

Minimalinvasive Resektion von subsolidem NSCLC mittels hybrider ENB-Technik

OA Priv.-Doz. Dr. **Thomas Klikovits**, PhD

Abteilung Thoraxchirurgie, Klinik Floridsdorf Wien

Salzburger Symposium Thoraxchirurgie 2026



Wiener Gesundheitsverbund
Klinik Floridsdorf

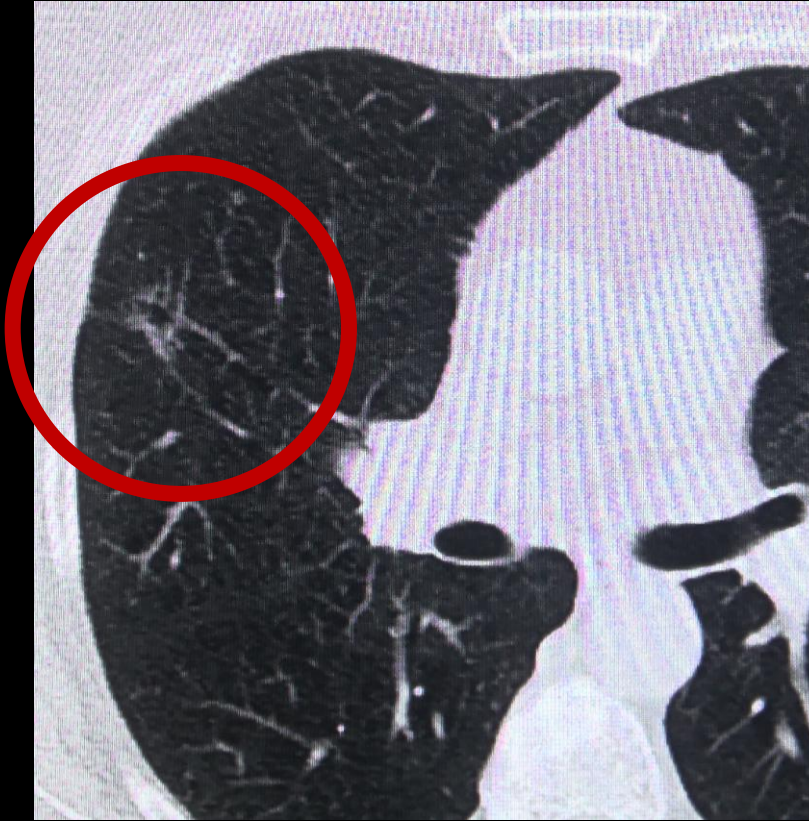
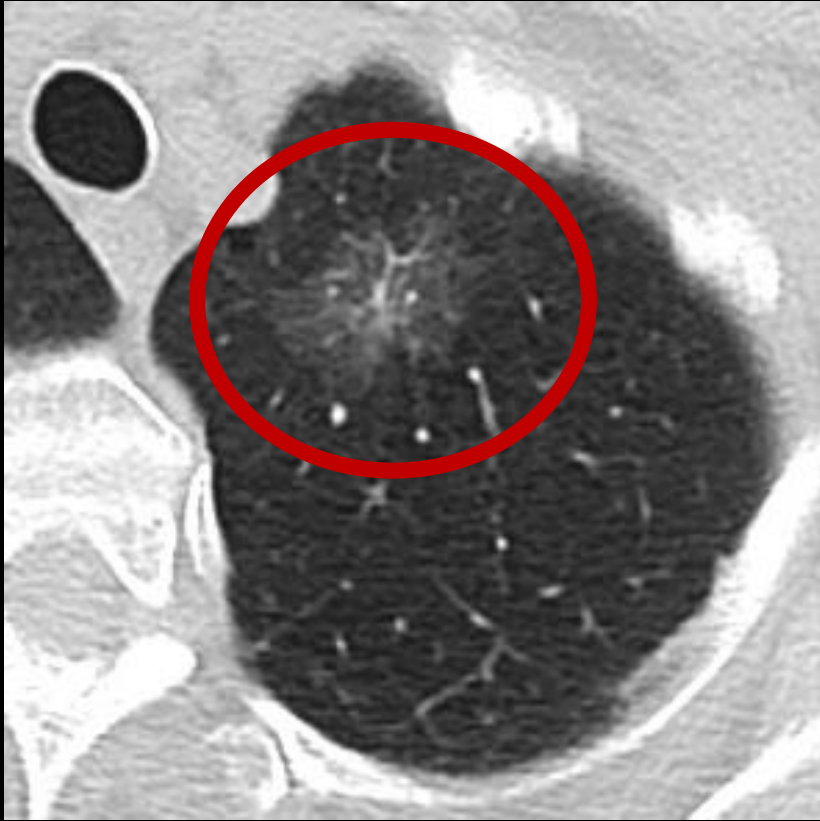


Karl Landsteiner Institut für
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Disclosures

- Speaker Fees, Advisory Boards, Proctoring:
 - MSD, BMS, AstraZeneca, Roche, Johnson&Johnson, Medtronic, Pfizer, Amgen
- All pictures shown are property of the presenter if not otherwise indicated

GGO - Diagnostisches und therapeutisches Dilemma



Characteristics of Lung Cancers Detected by Computer Tomography Screening in the Randomized NELSON Trial

Nanda Horeweg^{1,2}, Carlijn M. van der Aalst¹, Erik Thunnissen³, Kristiaan Nackaerts⁴,
Carla Weenink⁵, Harry J. M. Groen⁶, Jan-Willem J. Lammers⁷, Joachim G. Aerts², Ernst T. Scholten⁸,
Joost van Rosmalen¹, Willem Mali⁹, Matthijs Oudkerk¹⁰, and Harry J. de Koning¹



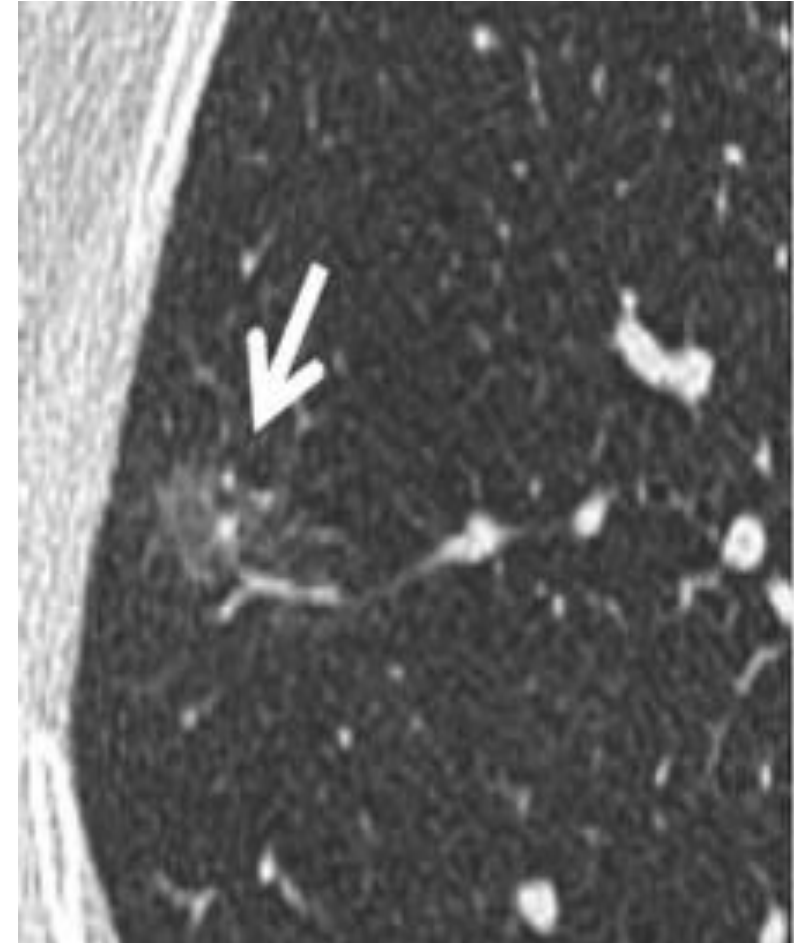
GGO Management

Diagnose

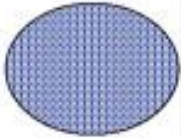
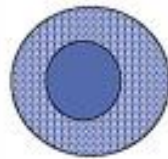
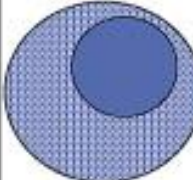
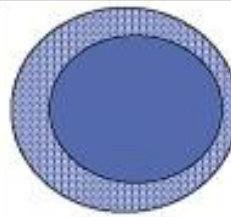
Follow-up CT

CT-gezielte Biopsie

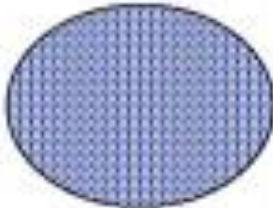
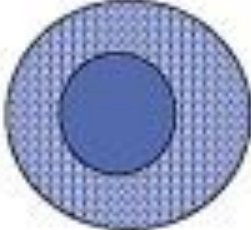
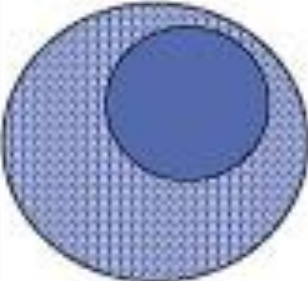
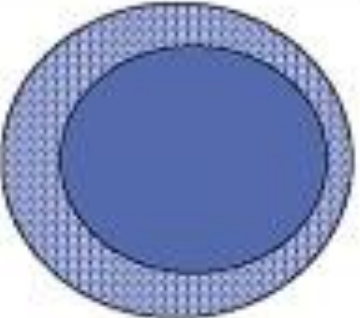
Bronchoskopie



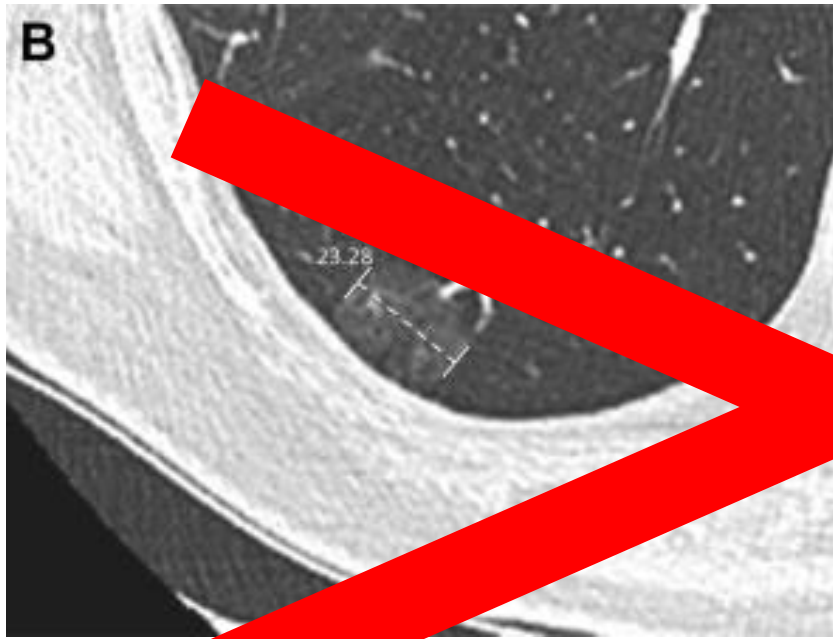
IASLC Classification of sub-solid and part-solid lesions

cT*	CT image on HRCT						
	Solid part	0 cm	0 cm	≤0.5 cm†	0.6-1.0 cm†	1.1-2.0 cm†	2.1-3.0 cm†
	Total tumor size including GG	≤0.5 cm	0.6-3.0 cm††	≤3.0 cm††	0.6-3.0 cm††	1.1-3.0 cm††	2.1-3.0 cm††
	Pathologic Differential Diagnosis	AAH‡, AIS, MIA	AIS, MIA, LPA	MIA, LPA, AIS	LPA, Invasive AD, MIA	LPA, Invasive AD	Invasive AD
	Clinical Stage*		cTis††	cT1mi††	cT1a	cT1b	cT1c
pT	Invasive part	0 cm	0 cm	≤0.5 cm††	0.6-1.0 cm†	1.1-2.0 cm†	2.1-3.0 cm†
	Total tumor size including lepidic growth part	Usually ≤0.5 cm‡	≤3.0 cm††	≤3.0 cm††	0.6-3.0 cm††	1.1-3.0 cm††	2.1-3.0 cm††
	Pathology	AAH	AIS	MIA	Lepidic predominant AD or Invasive AD with lepidic component	Invasive AD with a lepidic component or lepidic predominant AD	Invasive AD with lepidic component
	Pathologic Stage		pTis††	pT1mi††	pT1a	pT1b	pT1c

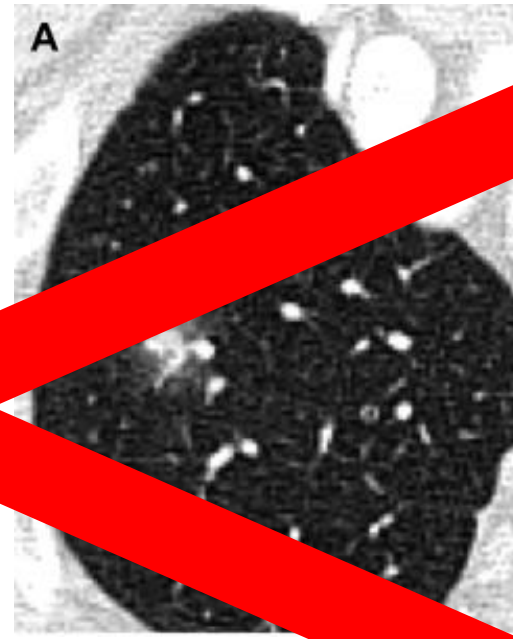
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	Clinical Stage*		cTis‡‡	cT1mi‡‡	cT1a	cT1b	cT1c

IASLC Classification of sub-solid and part-solid lesions



Adenocarcinoma in situ (AIS)



Minimally invasive
Adenocarcinoma (MIA)

GGOs sind OFT INVASIV !!!

