The 8th Edition TNM Classification for Lung Cancer

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NHS Trust

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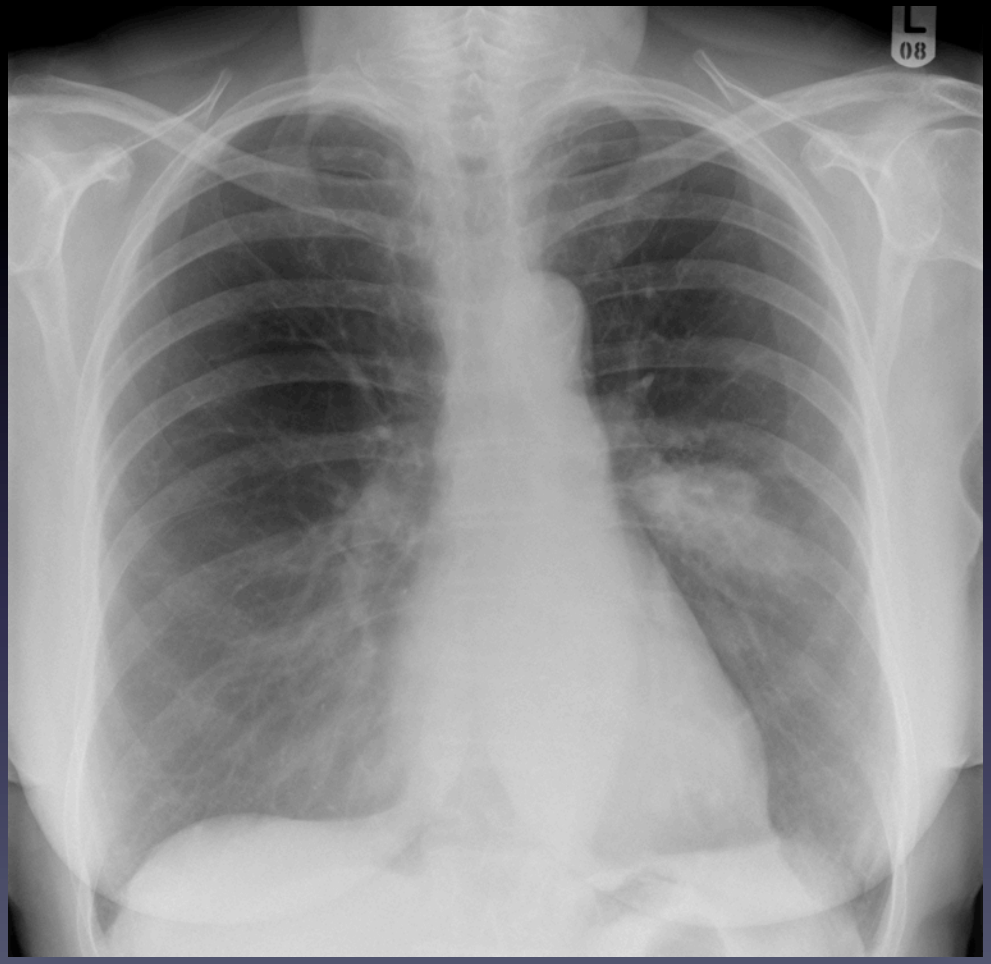
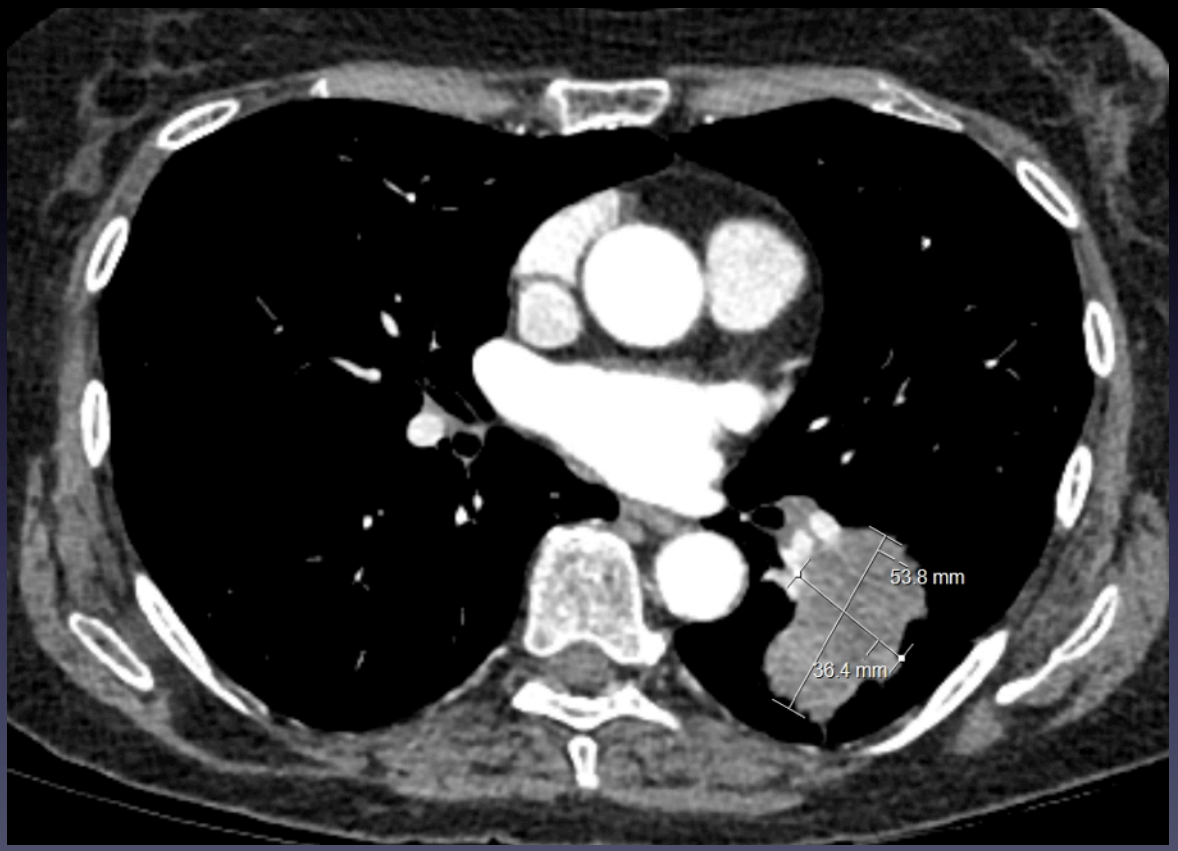
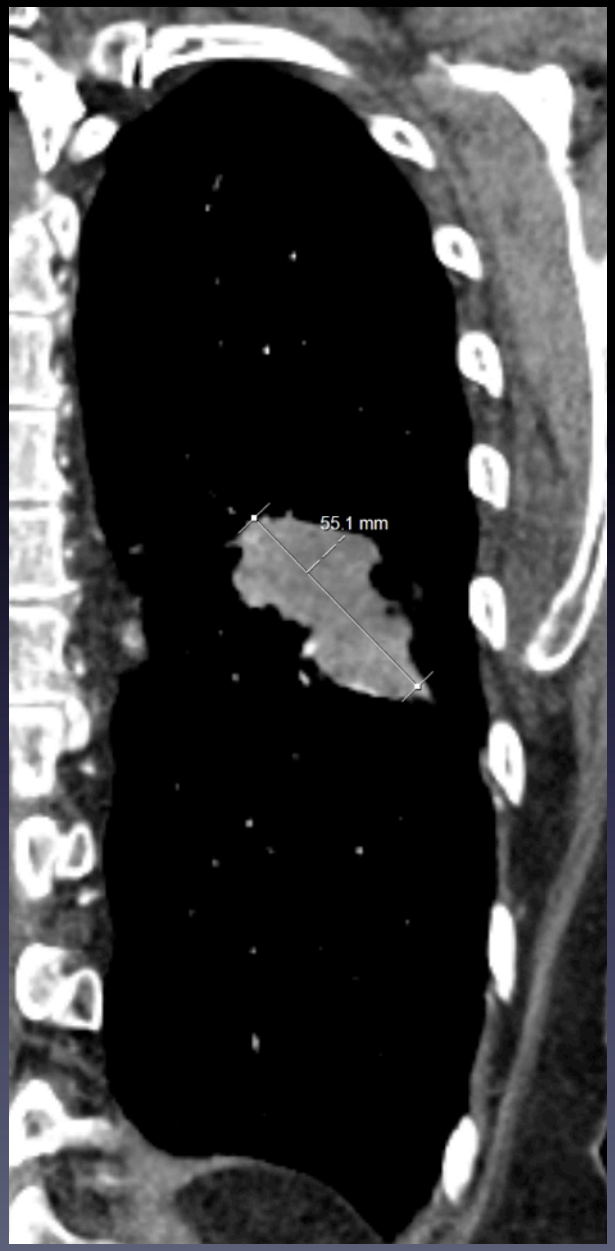
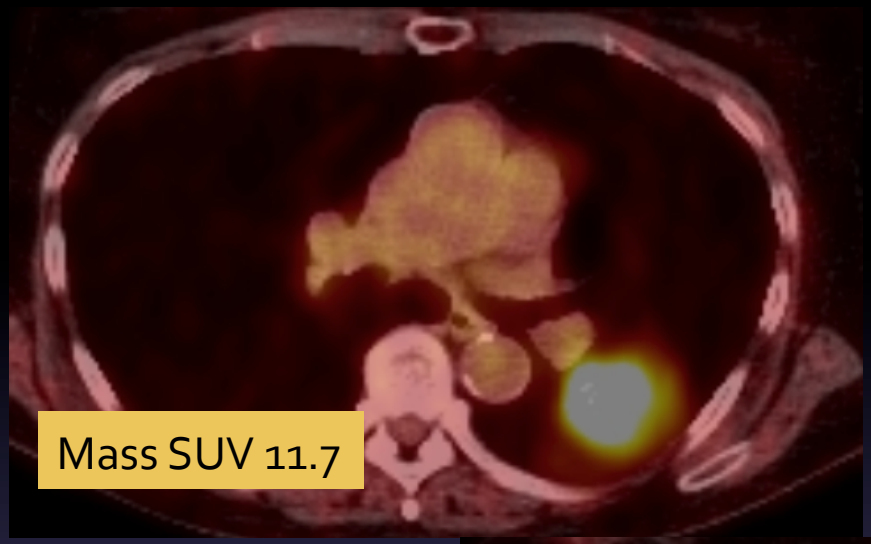
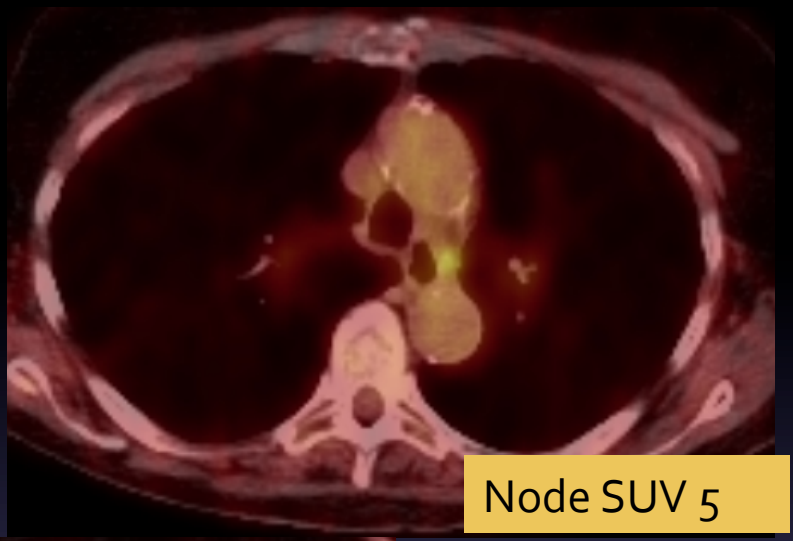
Case 1

