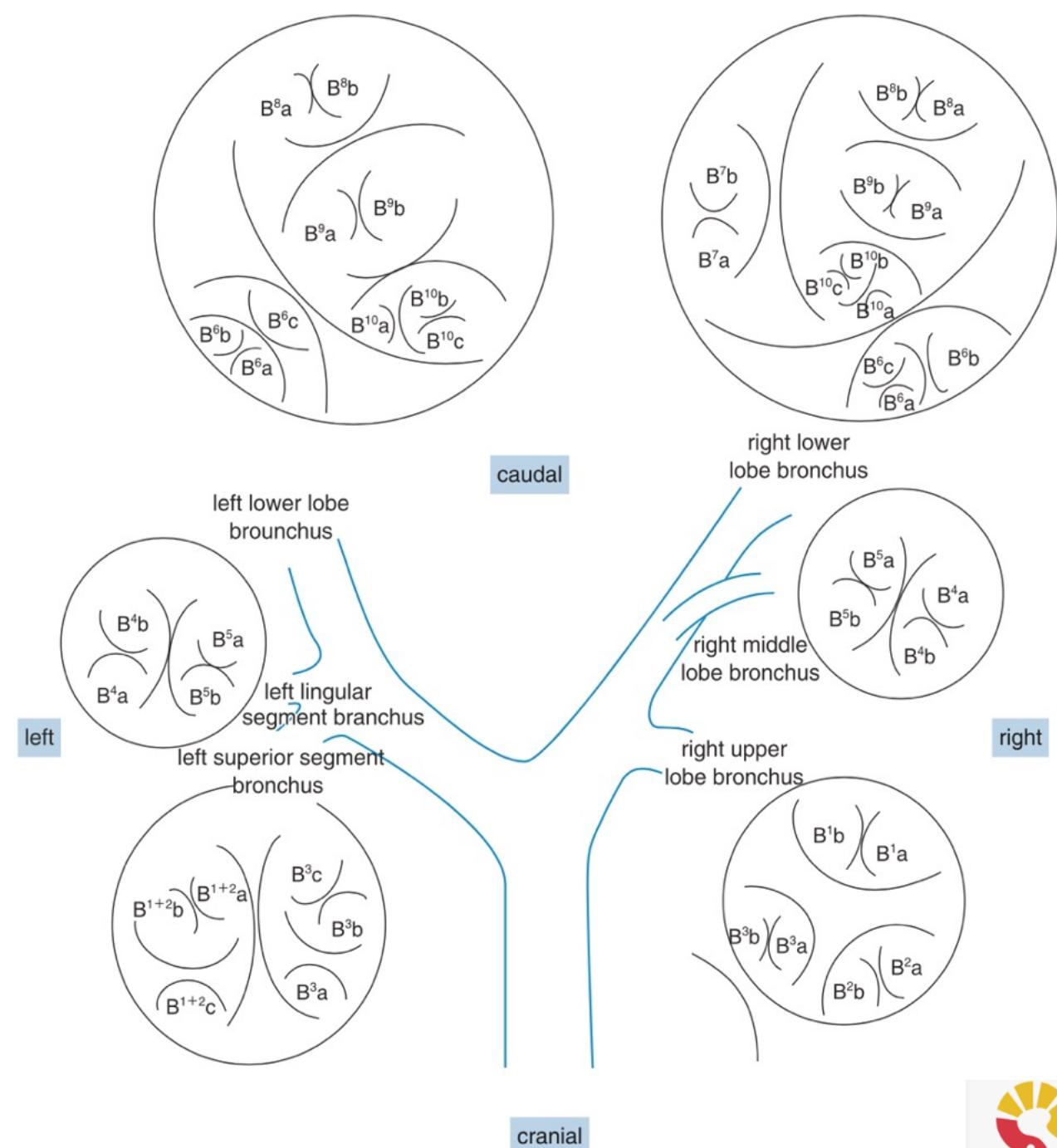
Bronchial nomenclature

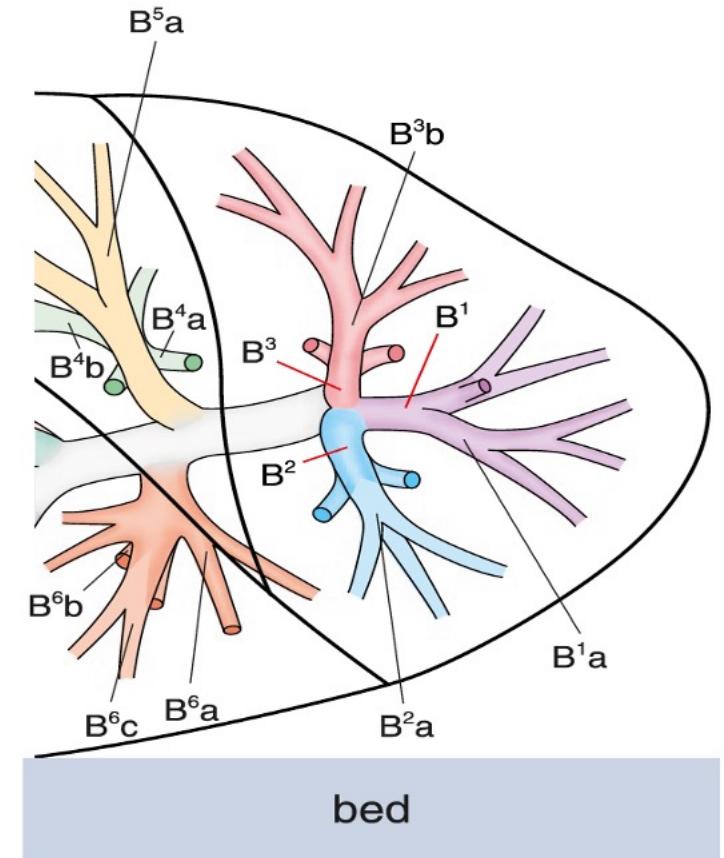
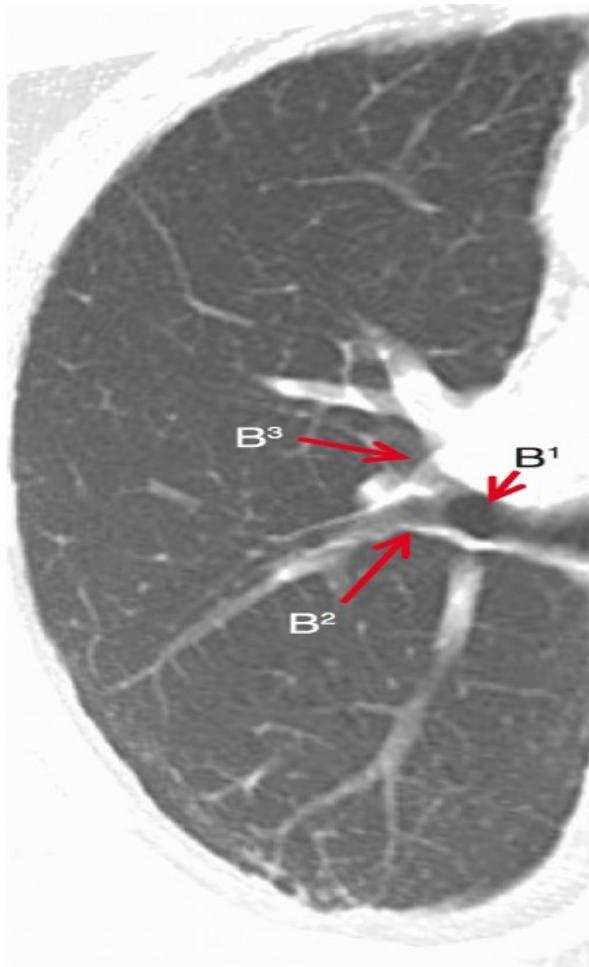
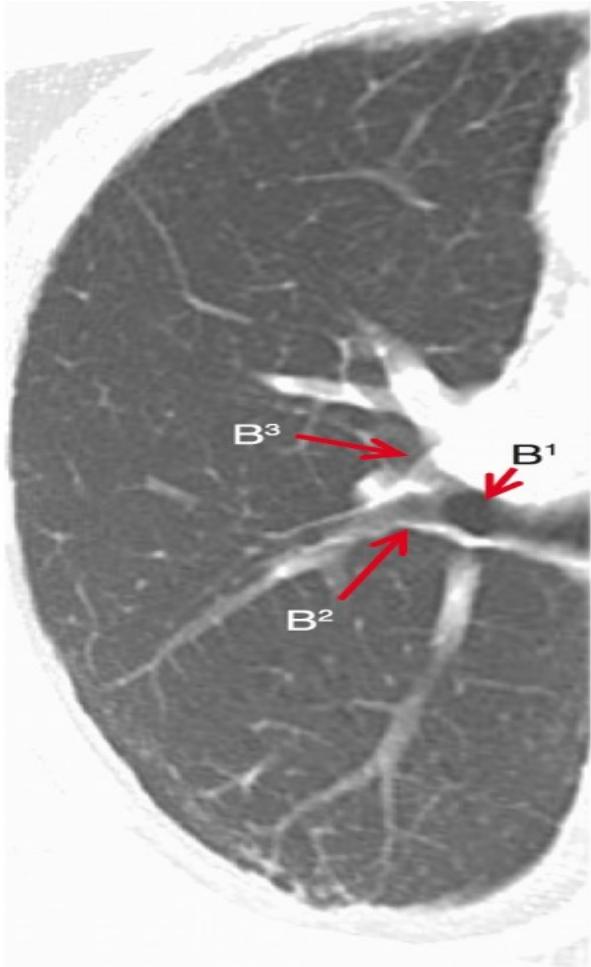
3 huvudprincip:
Kranial-Kaudal
Posterior-Anterior
Medial-Lateral

Bronkialsegment – arabiska siffror - tex RB2
Bronkialsubsegment - a, b, c i sekvens - tex RB2a
Bronkial sub-subsegment i, ii, iii - tex RB2ai
Bronkial sub-sub-subsegment α , β , γ - tex RB2aia
Bronkial sub-sub-subsegment x,y - tex RB2aiax

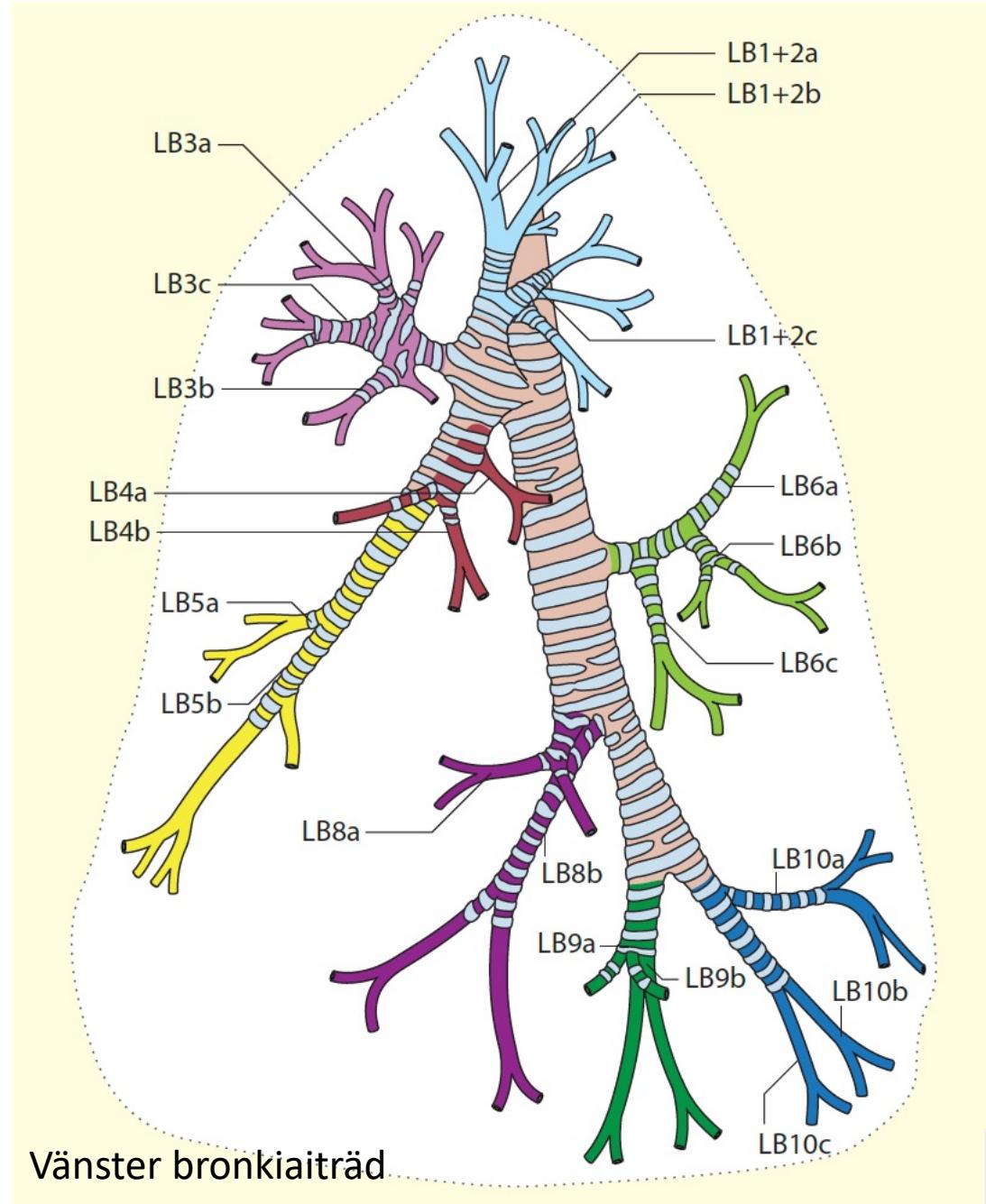
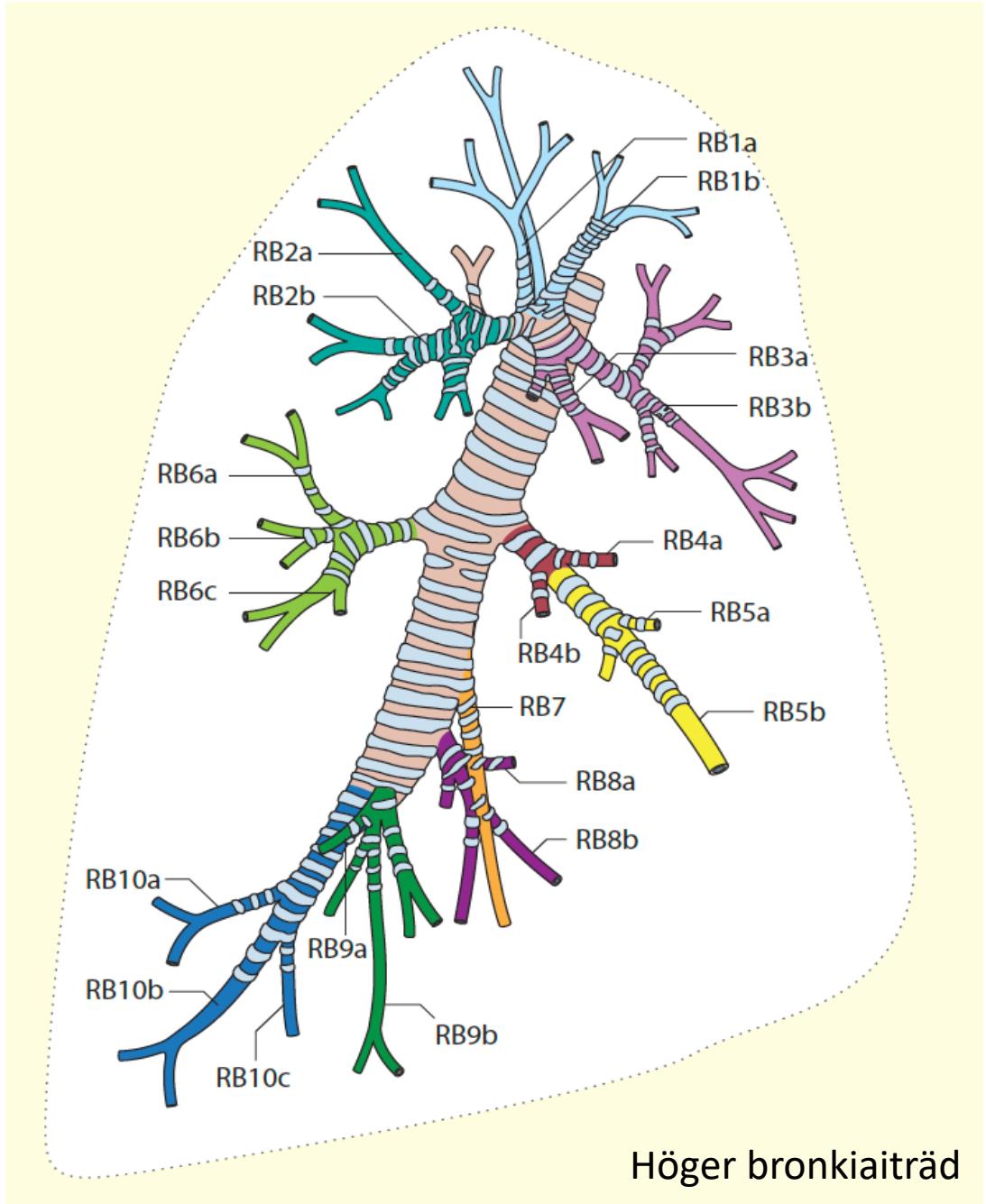
I vänster lunga clockwise

I hö lunga anticlockwise





Bronchial branch tracing, Kurimoto, 2015



Patfall 1

80 år, rökare

Hö kolektomi 2016 pga kolorektal ca. Recidiv i paraaortala LN och tumörtromb i VCI 2020 – fick radioterapi.

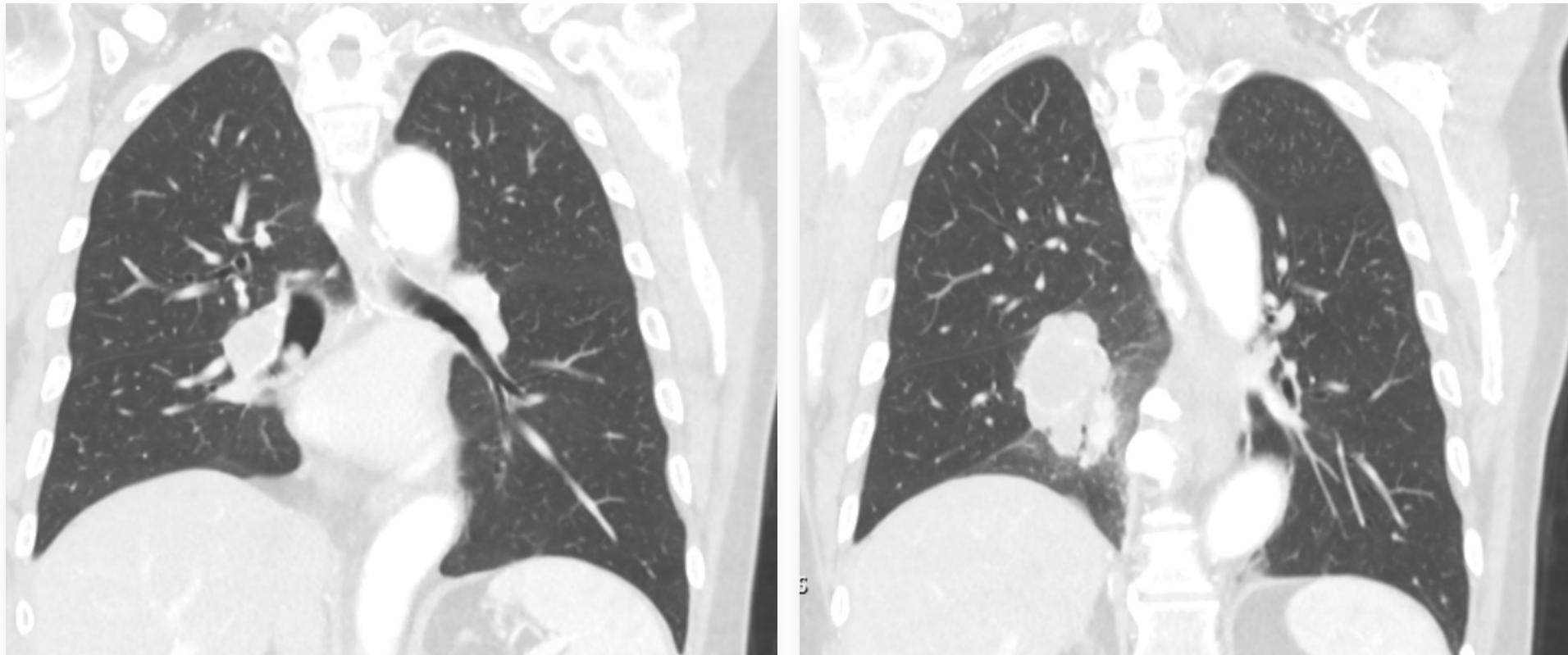
Nytillkommen förändring i hö hilus – recidiv av kolorektal cancer?

Vidare utredning?

Vävnadsprovtagning?

Vilken typ av bronkoskopi?

Hur många biopsier?