456 resezierte GGOs und semisolid Läsionen, 228 invasives Adenokarzinom (50%)

	AAH (n = 11)	AIS (n = 103)	MIA (n = 86)	IA (n = 228)	χ^2	p
Size						
<10mm	11 (100.0%)	77 (74.8%)	52 (60.5%)	35 (15.4%)	139.944	0.000
≥ 10mm	0	26 (25.2%)	34 (39.5%)	193 (85.6%)		
Shape						
Round	8 (72.7%)	57 (55.3%)	25 (29.1%)	30 (13.2%)	80.229	0.000
Round-shaped	2 (18.2%)	36 (35.0%)	46 (53.5%)	123 (53.9%)		
Irregular shape	1 (9.1%)	10 (9.7%)	15 (17.4%)	75 (32.9%)		
Solid ingredient						
No	11 (100.0%)	90 (87.4%)	61 (70.9%)	55 (24.1%)	144.647	0.000
Yes	0	13 (12.6%)	25 (29.1%)	173 (75.9%)		

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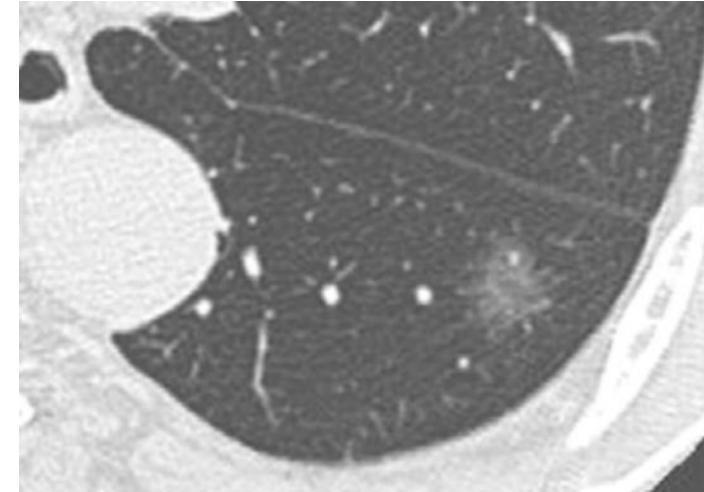
172 resezierte GGOs und semisolid Läsionen

	All	Consolidation-to-Tumor Ratio (CTR)				<i>p</i> -Value *
	Patients	Pure GGO	≤0.50	0.50–0.75	0.75–1.00	
	N (%)	N (%)	N (%)	N (%)	N (%)	
All patients	172 (100.)	90 (100.)	56 (100.)	18 (100.)	8 (100.)	
Invasiveness						
AIS	5 (2.9)	5 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)	
MIA	31 (18.0)	24 (26.7)	6 (10.7)	0 (0.0)	1 (12.5)	
IA	136 (79.1)	61 (67.8)	50 (89.3)	18 (100.)	7 (87.5)	0.0006

Rezente Meta-Analyse

Alshammari et al. EJC November 2024, n=3,874

- Pure GGOs up to 3cm
- The proportion of **minimally invasive and invasive** cancer ranged from 0.9 % to 100 % with a **pooled prevalence of 42.4 %**
 - ≤ 1cm: 25%
 - ≤ 2cm: 35%
 - ≤ 3cm: 40%



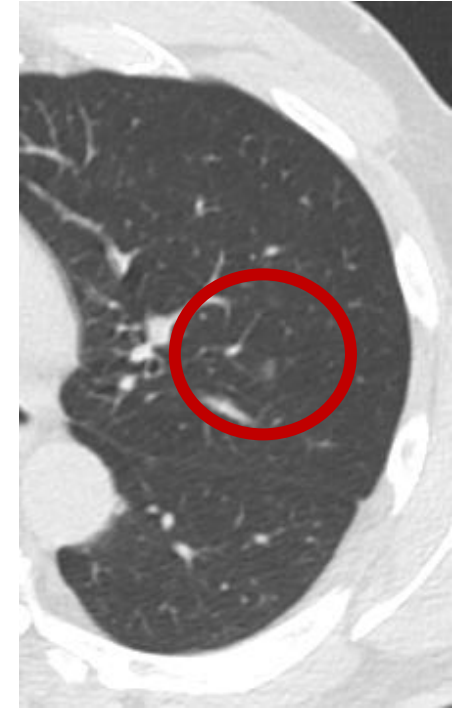
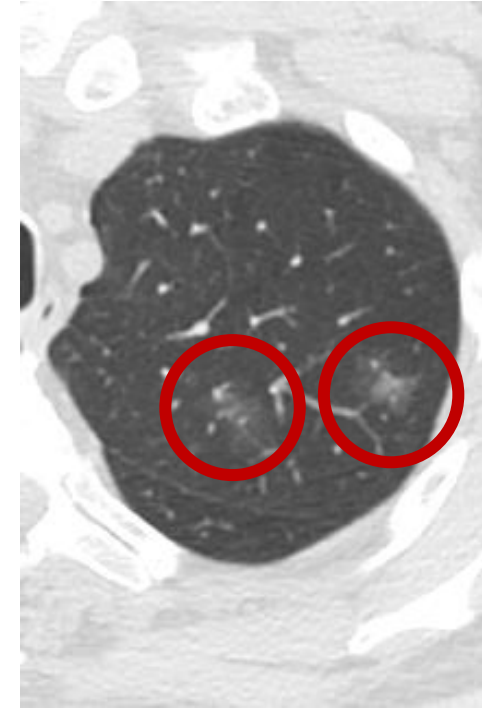
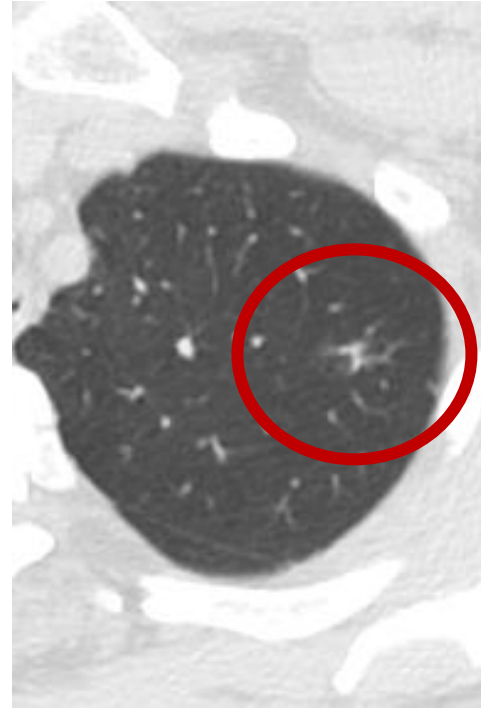
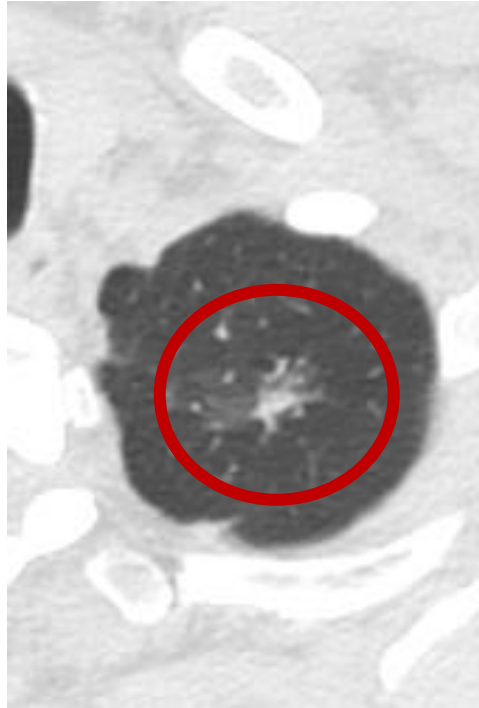
Multiple GGOs

Invasive Adenokarzinome

AIS

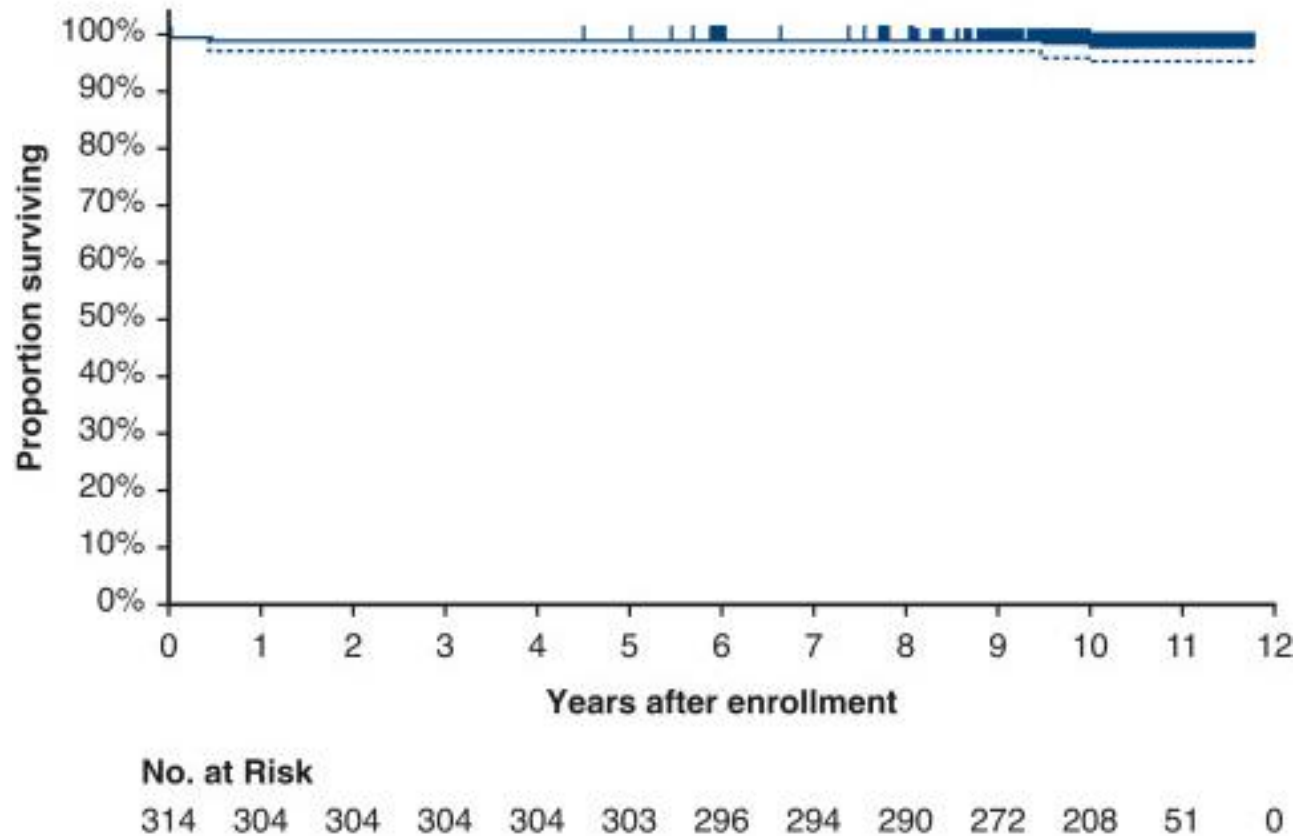


KRAS G12V



KRAS G12C, EGFR Ampl, BRAF Exon 11, ohne Mutation

Ausmaß der Resektion bei GGOs



333 Patienten

258 Keilresektionen
56 Segmentektomien

10-year OS 98.5%
1 Lokalrezidiv

Ausmaß der Lymphadenektomie

Phase III RCT, 302pts, GGO dominant Adeno $\leq 3\text{cm}$, CTR ≤ 0.5
Systematic MLND vs. NO MLND

Variable	No LND (n = 151)	Systematic LND (n = 151)	P
Resected lymph node counts, median (IQR)	3 (1-6)	10 (8-15)	<.001
Resected lymph node stations, median (IQR)	2 (1-3)	6 (5-7)	<.001
Operative procedure, No. (%)			.246
Segmentectomy	114 (75.5)	105 (69.5)	
Lobectomy	37 (24.5)	46 (30.5)	
Duration of surgery, minutes, mean	74	109	<.001
Blood loss, mL, mean	44	82	.033
Duration of chest tube, days, mean	2.7	3.0	.037
Length of postoperative stay, days, mean	3.9	4.5	.002