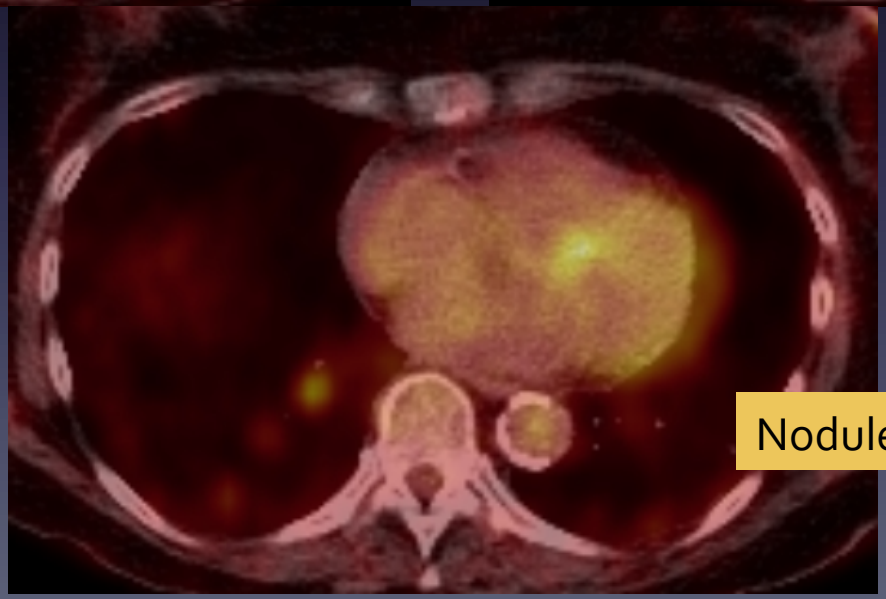



53.8 mm
36.4 mm


55.1 mm


Mass SUV 11.7


Node SUV 5

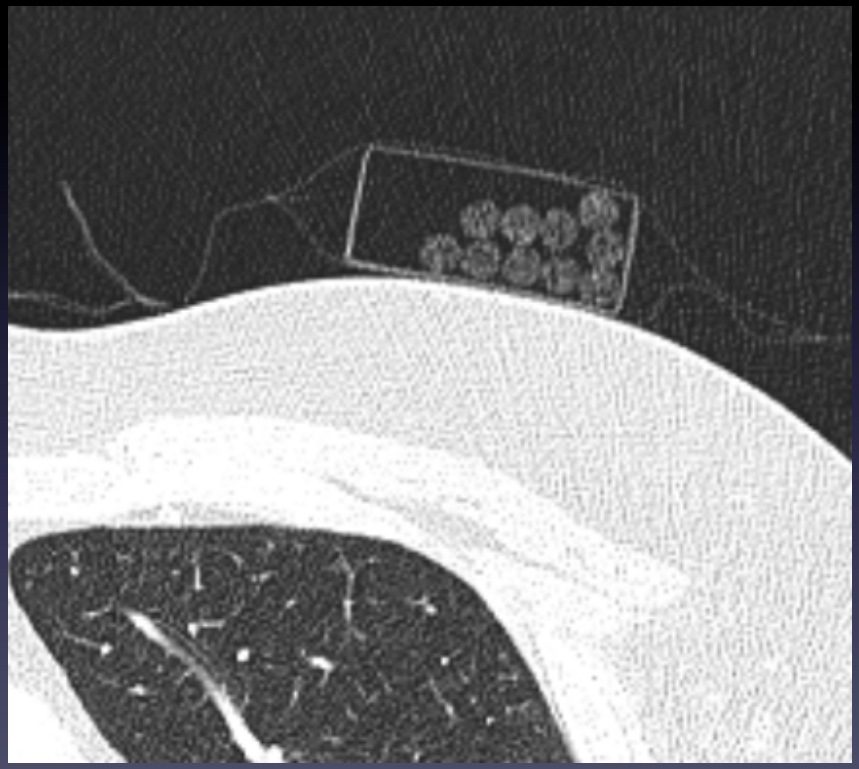

Nodules SUV 4

Case 1

- Staging
- Any implications on imaging for Mx?

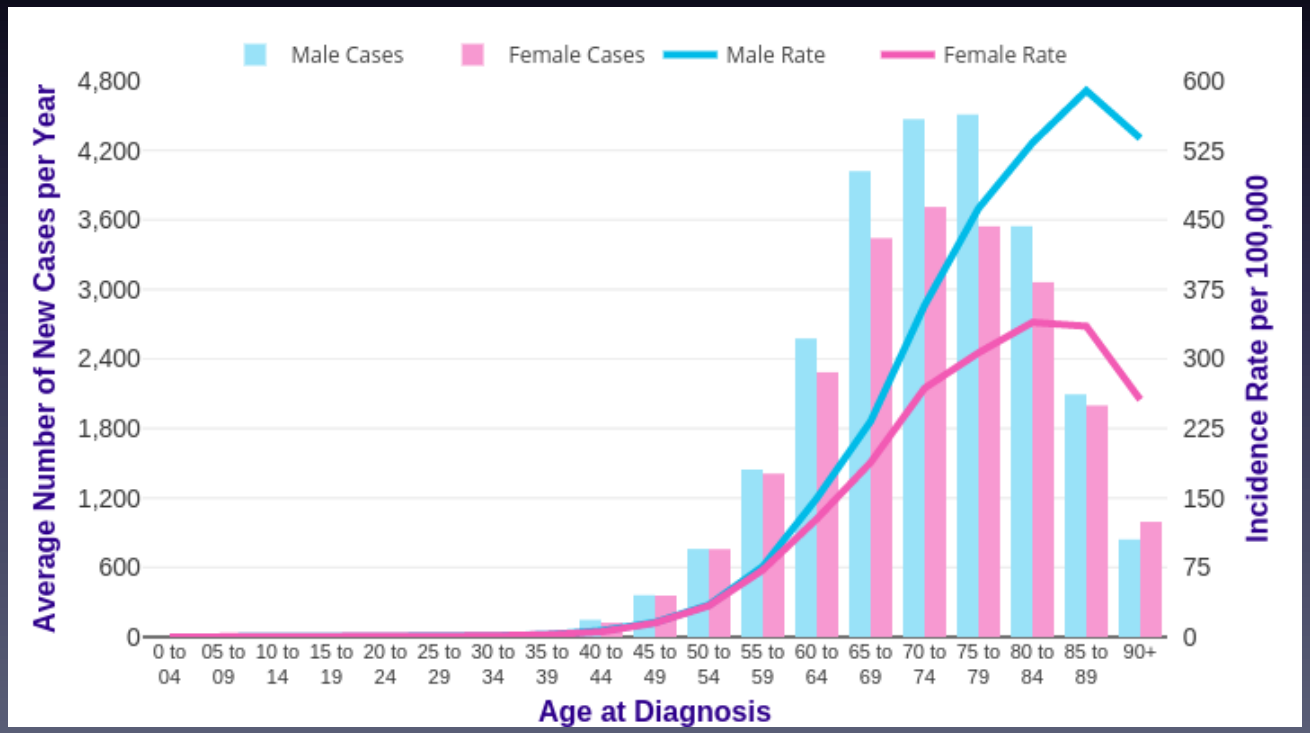
Case 1

- 5-7cm toward L hilum but not invading mediastinum T3
  - Longest dimension on coronal view
- AP window nodal met ipsilat mediastinum N2
- Bilateral metastases M1a
- Fissural involvement – implications for resection