Lungcancer - diagnostik

Parallel diagnosis, staging, and molecular genetic testing

ACCP 2013

Clinical Practice Guidelines for NSCLC of National Comprehensive Cancer Network (NCCN) 2017

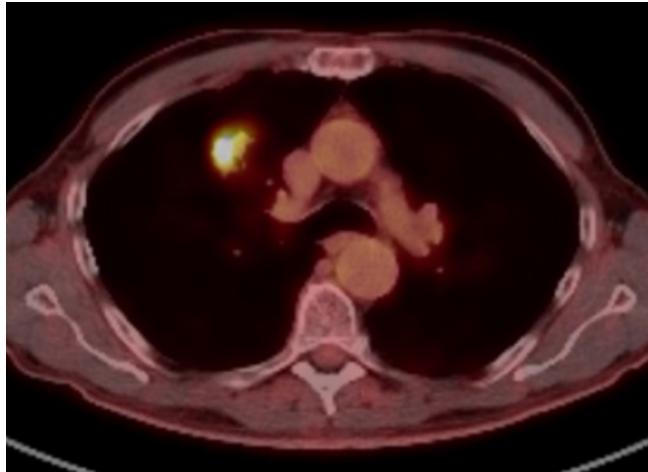
ESMO 2021

Lung Cancer – the diagnostic process

Anatomical distribution

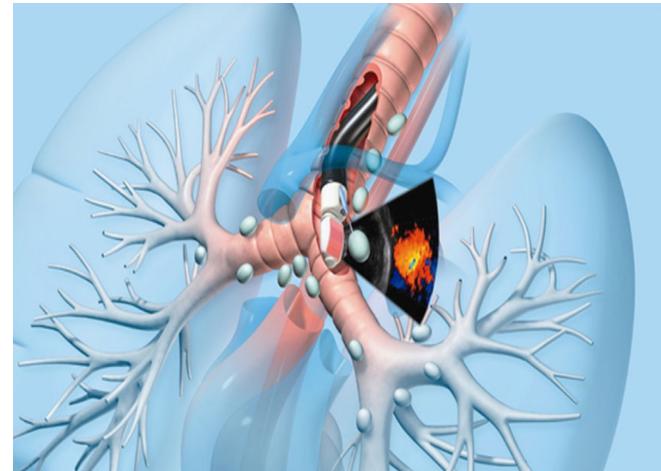


Metabolic distribution

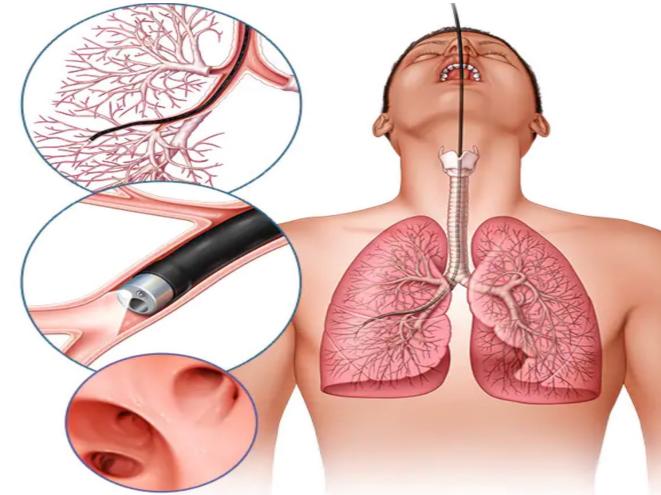


Suspicion, imaging and non-invasive staging

EBUS-TBNA

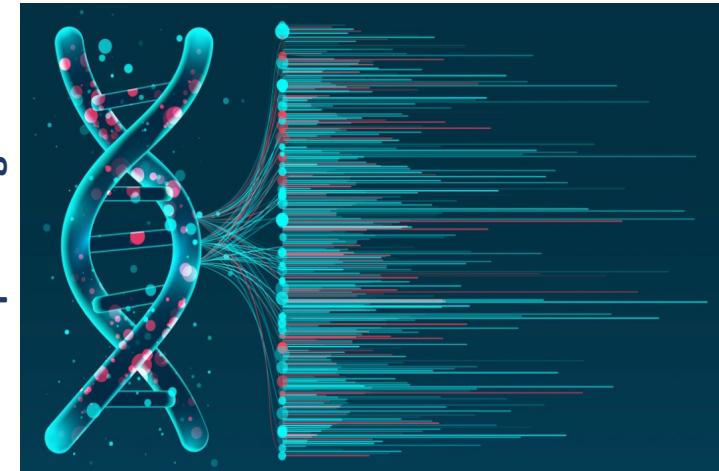


Bronchoscopy

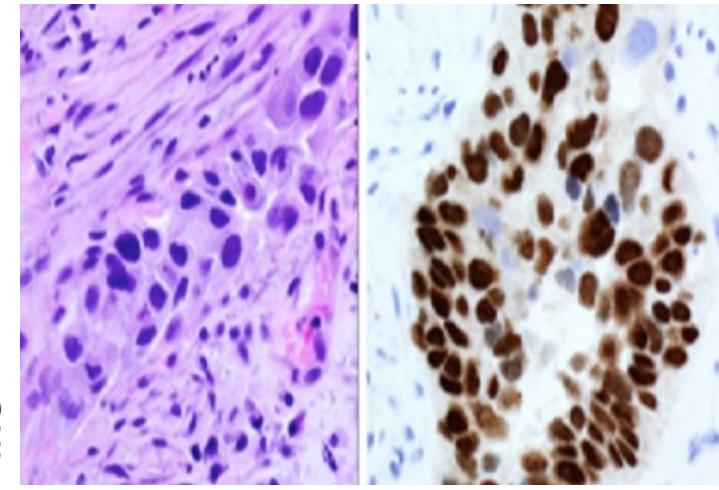


Tumor sampling and invasive staging

Genomic profiling



IHC



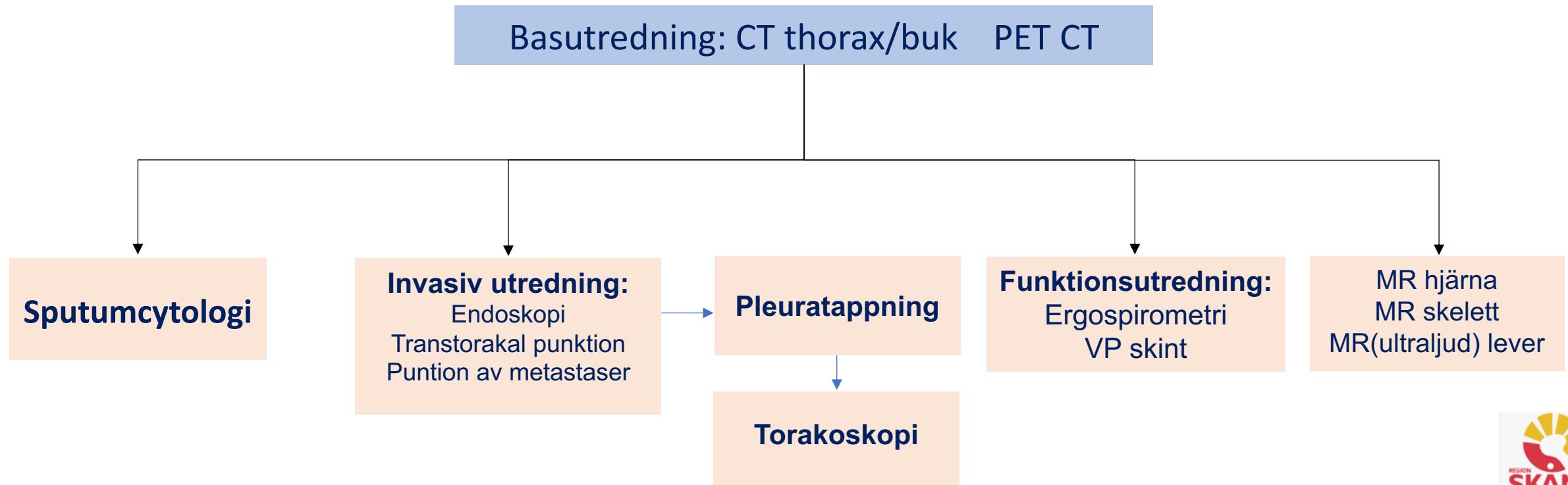
Hystopathology and genomic profiling

Lungcancer - diagnostik

Anamnes - rökning, exponering, tidigare sjukdomar, annan cancer

Status - allmäntillstånd PS, hjärt- och lungstatus, LN

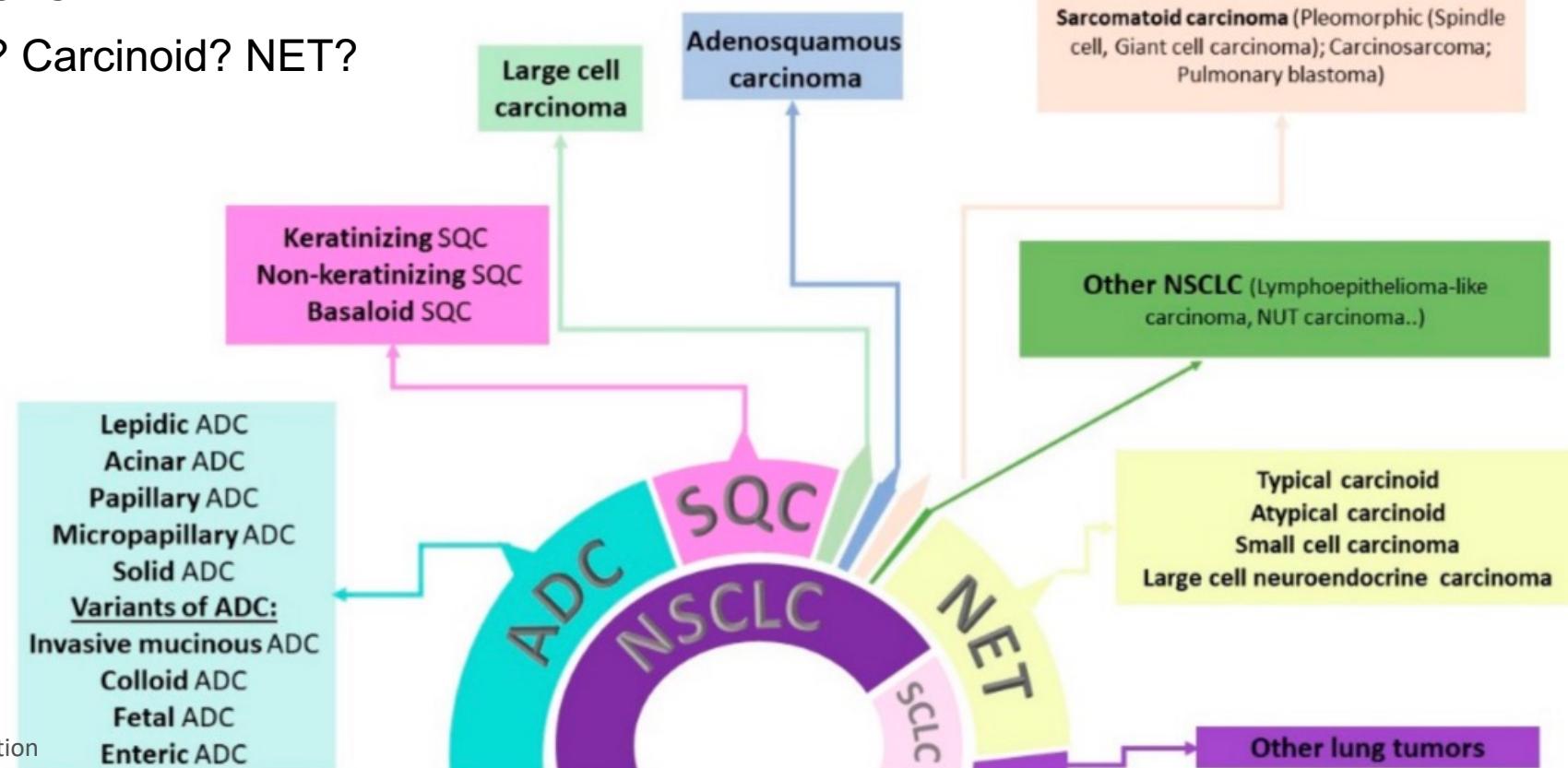
Lungfunktion - spirometri med DLCO



Tumörvävnadsdiagnostik

Svara på följande diagnostiska frågorna:

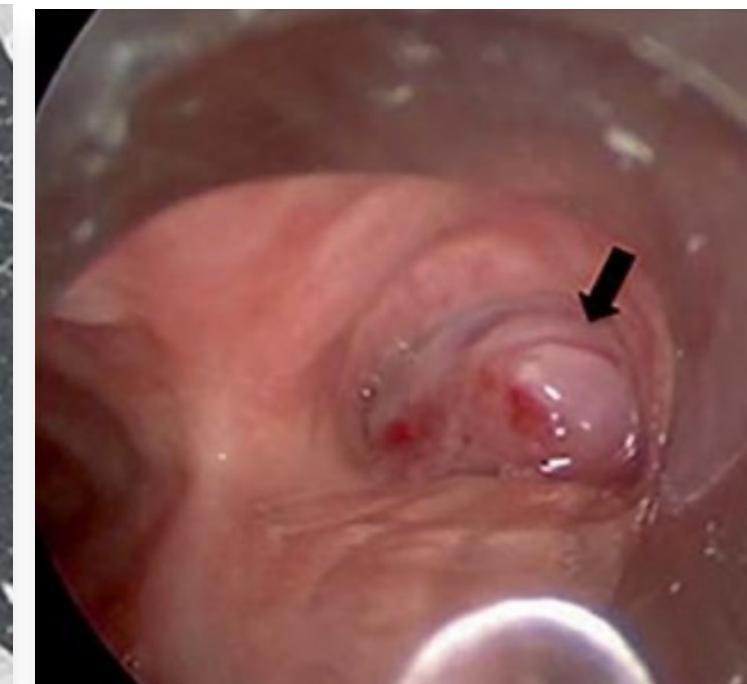
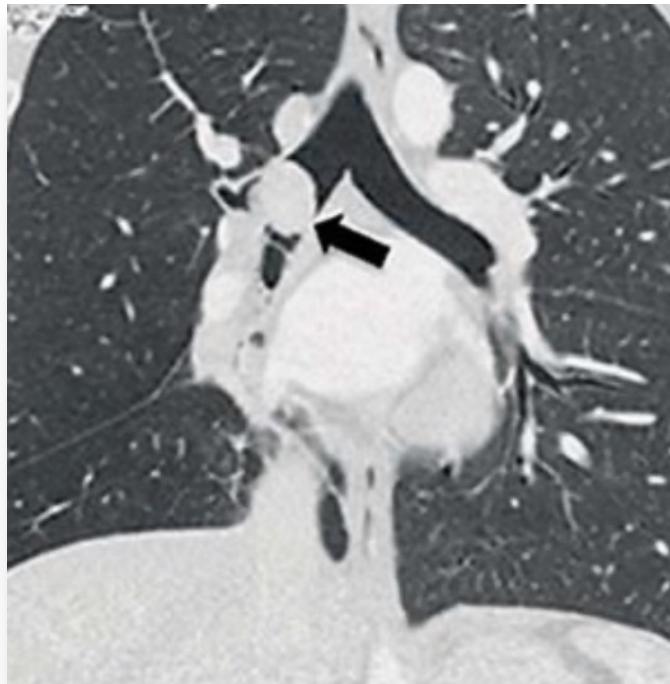
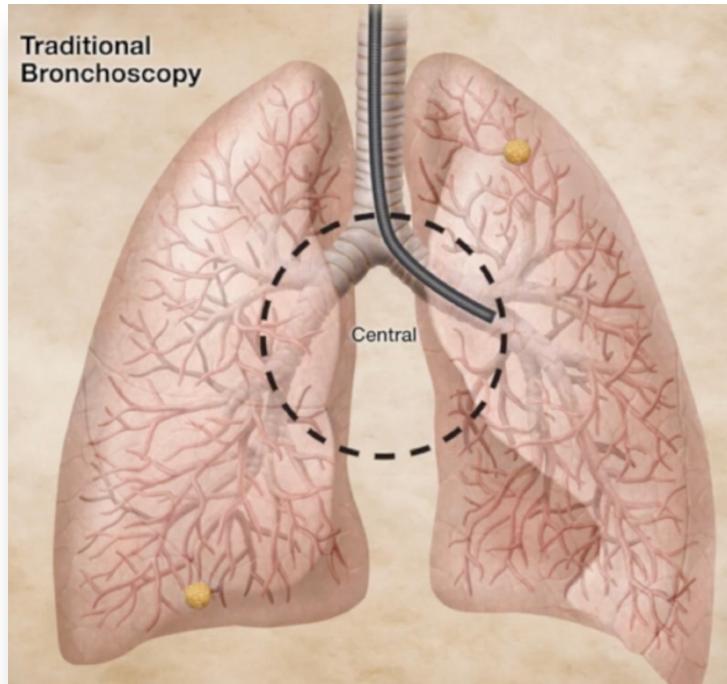
- Tumörtyp: NSCLS eller SCLC?
- Tumörsubtyp: AC? SqCC? Carcinoid? NET?
- Tumörgenetik?
- PD-L1?



Konventionell bronkoskopi

Direkt biopsering av synliga förändringar, hög sensitivitet

Meta-analys, 35 studier mellan 1971 och 2004, sensitivitet 88%



Patfall 2

66 år, exrökare, KOL, CVD, Pacemaker

Icke produktiv hosta sedan dec 2020. Kompenserad. Normalt NT pro BNP

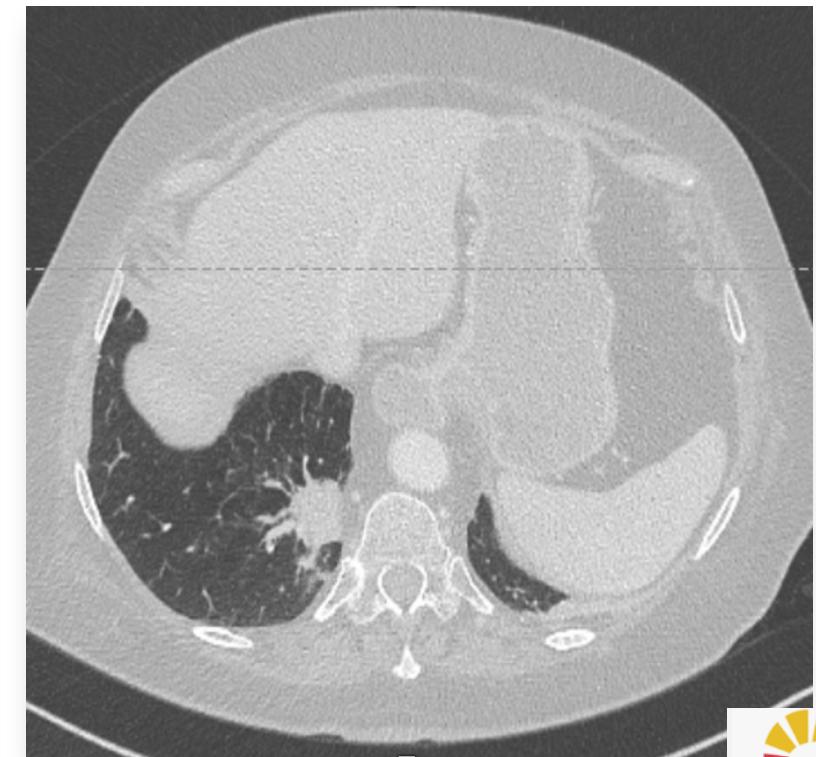
Rtg pulm feb 2021. CT thorax aug 2021



Februari 2021



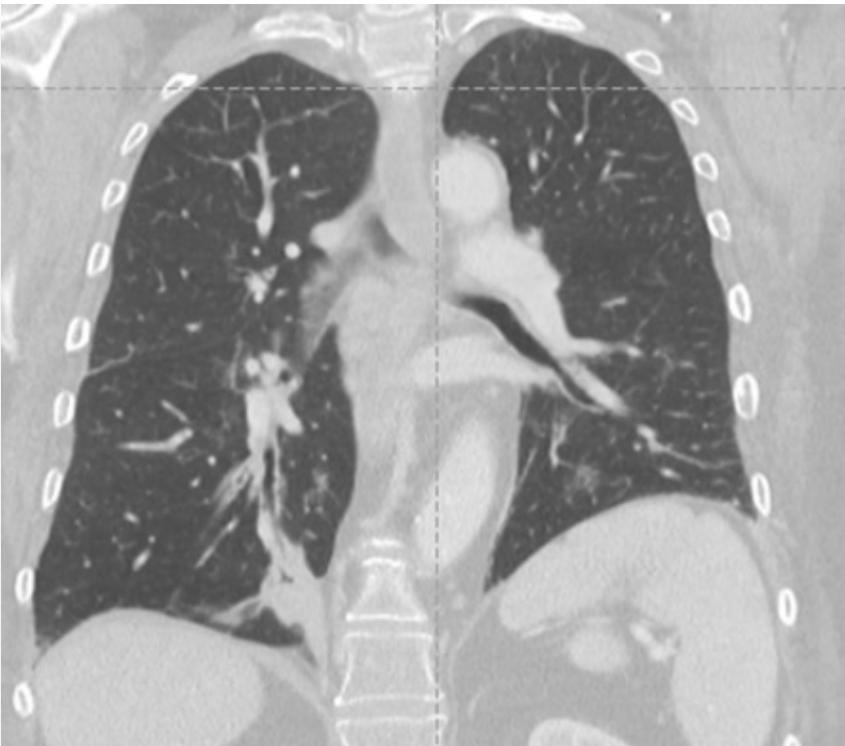
Augusti 2021



Peripheral Pulmonary Lesion

Patfall 2

Hur ska vi komma åt tumoren?



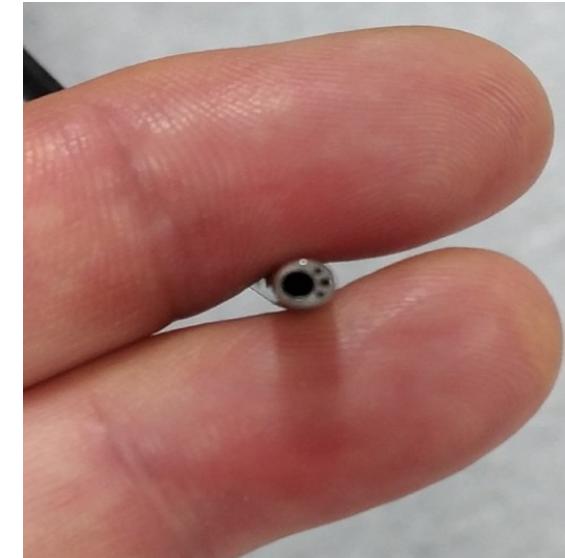
Konventionell bronkoskopi för perifera lungförändringar - sensitivitet för malignitet < 20 %

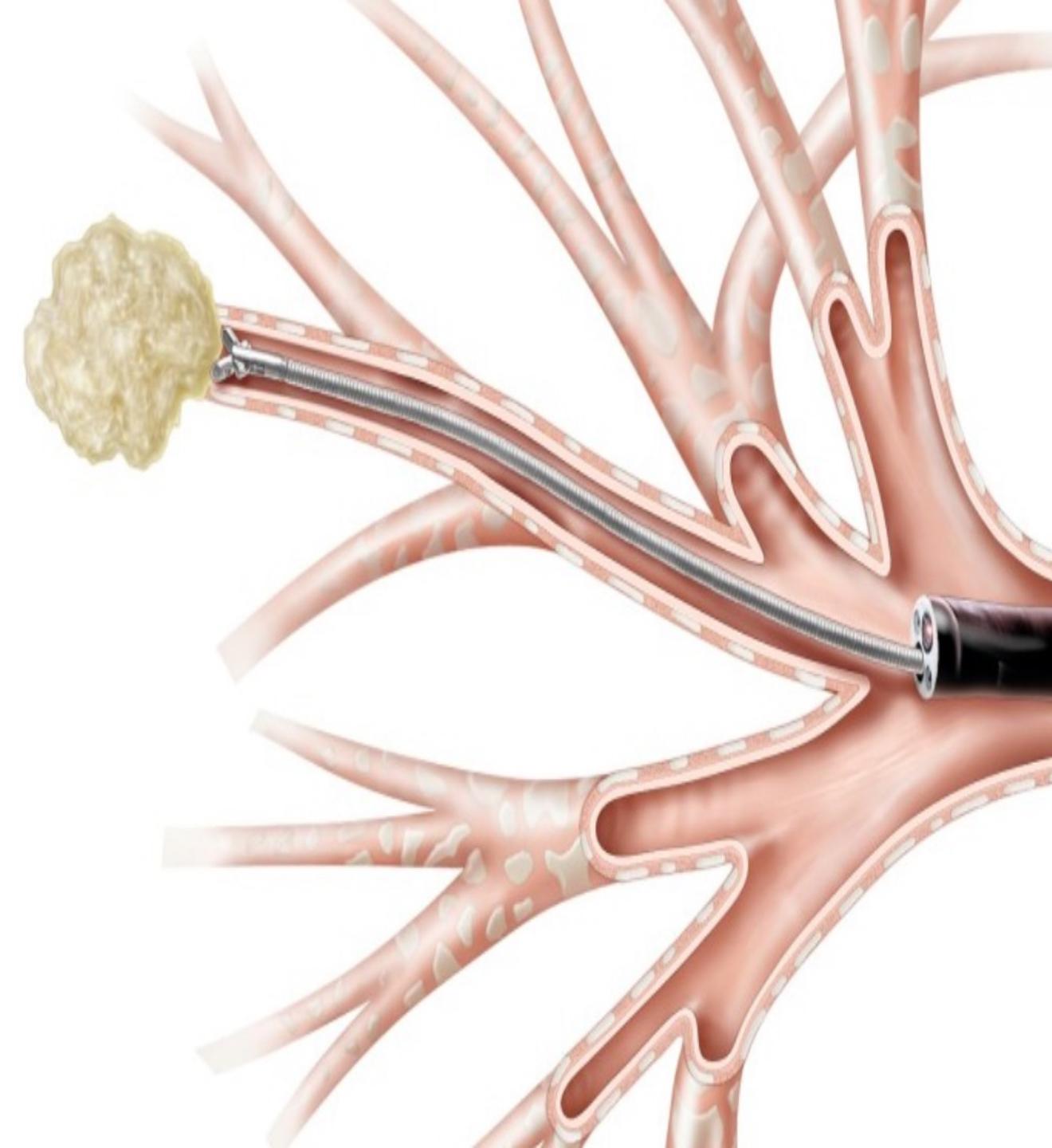
Avancerad Bronkoskopi av perifera lungförändringar

	Generation	Diameter, cm	Length, cm
conducting zone	trachea	0	1.80
	bronchi	1	1.22
	bronchioles	2	0.83
	terminal bronchioles	3	0.56
		4	0.45
		5	0.35
		16	0.06
transitional and respiratory zones	respiratory bronchioles	17	1.07
		18	
		19	
	alveolar ducts	T ₃	0.05
		T ₂	0.10
		T ₁	
	alveolar sacs	T	0.04
		23	0.05

Standard bronkoskop (6mm)
till 4:e bronkgenerationen

Ultratunn (3 mm) till 6:e
bronkgenerationen





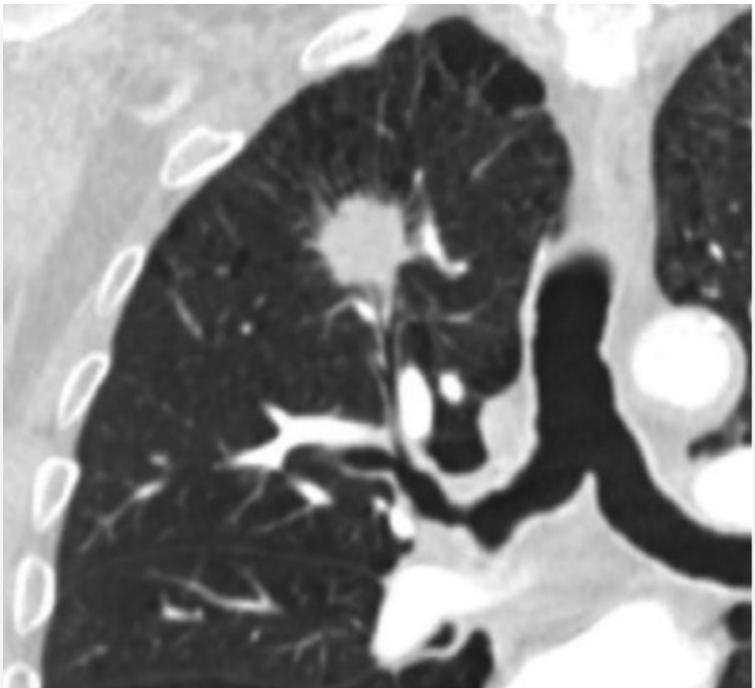
Avancerad bronkoskopi för diagnos av PPL

Bronchoscopy with radial EBUS and fluoroscopy

EMN – electromagnetic navigational bronchoscopy

Robotic-assisted bronchoscopy

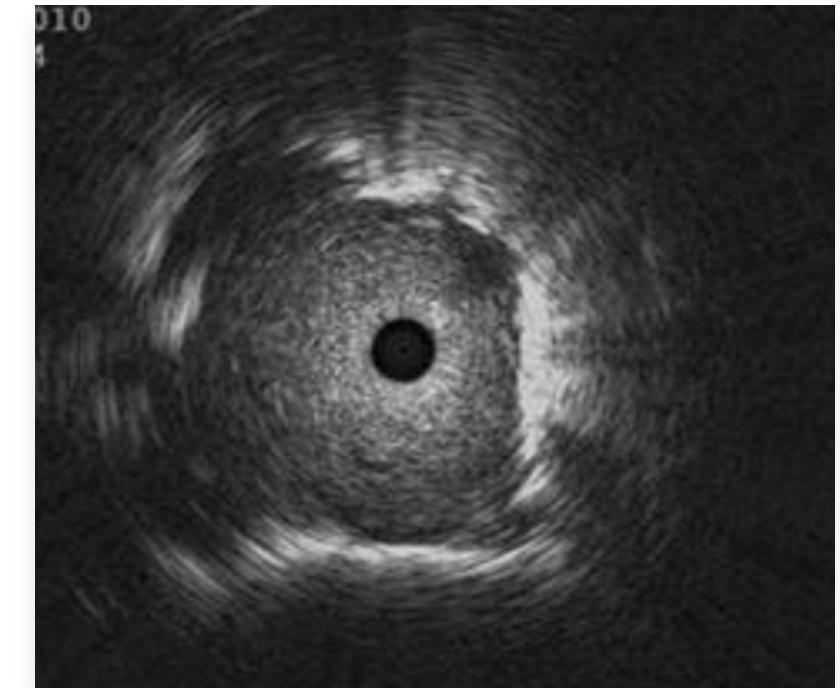
Bronkoskopi av perifera lungförändringar (PPL)



Bronchus sign?