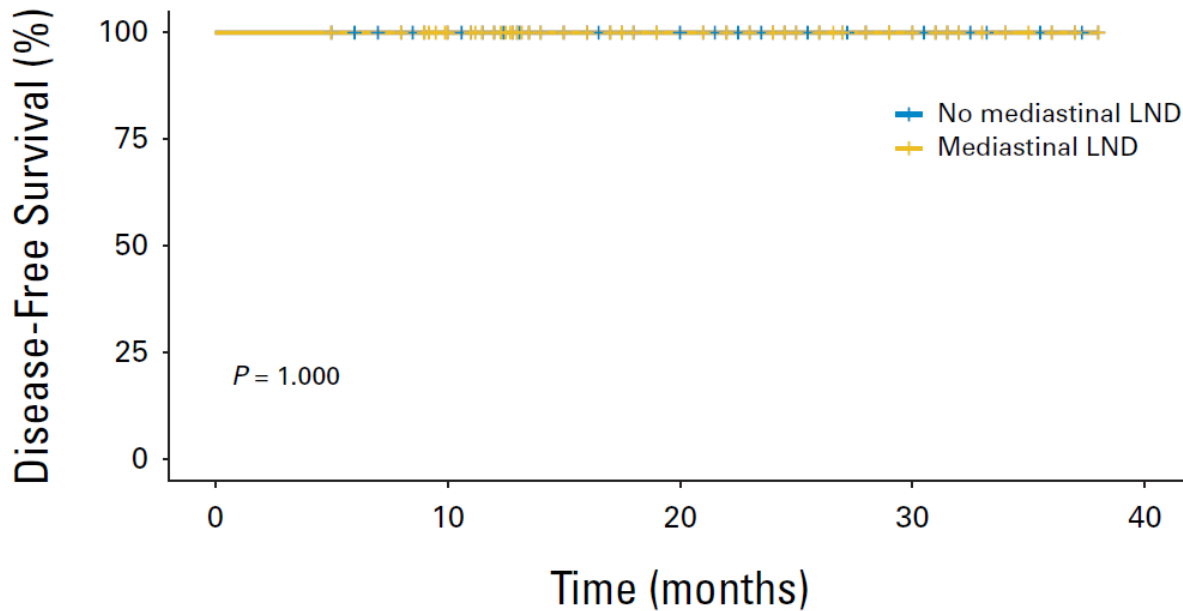
Ausmaß der Lymphadenektomie

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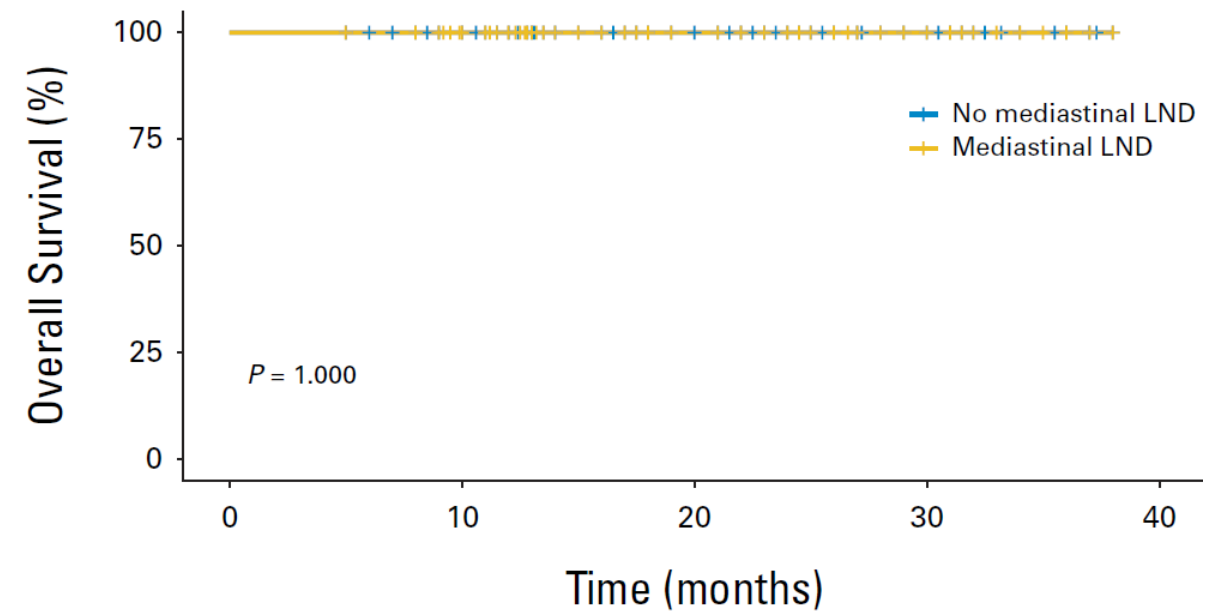
Predominant histologic pattern, No. (%)			.786
LPA	60 (39.7)	57 (37.7)	
APA	70 (46.4)	72 (47.7)	
PPA	19 (12.6)	19 (12.6)	
IMA	1 (0.7)	0	
SPA	1 (0.7)	2 (1.3)	
MPA	0	1 (0.7)	
pT, No. (%)			.287
1a	23 (15.2)	13 (8.6)	
1b	101 (66.9)	104 (68.9)	
1c	26 (17.2)	32 (21.2)	
2a	1 (0.7)	2 (1.3)	
pN, No. (%)			1.000
N0	151 (100)	151 (100)	

Ausmaß der Lymphadenektomie

Phase III RCT, 302pts, GGO dominant Adeno $\leq 3\text{cm}$, CTR ≤ 0.5
Systematic MLND vs. NO MLND



Number at risk					
151	133	61	26	0	
151	135	60	25	0	



Number at risk					
151	133	61	26	0	
151	135	60	25	0	

GGO Management

Diagnose

Follow-up CT

CT-gezielte Biopsie

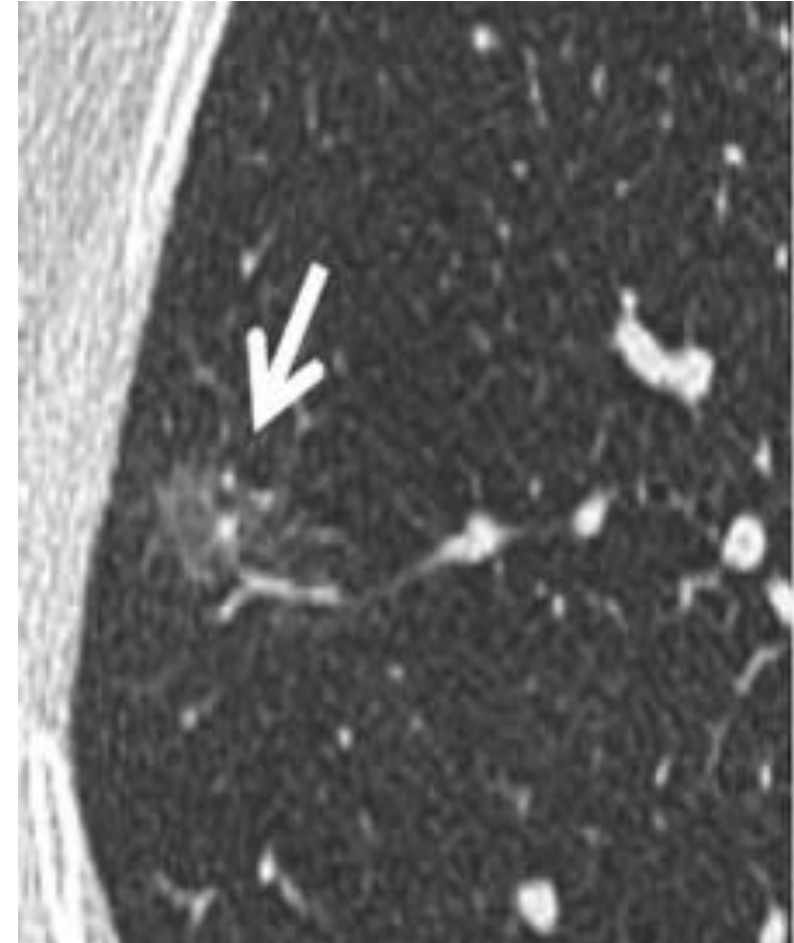
Bronchoskopie

Resektion

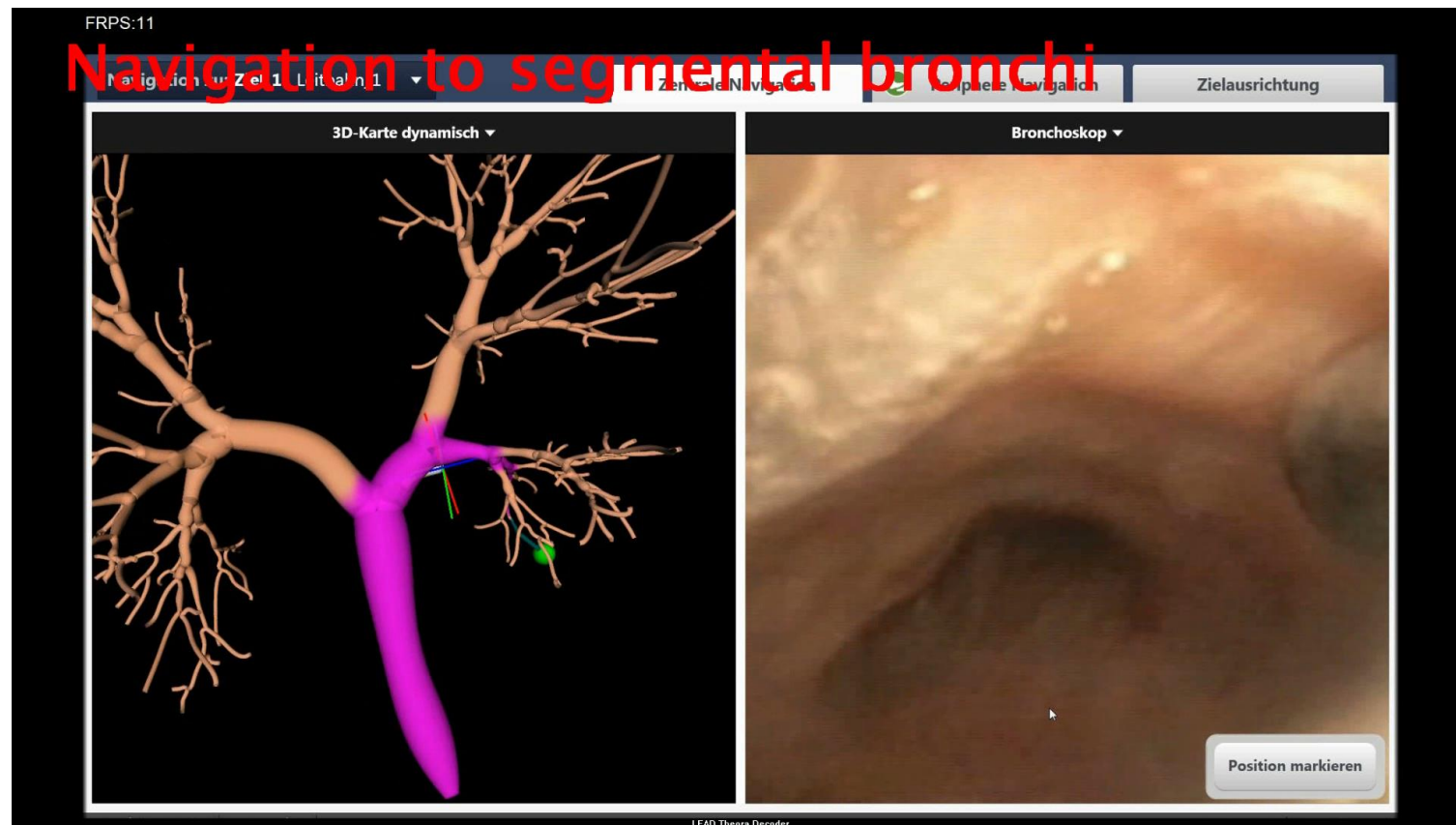
**CT-gezielte
Markierung + OP**

**Primäre
Segmentektomie**

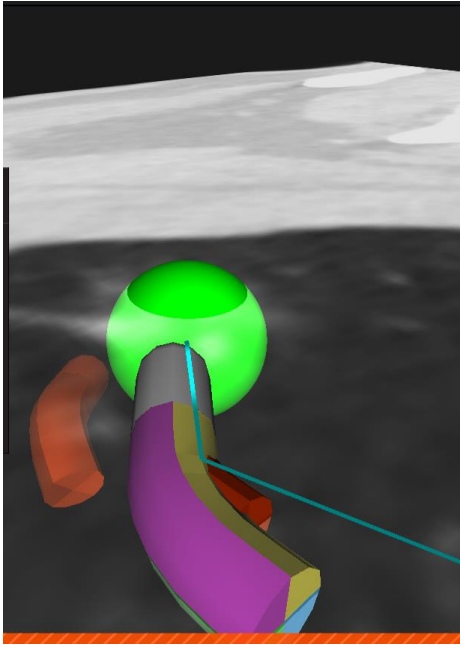
**ENB-Markierung +
Resektion**



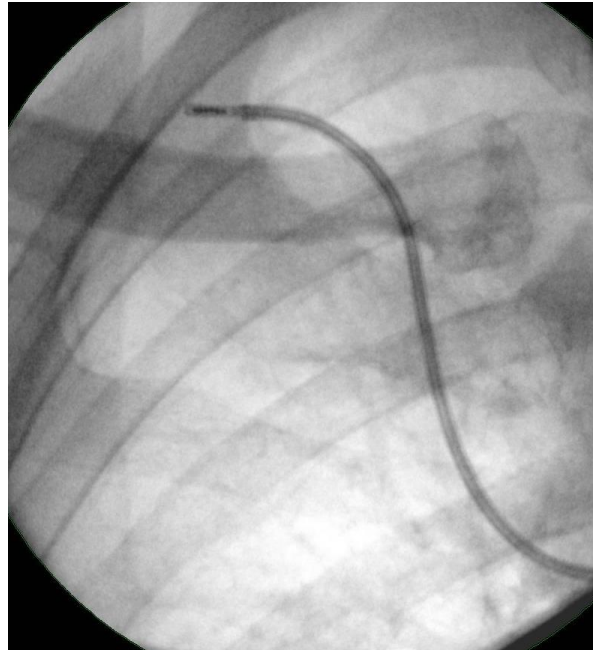
Electromagnetic Navigation Bronchoscopy (ENB)