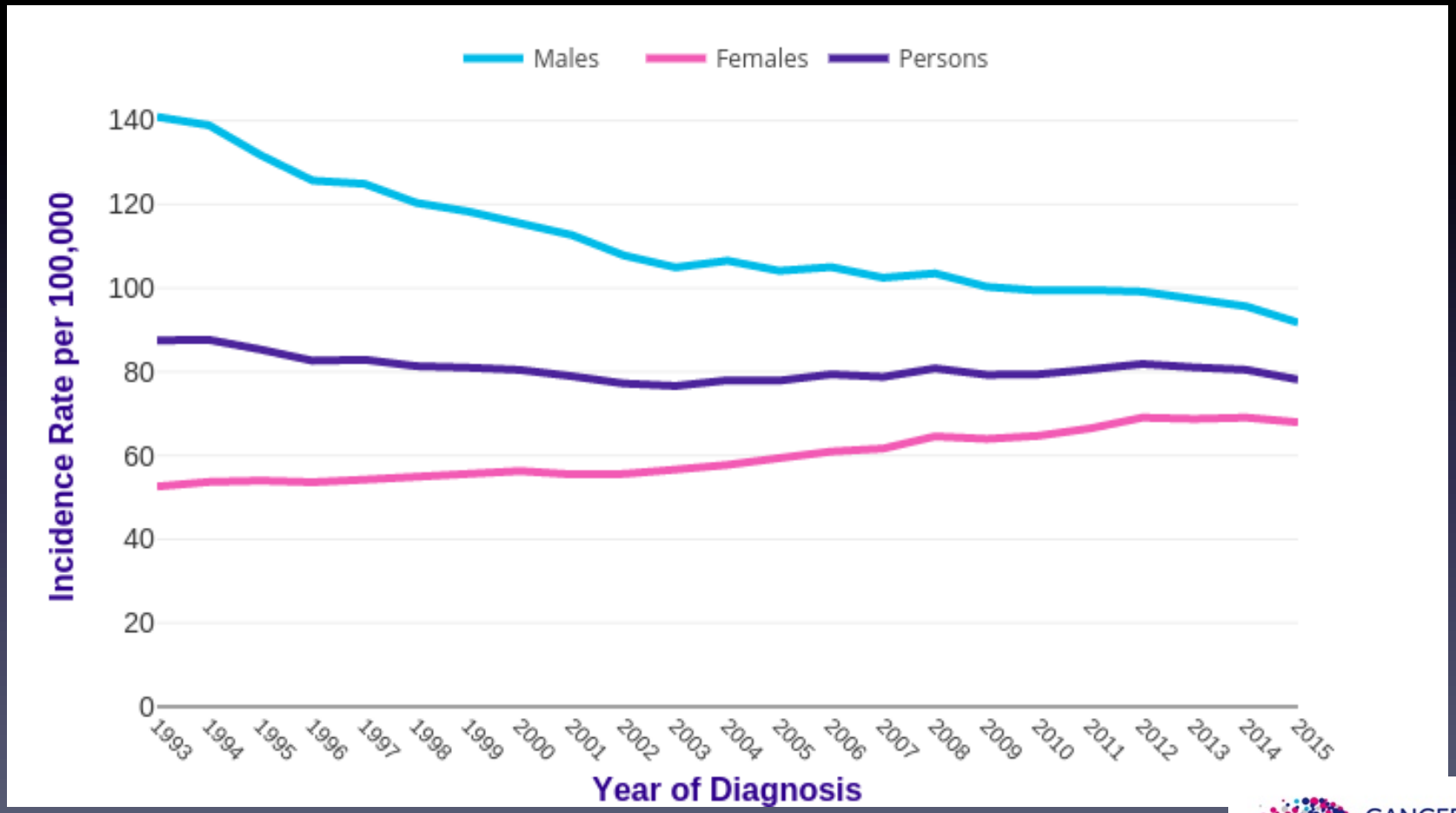


Epidemiology

- 2015 – 3rd most common cancer, 46, 388 cases
- 13% of all new cancer cases



CANCER RESEARCH UK



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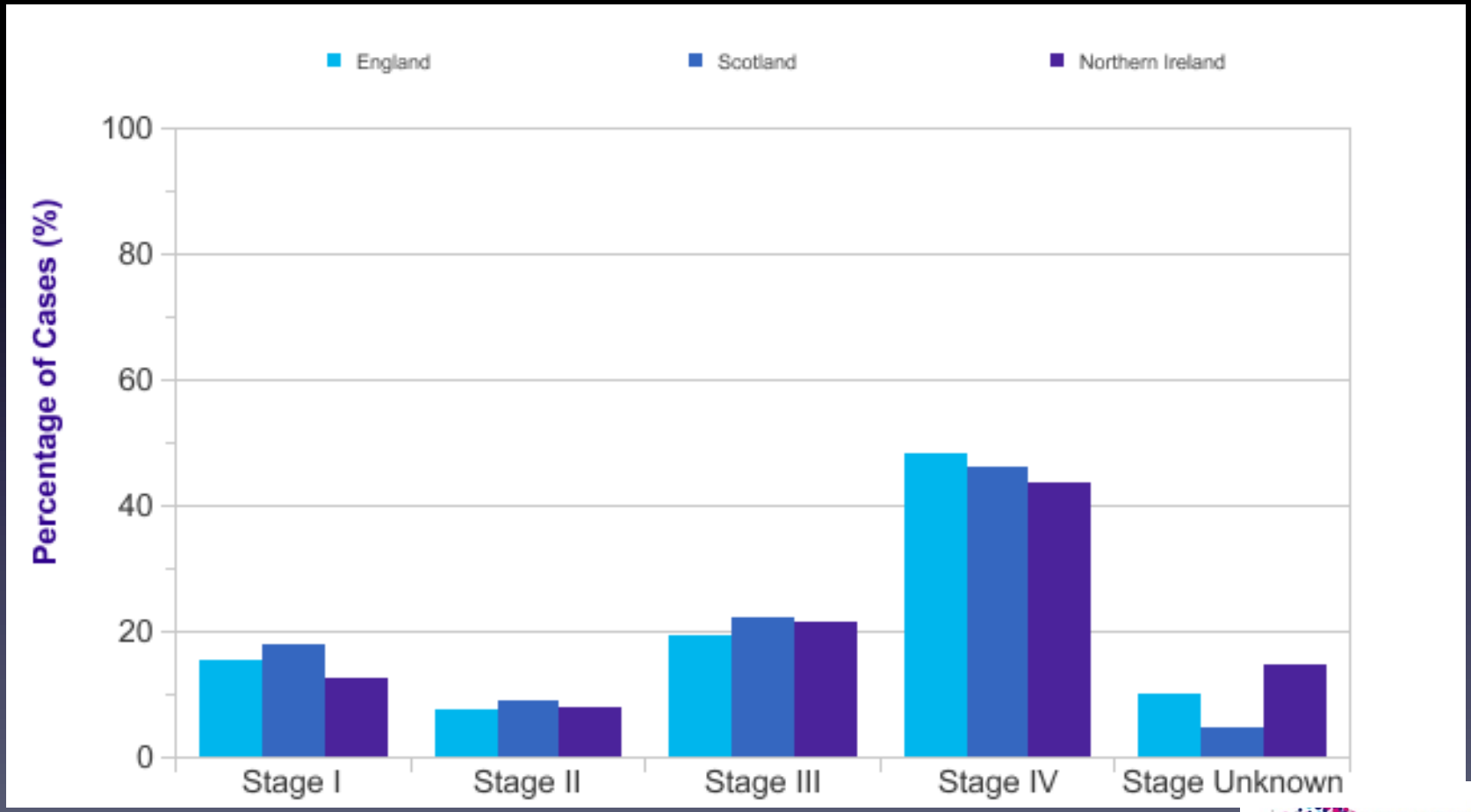
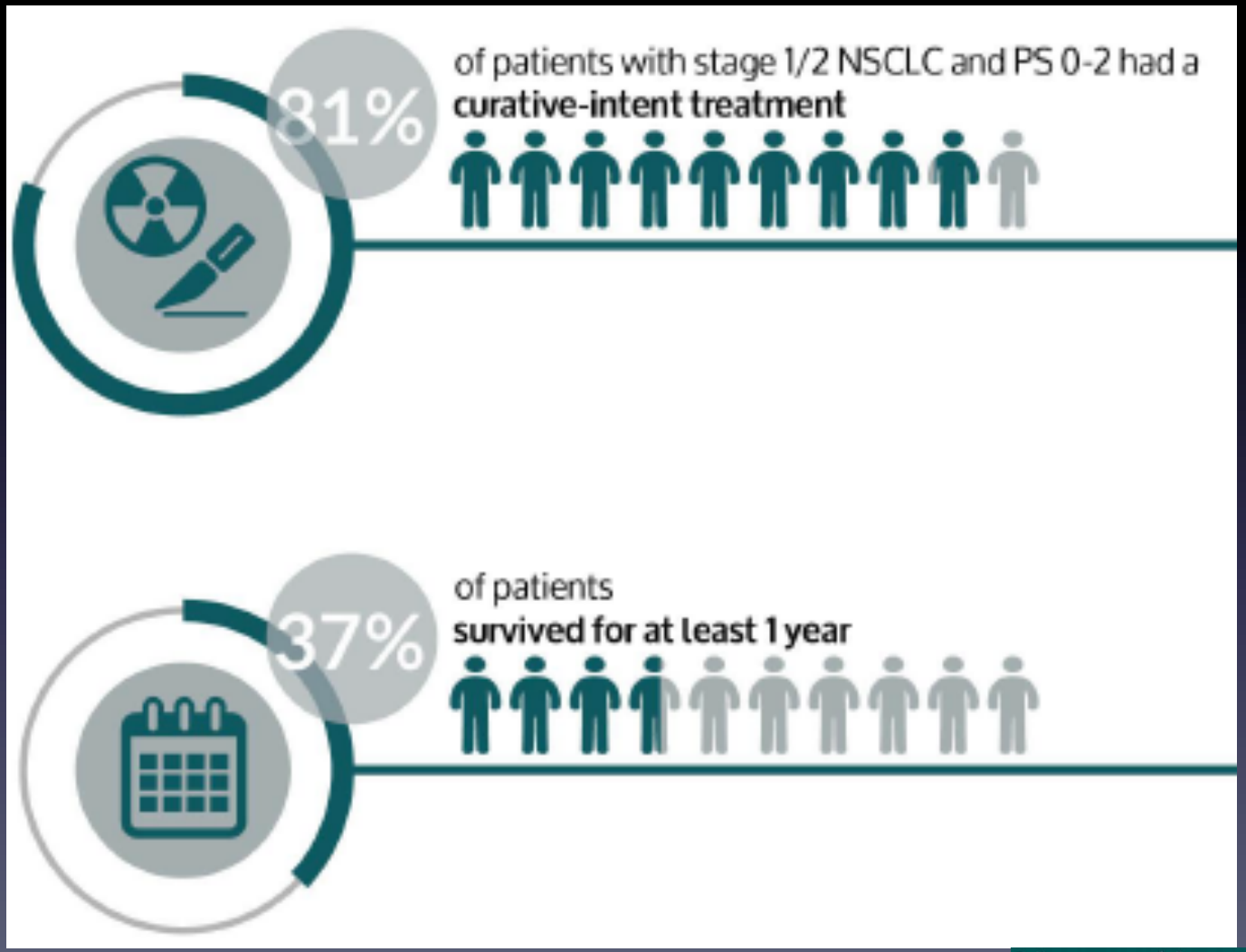


Proportion of Cases Diagnosed at Each Stage, All Ages

CANCER RESEARCH UK

Survival



National Lung Cancer Audit
Annual report 2017

TNM

- Conceived by Pierre Denoix between 1943 and 1952
- International Association for the Study of Lung Cancer (IASLC) formed in 1997

General principles of TNM

- Staging
  - Anatomical extent of tumour
  - Facilitates planning of treatment and measurement of response
  - Estimate survival
  - Communication between centres
  - Trials
- TNM
  - T: Extent of primary tumour
  - N: Absence or presence and extent of regional lymph node metastases
  - M: Absence or presence of distant metastases

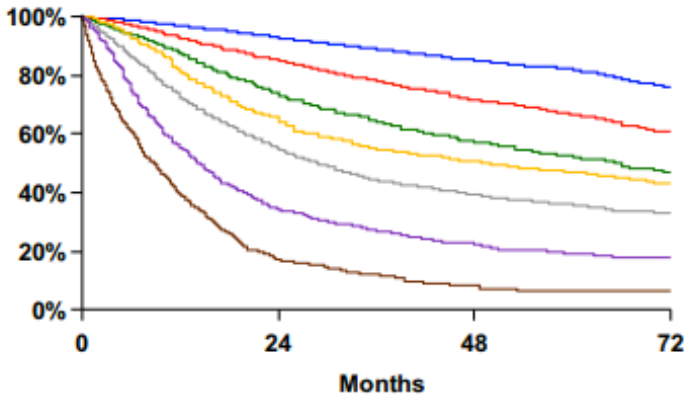
8th Edition lung TNM

- Database collected between 1999-2010
  - 16 countries
  - 94,708 cases (70, 967 NSCLC, 6, 189 SCLC)
- Demographic data
- SUV uptake if available but PET was not as routinely used during the earlier dates of data collection
- Survival data

8th Edition lung TNM

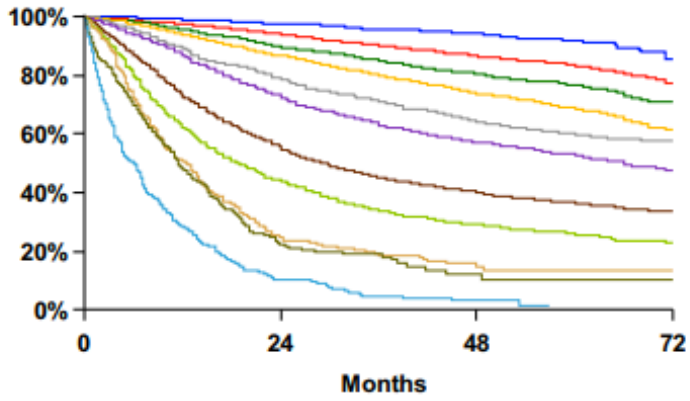
- Aim is to improve prognostic ability
- Better select patients who will benefit from radical treatment
- Overall improved survival per stage
- More complex staging system
- Size now more important than ever before
- Recognition of oligo-metastatic state

A



7th Ed.	Events / N	MST	24 Month	60 Month
IA	1119 / 6303	NR	93%	82%
IB	768 / 2492	NR	85%	66%
IIA	424 / 1008	66.0	74%	52%
IIB	382 / 824	49.0	64%	47%
IIIA	2139 / 3344	29.0	55%	36%
IIIB	2101 / 2624	14.1	34%	19%
IV	664 / 882	8.8	17%	6%

B



Proposed	Events / N	MST	24 Month	60 Month
IA1	68 / 781	NR	97%	92%
IA2	505 / 3105	NR	94%	83%
IA3	546 / 2417	NR	90%	77%
IB	560 / 1928	NR	87%	68%
IIA	215 / 585	NR	79%	60%
IIB	605 / 1453	66.0	72%	53%
IIIA	2052 / 3200	29.3	55%	36%
IIIB	1551 / 2140	19.0	44%	26%
IIIC	831 / 986	12.6	24%	13%
IVA	336 / 484	11.5	23%	10%
IVB	328 / 398	6.0	10%	0%

The IASLC Lung Cancer Staging Project

Proposals for the Revisions of the T Descriptors in the Forthcoming Eighth Edition of the TNM Classification for Lung Cancer

(*J Thorac Oncol*. 2015;10: 990–1003)