Genomlysning



Radiellt ultraljud

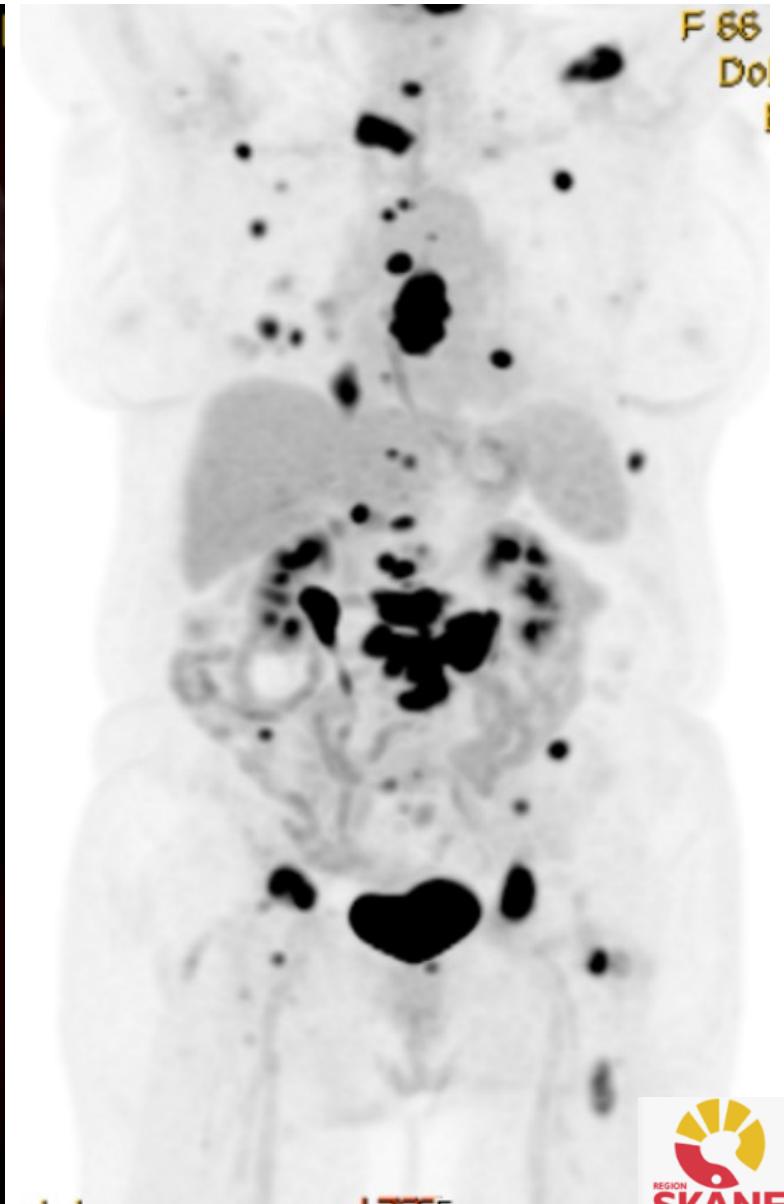
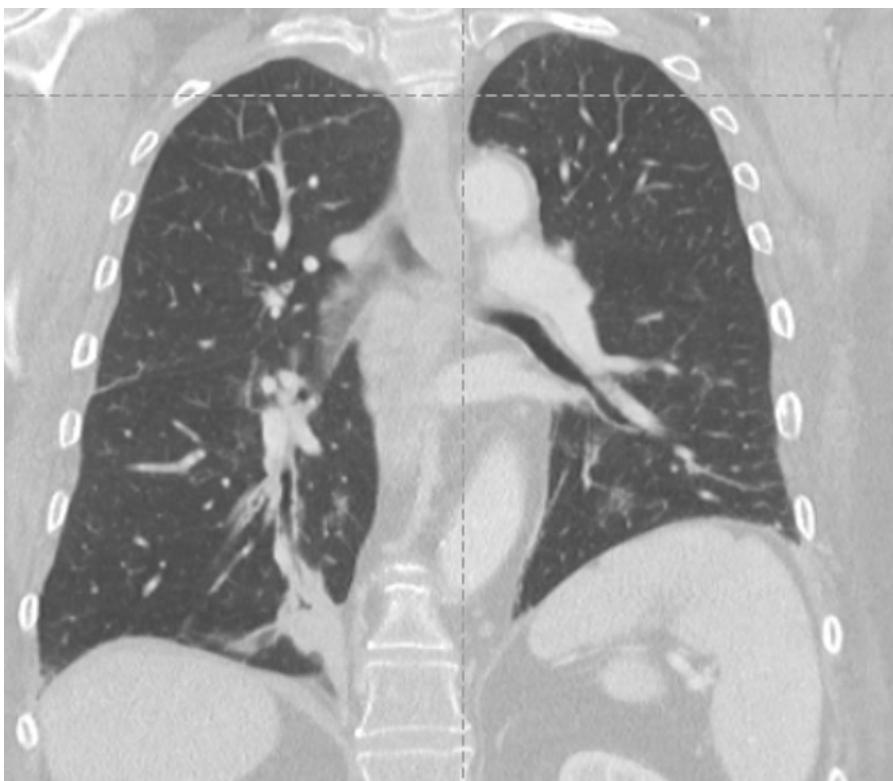
> Chest. 2020 Apr;157(4):994-1011. doi: 10.1016/j.chest.2019.10.042. Epub 2019 Nov 15.

Sensitivity of Radial Endobronchial Ultrasound-Guided Bronchoscopy for Lung Cancer in Patients With Peripheral Pulmonary Lesions: An Updated Meta-analysis

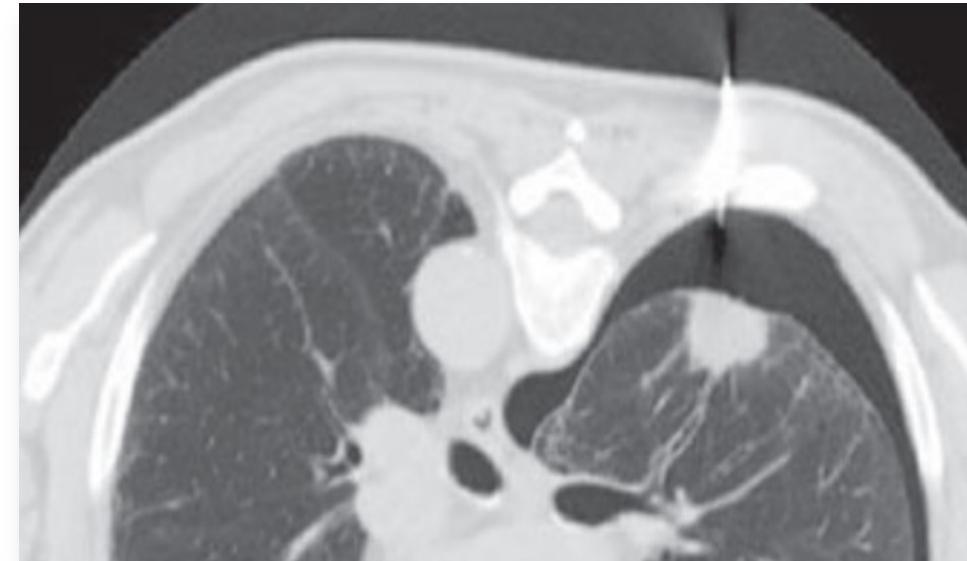
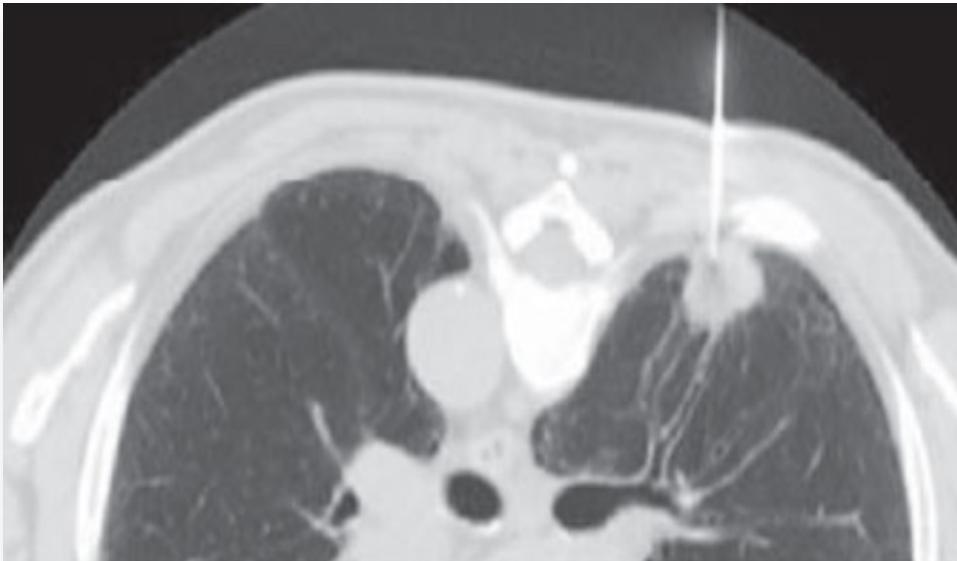
Paula V Sainz Zuñiga ¹, Erik Vakil ², Sofia Molina ¹, Roland L Bassett Jr ³, David E Ost ⁴

- 51 study, total of 7601 pat
- Pooled radial EBUS sensitivity of 0,72 (95% CI, 0,70-0,75)
- Failed to demonstrate an association between **sensitivity** and **air bronchus sign**, average **nodule size**, **use of guide sheet**, use of fluoroscopy, virtual bronchoscopy.
- **ROSE** was associated with increased sensitivity ($p < 0.01$)
- Pooled **pneumothorax** rate 0,7% - excellent safety profile
- Significant between-study heterogeneity

Patfall 2



Transtorakal punktion



Komplikationer from transtorakal lungbiopsi

Pneumothorax hos 11%
Hemoptys 2%
Hematom 1%

Kontraindikationer - Inga absoluta!

Kan ej ligga stilla eller samarbeta med operatören
Emfysem och låg FEV 1 hos KOL patienter
Trombocytopeni och antikoagulantia

Practice Guideline > *Chest*. 2013 May;143(5 Suppl):e142S-e165S.

doi: 10.1378/chest.12-2353.

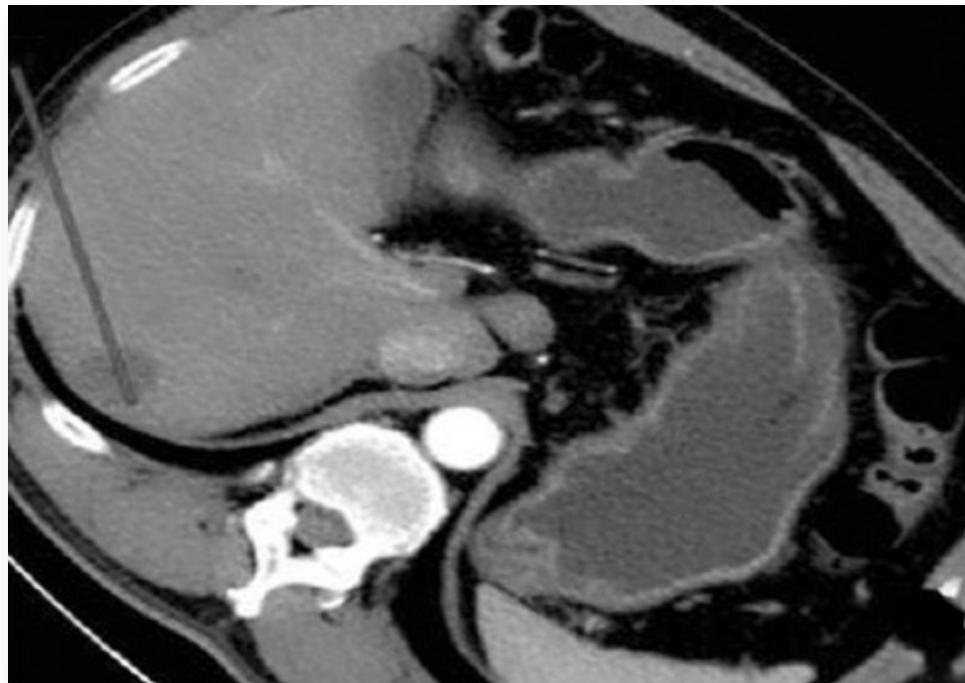
Establishing the diagnosis of lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines

M Patricia Rivera ¹, Atul C Mehta ², Momen M Wahidi ³

Conclusions: The sensitivity of bronchoscopy is high for endobronchial disease and poor for peripheral lesions < 2 cm in diameter. The sensitivity of TTNA is excellent for malignant disease (pooled sensitivity 90%), but TTNA has a higher rate of pneumothorax than do bronchoscopic modalities. R-EBUS and EMN bronchoscopy show potential for increasing the diagnostic yield of FB for peripheral lung cancers. Thoracoscopic biopsy of the pleura has the highest diagnostic yield for diagnosis of metastatic pleural effusion in a patient with lung cancer. Adequate tissue acquisition for histologic and molecular characterization of NSCLCs is paramount.

Lungcancer - diagnostik

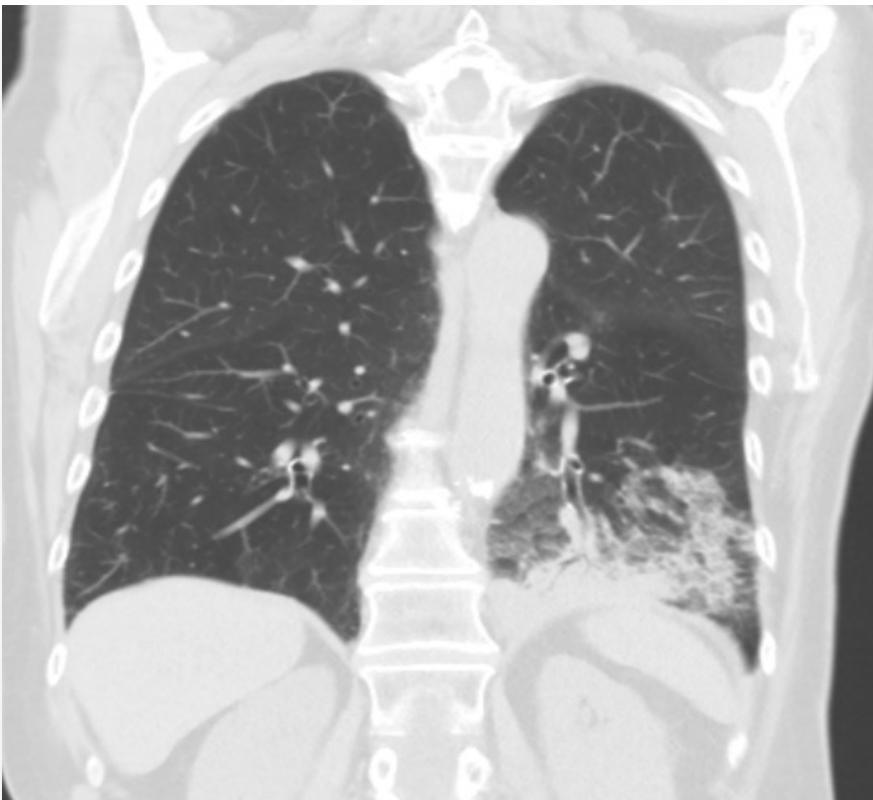
Biopsi from annat organ: lever, binjure, skelett, hudmetastas, ytlig lymfkörtel



Patfall 3

76 år, exrökare. PMR, kortison. Följts på lungmottagningen pga "en skugga vä lunga"

Sista 3 månader ökad produktiv hosta. **Vidare handläggning?**



Januari 2021



Juli 2021

Patfall 3

PET CT juli 2021

Vilken typ av invasiv undersökning?

Bronkoskopi med kryobiopsering

PAD: Mucinöst adenocarcinom



Bronkoskopi med kryoprob

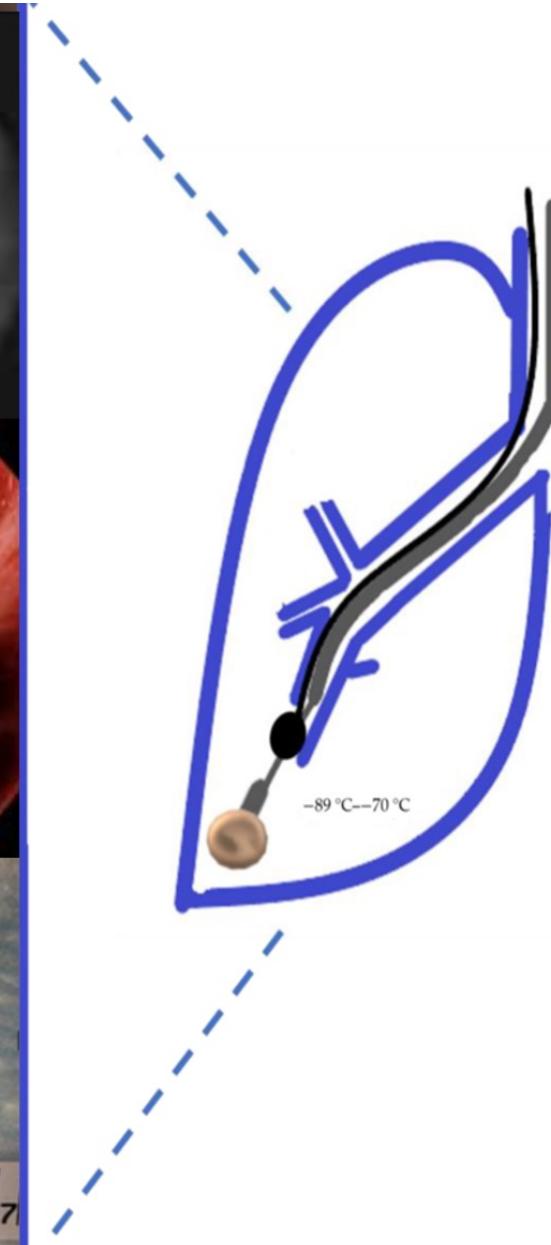
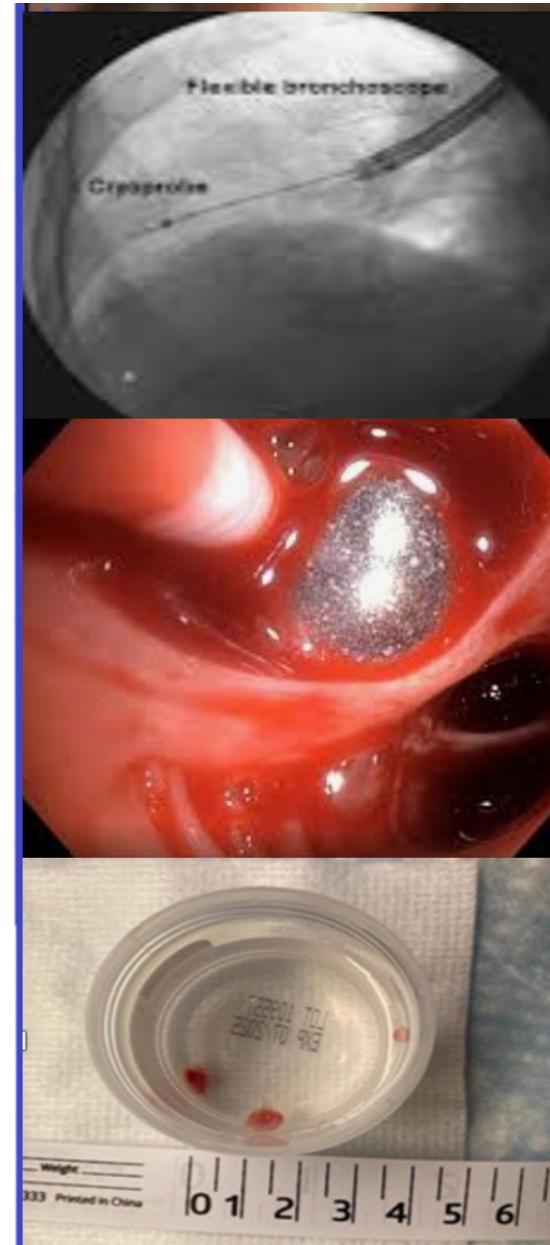
Joule –Thompson effekt - högt flöde och snabb expandering av komprimerad gas (CO_2 , N_2O) -70 till -89 °C

Kryogen – CO_2

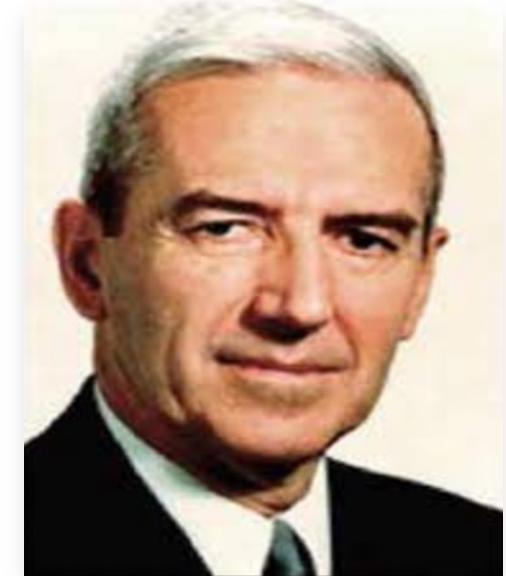
Kryoprob: 1.1mm, 1.7mm, 1.9mm, 2.4mm

Syfte:

- transbronkiella kryobiopsier (lungtransplanterade)
- interstitiell lungsjukdom
- biopsering av misstänkt tumor (i sbd med ILS, MP och GL)
- EBUS-TBMCB
- rekanalisering av centrala luftvägar med rigid bronkoskop



TNM – stadieindelning av lungcancer



Dr. Pierre Denoix 1912-1990, cancerkirurg
Institutet Gustave Roussy Paris

TNM 1st Edition - 1968, 2155 - lungcancer pat

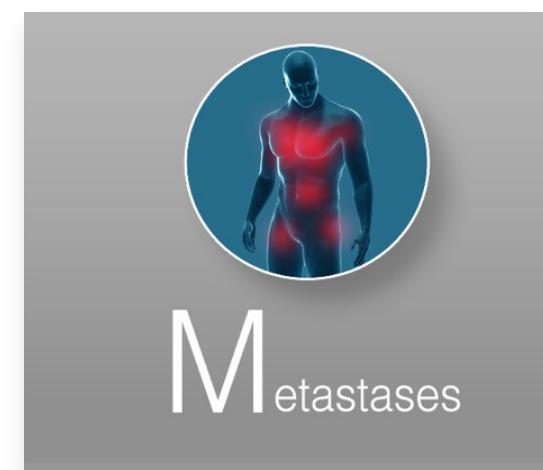
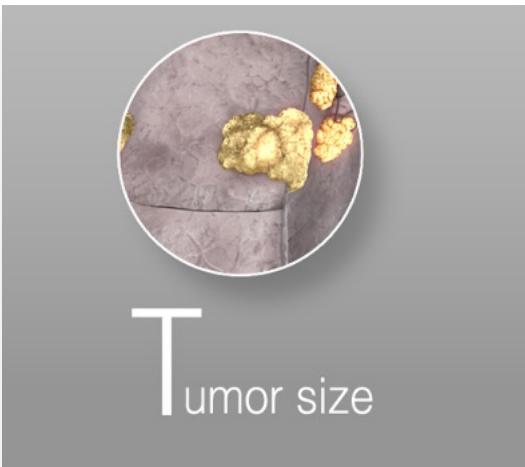
TNM 5th Edition - 1997, 5319 - lungcancer pat

TNM 8th Edition - 2018 i Sverige, 77200 lungcancer pat (Europa, Asien, Nord Amerika)

TNM 9th Edition förväntas 2024

Vad är TNM?