ENB Markierung + Resektion



Navigation



Navigation

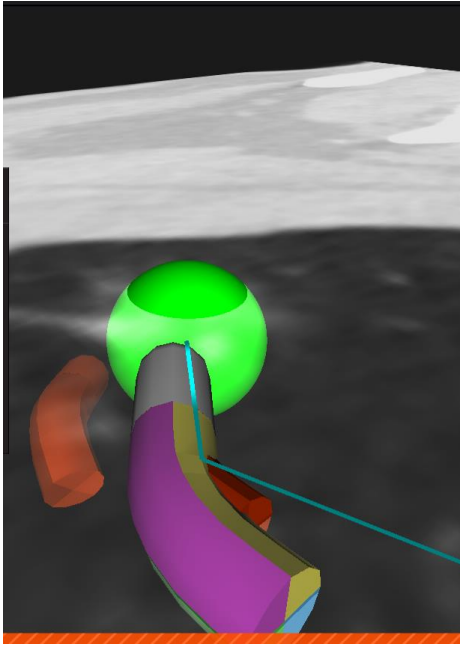


Pleural
marking

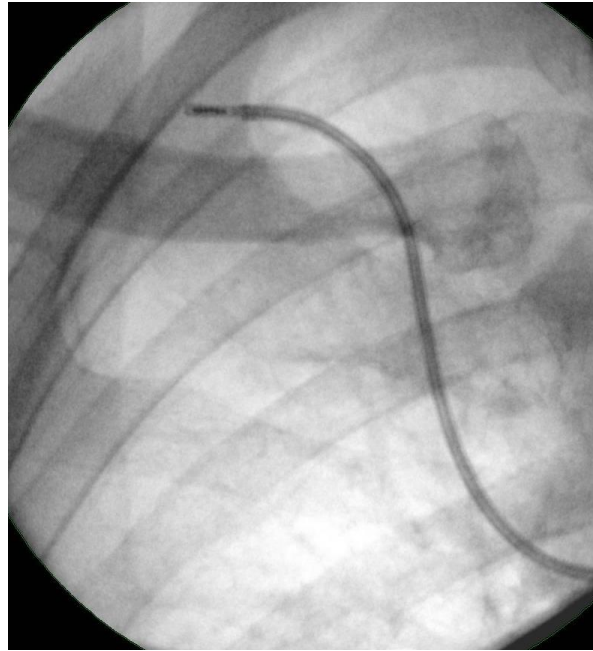


Fiducial
marking

ENB Markierung + Resektion



Navigation

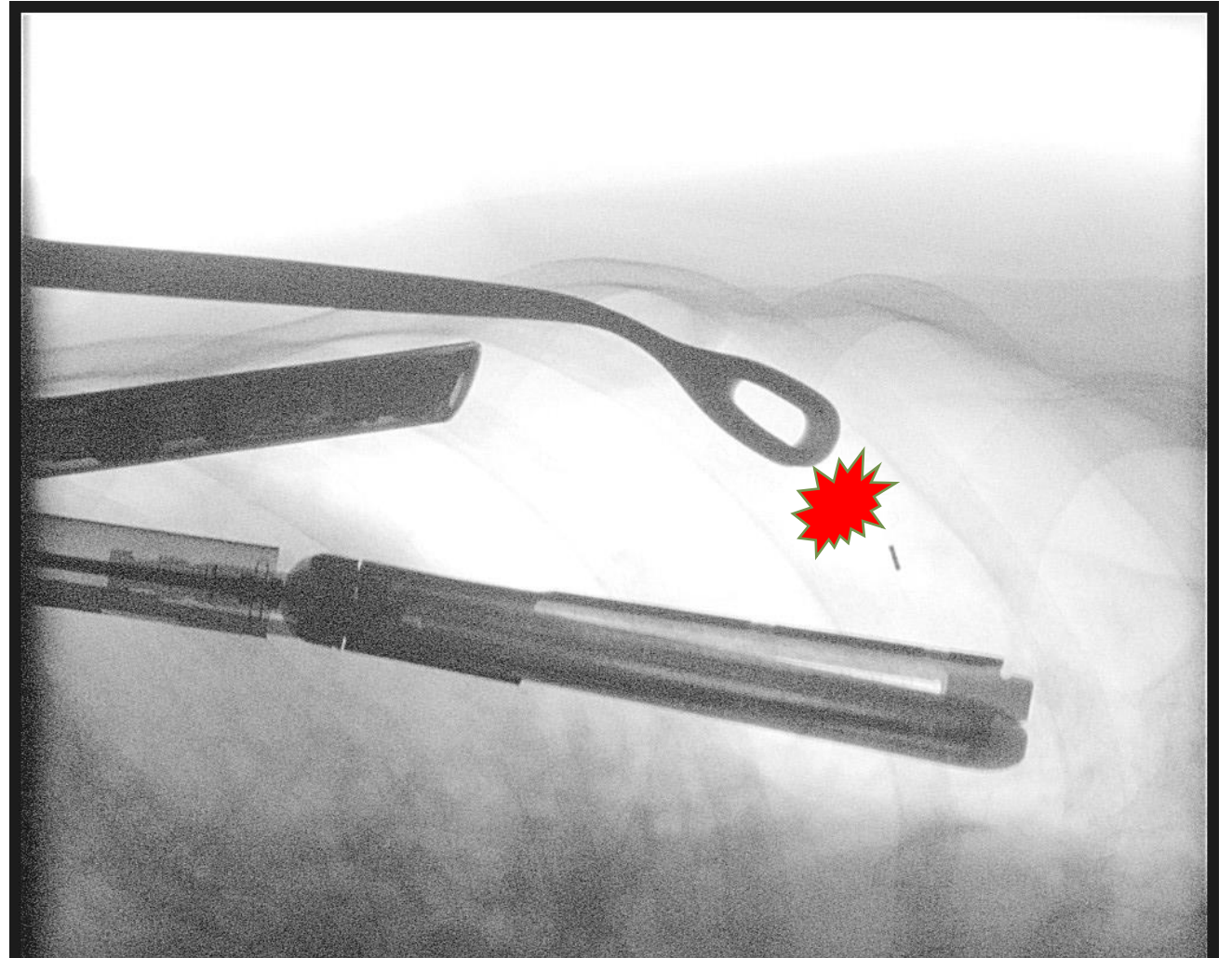
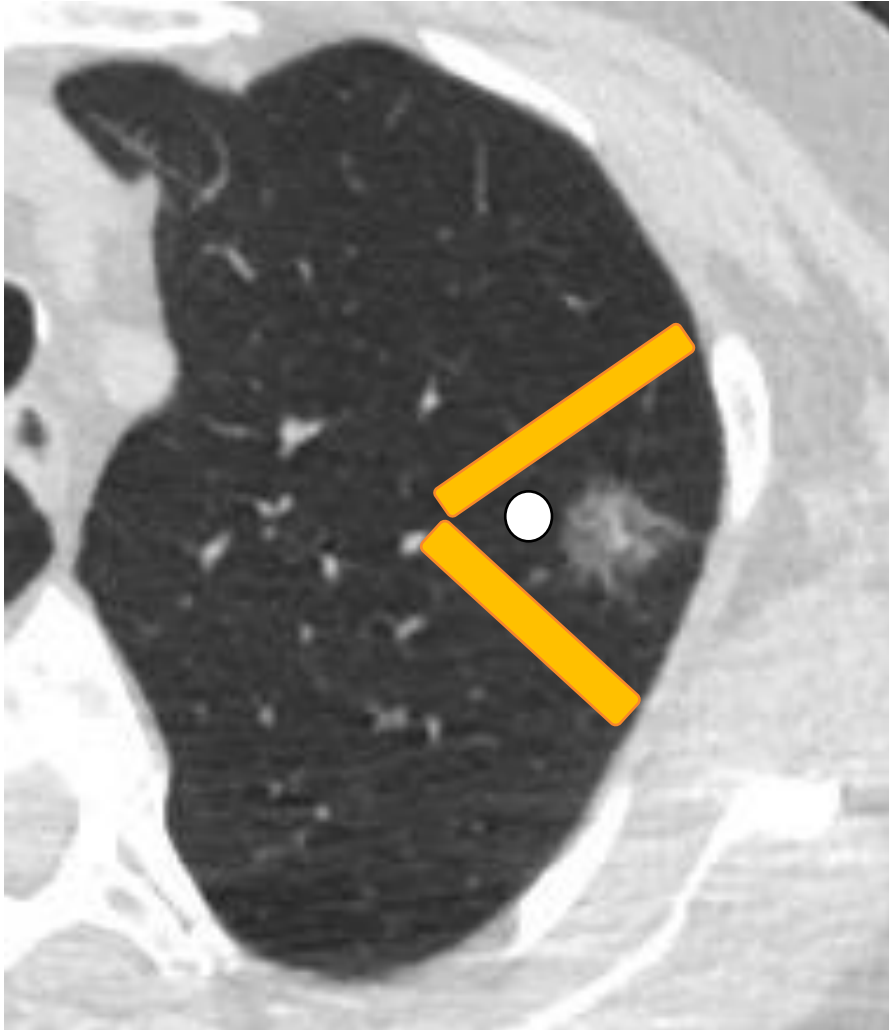