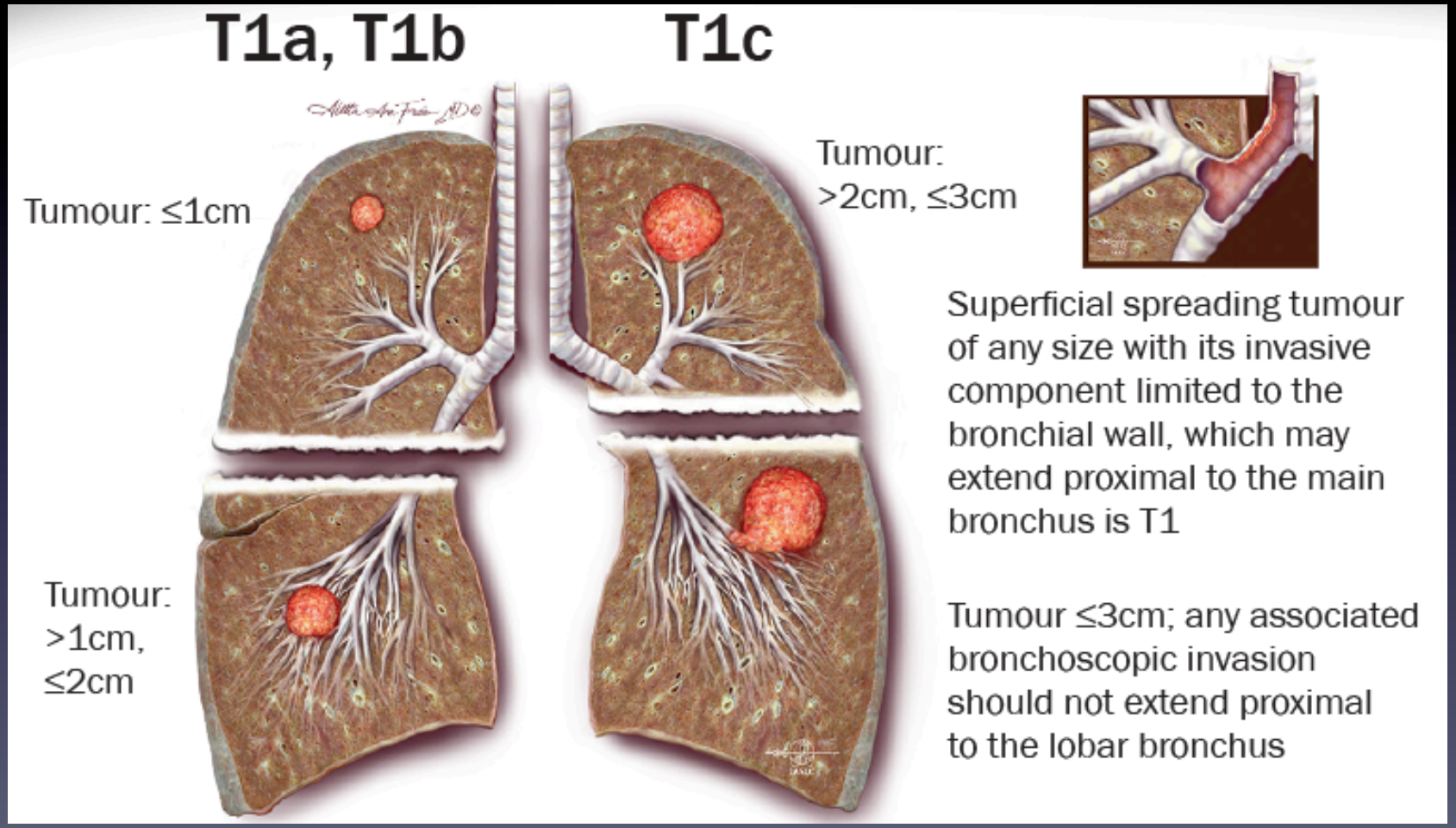
TNM 7	TNM8
T	Tis Tmi
T1a (<2cm)	T1a (</=1cm) T1b (>1-2cm)
T1b (2-3cm)	T1c (>2-3cm)
T2a (>3-5cm)	T2a (>3-4cm) T2b (>4-5cm)
T2b (5-7cm)	T3 (>5-7cm)
T3 atelectasis/pneumonitis whole lung	T2 atelectasis/pneumonitis irrespective of extent (lobe or lung)
T3 involving main bronchus <2cm from carina	T2 involving main bronchus irrespective of distance from carina
T3 invasion of diaphragm	T4 invasion of diaphragm
N	NO CHANGE
M1b distant metastases	M1b single extrathoracic metastasis M1c multiple

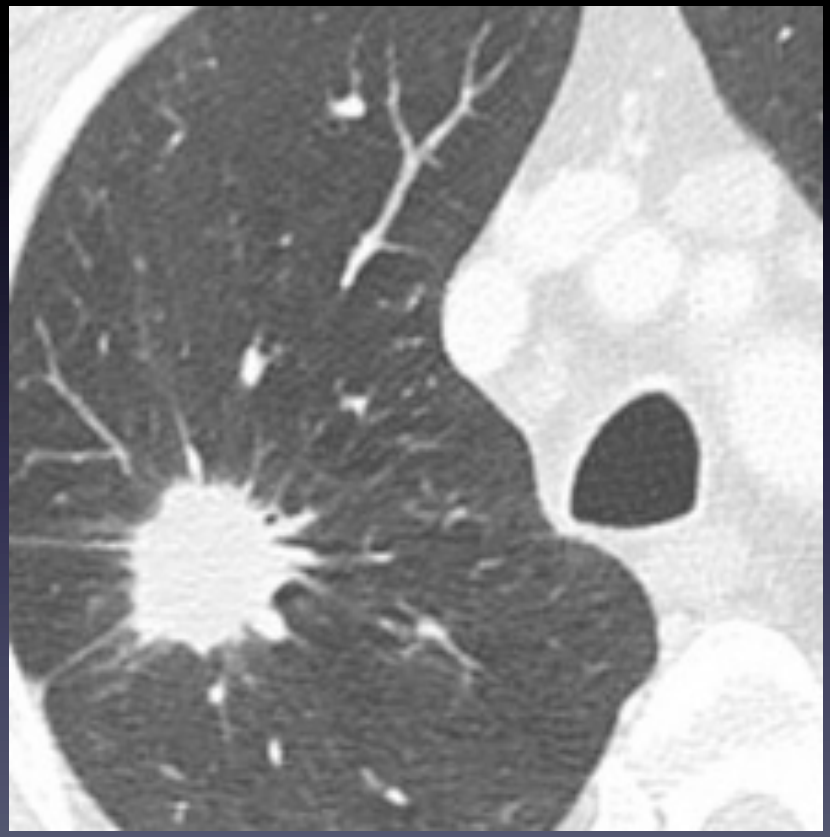
	N0	N1	N2	N3
T1	IA	IIB	IIIA	IIIB
T2a	IB	IIB	IIIA	IIIB
T2b	IIA	IIB	IIIA	IIIB
T3	IIB	IIIA	IIIB	IIIC
T4	IIIA	IIIA	IIIB	IIIC
M1a	IVA	IVA	IVA	IVA
M1b	IVA	IVA	IVA	IVA
M1c	IVB	IVB	IVB	IVB

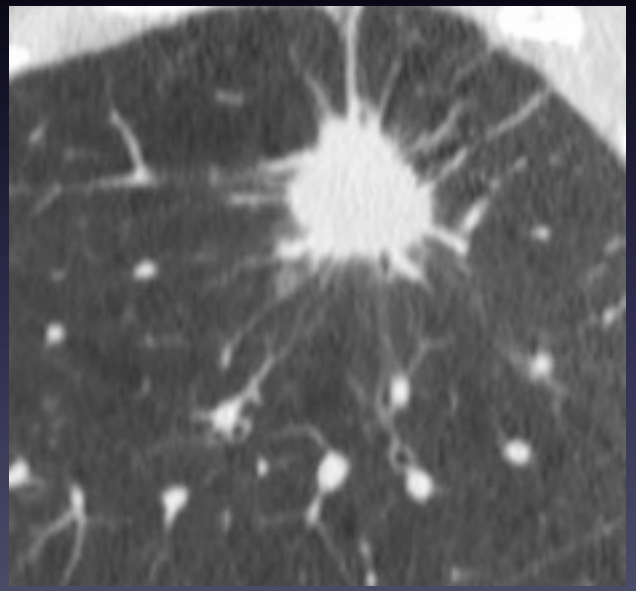
T

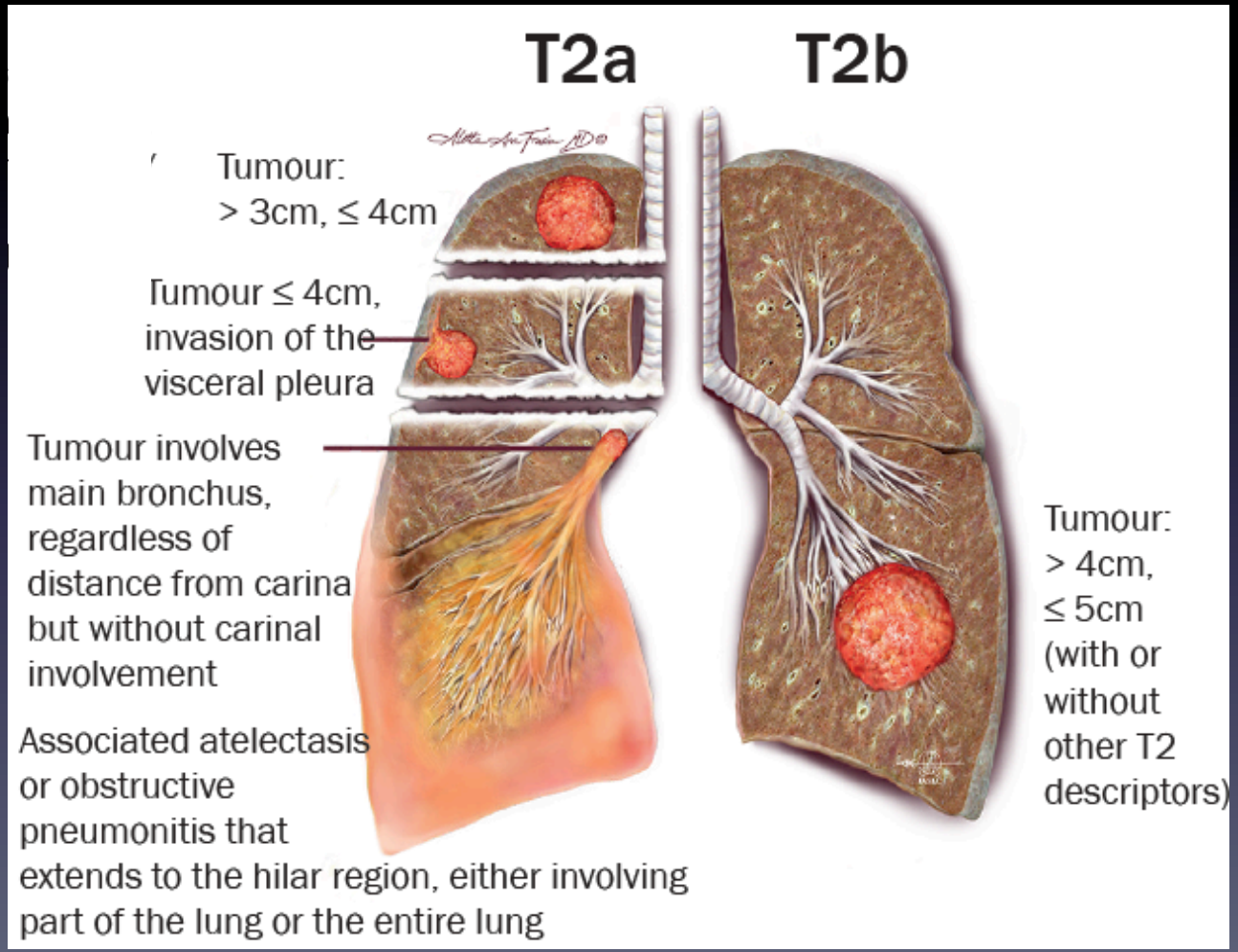
T_x	Tumor in sputum/bronchial washings but not be assessed in imaging or bronchoscopy
T_0	No evidence of tumor
T_{is}	Carcinoma in situ
T_1	≤ 3 cm surrounded by lung/visceral pleura, not involving main bronchus
$T_{1a(mi)}$	Minimally invasive carcinoma
T_{1a}	≤ 1 cm
T_{1b}	> 1 to ≤ 2 cm
T_{1c}	> 2 to ≤ 3 cm
T_2	> 3 to ≤ 5 cm *or* involvement of main bronchus without carina, regardless of distance from carina or invasion visceral pleural *or* atelectasis or post obstructive pneumonitis extending to hilum
T_{2a}	>3 to ≤4cm
T_{2b}	>4 to ≤5cm
T_3	>5 to ≤7cm in greatest dimension *or* tumor of any size that involves chest wall, pericardium, phrenic nerve *or* satellite nodules in the same lobe
T_4	> 7cm in greatest dimension *or* any tumor with invasion of mediastinum, diaphragm, heart, great vessels, recurrent laryngeal nerve, carina, trachea, oesophagus, spine *or* separate tumor in different lobe of ipsilateral lung