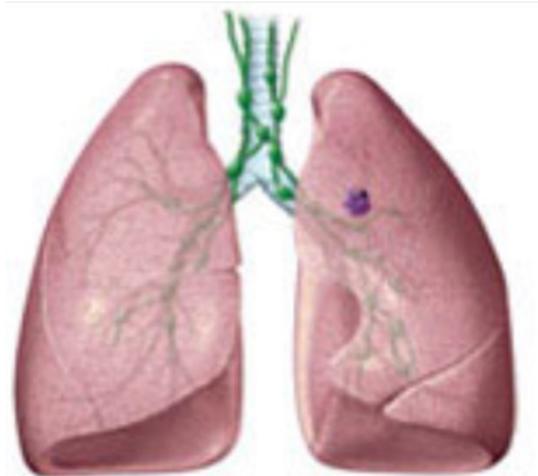
Obligatoriska parametrar



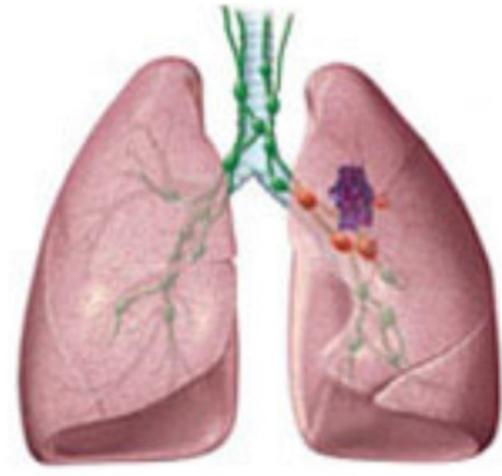
Andra parametrar: PL, R, STAS, LIV

TNM – varför?

Grundläggande för behandlingsval



Stage I
Tumor only in the lung



Stage II
Tumor in the lung and LN



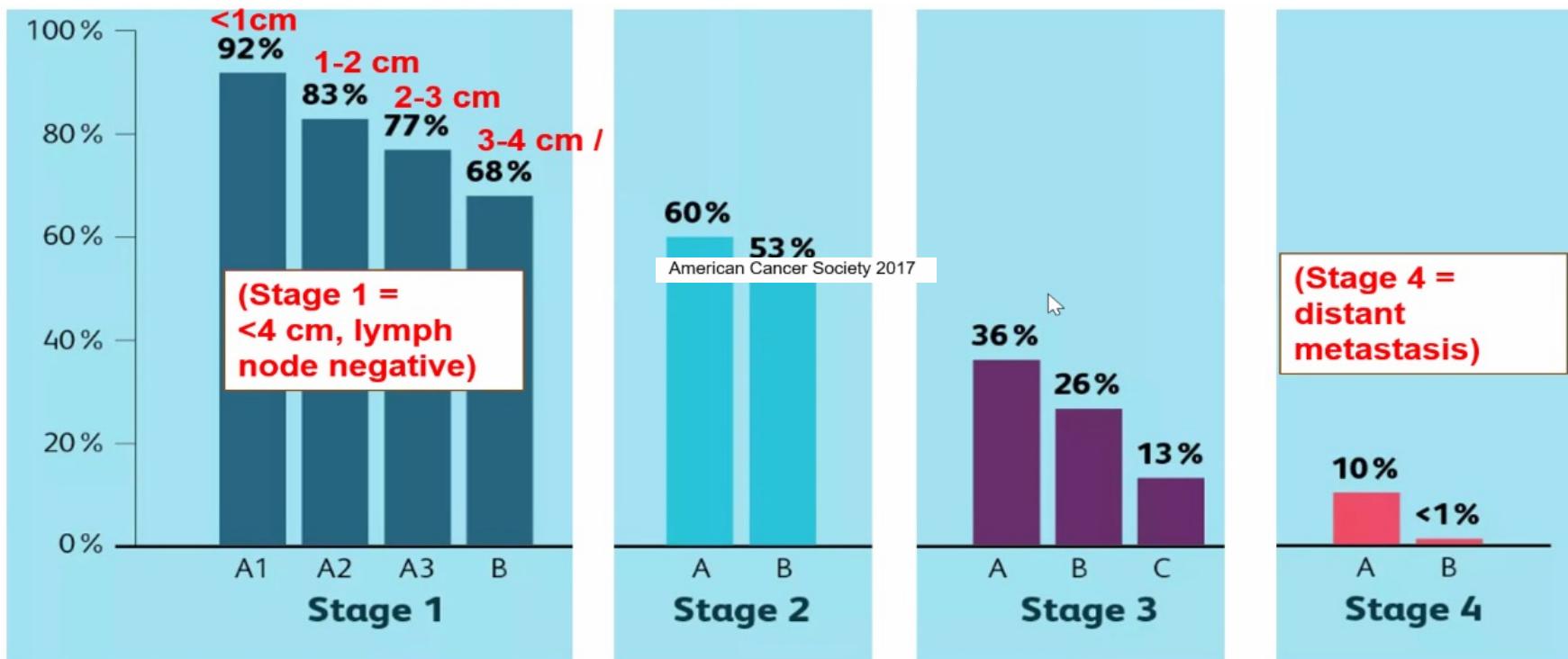
Stage III
Tumor in the lung and
surrounding tissue



Stage IV
Tumor in other organs
or the other lung

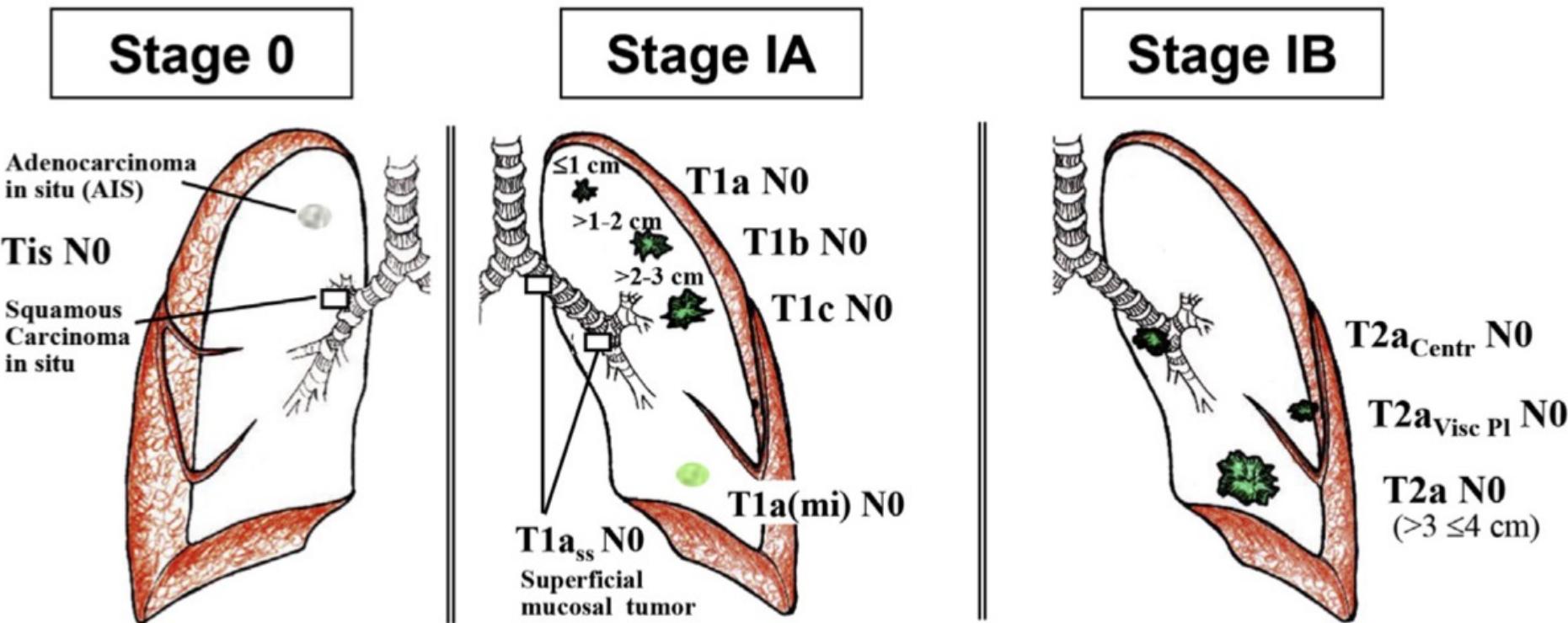
TNM – varför?

Bedömning av prognos



American Cancer Society 2017

Stadieindelning lungcancer TNM 8



Stadieindelning lungcancer TNM 8

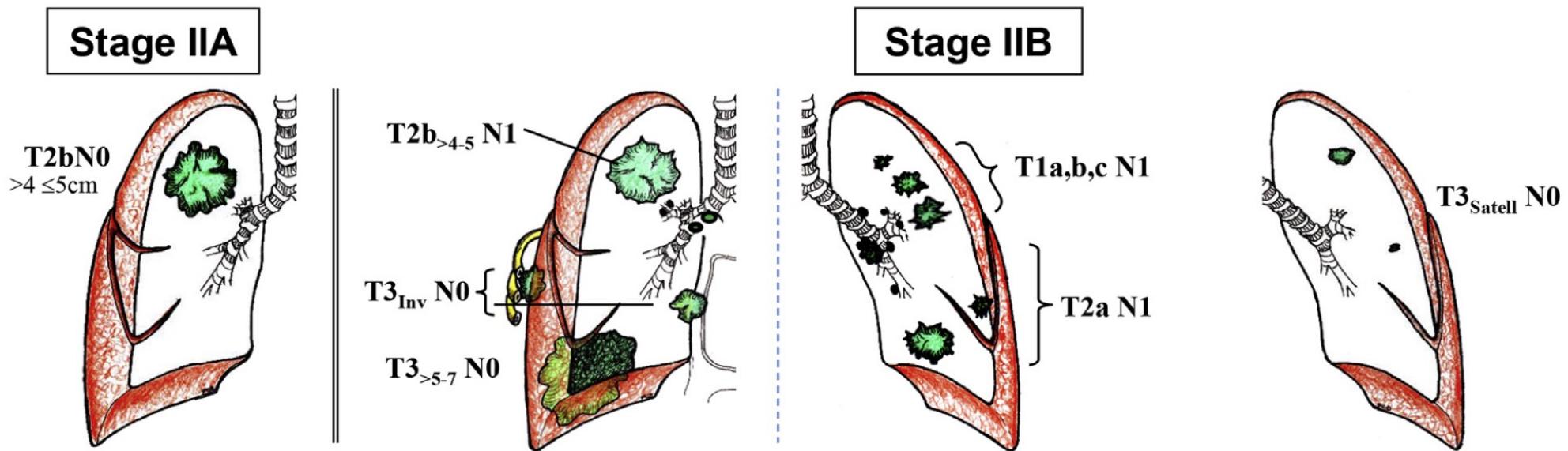
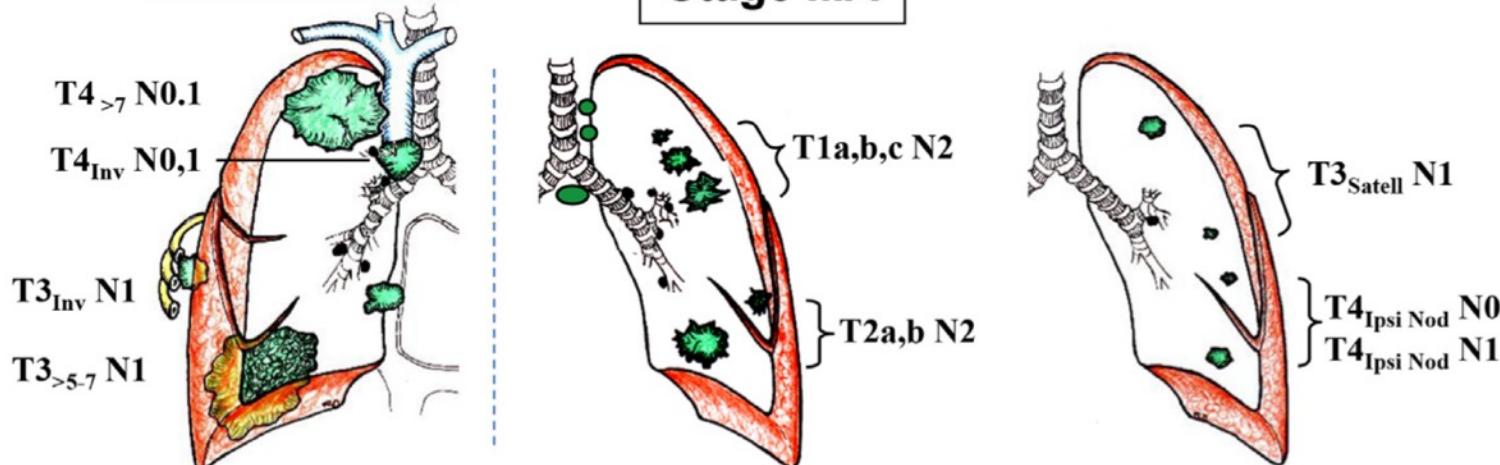


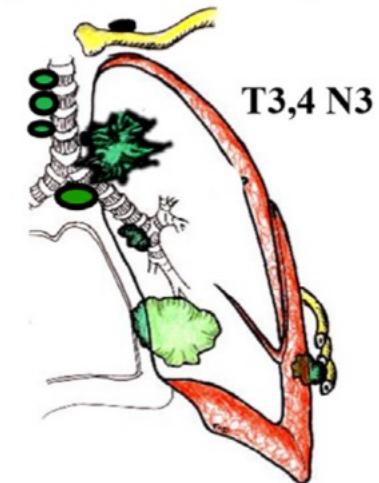
Figure 2 – Graphic illustration of stages 0, I, and II.

Stadieindelning lungcancer TNM 8

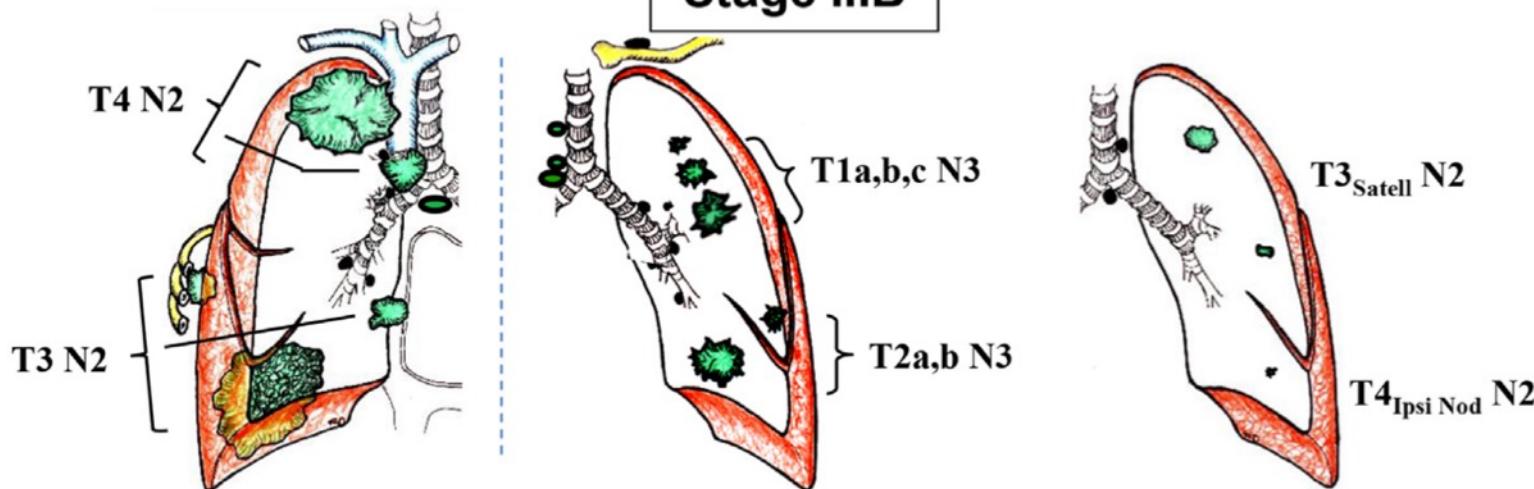
Stage IIIA



Stage IIIC

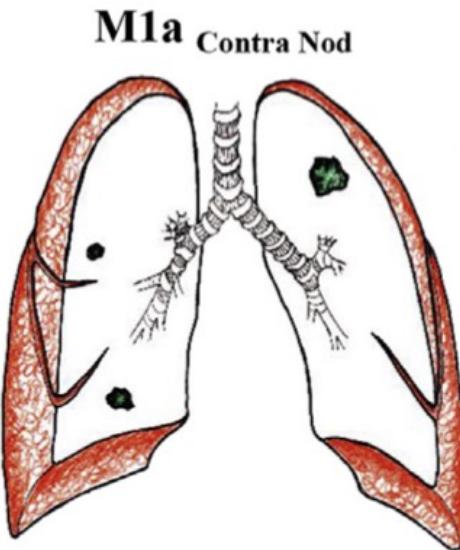
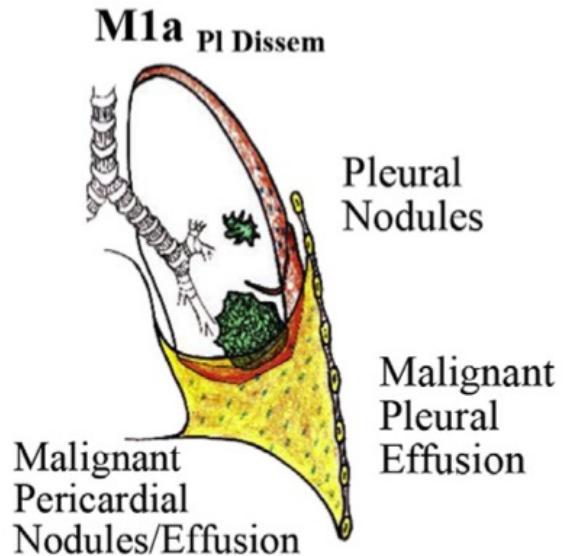


Stage IIIB

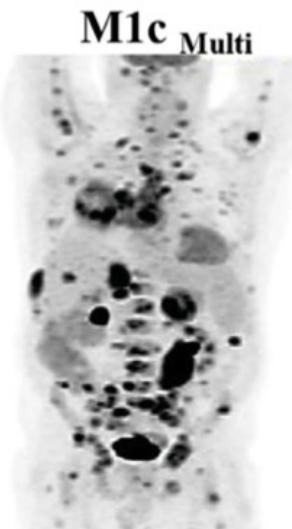
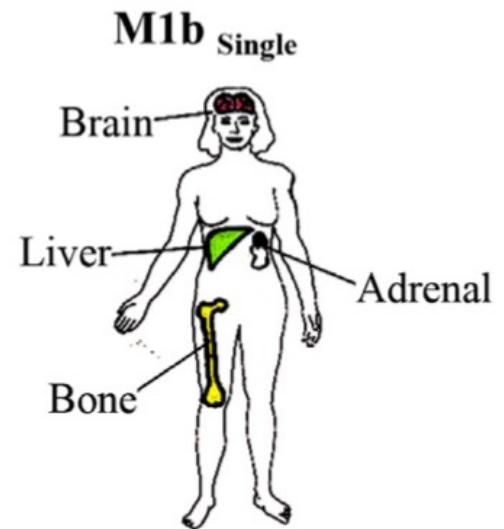


Stadieindelning lungcancer TNM 8

Stage IVA



Stage IVB



cTNM - Metoder

Non-invasiva

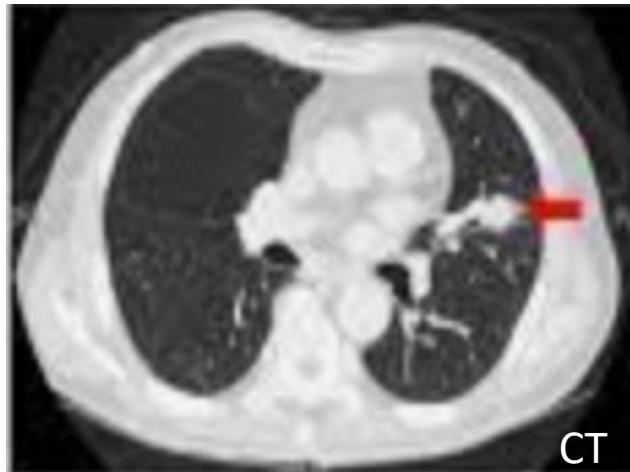


Minimalt Invasiva
Endoskopiska



Invasiva kirurgiska

Anatomisk



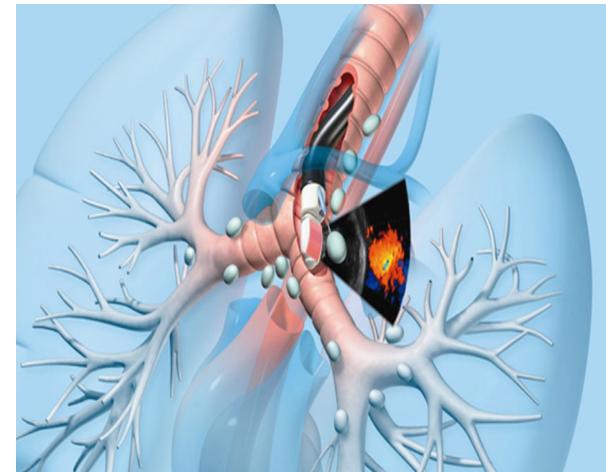
CT

Metabol

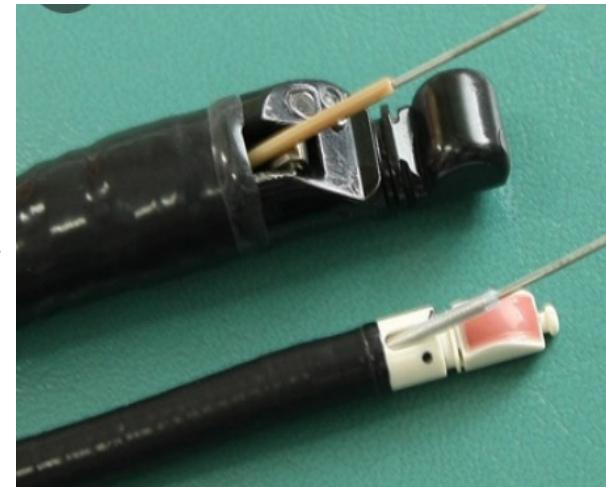


PET CT

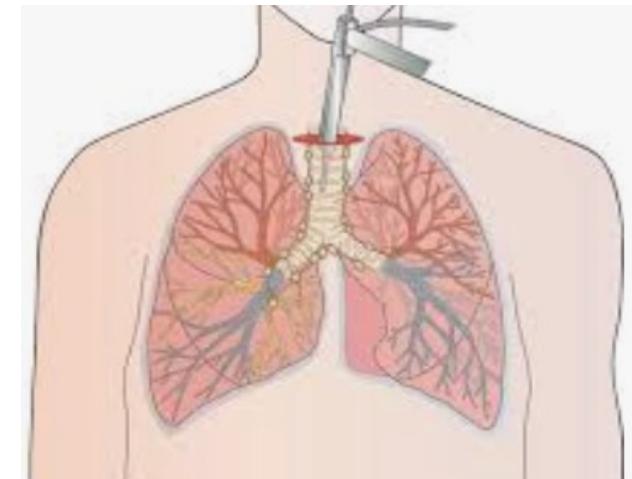
EBUS-TBNA



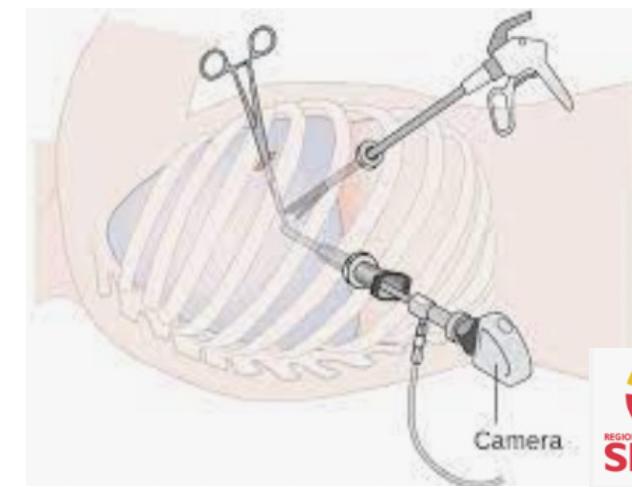
EUS-B-FNA, EUS



Cervikal Mediastinoskopi



VATS

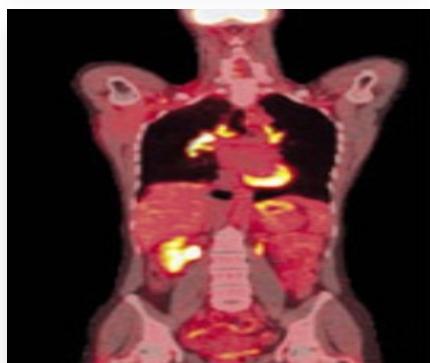


Non-invasiv mediastinal staging

Radiologiskt suspekt mediastinum: LN med kort axis > 1cm och FDG-upptag



Sensitivitet 55%



Sensitivitet 48 - 77%
beroende av SUV_{max} och LN
storlek (LN<10mm sensitivitet 32%)