Navigation



Pleural marking with ICG

ENB Markierung + Resektion



Männlich, 55 Jahre, Ex-Raucher

2018



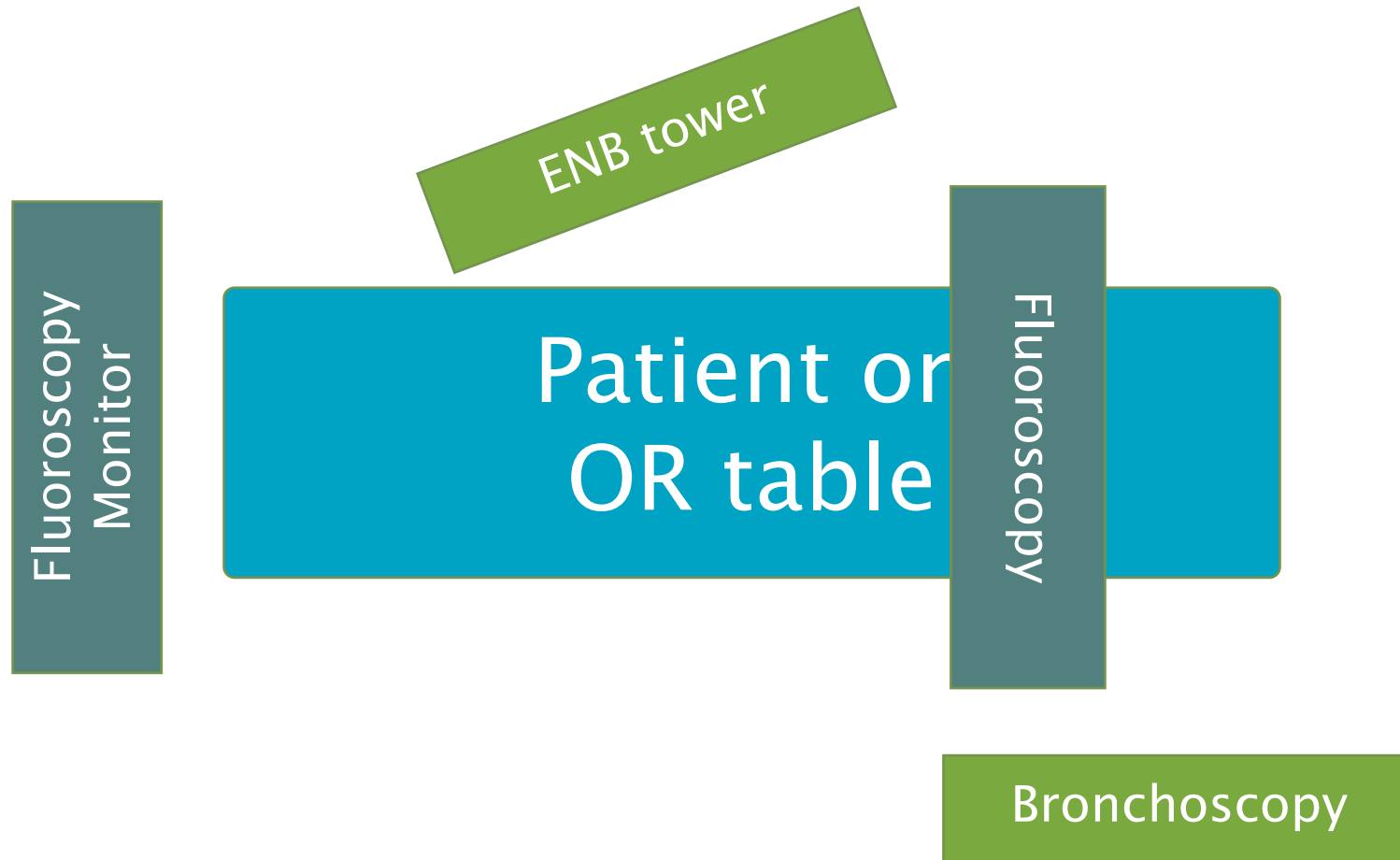
2025



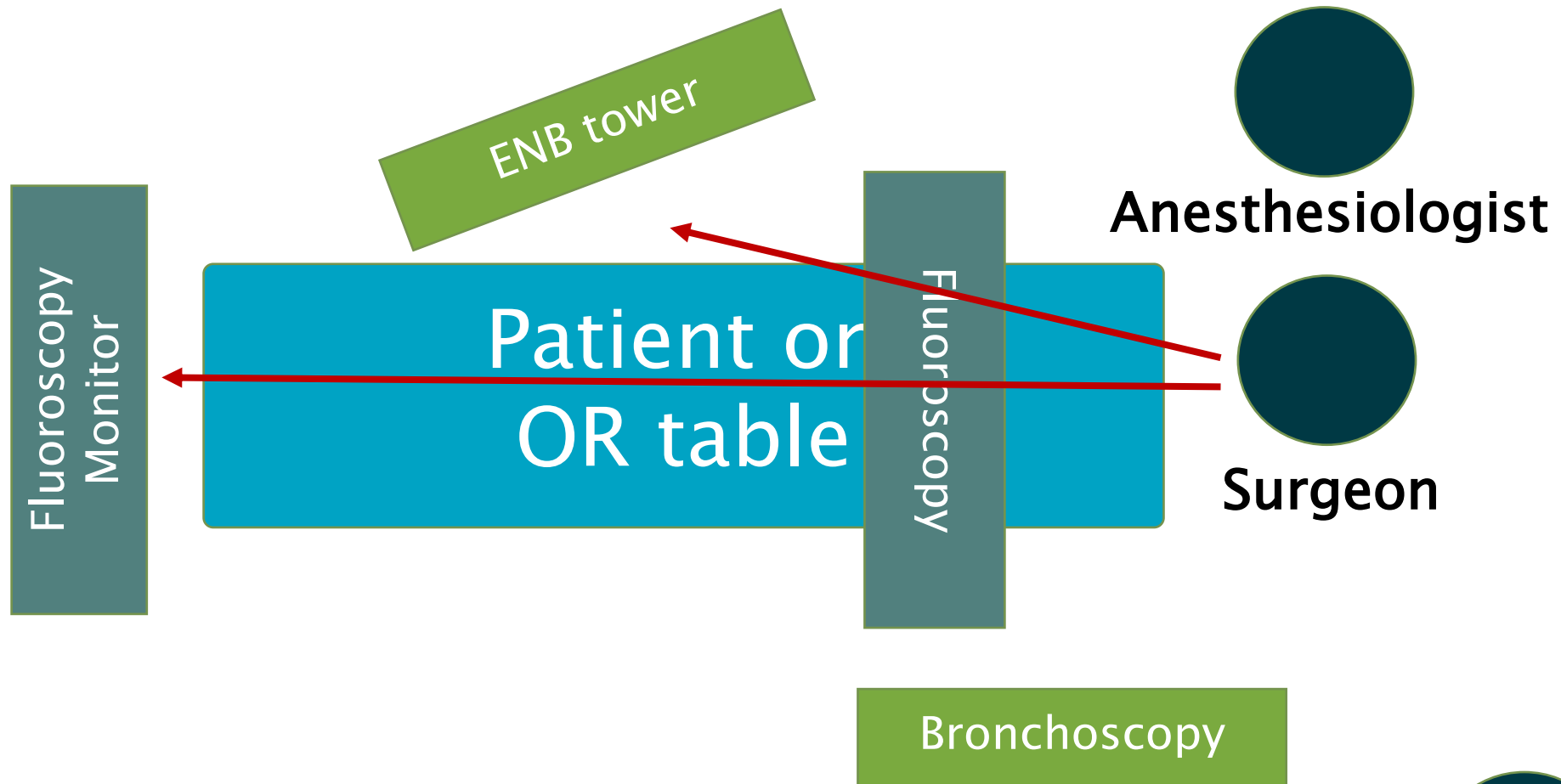
One-Step approach – Markierung

Patient on
OR table

One-Step approach – Markierung



One-Step approach – Markierung



One-Step approach – Markierung



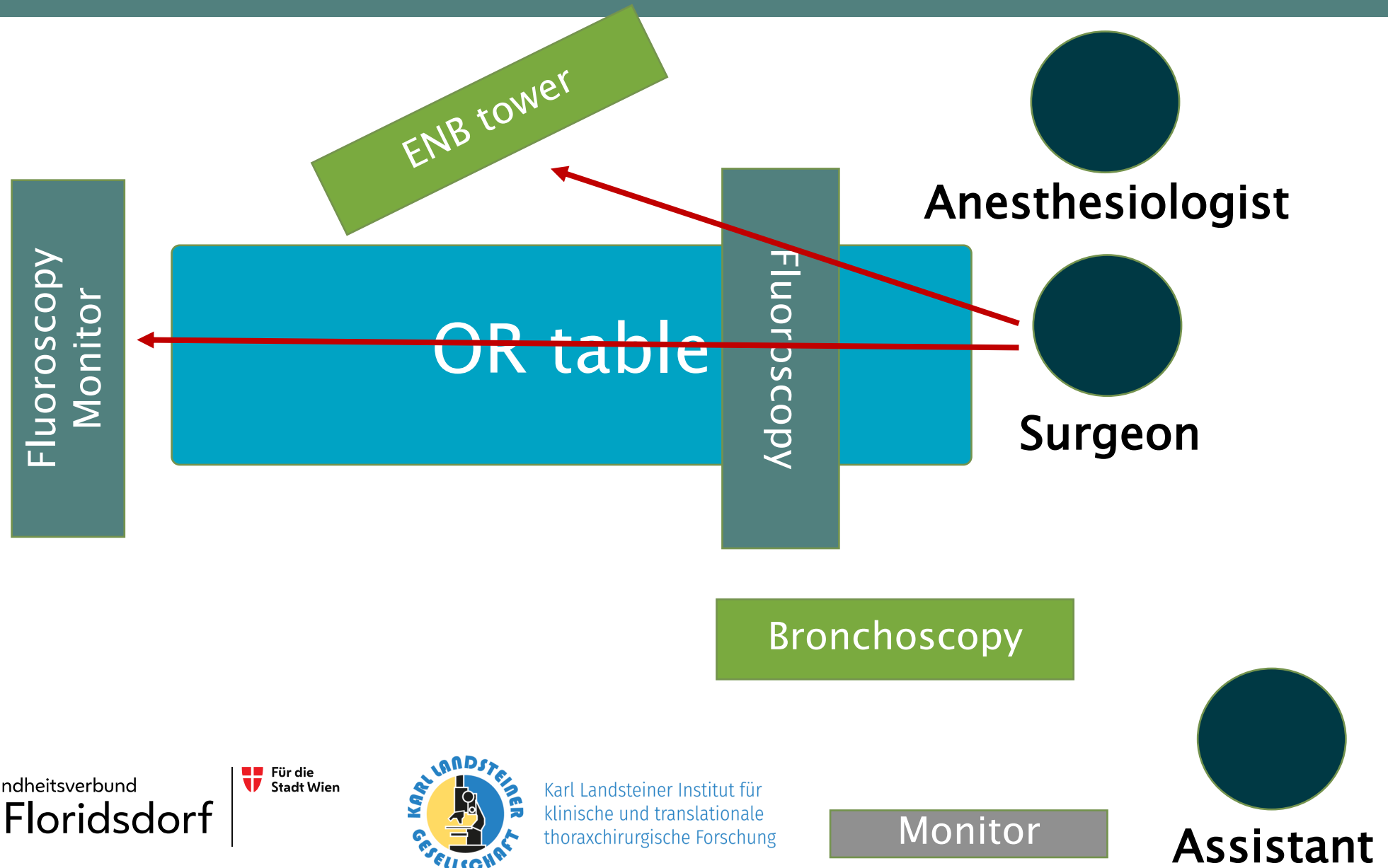
Setting in OR - Marking



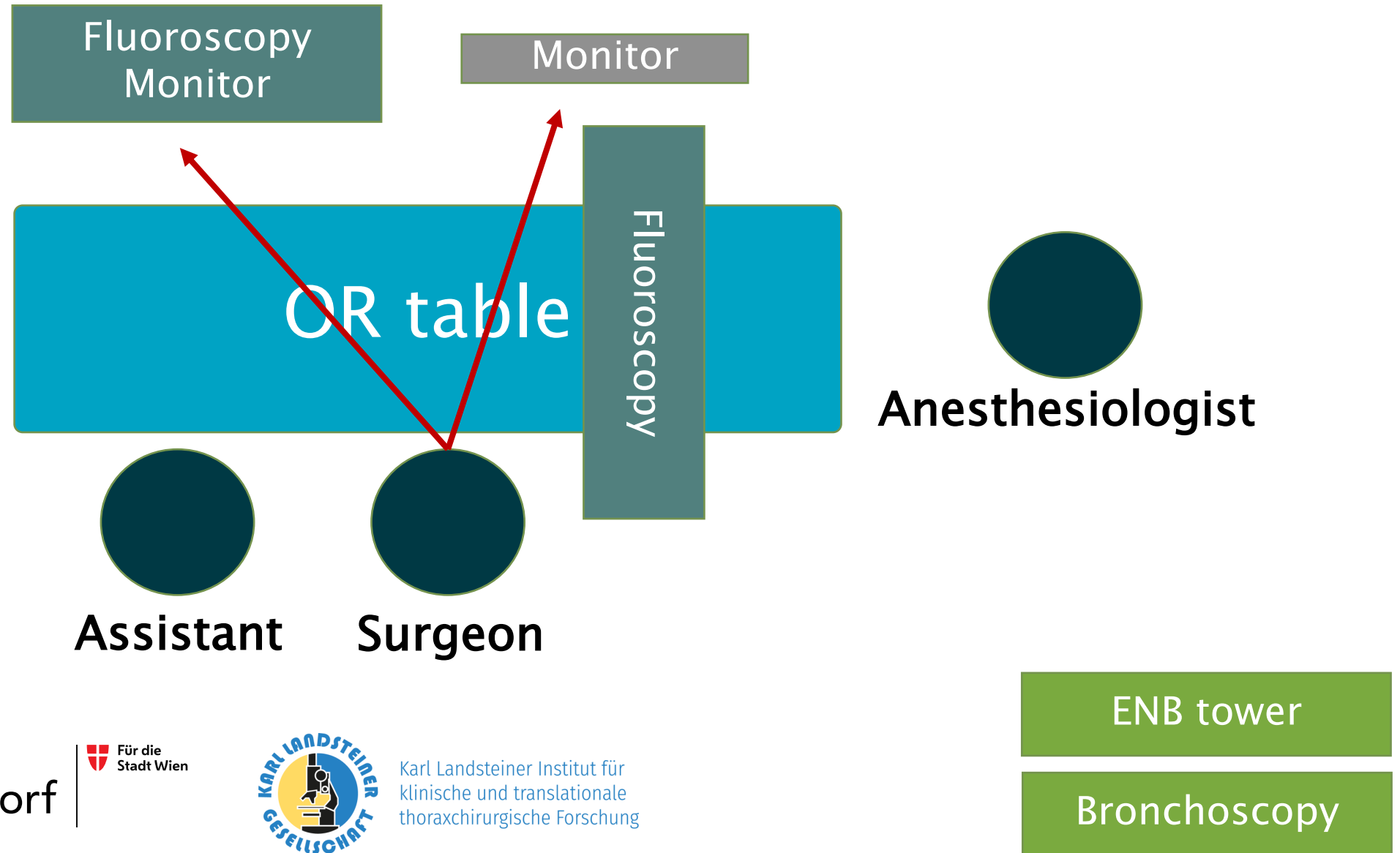
One-Step approach – Markierung



Setting im OP - Resektion



Setting im OP - Resektion



Setting im OP - Resektion



Setting im OP - Resektion



Outcome

- Gefrierschnitt
 - Adenokarzinom
- Lobektomie + Lymphadenektomie im gleichen Setting
- Pathologie
 - pT2a (pleurale Invasion) pN0 cM0, Stadium IB
- Entlassung POD 3



Zusammenfassung

Abklärung in **multidisziplinärem Team** erforderlich

One-Step ENB Markierung als hilfreiches Tool etabliert

ENB Markierung + OP als Option bei **early-stage NSCLC**

Danke



Wiener Gesundheitsverbund
Klinik Floridsdorf

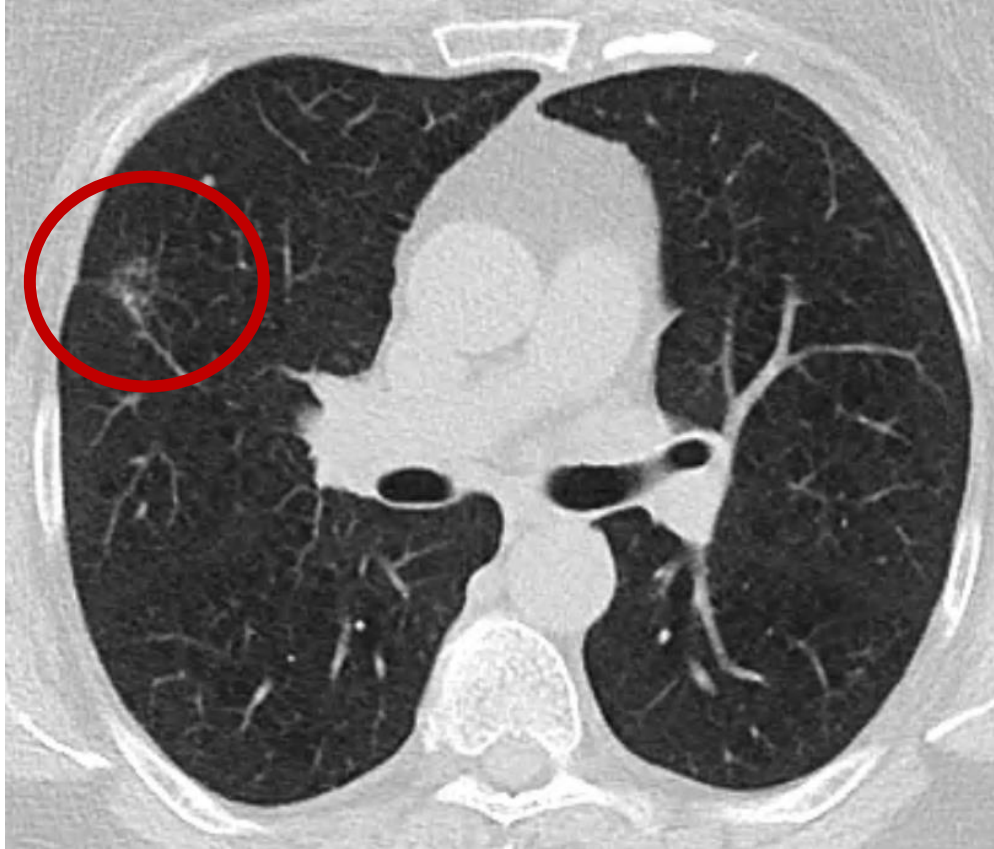


Für die
Stadt Wien



Karl Landsteiner Institut für
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Case 20 – GGO ML