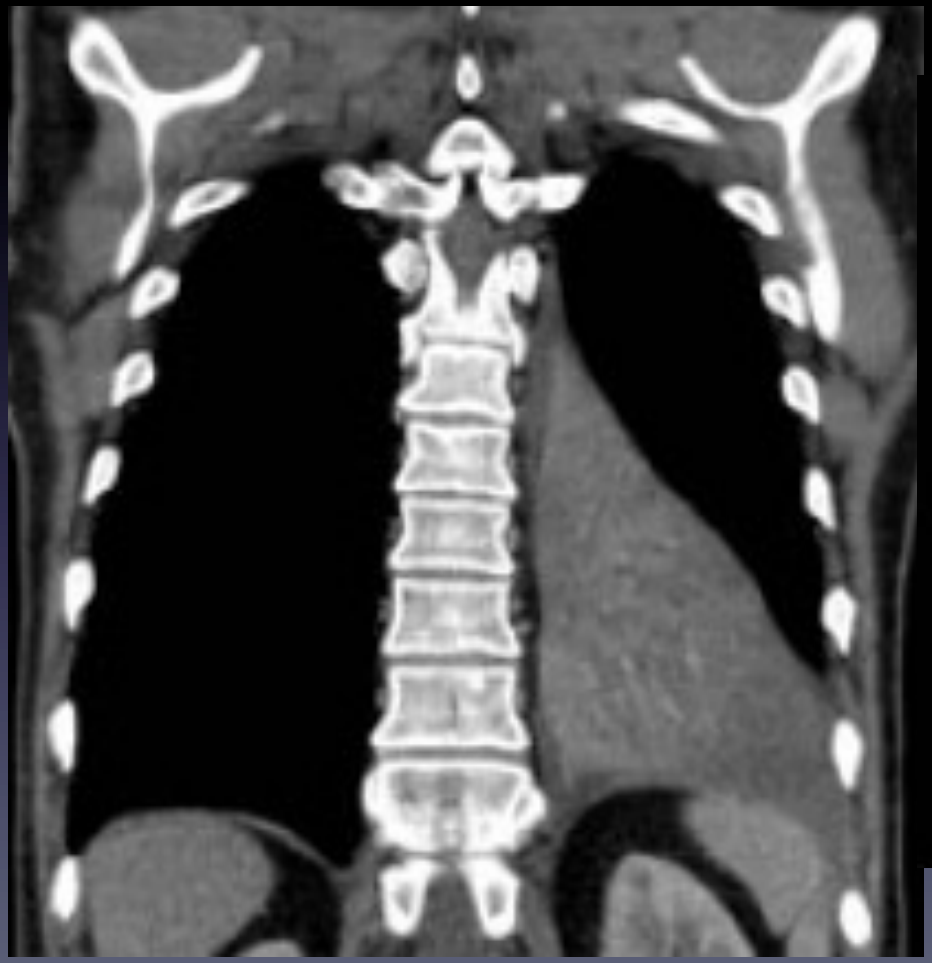
T

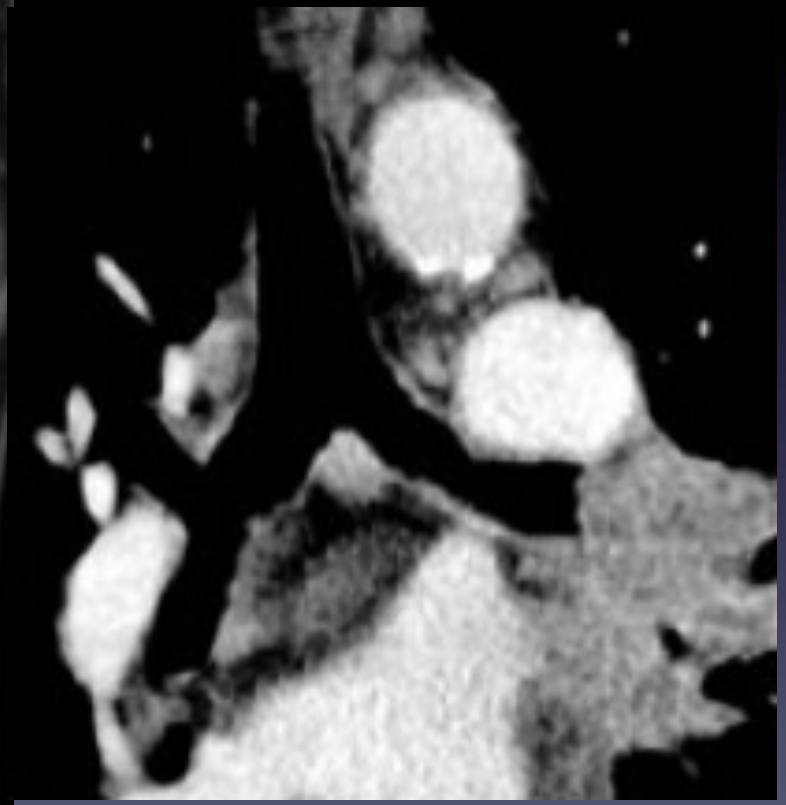

T1a, T1b
T1c
Tumour: ≤1cm
Tumour: >1cm, ≤2cm
Tumour: >2cm, ≤3cm
Superficial spreading tumour of any size with its invasive component limited to the bronchial wall, which may extend proximal to the main bronchus is T1
Tumour ≤3cm; any associated bronchoscopic invasion should not extend proximal to the lobar bronchus






T2a
T2b
Tumour:
> 3cm, ≤ 4cm
Tumour ≤ 4cm,
invasion of the
visceral pleura
Tumour involves
main bronchus,
regardless of
distance from carina
but without carinal
involvement
Associated atelectasis
or obstructive
pneumonitis that
extends to the hilar region, either involving
part of the lung or the entire lung
Tumour:
> 4cm,
≤ 5cm
(with or
without
other T2
descriptors)





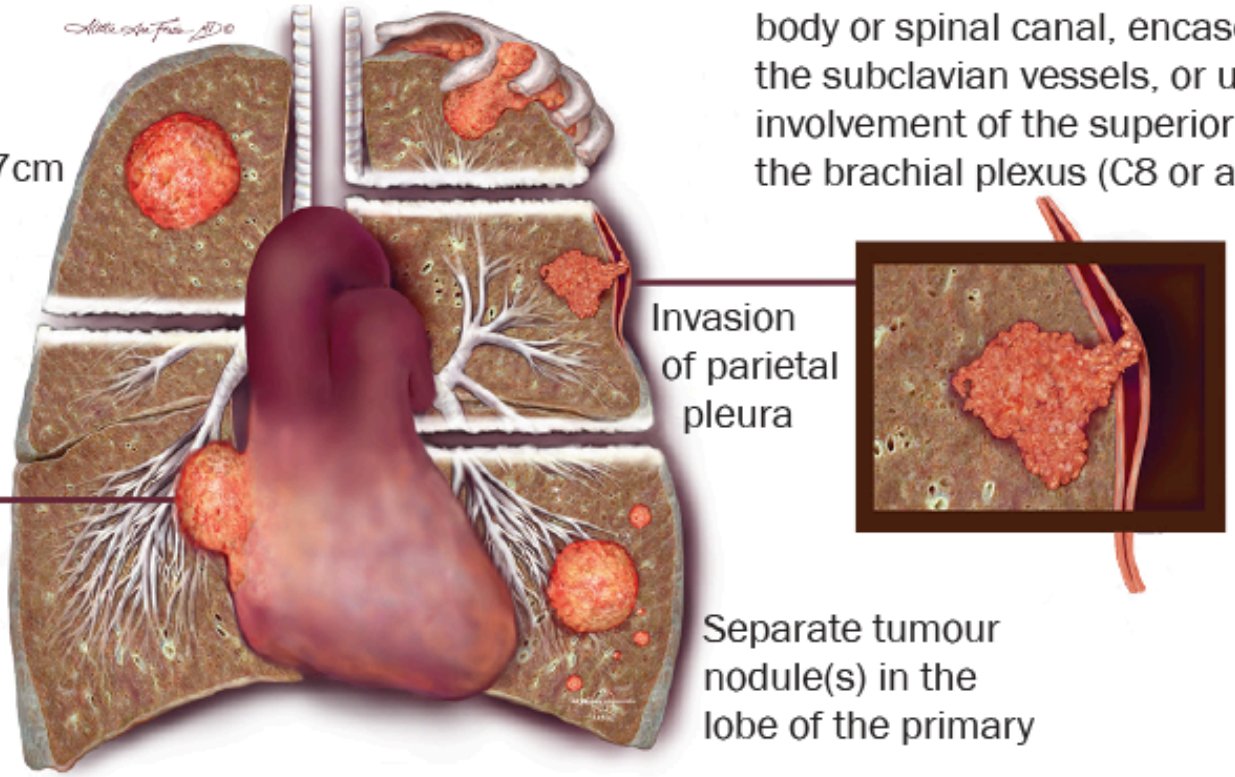
OLD T3 NEW T2b

OLD T3 NEW T4

T3

Chest wall invasion, including Pancoast tumours without invasion of vertebral body or spinal canal, encasement of the subclavian vessels, or unequivocal involvement of the superior branches of the brachial plexus (C8 or above)

Tumour:
> 5cm, ≤ 7cm



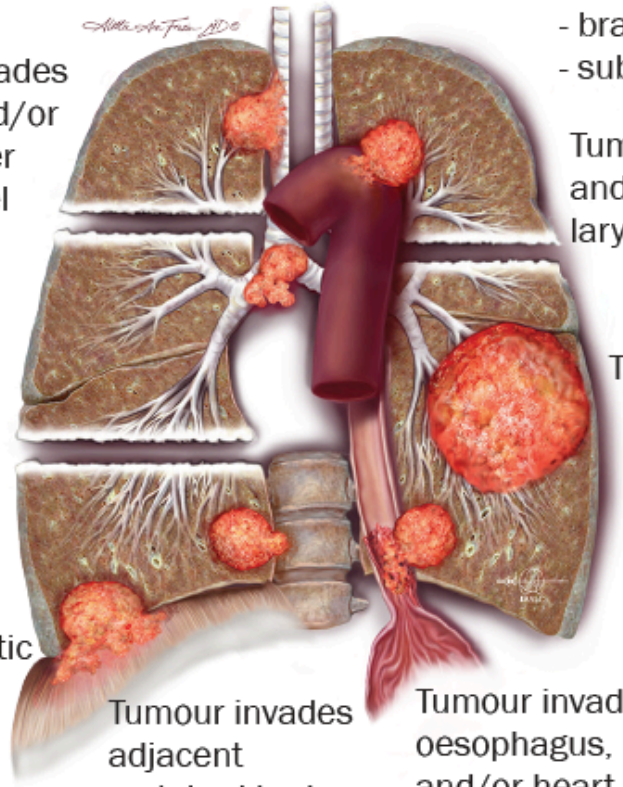
Invasion of parietal pleura

Phrenic nerve or parietal pericardium invasion

Separate tumour nodule(s) in the lobe of the primary

IASLC

T4



Tumour invades trachea and/or SVC or other great vessel

Tumour involves carina

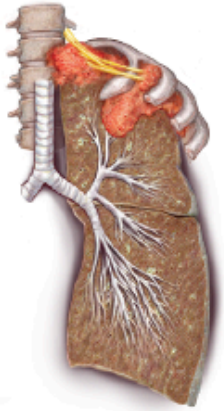
Diaphragmatic invasion

Tumour invades adjacent vertebral body

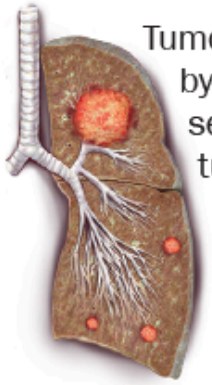
Tumour invades oesophagus, mediastinum and/or heart

Tumour > 7cm

Pancoast tumours with invasion of one or more of the following structures:
- vertebral body or spinal canal
- brachial plexus (C8 or above)
- subclavian vessels