PPV 56% - Falskt positiva LN - Central tumörväxt, TB, sarcoidos

NPV 88% Falskt negativa LN - Adenocarcinom, tumorstorlek > 3cm

Låg sensitivitet

Hög andel falskt neg/pos

Ingen vävnadsdiagnostik

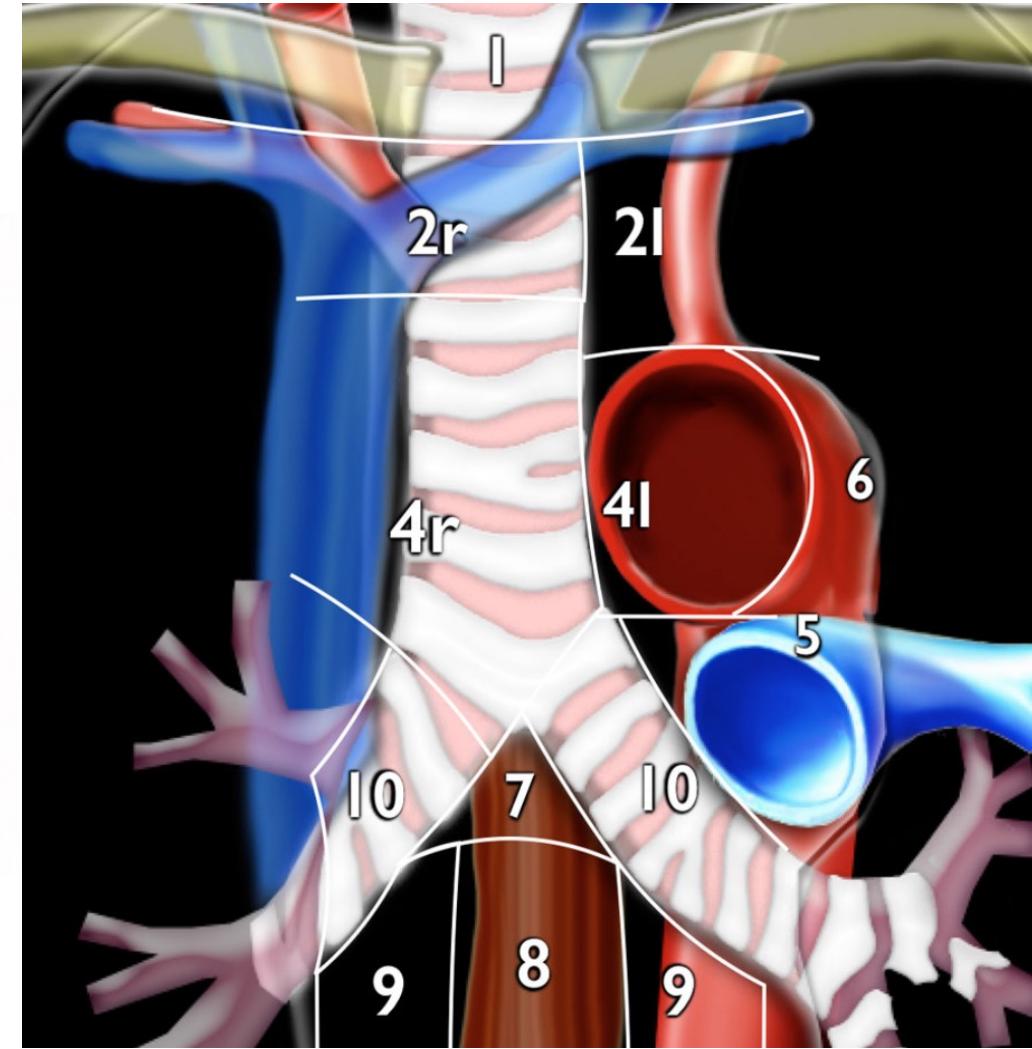
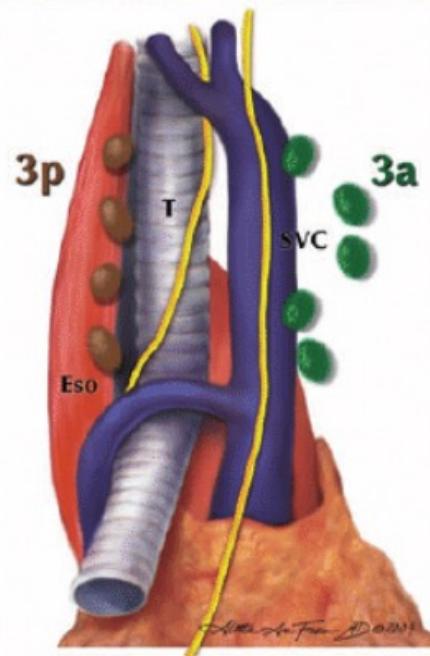
Prenzel KL, Mönig SP, Sinning JM, et al. Lymph node size and metastatic infiltration in non-small cell lung cancer. *Chest* 2003

Kaseda, K et al Identification of false-negative and false-positive diagnoses of lymph node metastases in non-small cell lung cancer patients staged by integrated ^{18}F -fluorodeoxyglucose-positron emission tomography/computed tomography: A retrospective cohort study. *Thorac Cancer*, 2016

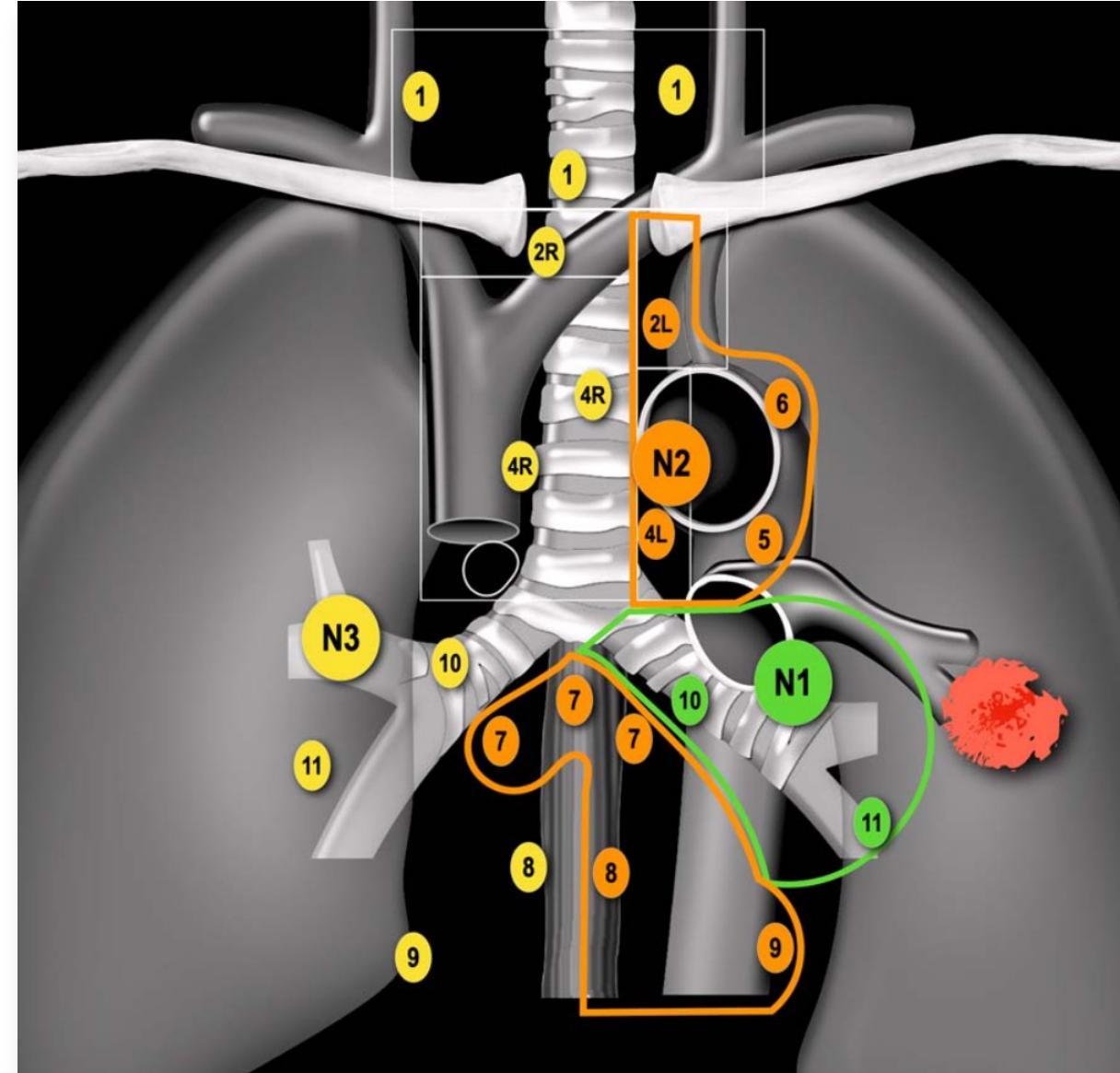
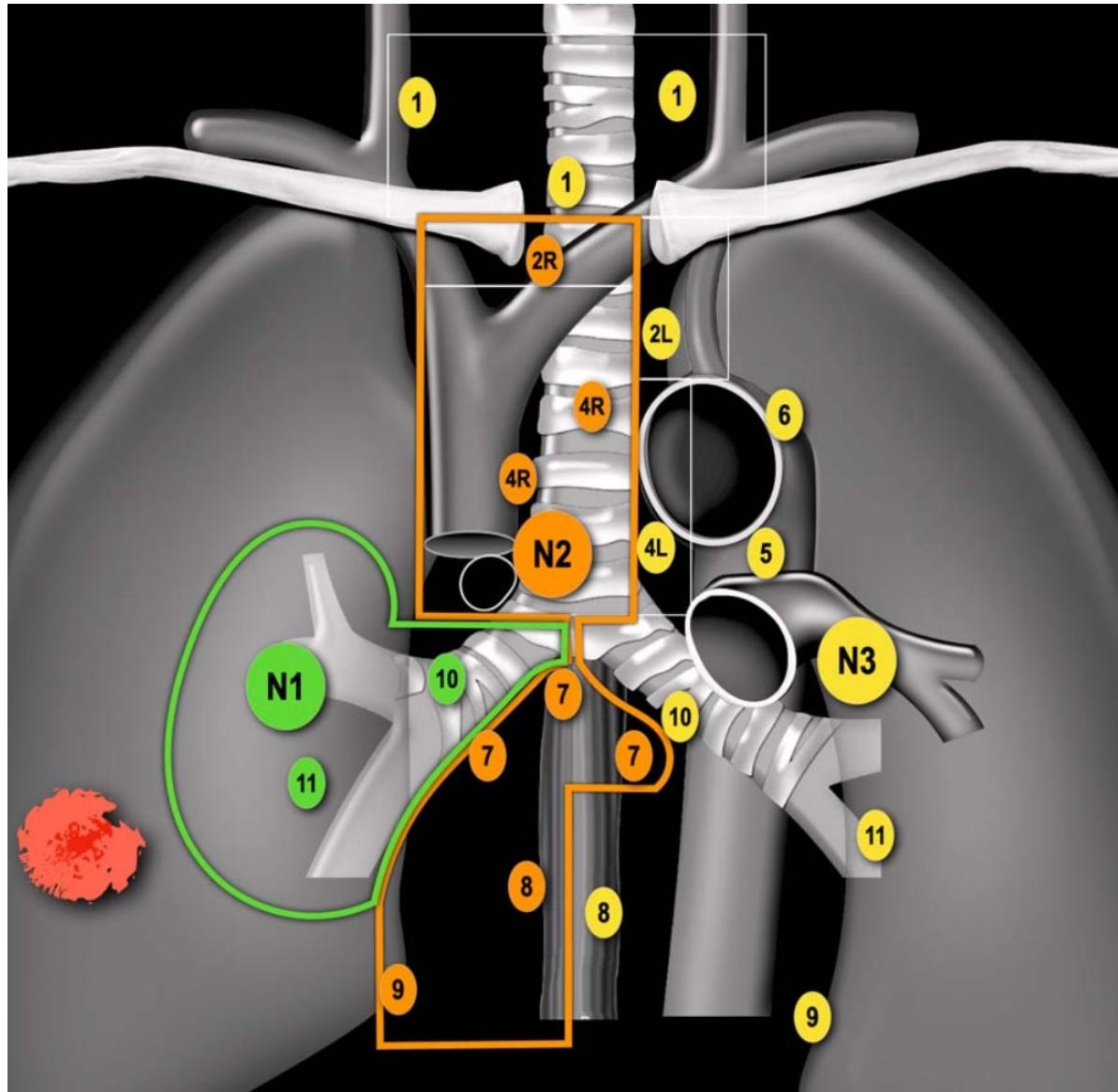
Schmidt-Hansen M et al PET-CT for assessing mediastinal lymph node involvement in patients with suspected resectable non-small cell lung cancer. *Cochrane Database Syst Rev*. 2014

LN map – TNM 8

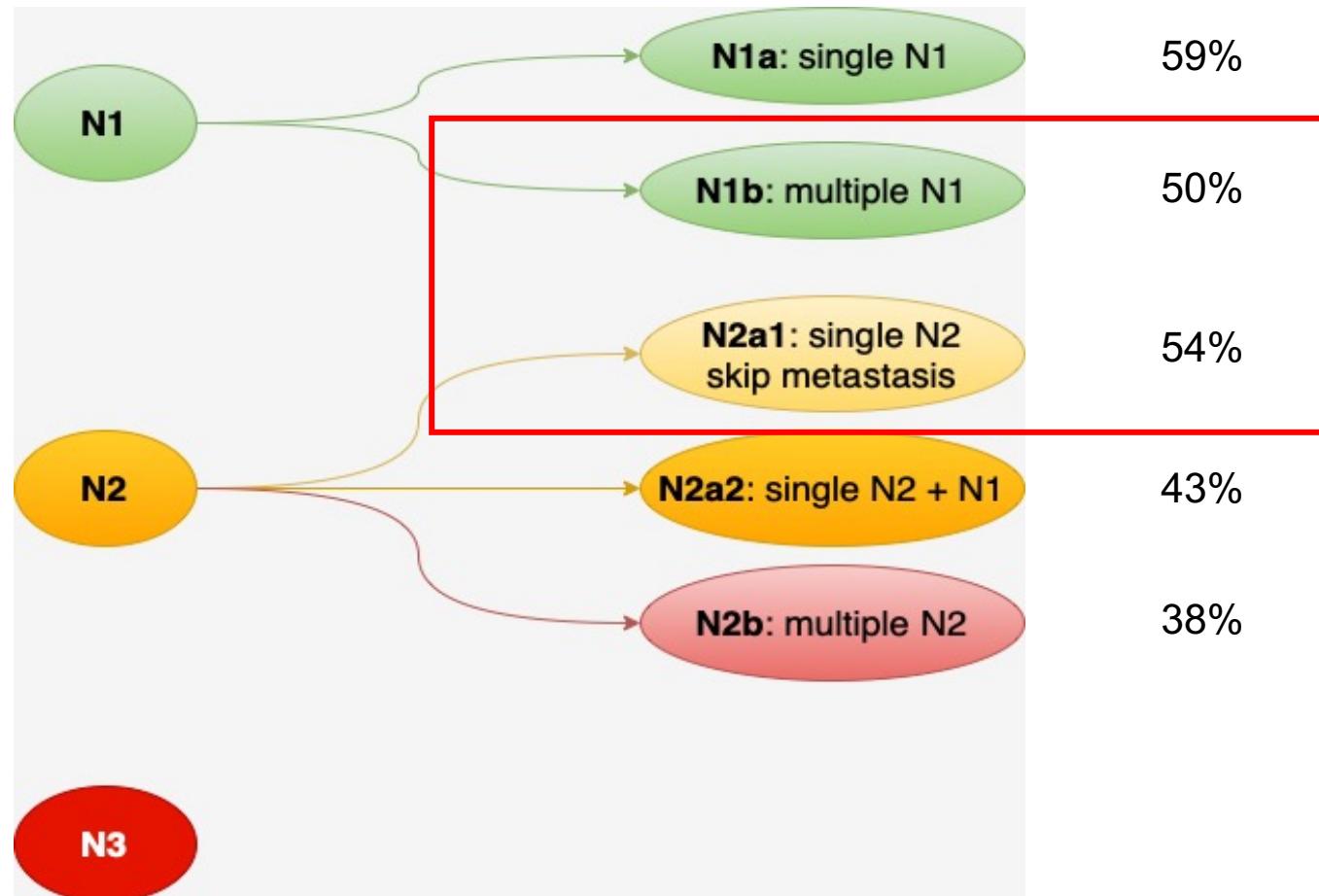
N - deskriptor



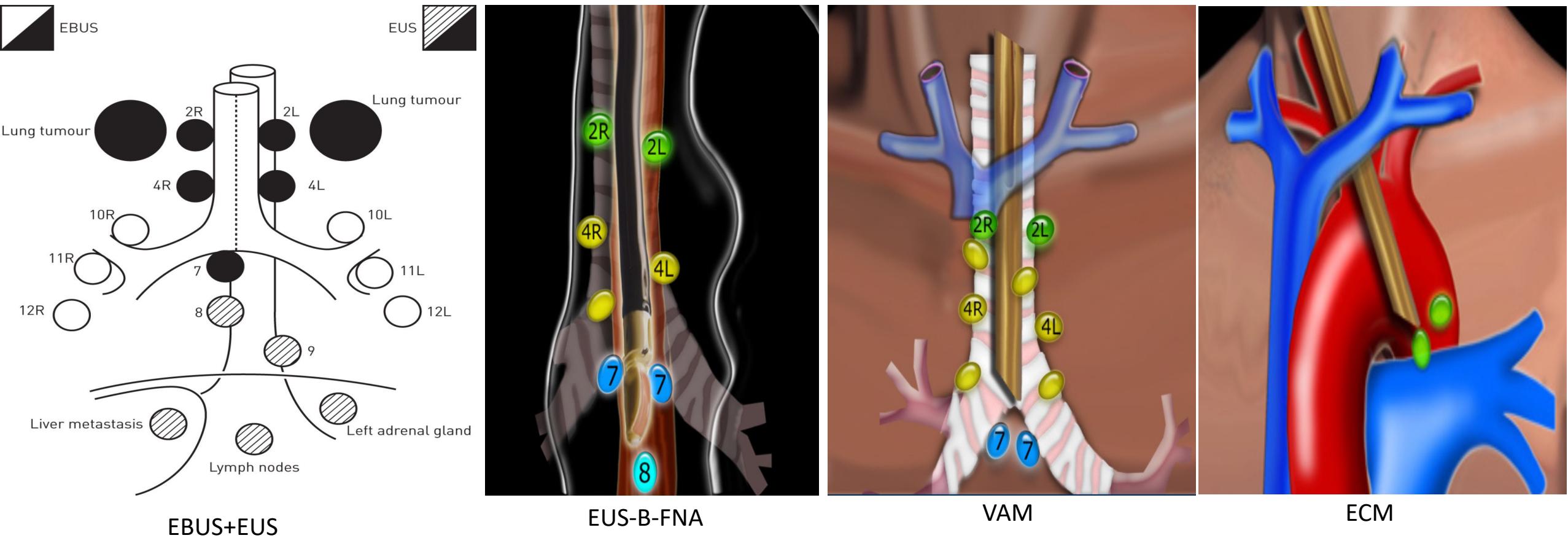
Mediastinal stadieindelning



Nodal staging - TNM 8



Mediastinal staging



Bronchoscopy med EBUS-TBNA

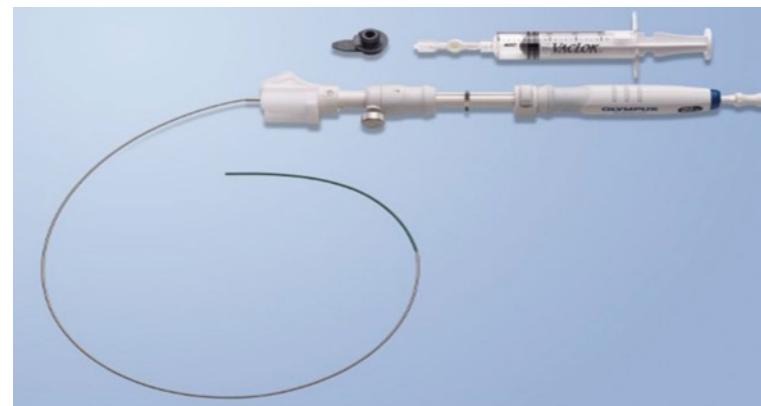
EndoBronchial UltraSound guided - TransBronchial Needle Aspiration



Att se runt hörn och gå igenom väggar

You can use a stick!

But there's more hope with an EBUS bronchoscope!