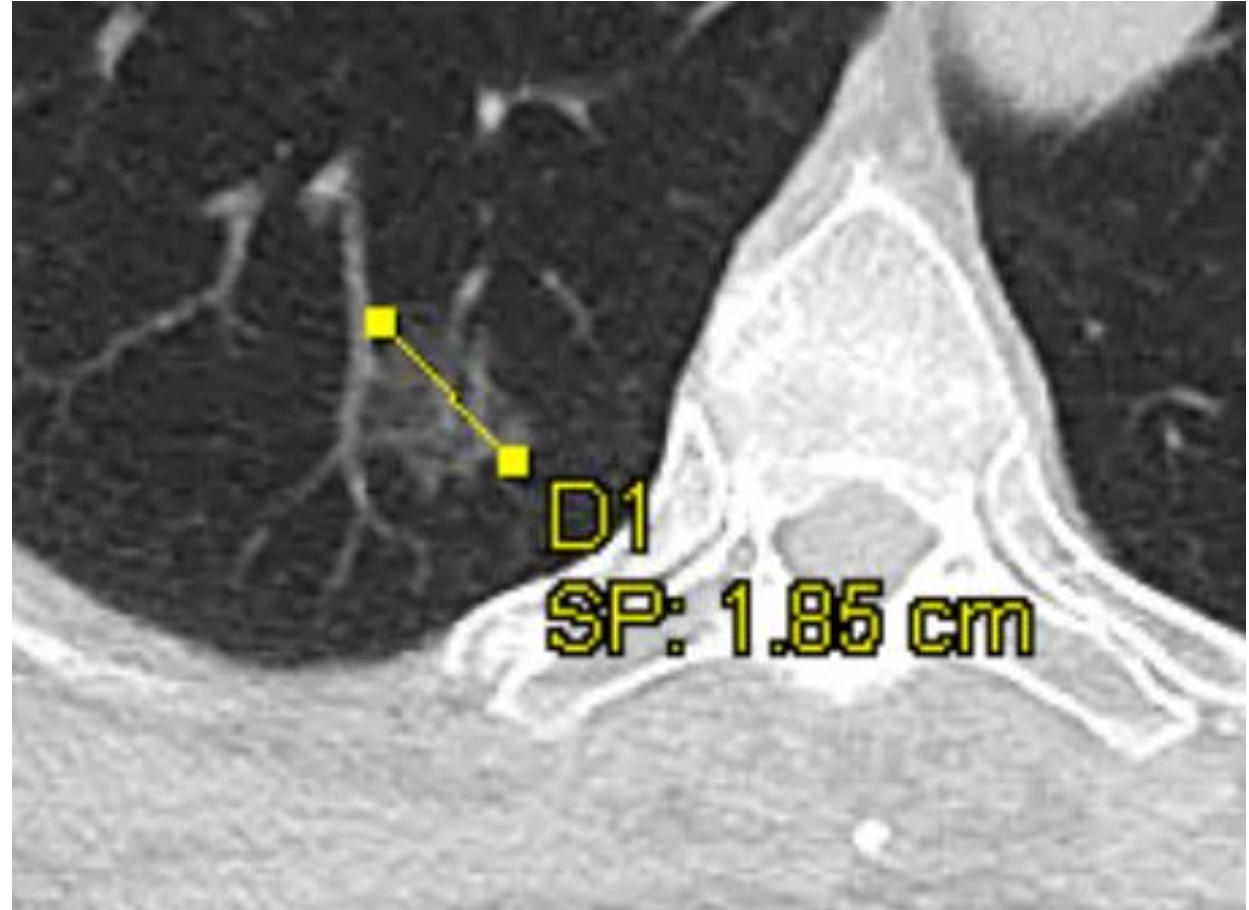
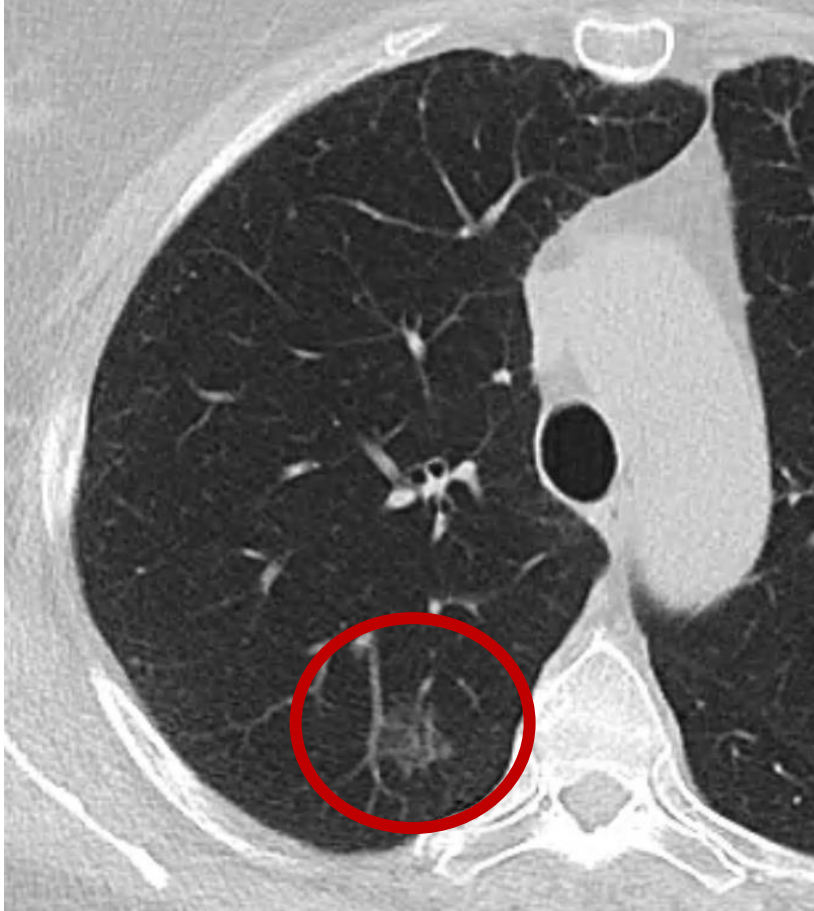
VATS–Procedure

- ENB–guided marking
- Wedge resection ML
- Frozen–section: Adenocarcinoma
- Middle lobe lobectomy +
Lymphadenectomy

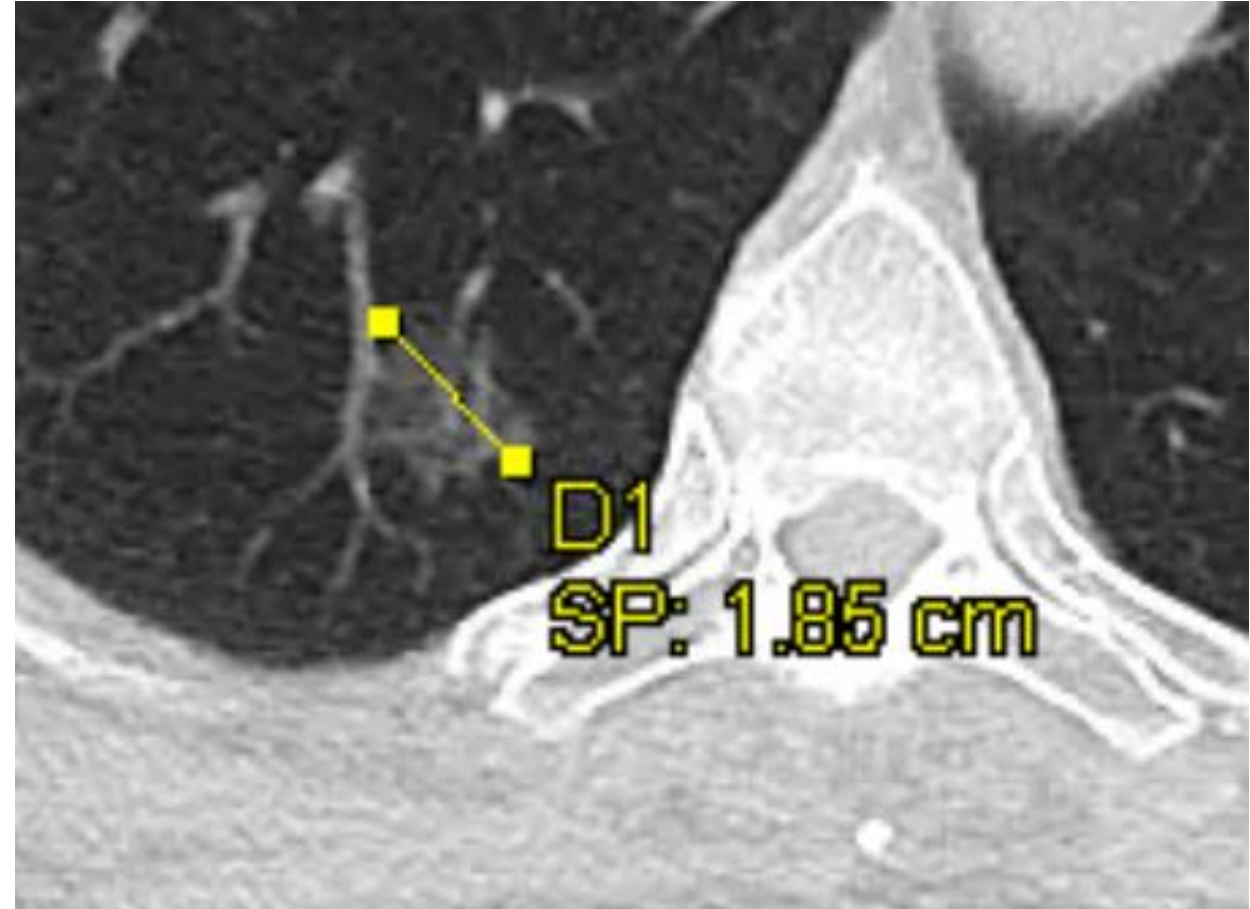
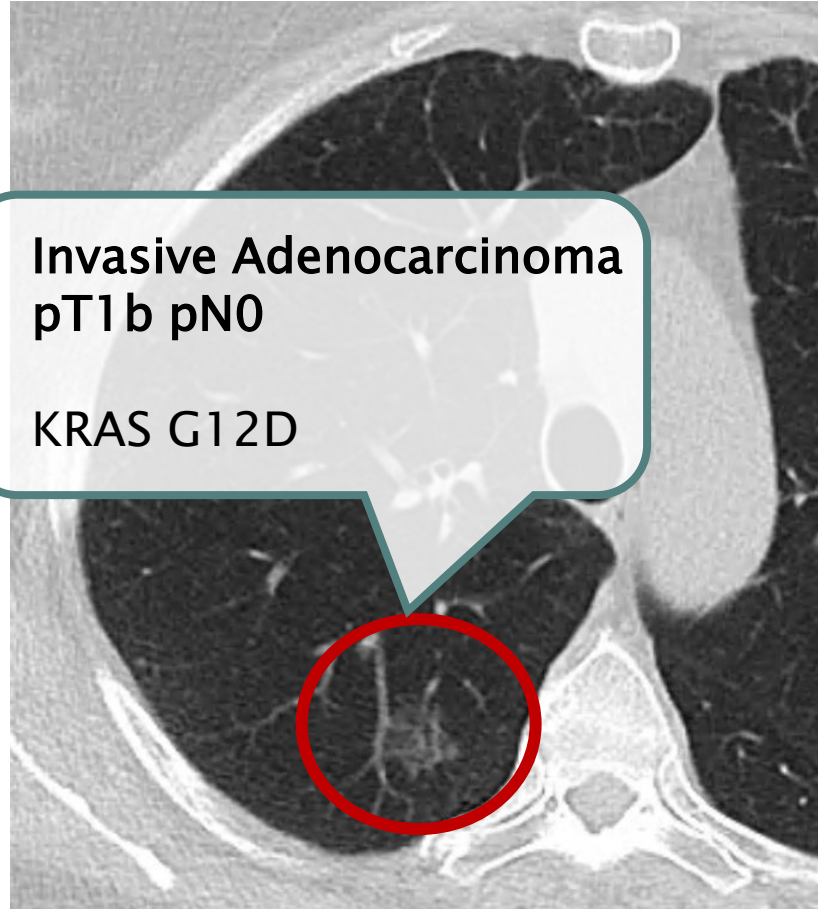
Histology