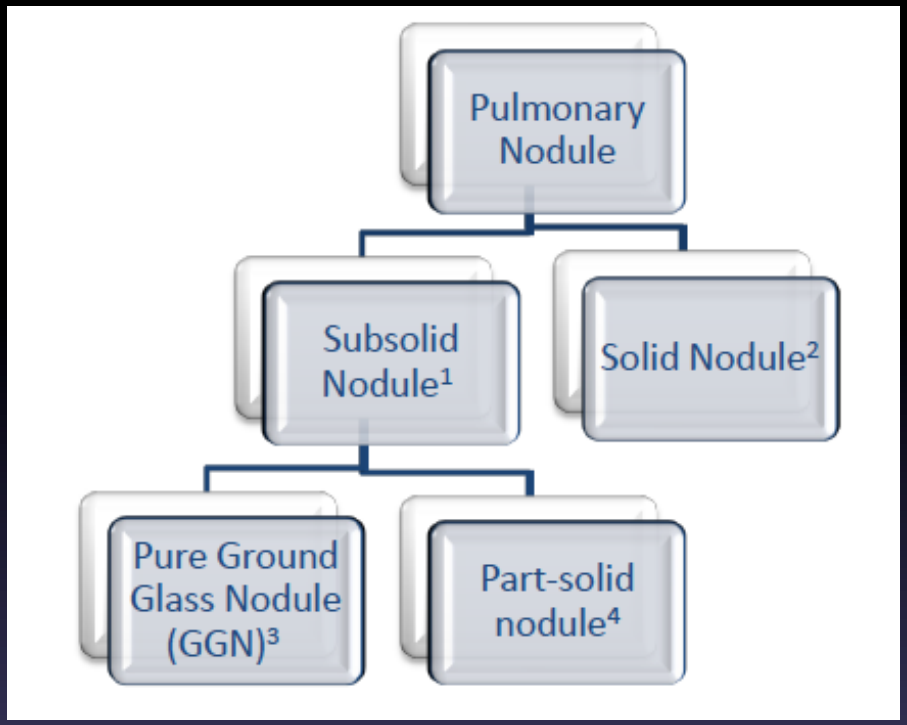


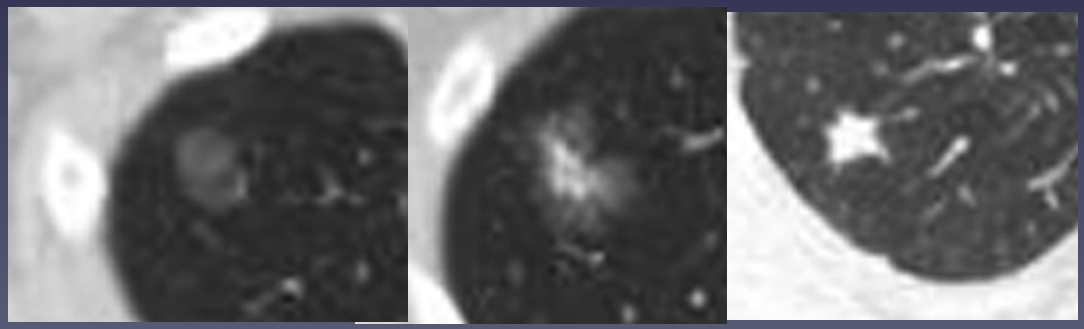
Tumour invades aorta and/or recurrent laryngeal nerve



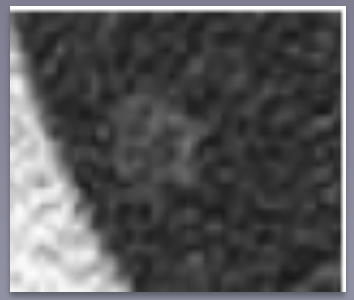
Tumour accompanied by ipsilateral, separate tumour nodules, different lobe

- New staging also deals with subsolid nodules

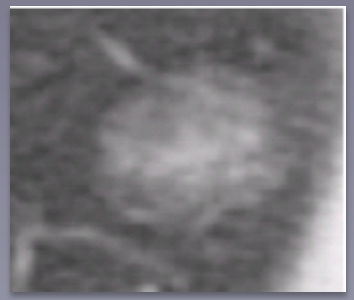

Pulmonary Nodule
Subsolid Nodule[1]
Solid Nodule[2]
Pure Ground Glass Nodule (GGN)[3]
Part-solid nodule[4]



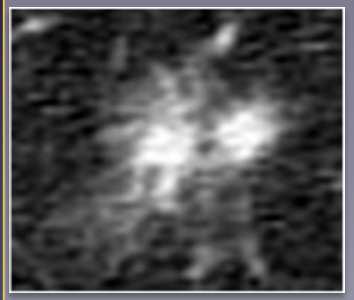
Term	Malignant potential	CT correlate
Atypical adenomatous hyperplasia (AAH)	Premalignant	pGGN <5 mm
Adenocarcinoma in situ (AIS)	Premalignant	pGGN >5 mm up to 30 mm
Minimally invasive adenocarcinoma (MIA)	Invasive	PSN, solid area <5 mm
Invasive adenocarcinoma	Invasive	Larger PSN or solid nodule



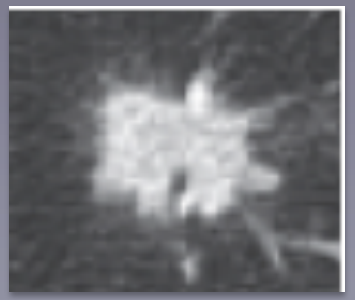
AAH



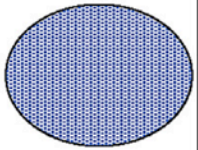
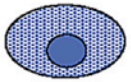
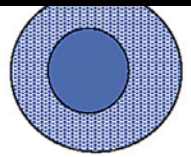
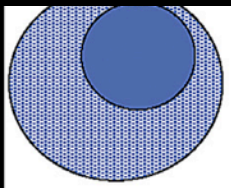
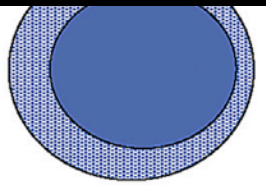
AIS



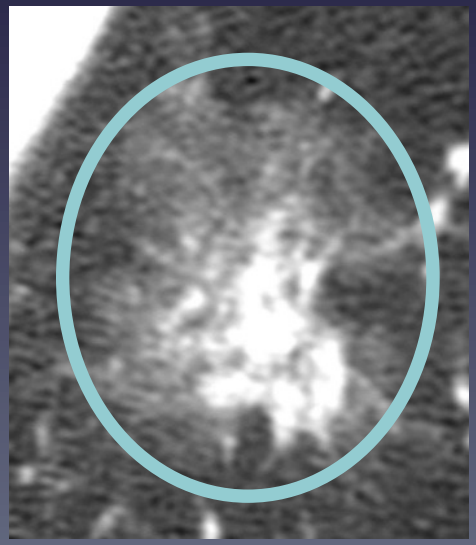
MIA or LPA

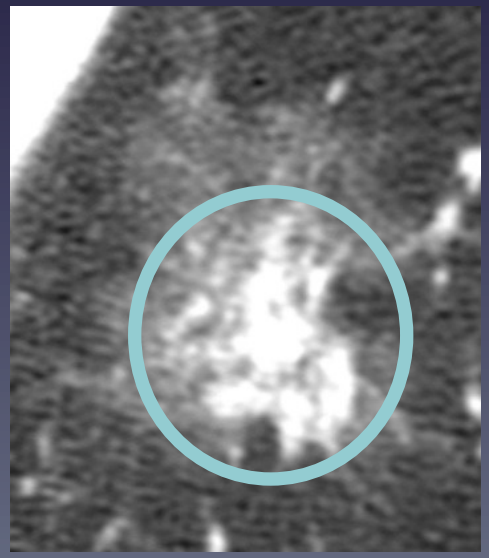


IA

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 compnent	Invasive AD with a lepidic component or lepidic predominant AD	Invasive AD with lepidic component

- Pure GGO <5mm AAH not ascribed T descriptor
- Pure GGO 6-30mm cTis (clinical adenocarcinoma in situ)
- Pure GGO >3cm considered Lepidic Predominant Adenoca cT1 (LPA)
  - May also be if the solid component is 5-20mm
- Part solid nodule <3cm with solid <5mm cT1MI (Minimally Invasive)
- Solid component >5mm T stage as per the size of the solid component
  - cT1a <1cm
  - cTb 1-2cm
  - cT1c 2-3cm

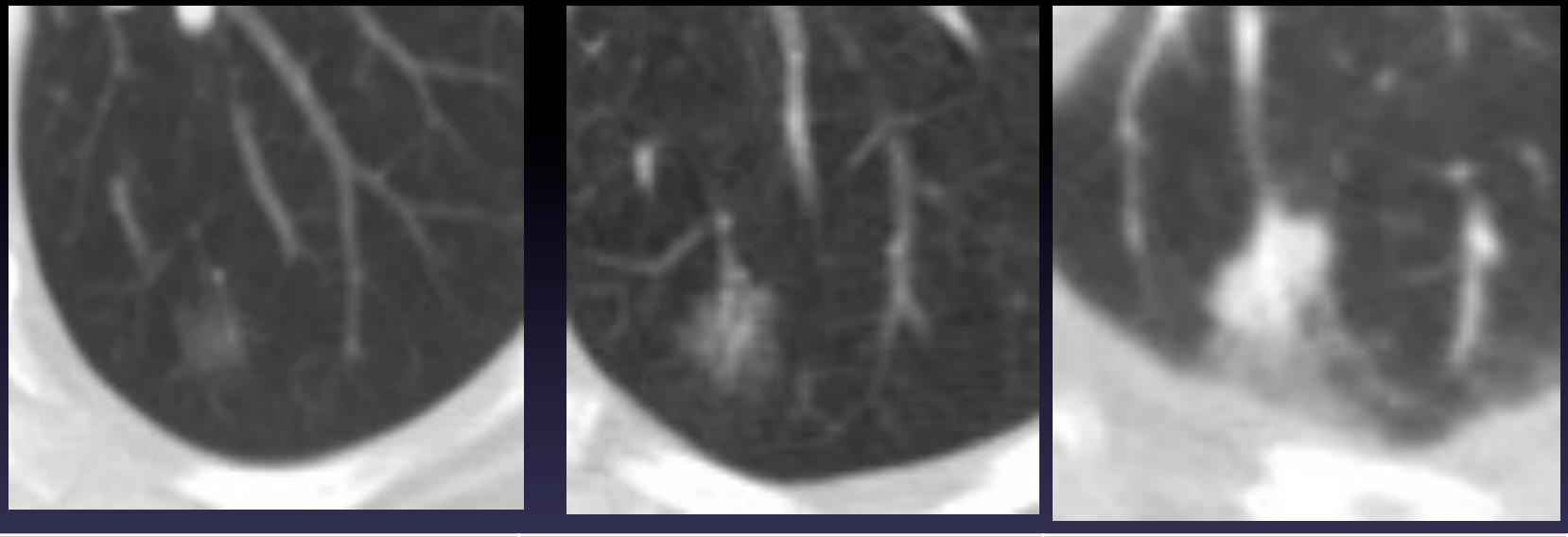




- Multifocal – stage the largest lesion with the greatest solid component. e.g. cT1b
- Add (m) – multiple or the number of GGOs
- N and M as usual

cT1b (2)