- Convex transducer 5–12 MHz
(vanligtvis 7 MHz)
- Arbetskanal 2.0mm



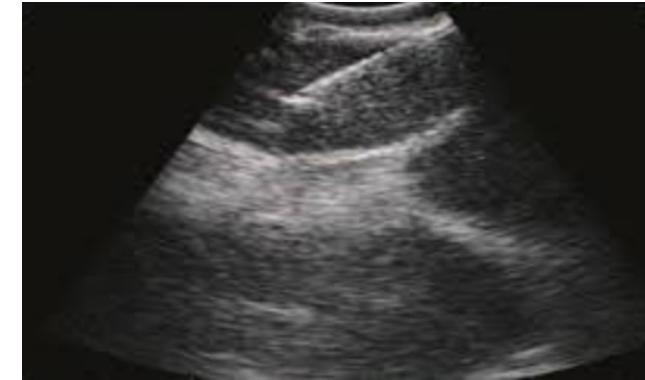
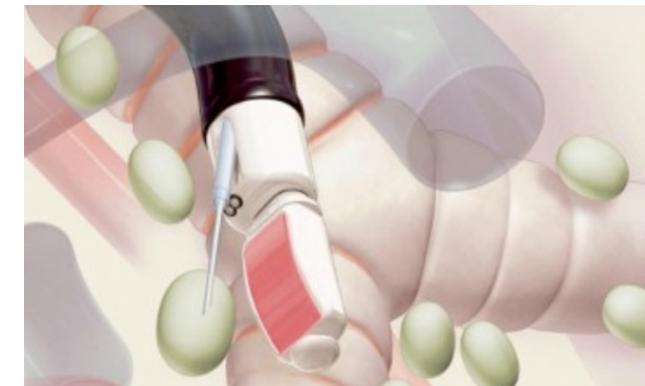
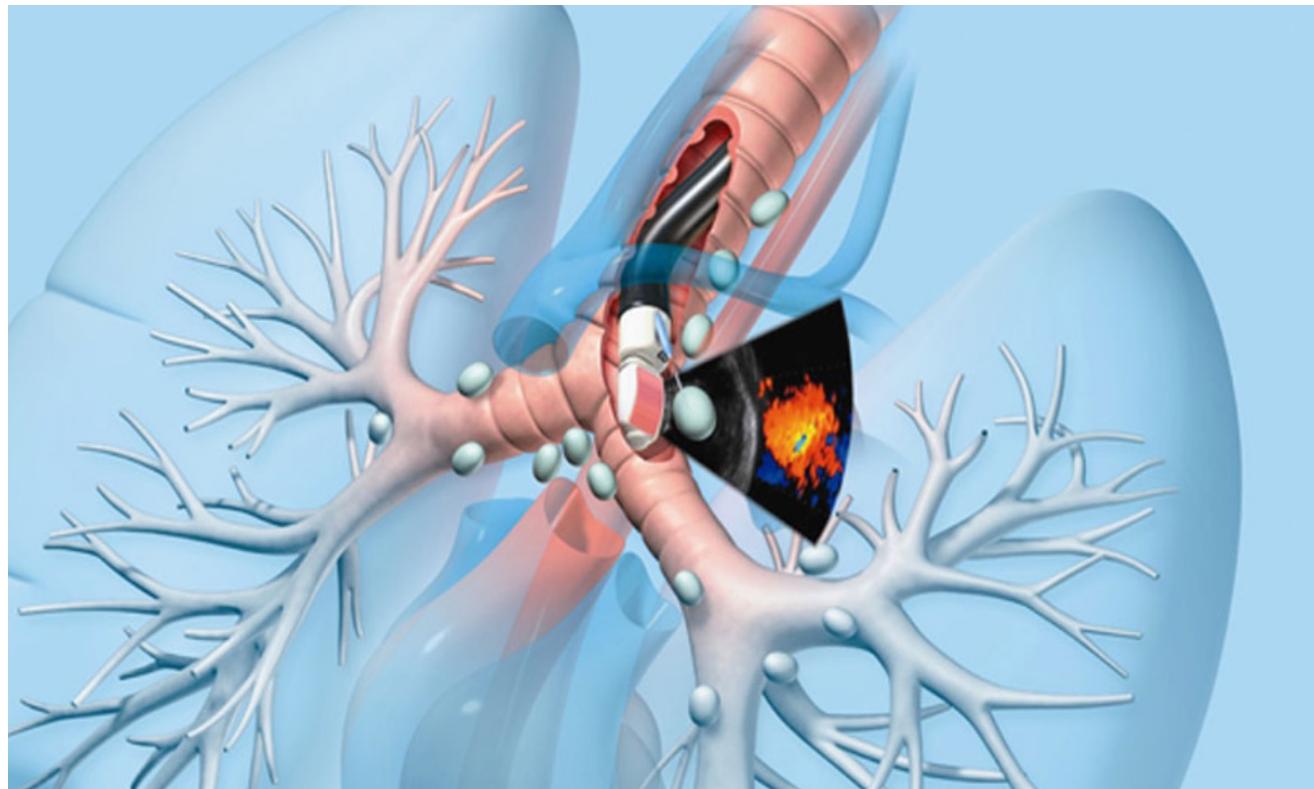
TBNA nålar 19G, 21G, 22G, 25G

Indikationer för EBUS-TBNA

Minimalt invasiv nodal staging vid lungcancer

Diagnos av centrala expansiteter

Oklar mediastinal lymfadenopati: benign? malign?



Typer av EBUS-TBNA

1. **Staging EBUS** – nodal staging av lungcancer
2. **Diagnostisk EBUS** – hilära och medoastinala lymfkörtlar samt expansiviteter nära centrala luftvägar

Diagnostisk EBUS-TBNA

Diagnostisk EBUS-TBMCB (kryo EBUS)

Dooms C et al Revised **ESTS** guidelines for preoperative mediastinal lymph node staging for non-small-cell lung cancer. Eur J Cardiothorac Surg. 2014

Silvestri et al. 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 (**ACCP**) Chest. 2013

Ettinger et al. **NCCN** Clinical Practice Guidelines in Oncology (NCCN Guidelines). Non-small cell lung cancer. Version 3. 2017

Maribel Botana-Rial et al. A systematic review: Is the diagnostic yield of mediastinal lymph node cryobiopsy (cryoEBUS) better for diagnosing mediastinal node involvement compared to endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)? Resp Med 2023



EBUS-TBNA - proceduren

Icke-invasiv och patientsäker metod

Poliklinisk procedur, lokalbedövning i svalget + Alfentanyl iv ± Rmimazolam iv

Först inspekitionsbronkoskopi

Sedan EBUS bronkoskop transoralt

Via larynxmask / rakbronkoskop vid generell anestesi

Vid dg EBUS punkteras förstorade och hypermetabola LN eller expansivitet

Vid staging EBUS provtagningsordning N3→ N2→N1

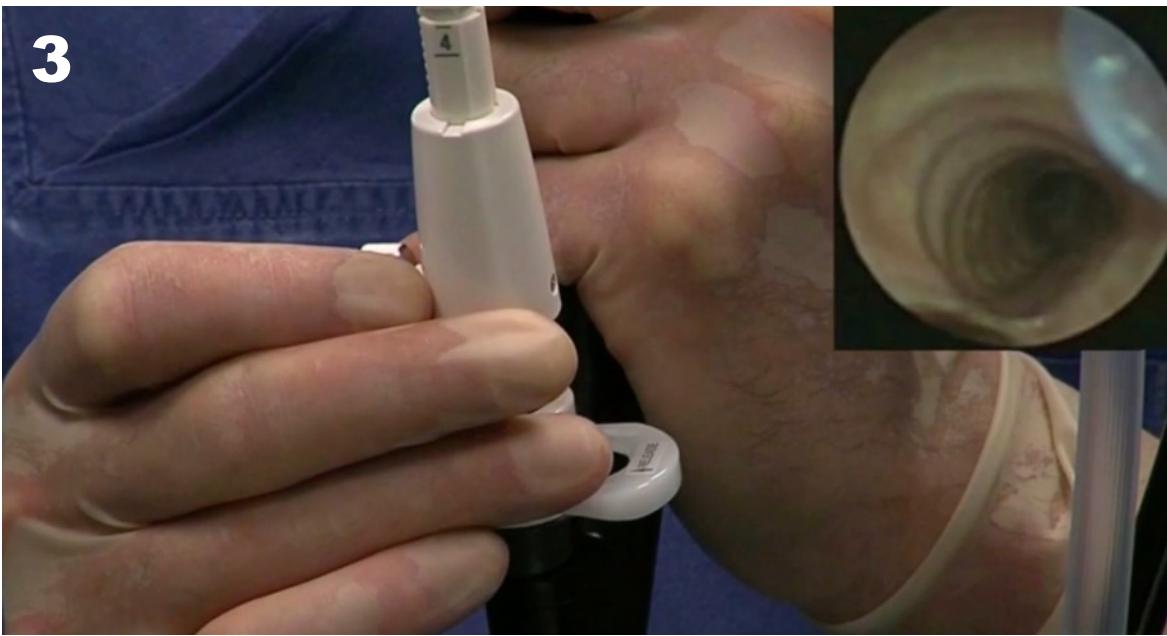
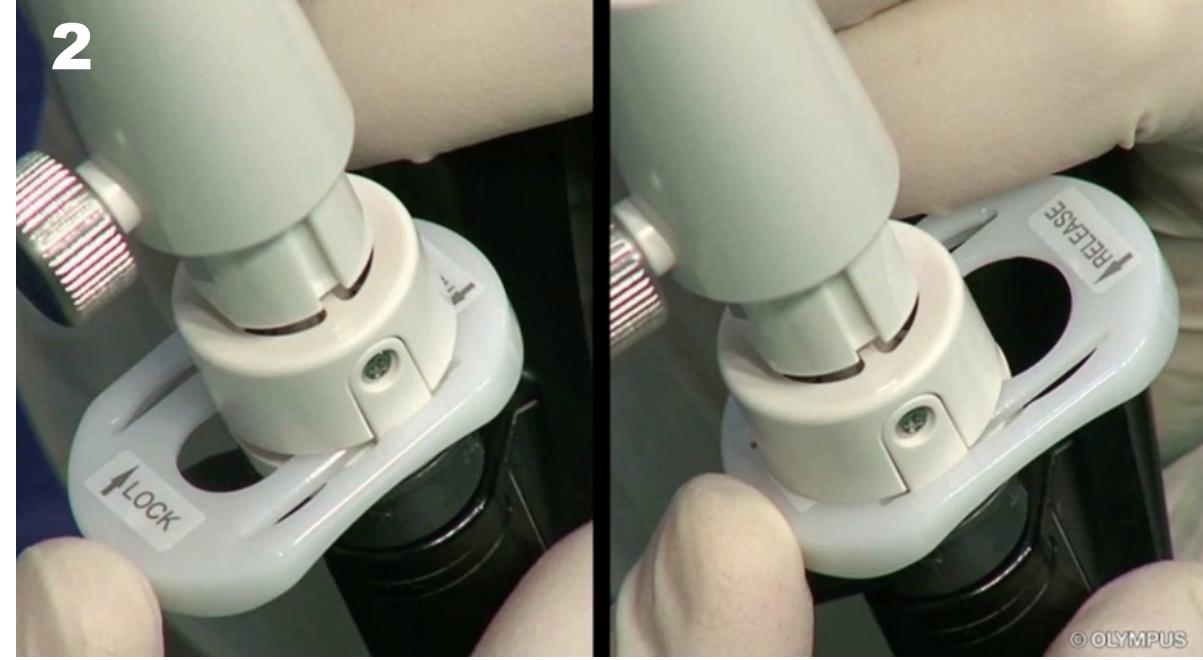
Rapid On site Examination, preliminär cytologi

Kontraindikationer: som för konventionell bronkoskopi

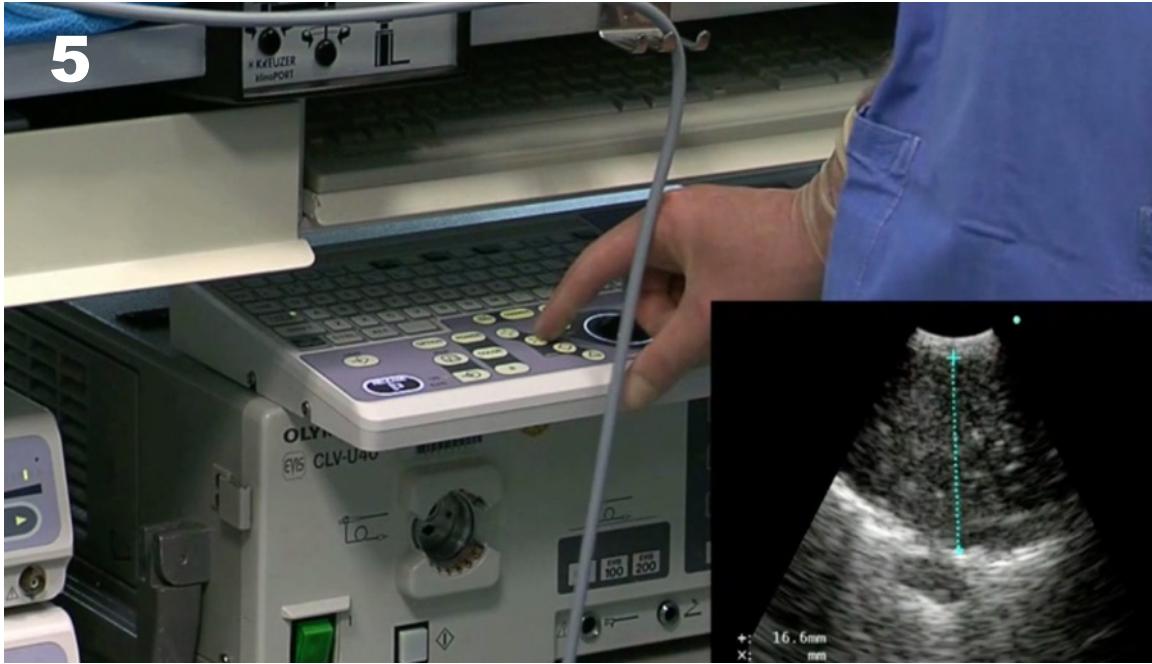
Komplikationer: blödning, pneumothorax, reaktion på anestesimedel, mediastinit



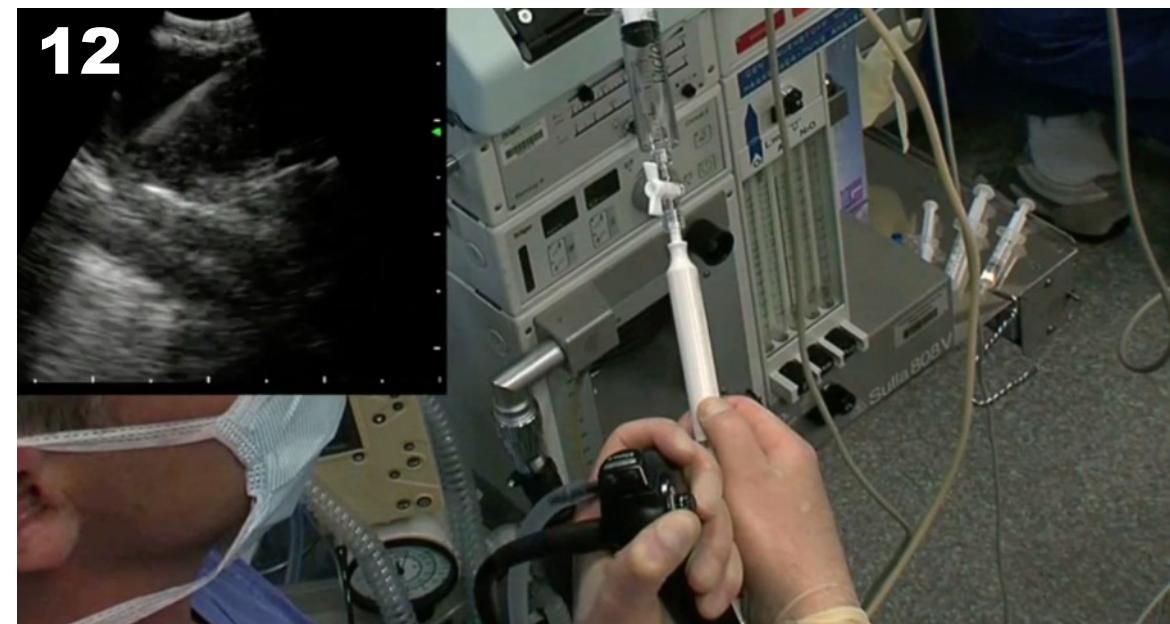
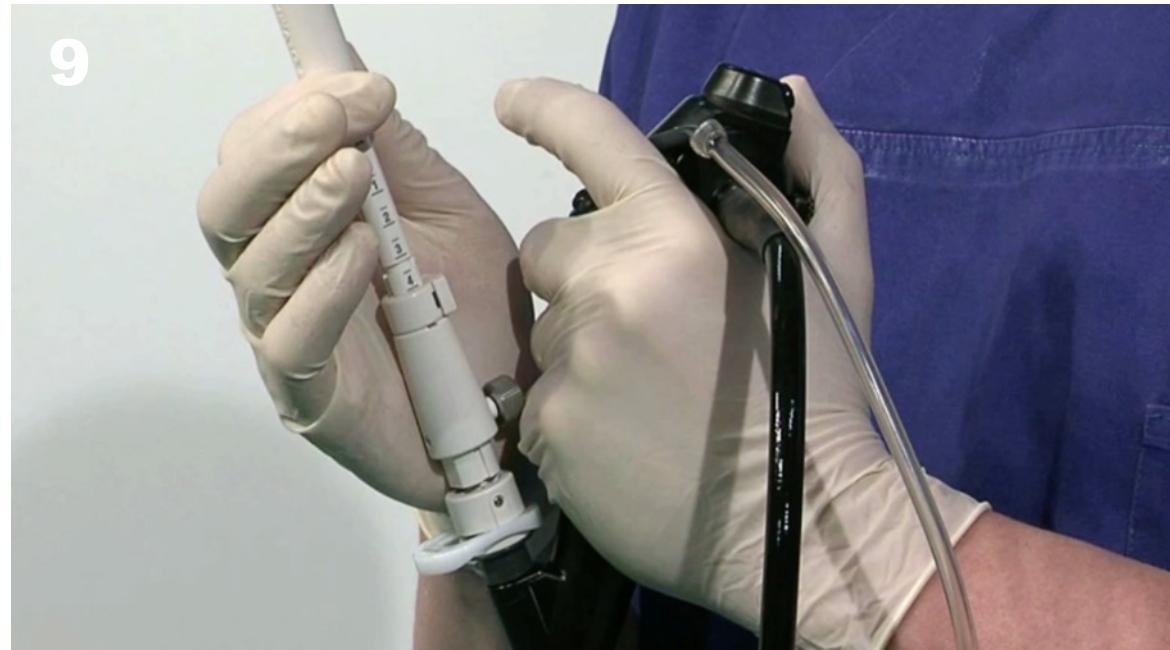
EBUS-TBNA – step by step



EBUS-TBNA – step by step



EBUS-TBNA – step by step



EBUS-TBNA



TABLE VI.—*Summary of published guidelines for numbers of procedures required in IP training.*

Type of procedure	BTS	TSANZ ⁸⁵	ERS/ATS	ACCP	AIPO
Flexible bronchoscopy	50*	200/12-20	NR	100/25	100/100
Rigid bronchoscopy	-	-	20/10-15	20/10	NR
TBNA		20	25/NR	25/10	NR
AFB	-	20/20	Long learning curve	20/10	NR
EBUS	-	50/20	40/25	50/20	NR
TINA/B	-	-	10/5-10	10 aspirates, 10 cores/10	NR
LB	-	-	>20/10-15	15/10	NR/30
EES/APC	-	-	10/5-10	15/10	NR
EBCT	-	-	10/5-15	10/5	NR
Airways stents	-	-	10/5-10	20/10	NR
EBBT	-	-	5/5-10	5/5	NR
PDT	-	-	10/5-10	10/5	NR
PT	-	-	5-10/10	20/10	NR
TTOT	-	-	5/5	10/5	NR

EBUS / EUS-B-FNA träning

- Structured, evidenced-based training programmes
- ERS course EBUS TBNA
- Part 1 – theory
- Part 2 – Clinical and simulations training
- Part 3 - Supervised training
- The Essential EBUS Bronchoscopist
<https://www.bronchoscopy.org/downloads/The%20Essential%20EBUS%20Bronchoscopist%20eBook.pdf>
- EBUS assessment tool (EBUSAT)
<https://www.bronchoscopy.org/downloads/BEP%20EBUS%20assessment%20tools.pdf>

Giudelines for invasive mediastinal staging

Rekommendation för mediastinal stadieindelning inför kurativ behandling
(Lungcancer Vårdprogram 2023)

PET-DT inkl. diagnostisk DT av torax är grundläggande undersökning

Mediastinal provtagning (EBUS-TBNA, ev. i komb med EUS-B-FNA, i andra hand mediastinoskopi) om:

- PET-positiva lymfkörtlar i N1-,N2- eller N3-position
- Centralt växande tumörer även om PET-negativa mediastinala lymfkörtlar
- Tumör > 3 cm oavsett lokalisering

Vid stark misstanke (PET positiv eller "bulky nodes") och EBUS/EUS-B-FNA benign **Mediastinoskopi** preop

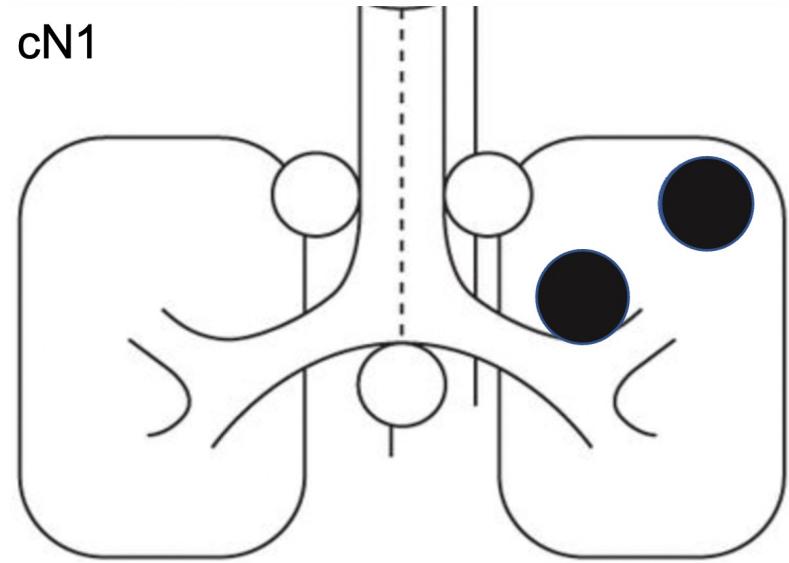
Table 1. Summary of staging guidelines

	ACCP [1]	ESTS [3]	ESGE/ERS-ESTS [4]
Indications of invasive staging	Central tumor ($\leq 1/3$) cN1 stage ^a cN2/3 stage	Central tumor ($\leq 2/3$) Tumor > 3 cm cN1 and cN2/3 stage ^b	Central tumor ($\leq 1/3$) Tumor ≥ 3 cm cN1 and cN2/3 stage ^b FDG-non-avid tumor
First procedure	EBUS/EUS	cN0/N1: EBUS/EUS or mediastinoscopy cN2/N3: EBUS/EUS	EBUS/EUS(-B)
Systematic endosonographic procedure	No clear recommendation as to how staging should be performed	Complete assessment of mediastinal and hilar nodal stations Sampling the largest node > 5 mm on ultrasonography within each of these stations and PET-avid nodes within each of these nodal stations	Complete assessment of mediastinal and hilar nodal stations Sampling of at least three different mediastinal nodal stations (4R, 4L, 7) in cN2/N3 stage ^b and all abnormal lymph nodes ^b
Surgical staging if first procedure negative	When the clinical suspicion of mediastinal node involvement remains high ^c	cN2/3 stage ^{b, d}	Central tumor ($\leq 1/3$) Tumor ≥ 3 cm FDG-avid tumor cN1 and cN2/N3 stage ^b (CT or PET)

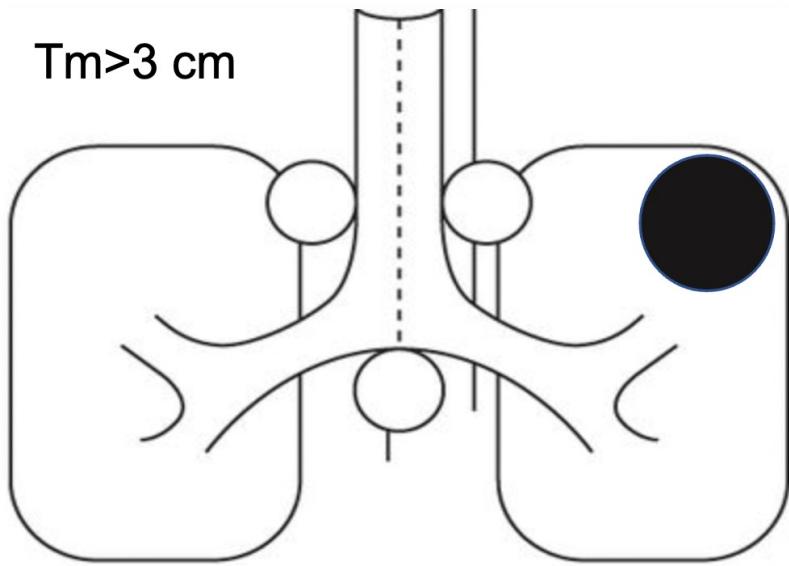
ACCP, American College of Chest Physicians; ESTS, European Society for Thoracic Surgery; ESGE, European Society of Gastrointestinal Endoscopy; ERS, European Respiratory Society; $\leq 1/3$, inner third of the lung; $\leq 2/3$, inner two thirds of the lung; FDG, fluorodesoxyglucose; CT, computed tomography; PET, positron emission tomography. ^aNode with a short axis > 10 mm. ^bNode with a short axis > 10 mm or node that is FDG-PET-avid. ^cWith mediastinoscopy, video-assisted thoracic surgery, etc. ^dWith video-assisted mediastinoscopy.