- Invasive Adenocarcinoma pT1a pN0

Case 28 – GGO ROL

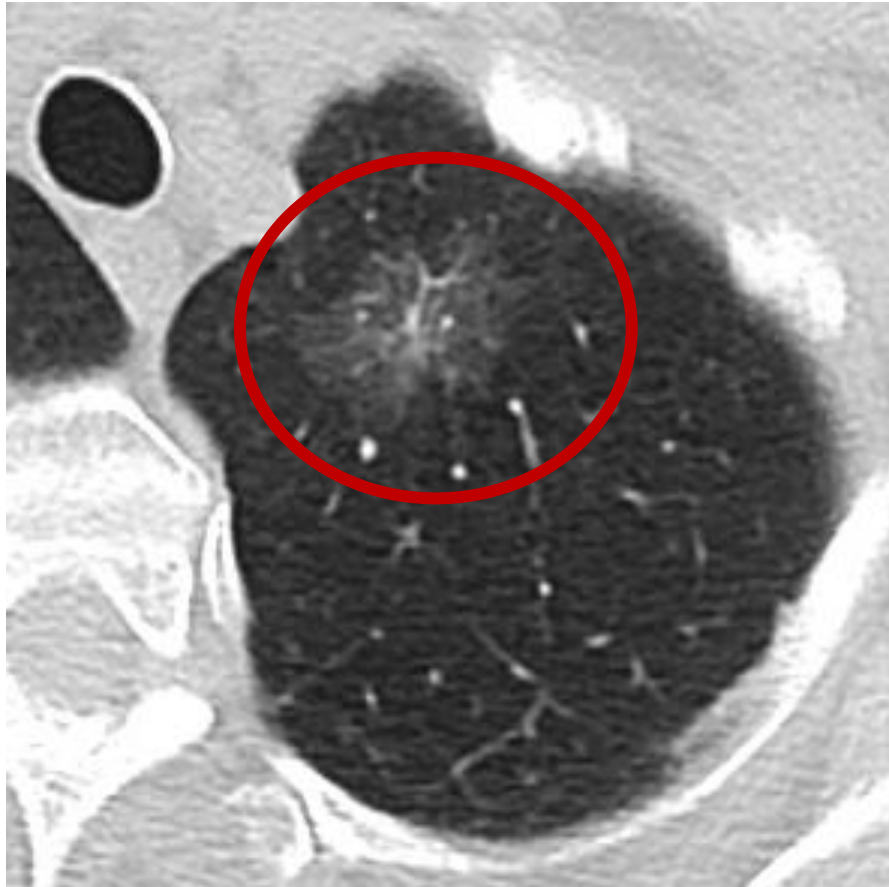


Case 28 – GGO ROL



Case 14 – multiple GGOs

ENB marked



unmarked

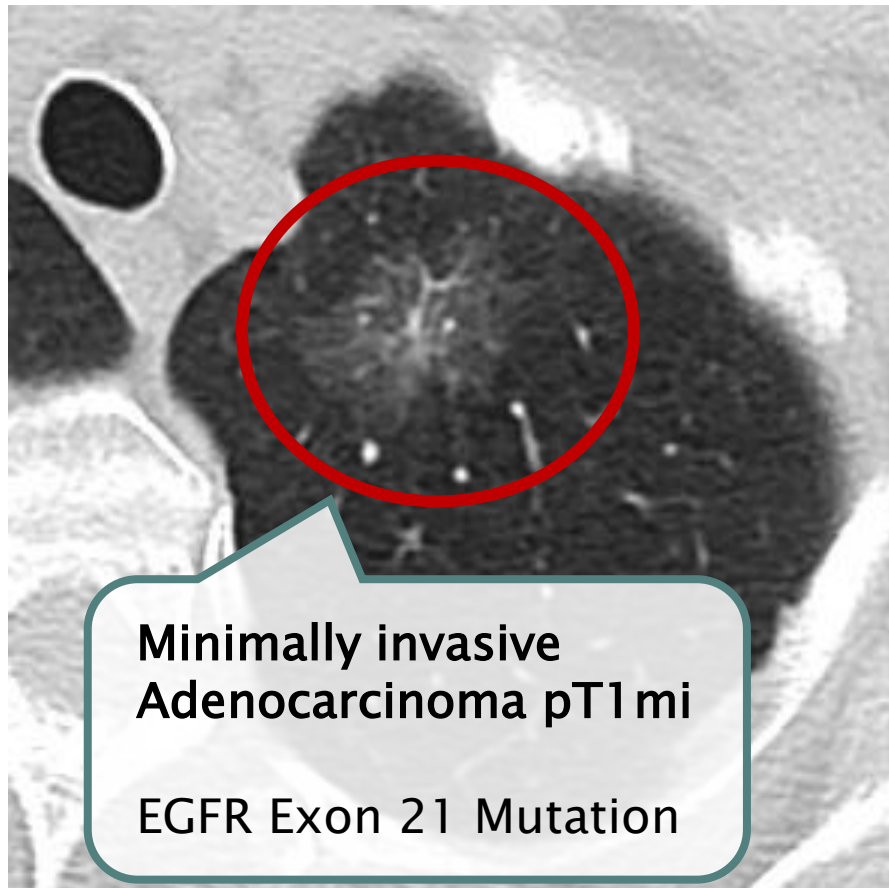


ENB marked

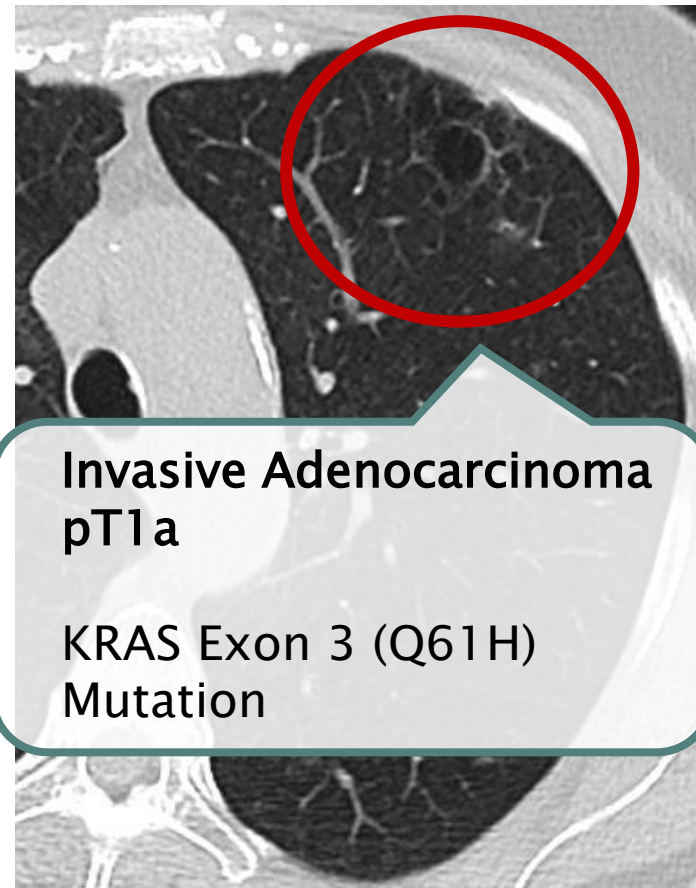


Case 14 – multiple GGOs

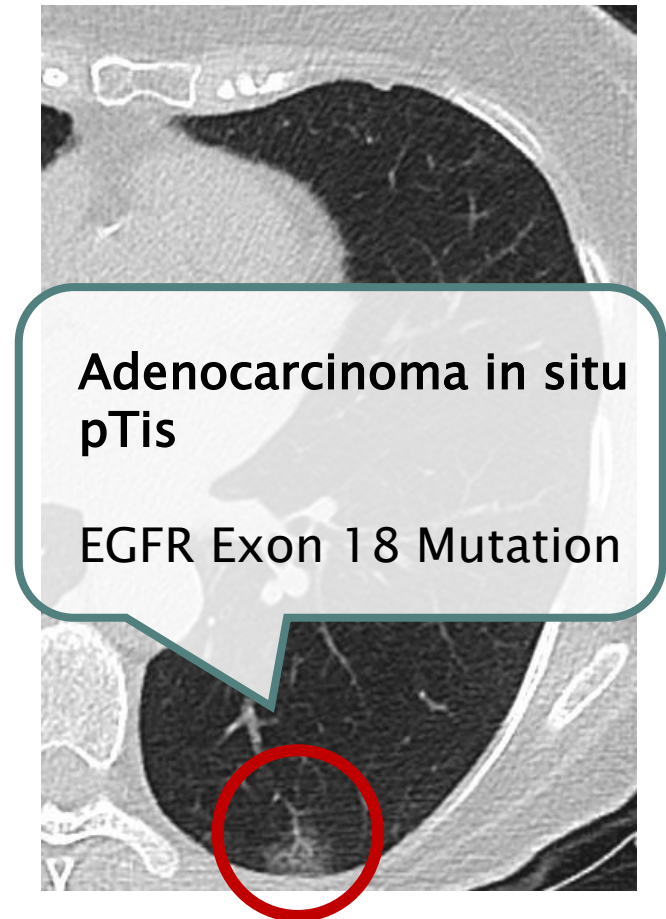
ENB marked



unmarked

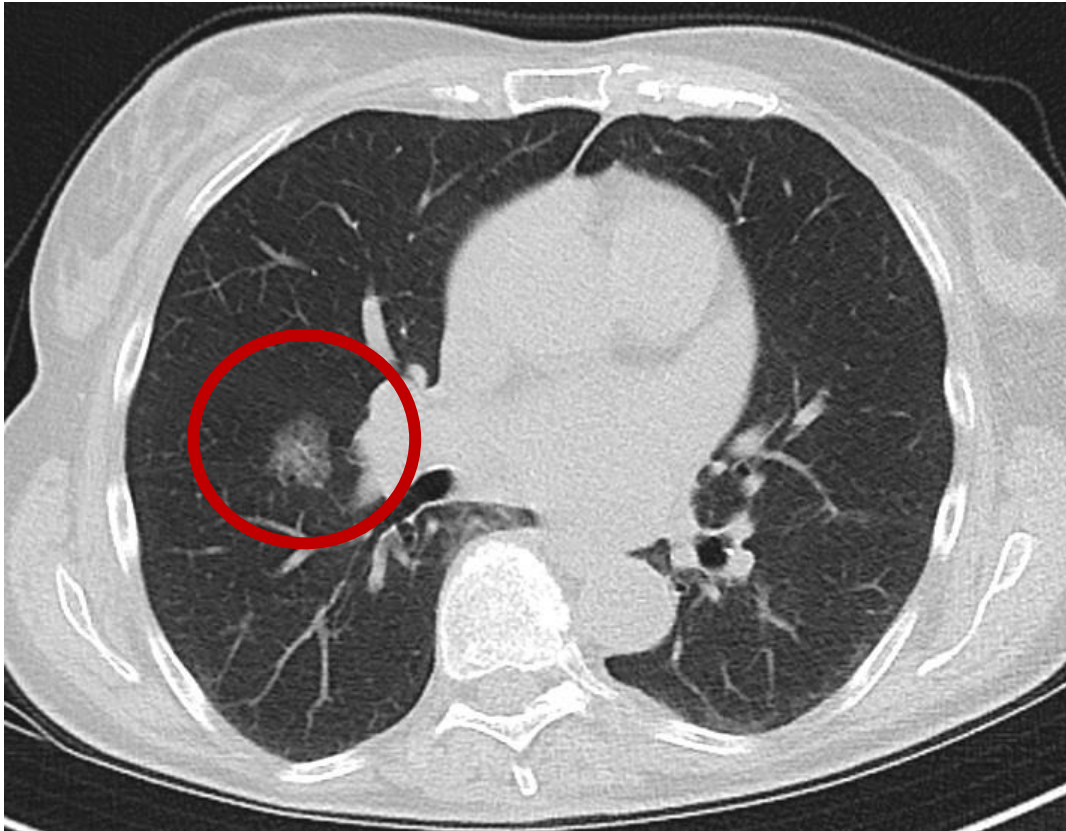


ENB marked

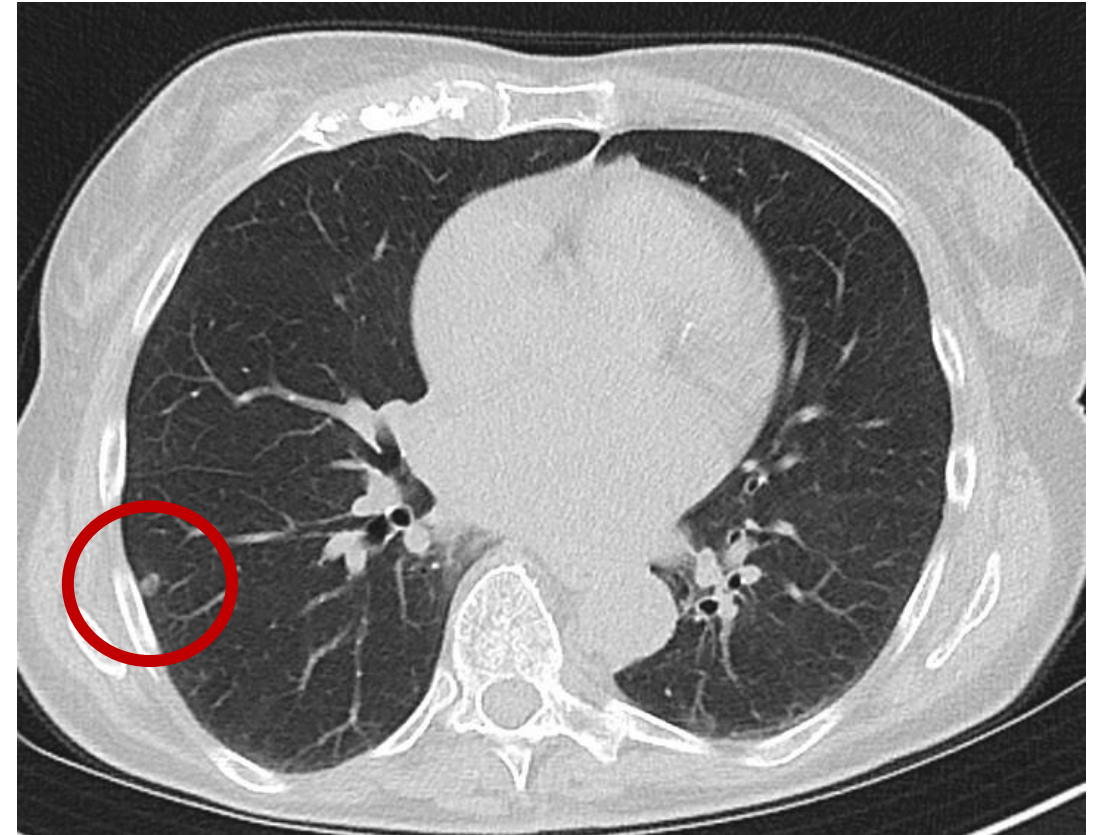


Case 19 – multiple GGOs

Primary ML lobectomy

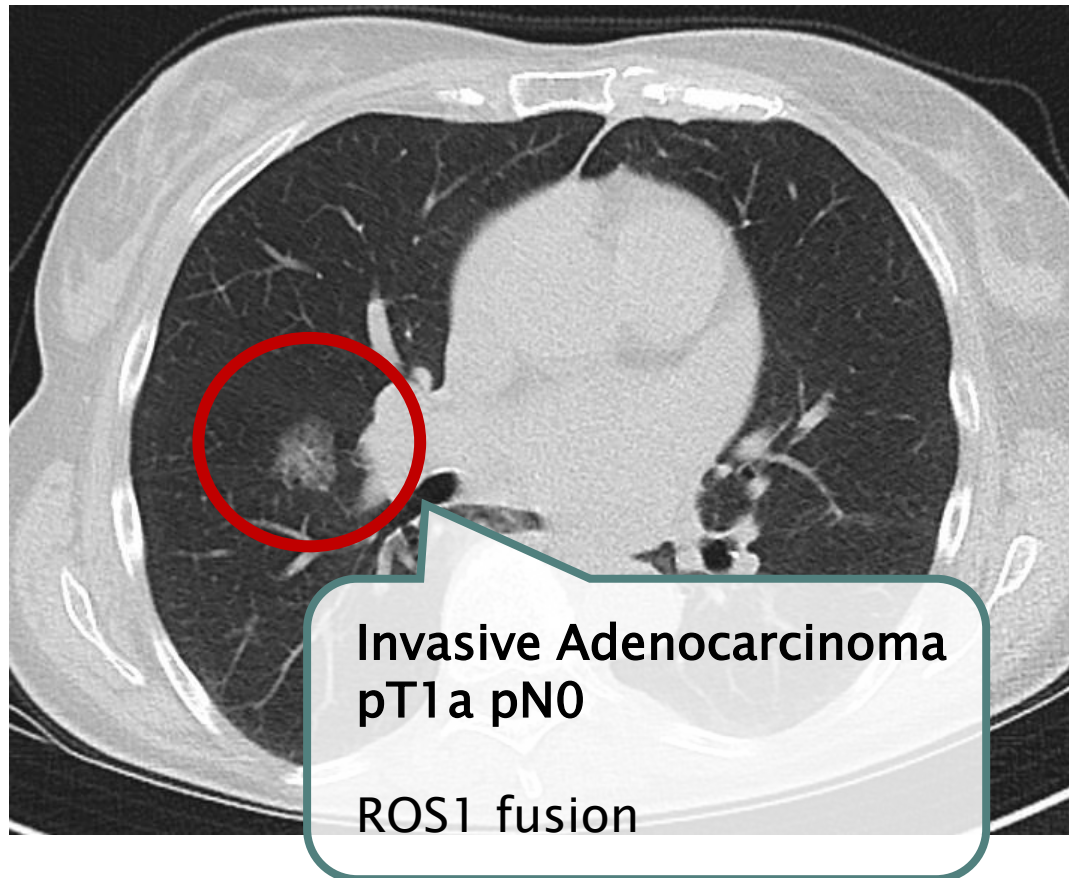


ENB marked

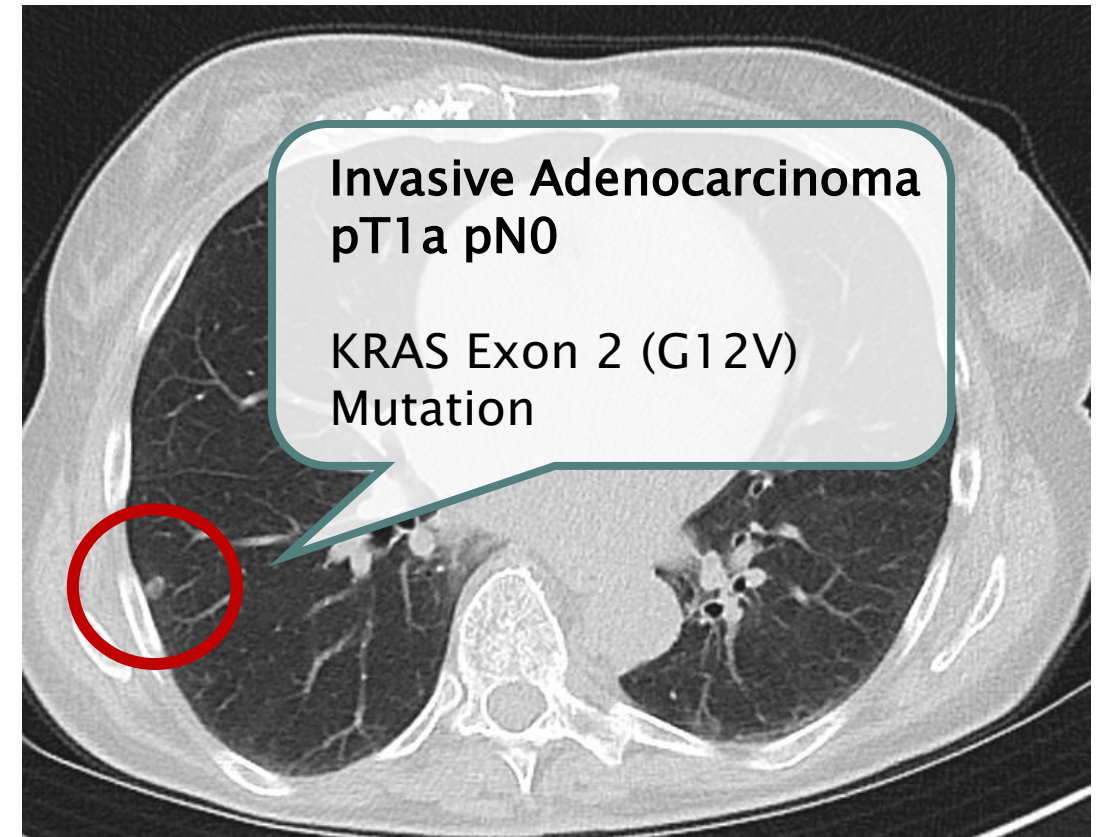


Case 19 – multiple GGOs

Primary ML lobectomy



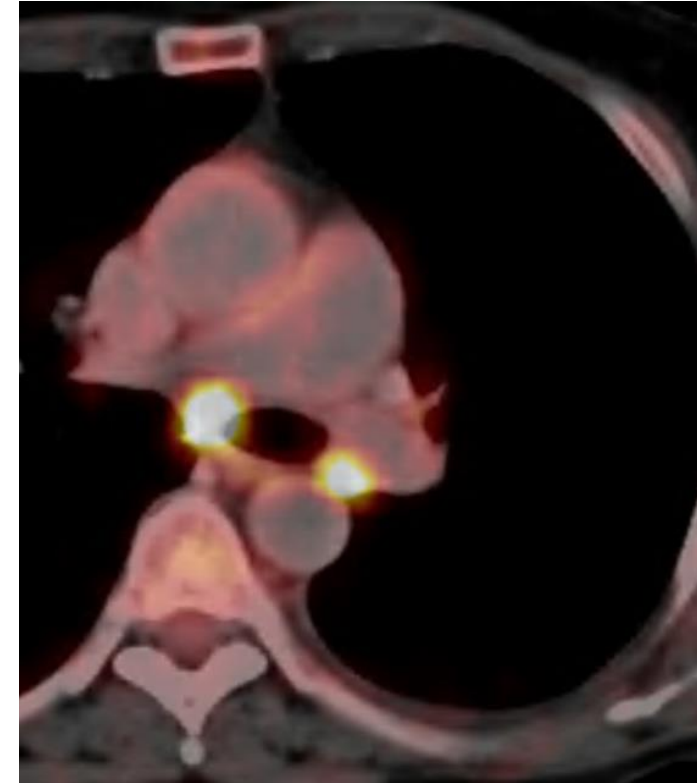
ENB marked