Largest – LPA or MIA, smaller lesion AIS

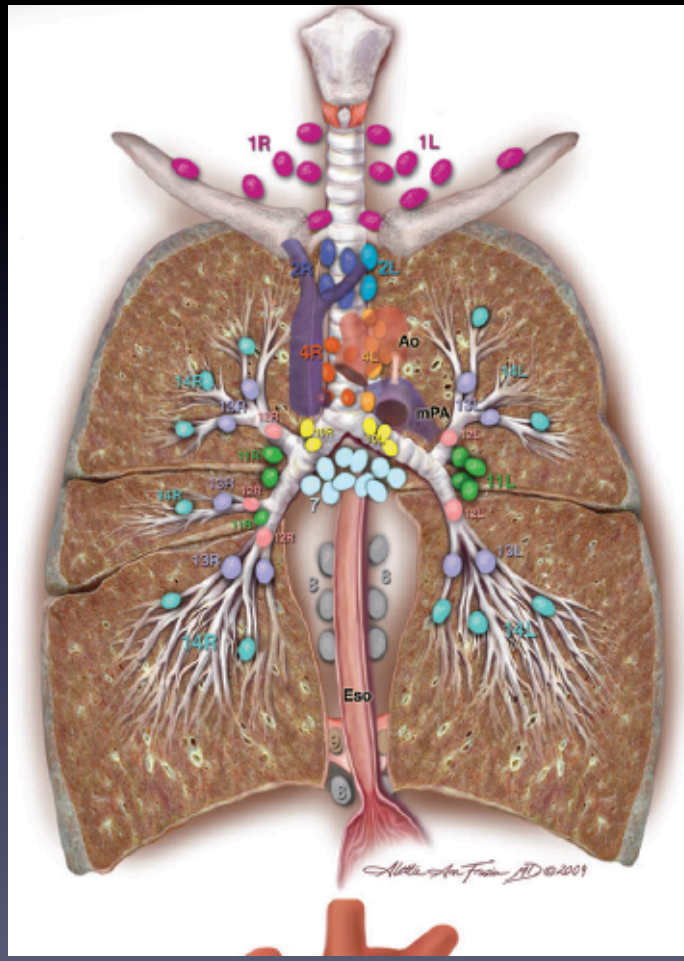


2006	2011	2012

N

N_1	Ipsilateral peribronchial and/or hilar nodes and intrapulmonary nodes
2	Ipsilateral mediastinal and/or subcarinal nodes
3	Contralateral mediastinal or hilar; ipsilateral/contralateral scalene/ supraclavicular

- No change to TNM 7
- ATS mapping scheme
- N1 nodes affect prognosis but not management
- N2 – depends on single vs multiple station, options for adjuvant Mx and exploration
- N3 irresectable



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

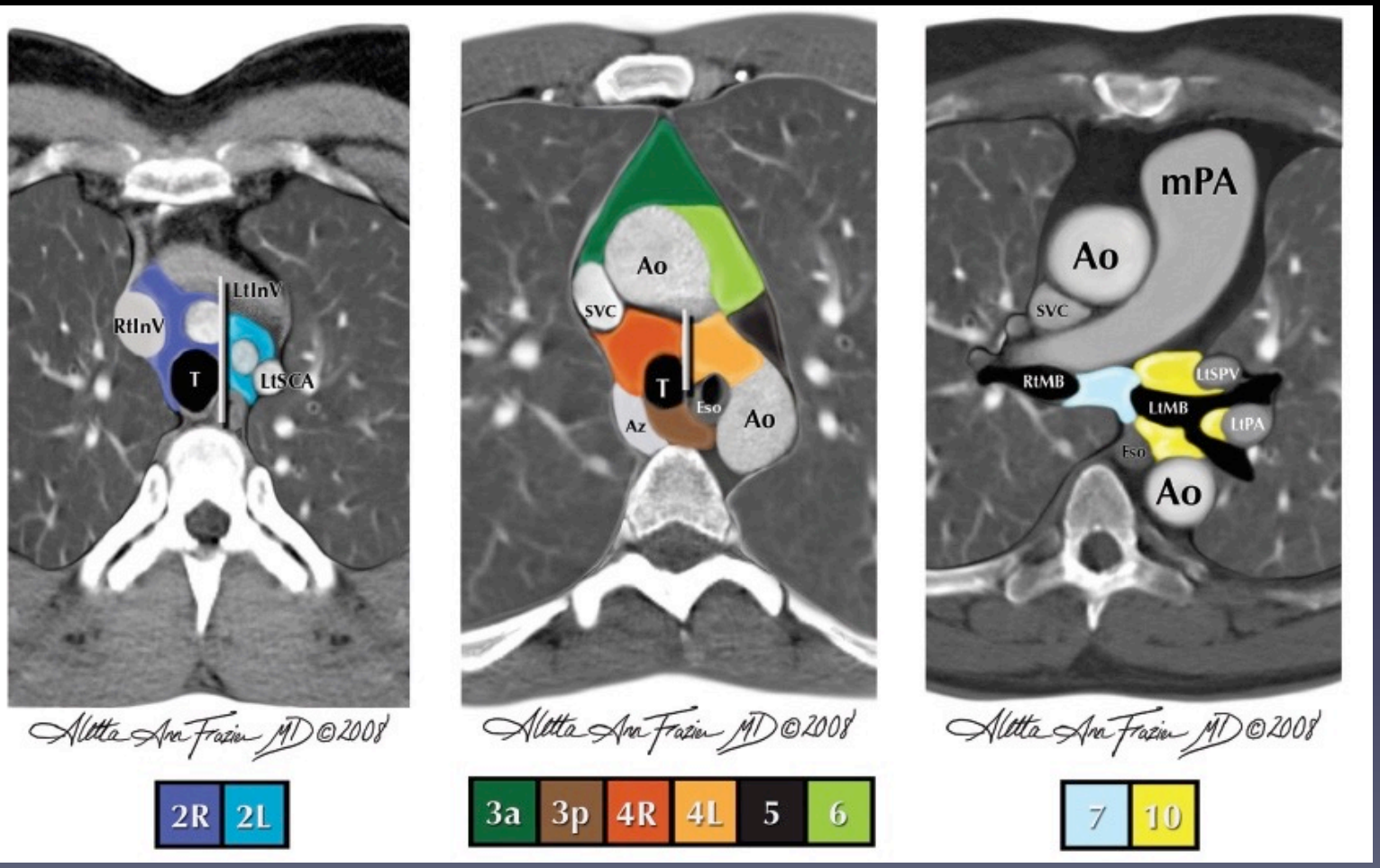
N1 nodes

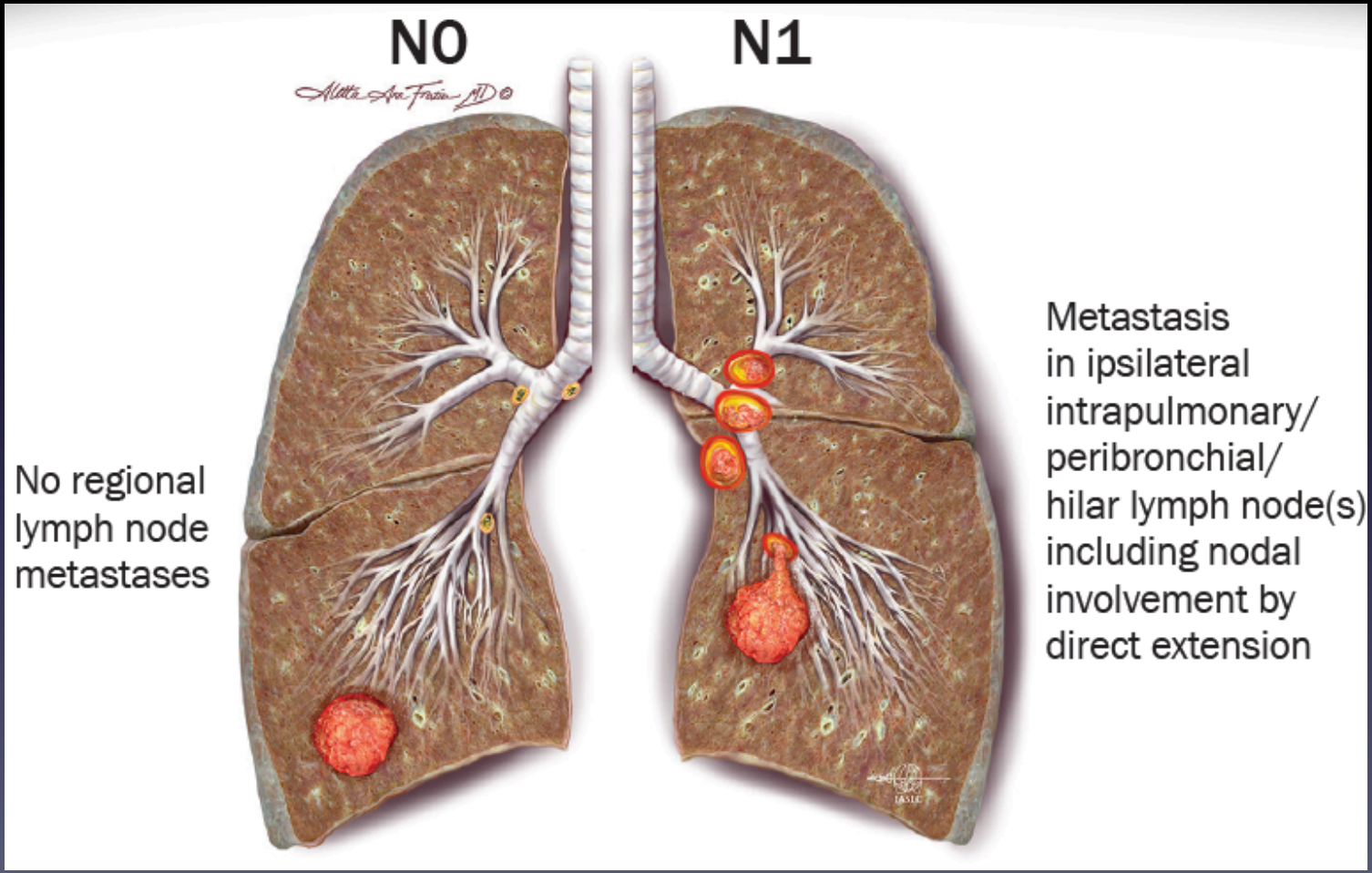
Hilar/interlobar zone

- 10 Hilar
- 11 Interlobar

Peripheral zone

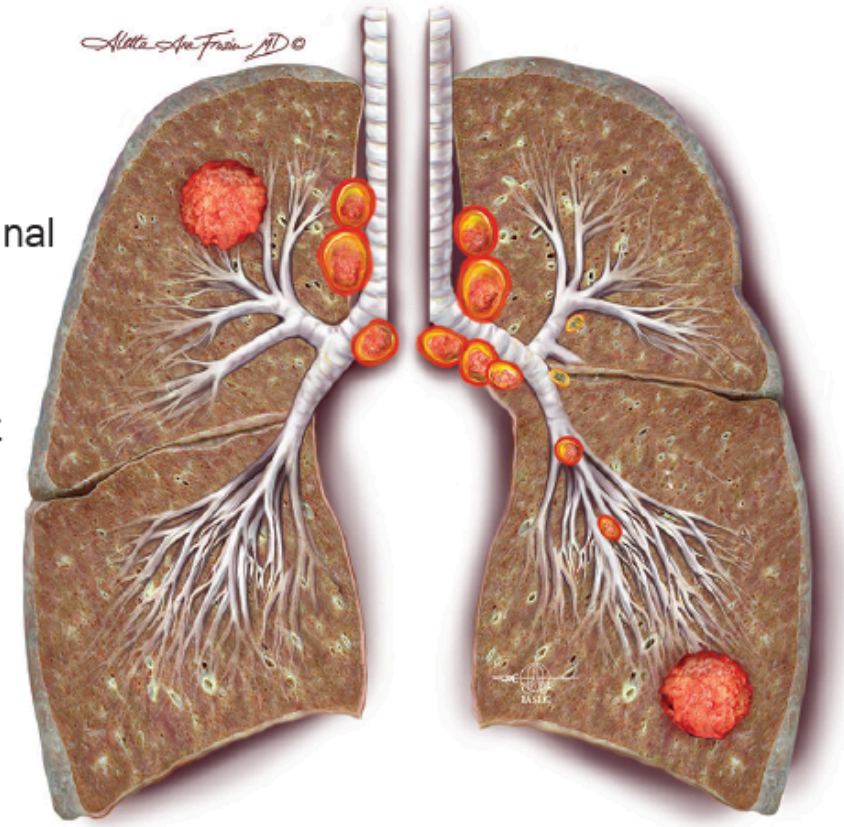
- 12 Lobar
- 13 Segmental
- 14 Subsegmental


RtInV
LtInV
T
LtSCA
Aletta Ann Frazier MD ©2008
2R
2L
Ao
SVC
T
Az
Eso
Ao
Aletta Ann Frazier MD ©2008
3a
3p
4R
4L
5
6
mPA
Ao
SVC
RtMB
LtSPV
LtMB
LtPA
Eso
Ao
Aletta Ann Frazier MD ©2008
7
10