Indikationer för invasiv staging

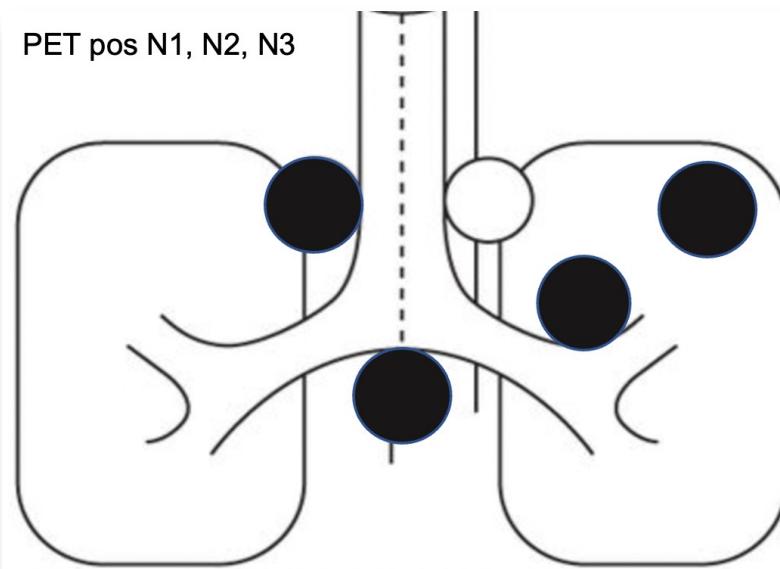
cN1



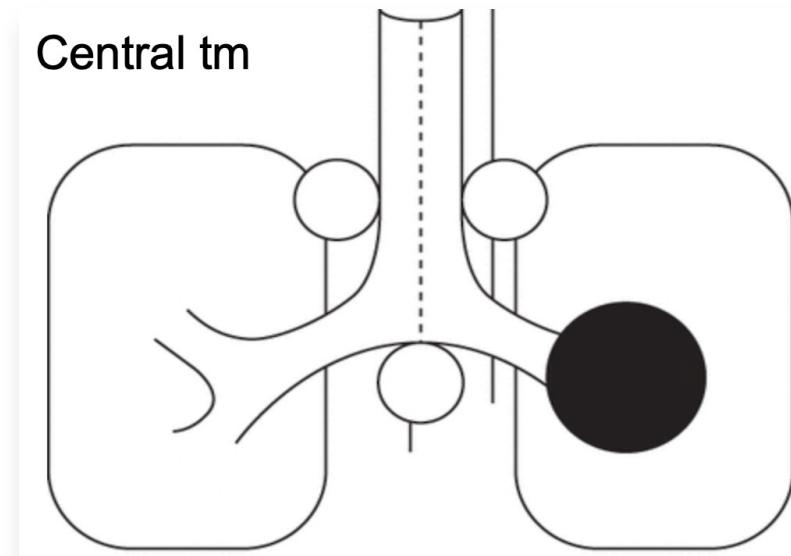
Tm>3 cm



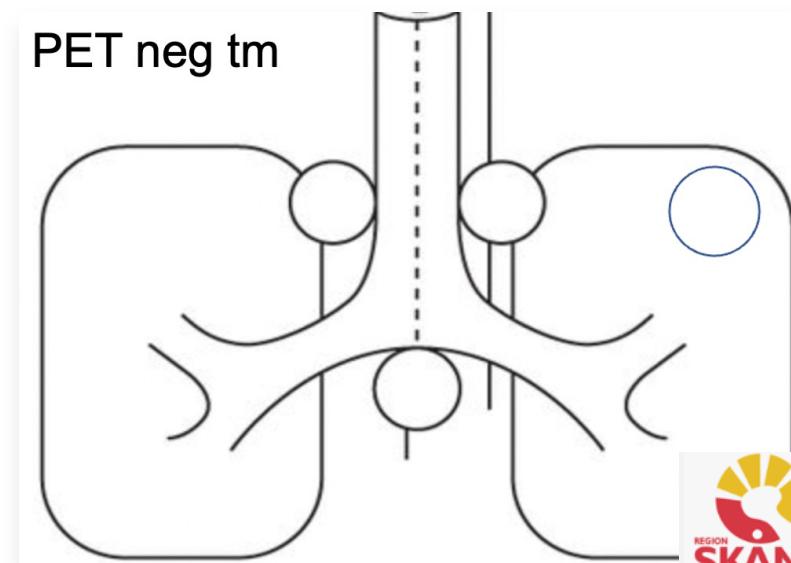
PET pos N1, N2, N3



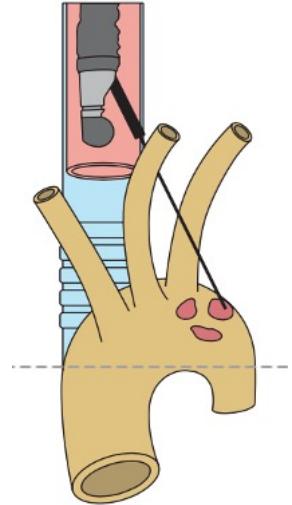
Central tm



PET neg tm



Guidelines for invasive mediastinal staging



Nodal basin	EBUS	EUS	CM	AM	VATS
1: Highest mediastinal	✓				
2: Upper paratracheal	✓	✓	✓	✓	✓
3: Pre-vascular retrotracheal	✓	✓			✓
4: Lower paratracheal	✓	✓	✓	✓	✓
5: Subaortic (AP window)		✓			✓
6: Para-aortic		✓ [#]		✓	✓
7: Subcarinal	✓	✓	✓		✓
8: Paraoesophageal		✓			✓
9: Pulmonary ligament		✓			✓
10: Hilar	✓		✓		✓
11: Interlobar	✓				✓

Lymph node stations accessible by different techniques

Staging EBUS

Systematisk endosonografisk undersökning av hilära och mediastinala LN

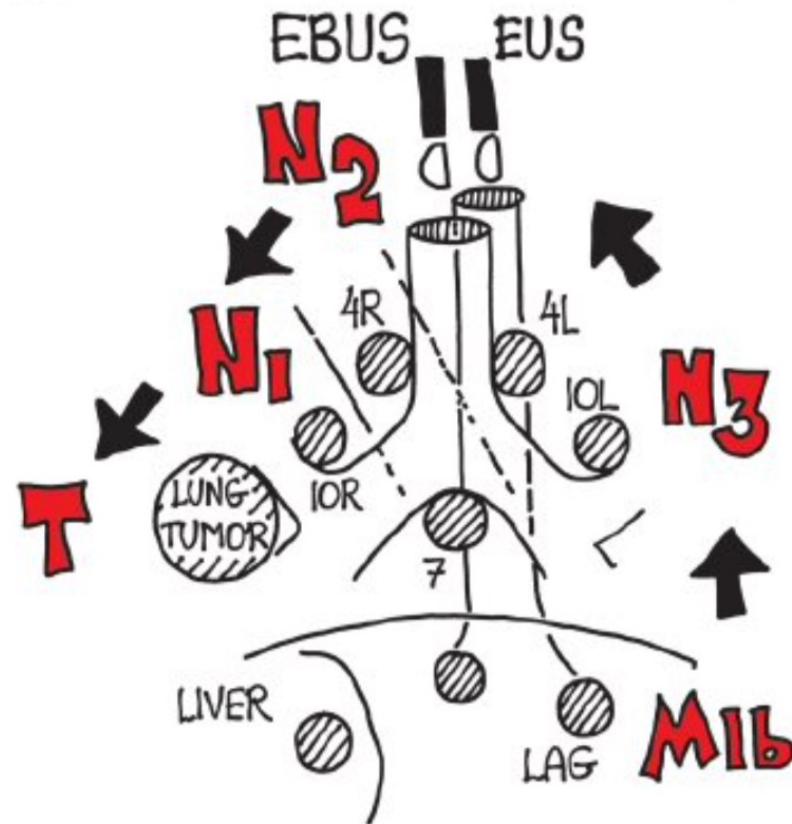
Poliklinisk procedur

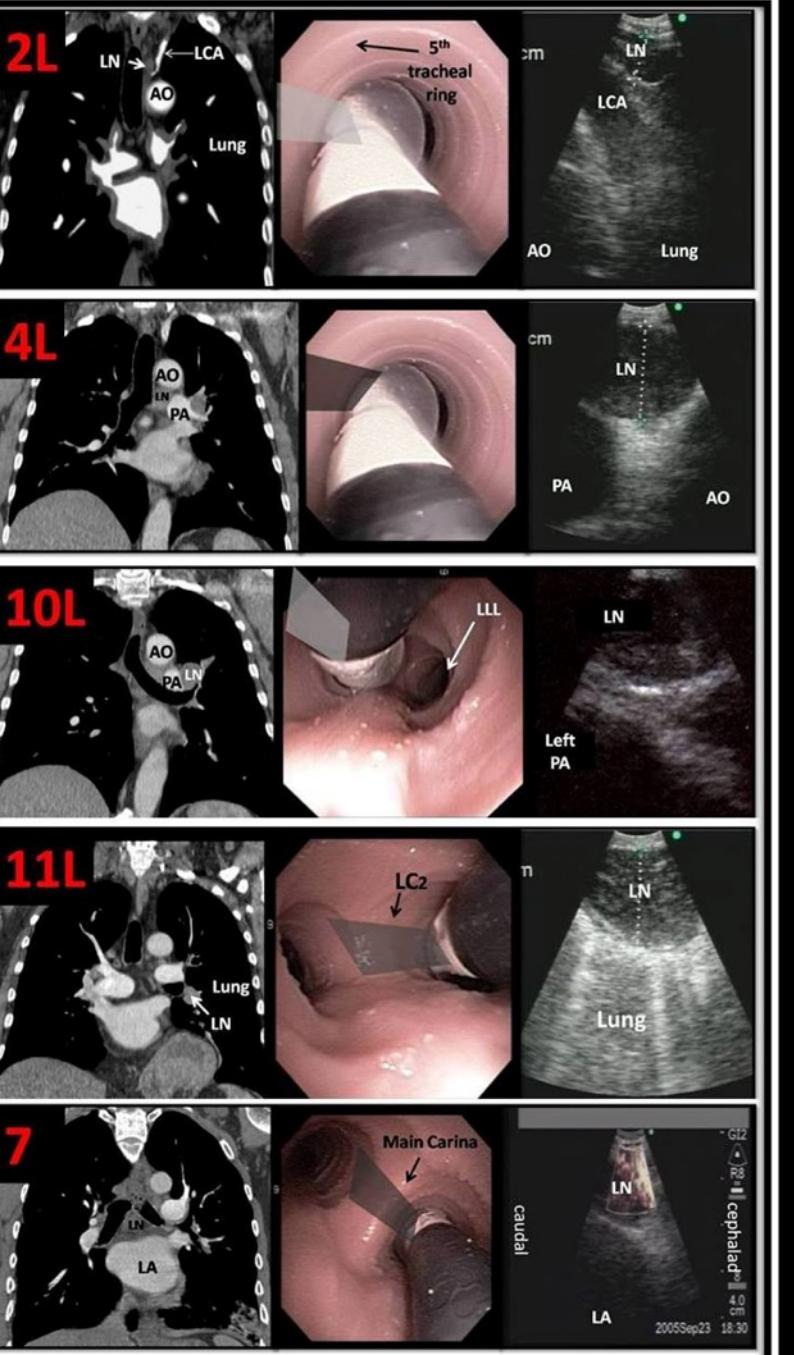
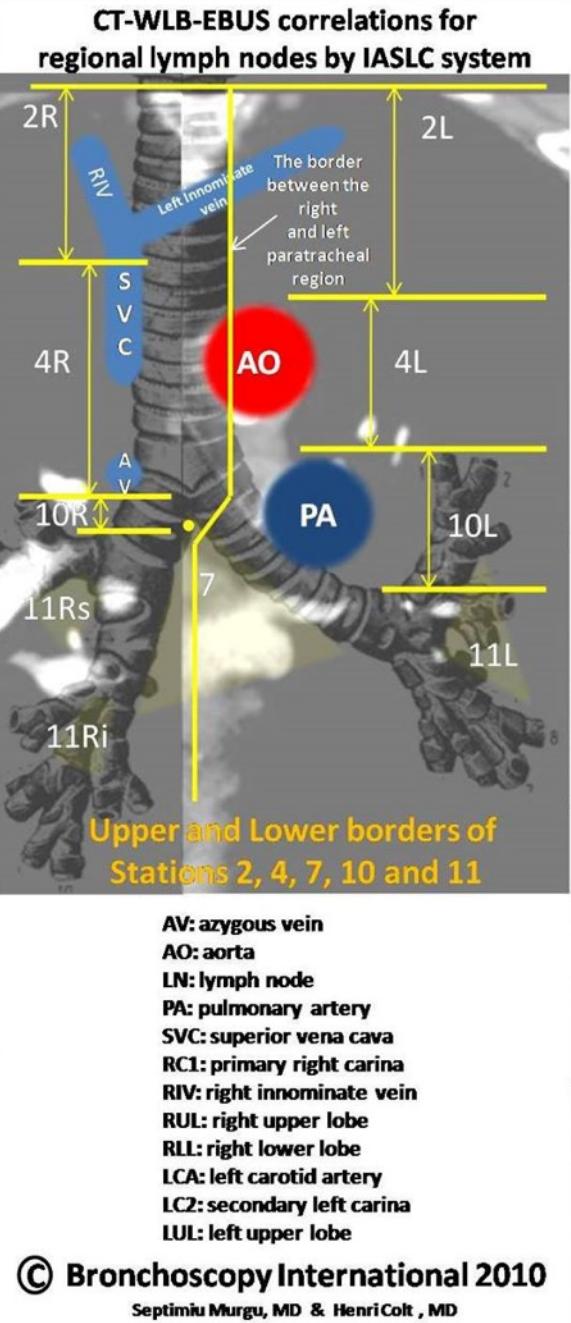
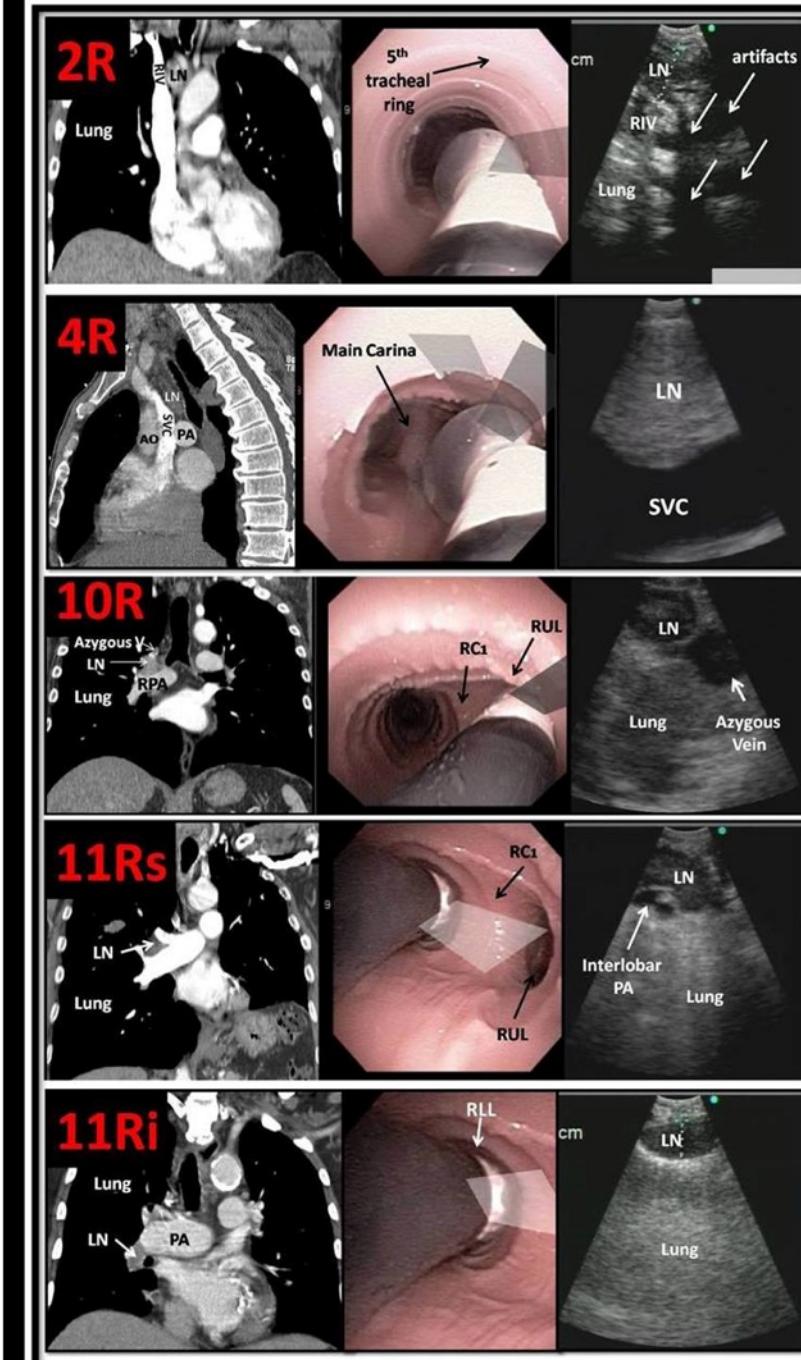
Lokalbedövning i svalget + Alfentanyl iv ± Remimazolam (Midazolam) iv

Först inspekitionsbronkoskopi, sedan EBUS bronkoskop transoralt

N3→ N2→N1, åtminstone 4R, 7 och 4L

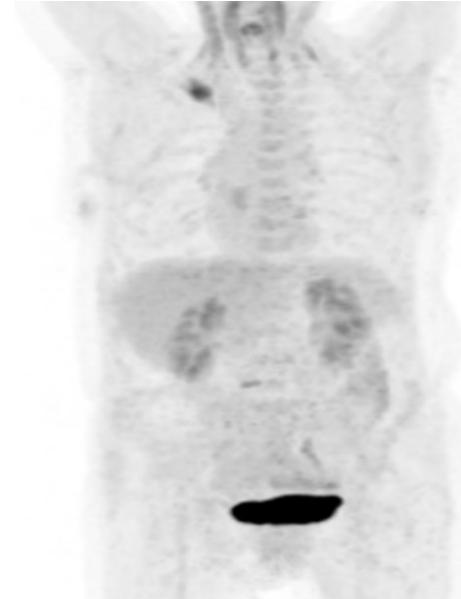
Komb med EUS-B-FNA





Endosonografi för cN0/N1

UPSTAGING



(Endosonography for Mediastinal Nodal Staging of Clinical N1 Non-small Cell Lung Cancer - A Prospective Multicenter Study - Christophe Dooms et al, Chest 2015)

Risk för ockult spridning i LN 15-25%

EBUS-TBNA – förhindrar onödiga operationer – ockult spridning till N2, N3

Överlägsen metod för bedömning av cN1 inför SBRT

Endosonografi för cN2/N3

DOWNSTAGING

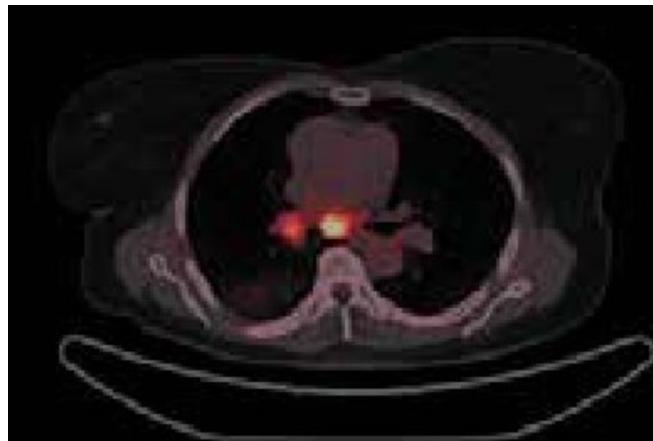


Hög risk för mediastinal spridning

Endosonografi (EBUS-TBNA ev komb med EUS-B-FNA (EUS) – sens 88%

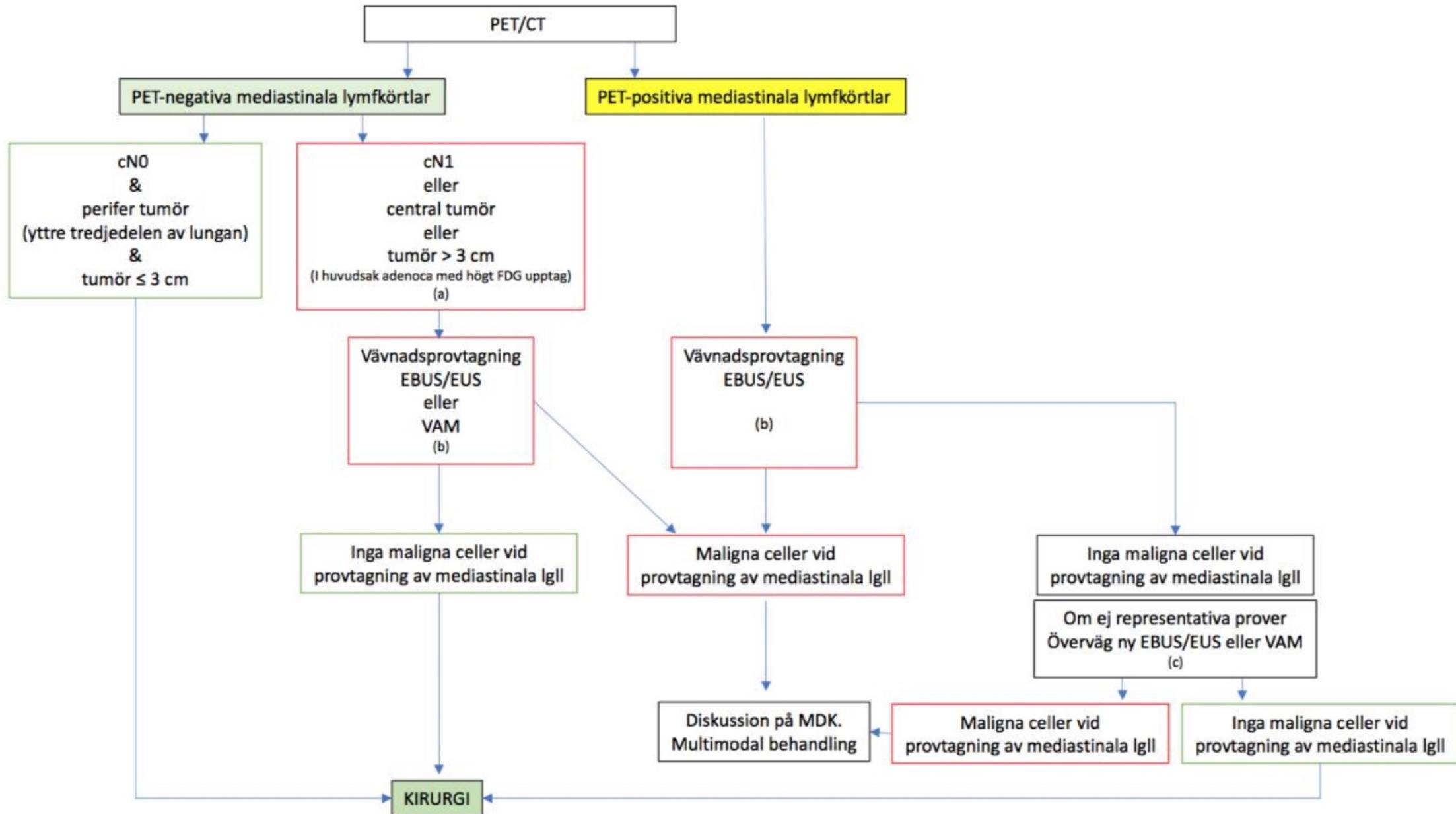
Mediastinoskopi – sensittivitet 79%

Mediastinoskopi som komplement (vid negativ EBUS) – 97%

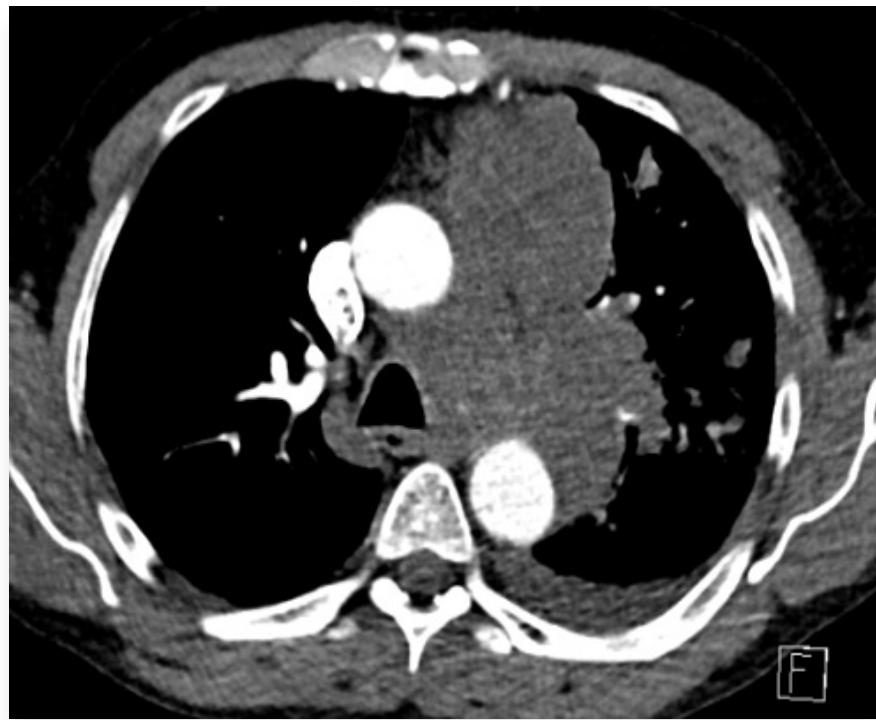
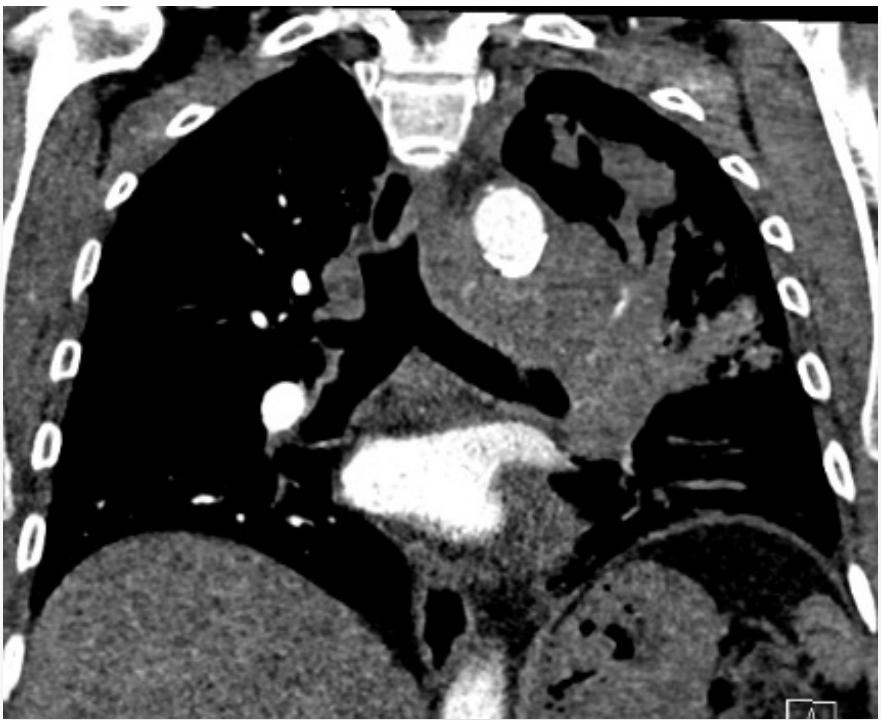


Labarca G et al. Minimally invasive methods for staging av lung cancer: Systematisk review and Meta-Analysis Pulmonary Medicine 2016

Figur 9.2 Mediastinal staging hos patienter med NSCLC inför kurativt syftande behandling. Algoritm modifierad från ESMO-guidelines.