Case 23 – multimodal treatment in locally advanced NSCLC

Adenocarcinoma
cT4 cN2 cM0 (oder M1a?)

PD-L1 TPS 5%
KRAS G12C

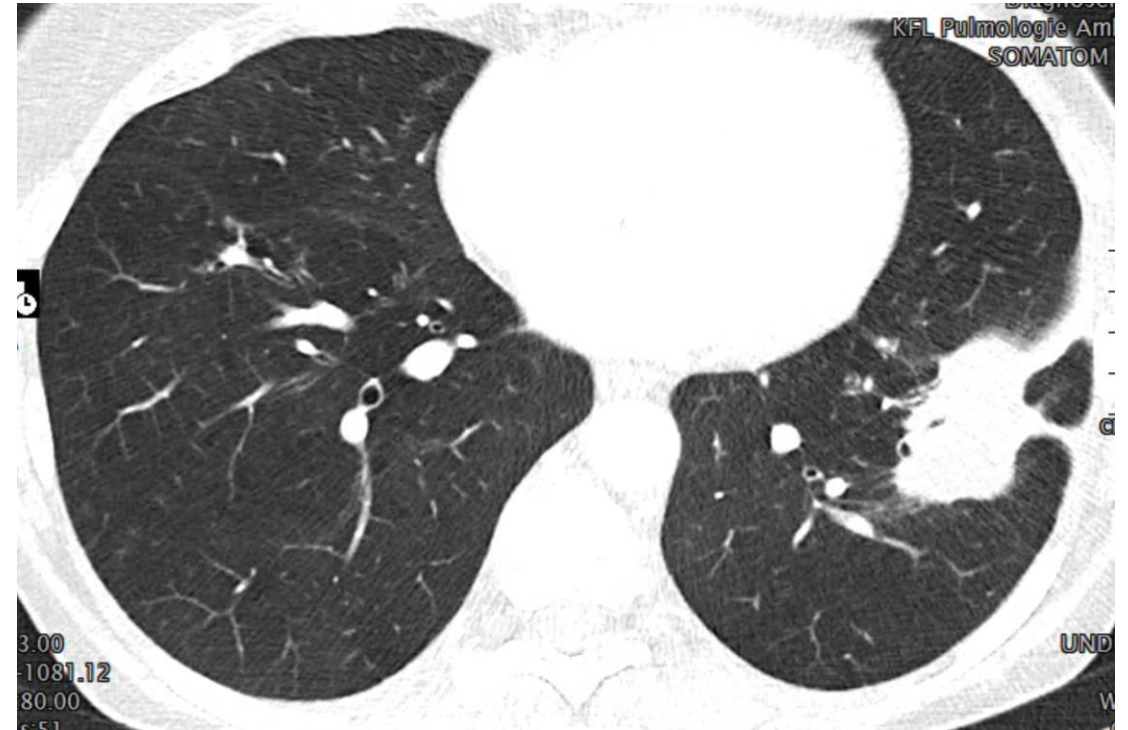


Case 23 – multimodal treatment in locally advanced NSCLC

VOR Chemo-Immuntherapie

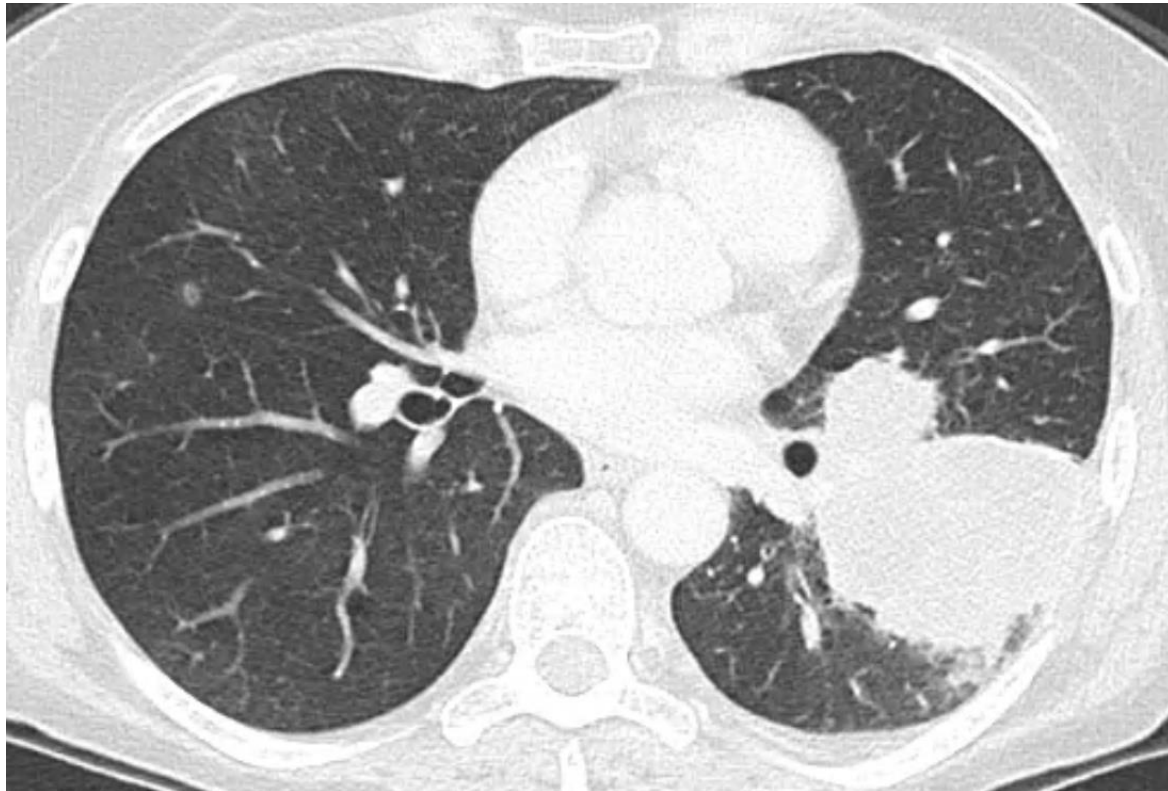


NACH Chemo-Immuntherapie



Case 23 – multimodal treatment in locally advanced NSCLC

VOR Chemo-Immuntherapie

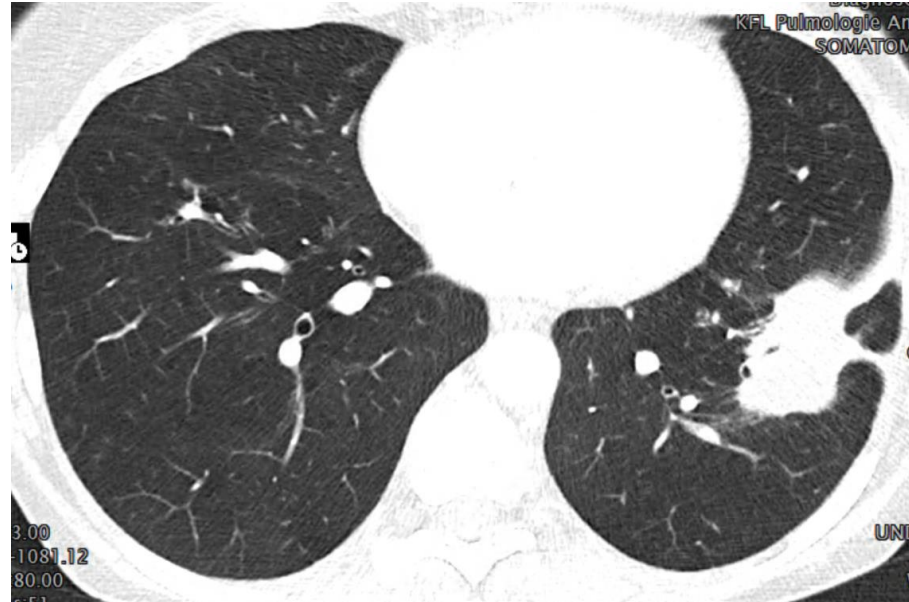


NACH Chemo-Immuntherapie



Case 23 – multimodal treatment in locally advanced NSCLC

- Lobectomy left lower lobe + anatomic lingulectomy + MLND
- Pathologic complete response ypT0 ypN0



Case 23 – multimodal treatment in locally advanced NSCLC