Diagnostisk EBUS



Diagnostisk EBUS

Hög träffsäkerhet - diagnos i 89%-98%

Molekylär profilering av lungcancer

Komplikationer:

- Mediastinit 0,2%, blödning 0,2%, pneumothorax 0,5%
- Fatal blödning 1 case report
- Övriga: pneumoni, perikardit, sepsis, hypoksi
- Needle breakage 4 case report, samtliga pat hostat upp nålen

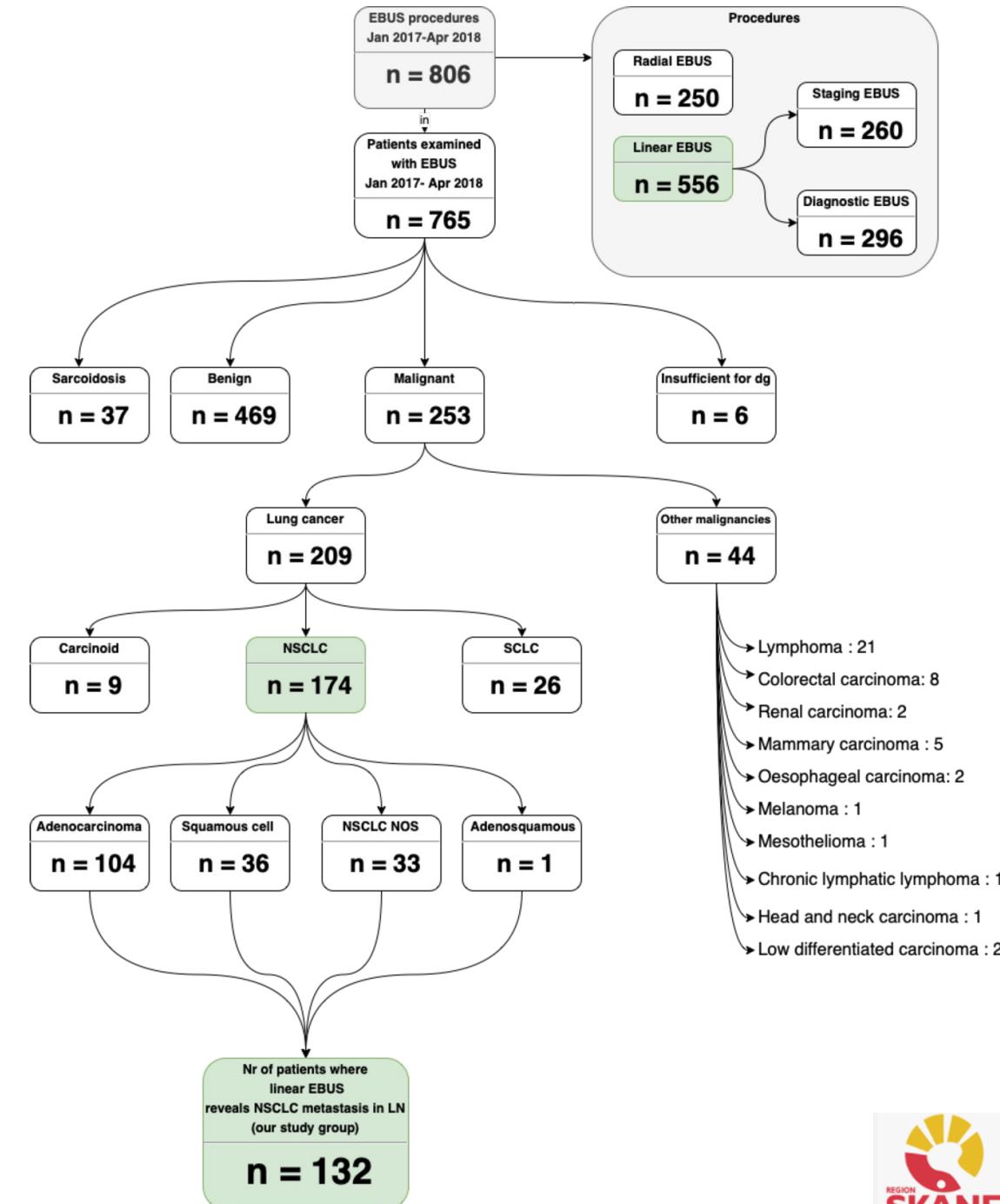
Vaidya et al. Endobronchial ultrasound-guided transbronchial needle aspiration: Risks and repairs. Respirology 2017 "The cumulative number of clinical complications reported in these large studies were 126 of 12 351 (1.02%) procedures"

Feasibility of EBUS-TBNA for histopathological and molecular diagnostics of NSCLC—A retrospective single-center experience

Marija Karadzovska-Kotevska , Hans Brunnström, Jaroslaw Kosieradzki, Lars Ek, Christel Estberg, Johan Staaf, Stefan Barath, Maria Planck

Published: February 2, 2022 • <https://doi.org/10.1371/journal.pone.0263342>

Retrospective review of 765 patients' records of all patients examined with EBUS bronchoscopy between January 2017 and April 2018



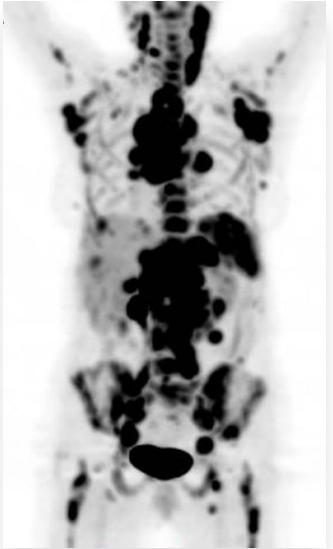
Resultat

(Feasibility of EBUS-TBNA for histopathological and molecular diagnostics of NSCLC)

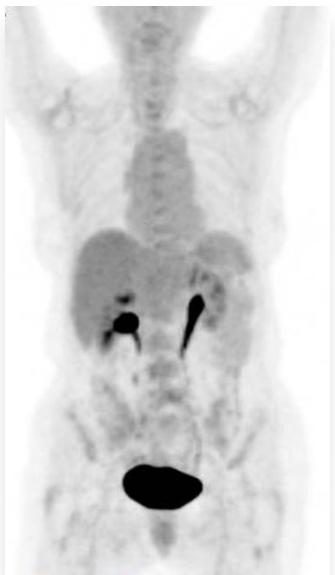
The EBUS-TBNA specimen proved to be sufficient:

- for subtyping of NSCLC in **83%**
- for analysis of treatment-predictive biomarkers in **77%**
- for analysis of multiple oncogenes by NGS in **53%**

Hodgkins



före behandling



efter behandling

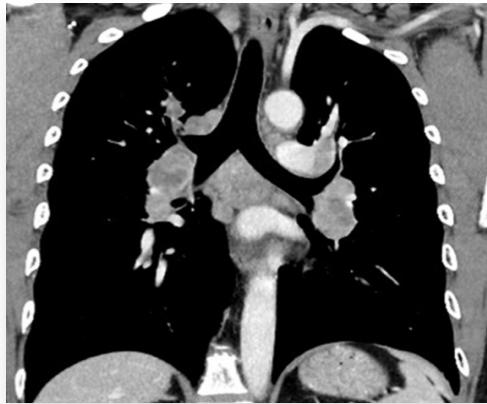
EBUS-TBNA – Lymfom?

- Stor heterogenitet av dg utfall av EBUS-TBNA för diagnostik av lymfom

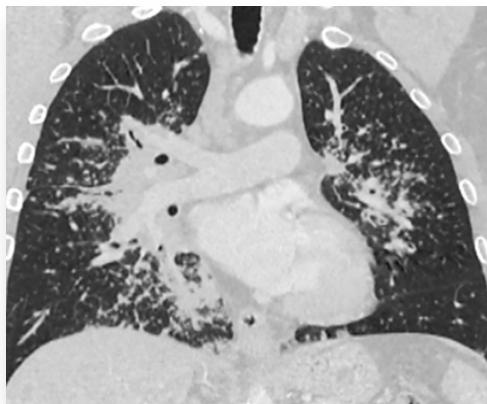
Gandotra S et al. Endobronchial ultrasound transbronchial needle aspiration for the diagnosis of lymphoma. J Bronchol Interv Pulmonol. 2018. 806 pat, dg utfall 85%

Iqbal S et al. Endobronchial ultrasound and lymphoproliferative disorders: a retrospective study. Ann Thorac Surg 2012. dg utfall 29%

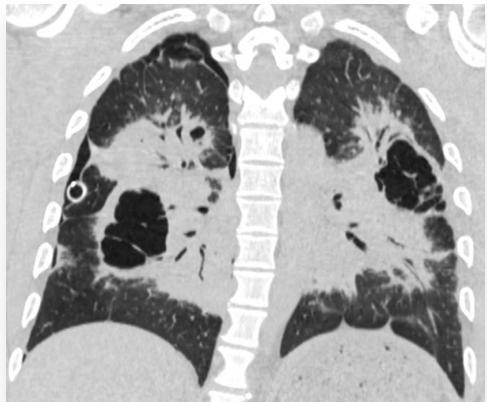
- Bättre träffsäkerhet för låg diff Non-Hodgkin lymfom jmf med Hodgkin
- Flödescytometri (transfix), nålens storlek (19G bättre?)
- EBUS TBNA vs EBUS TBMBC



Stadium I



Stadium II

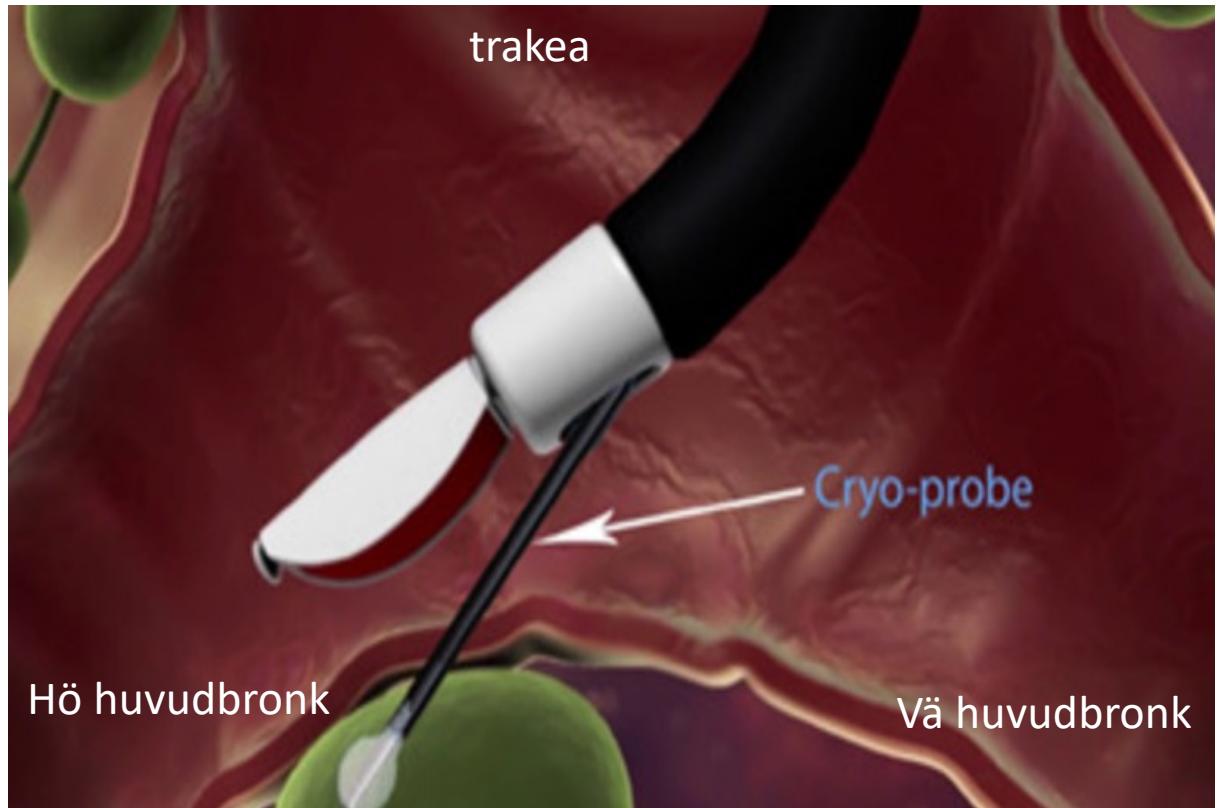
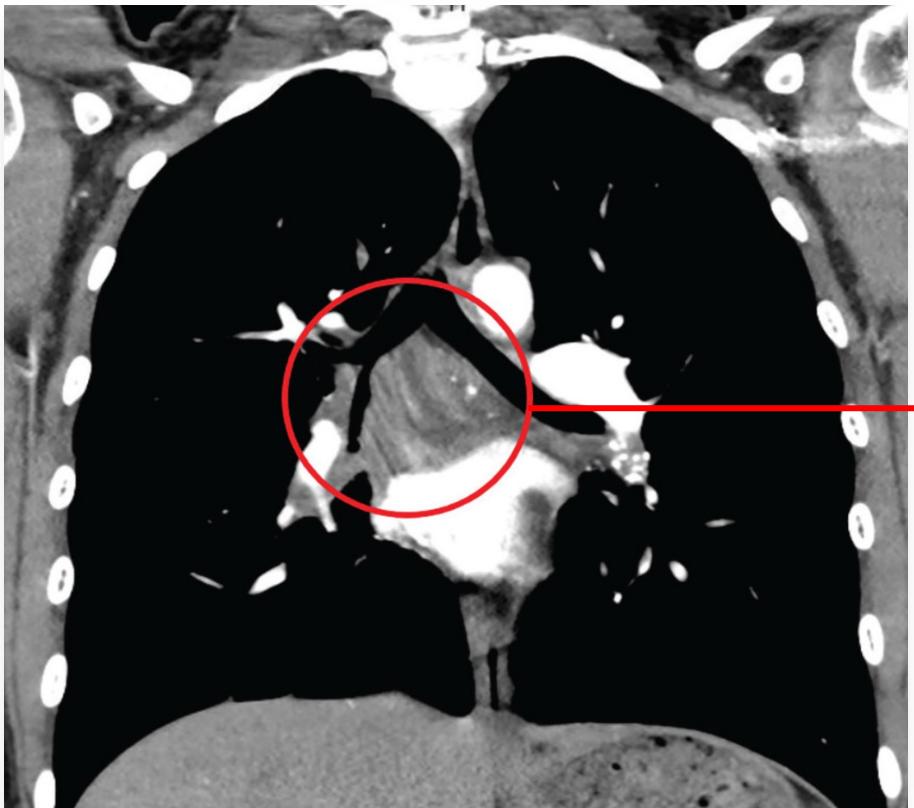


Stadium III

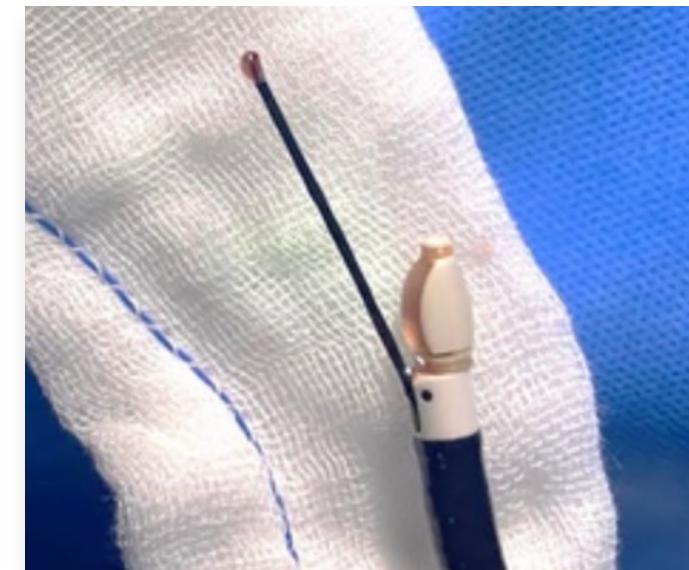
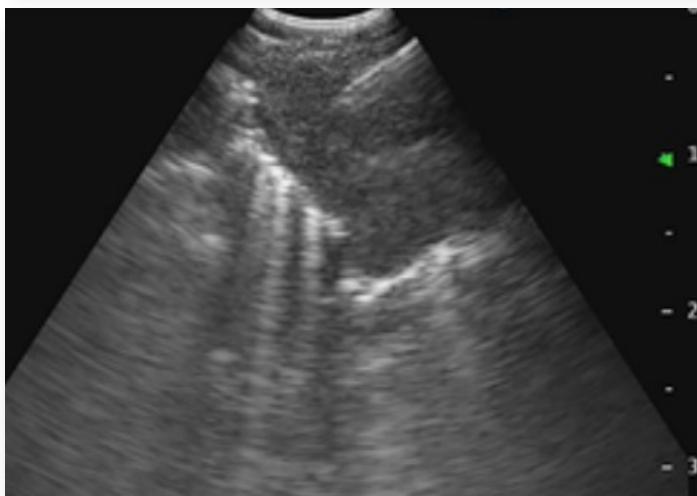
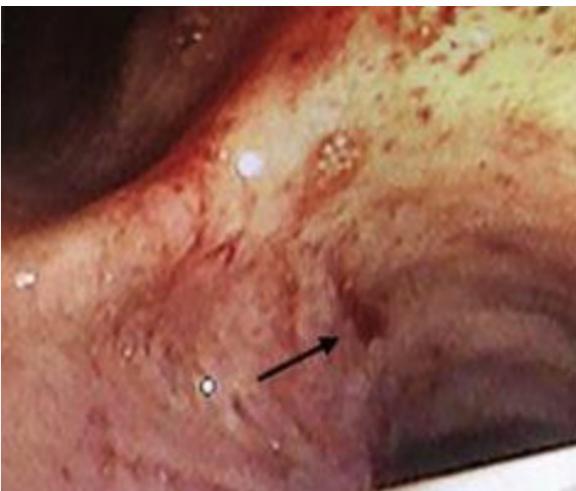
EBUS-TBNA – Sarcoidos?

- Trisolini R et al **Endobronchial ultrasound-guided transbronchial needle aspiration for diagnosis of sarcoidosis** in clinically unselected study populations. *Respirology*. **2015 Meta-analysis**
- 14 studier, 11 länder, 2097 patienter
- Träffssäkerhet 79%
- Högre dg utfall i stadium I, jmf med st II (högre densitet av granulom i lymfkörtlar vid st I sjukdom?)
- Påverkan på dg utfallet: nr of LN punktioner, minst 4 per LN station, ROSE

KRYO EBUS (TBMCB)



KRYO EBUS (TBMCB)



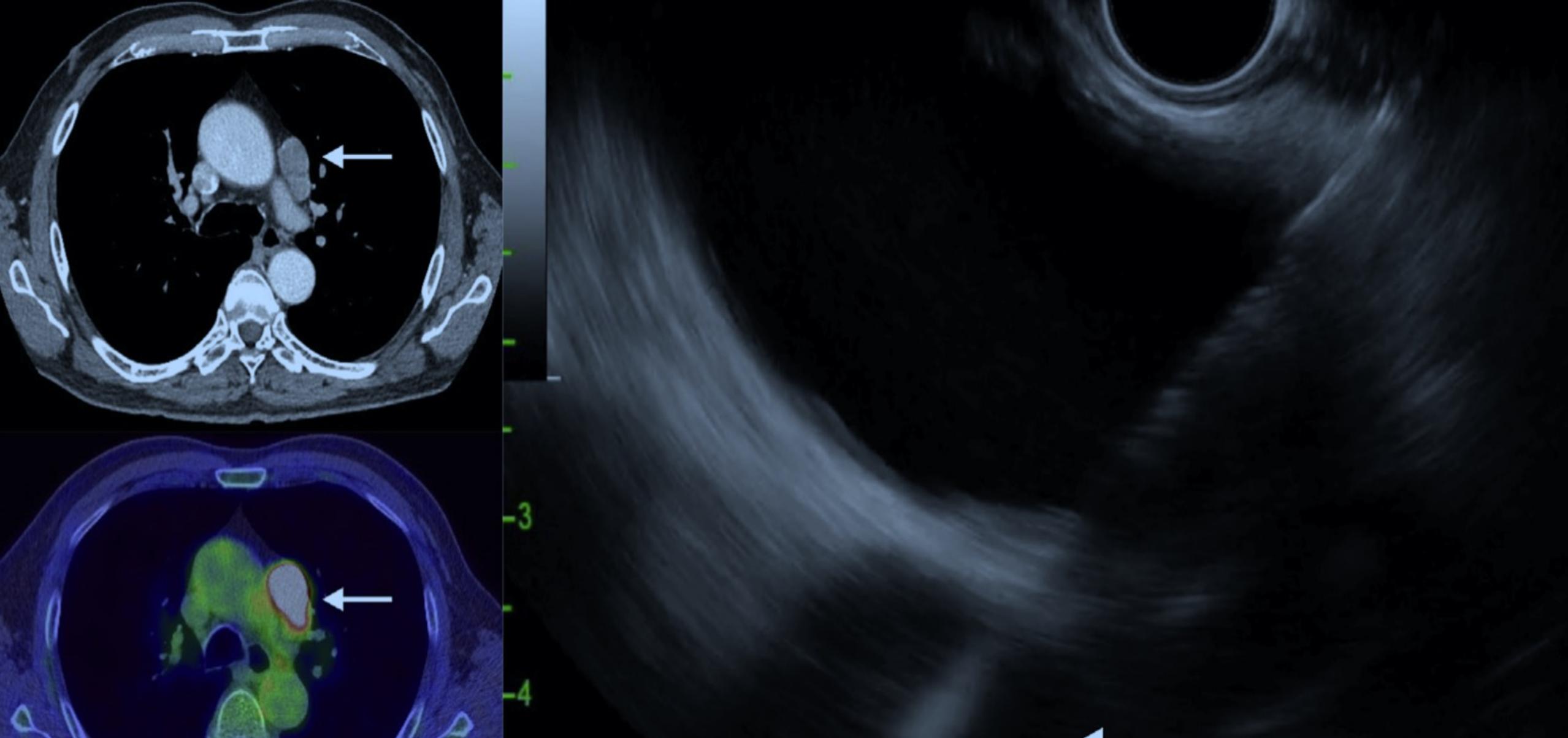
KRYO EBUS (TBMCB)

Resp Med 2023

A systematic review: *Is the diagnostic yield of mediastinal lymph node cryo biopsy (cryo EBUS) better for diagnosing mediastinal node involvement compared to endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)?*

Maribel Botana-Rial et al.

- 7 studier, 555 pat
- Overall sensitivitet: **cryo 92% jmf med 80% TBNA**
- Lymfom: **cryo 87% vs 12% TBNA**
- Sarkoidos: **cryo 87% vs 60% TBNA**
- PD-L1: **cryo 97% vs 79 %TBNA**



Transvascular EBUS-TBNA - new challenges?

Tumor tissue is still the issue





Tack!