N0
N1
No regional lymph node metastases
Metastasis in ipsilateral intrapulmonary/ peribronchial/ hilar lymph node(s) including nodal involvement by direct extension

N2

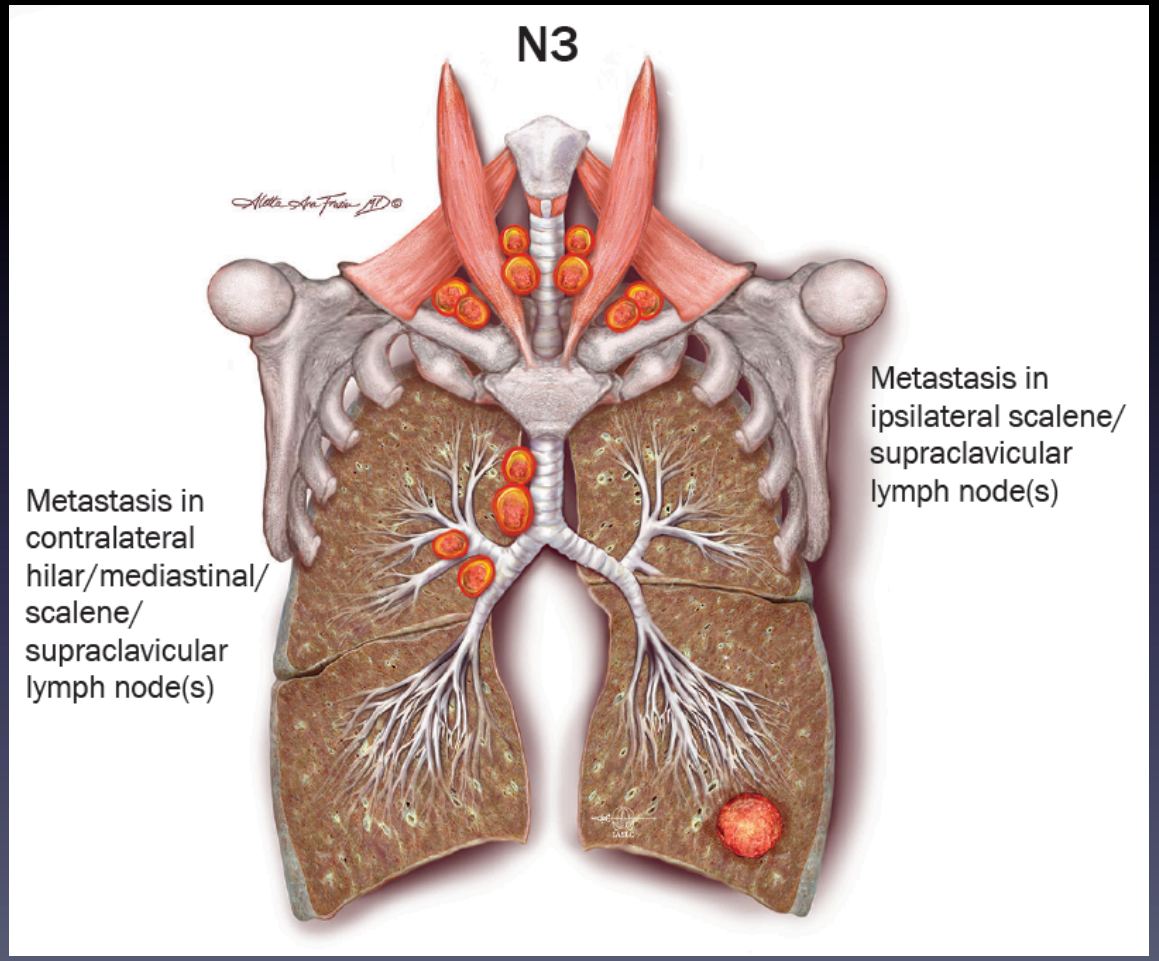
Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s), including “skip” metastasis without N1 involvement

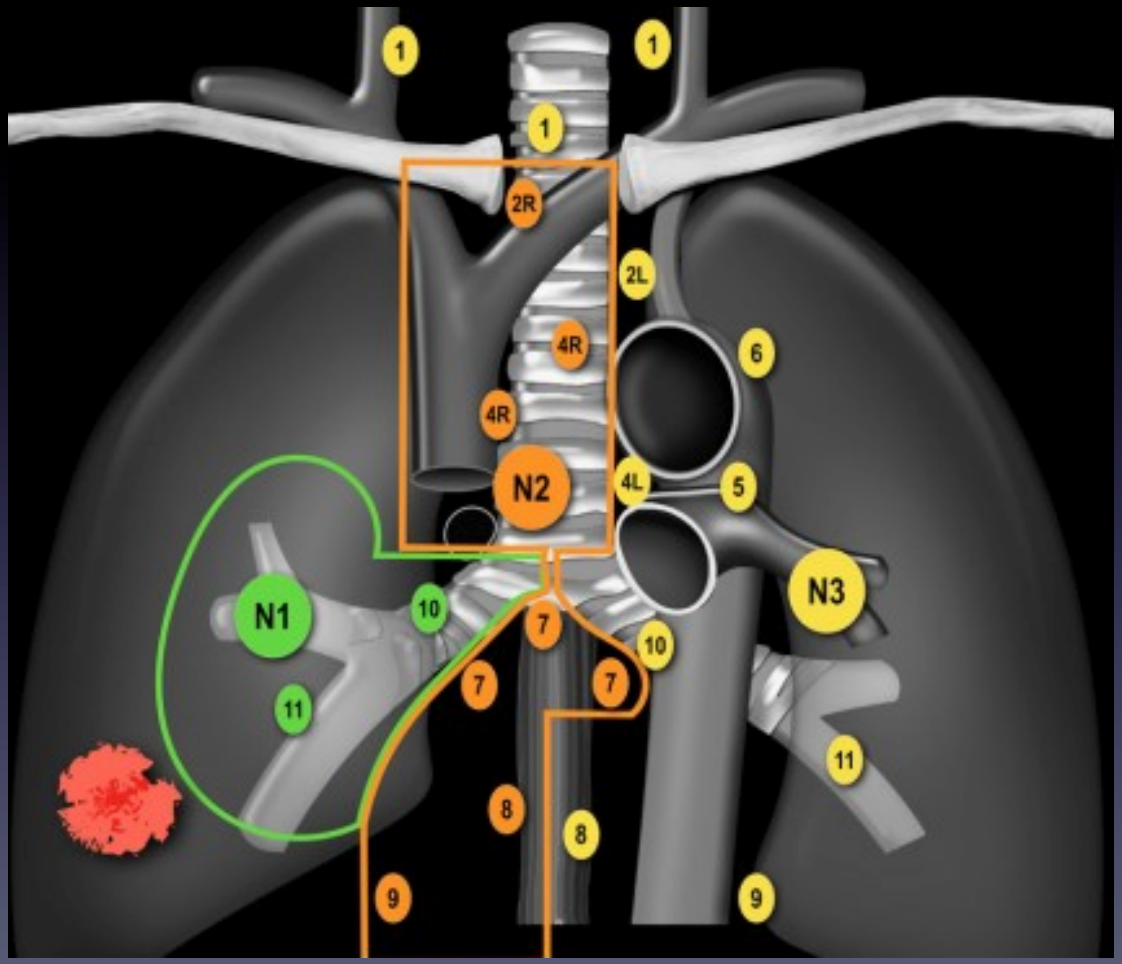


Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s) associated with N1 disease

IASLC

N3

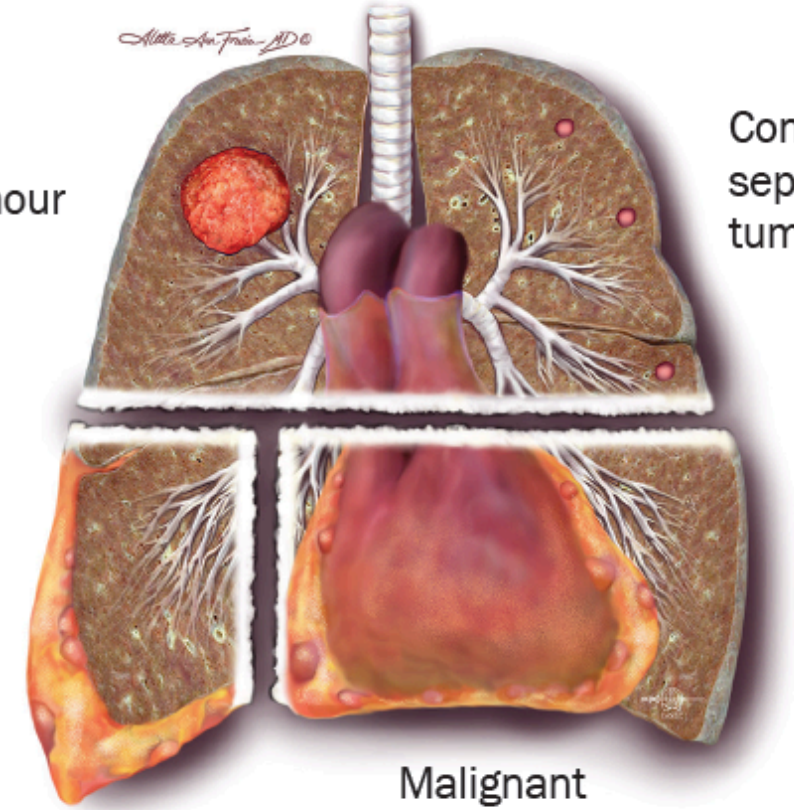

Metastasis in contralateral hilar/mediastinal/ scalene/ supraclavicular lymph node(s)
Metastasis in ipsilateral scalene/ supraclavicular lymph node(s)


1
1
1
2R
2L
4R
4R
6
N2
4L
5
N3
N1
10
7
10
7
7
11
11
8
8
9
9

M

M_1	Distant metastasis
M_{1a}	Tumor in contralateral lung or pleural/pericardial nodule/malignant effusion
M_{1b}	**Single extrathoracic metastasis, including single non-regional lymphnode**
M_{1c}	**Multiple extrathoracic metastases in one or more organs**

M1a

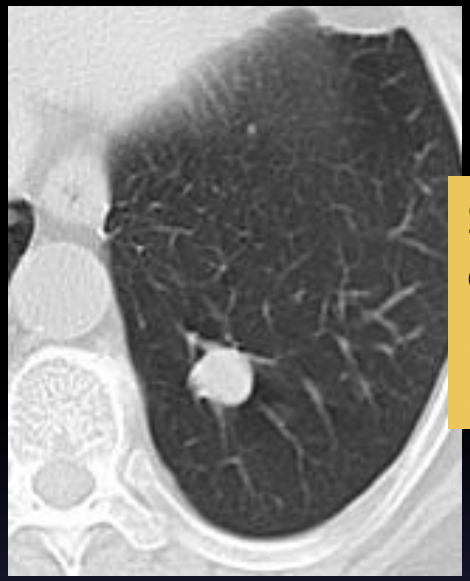


Primary tumour

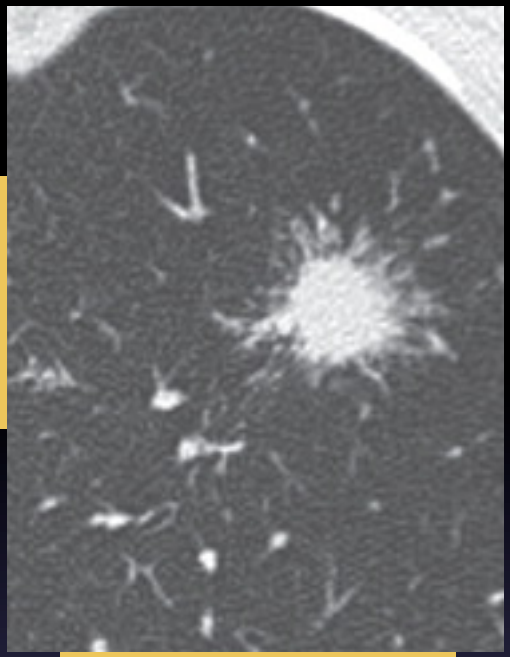
Contralateral, separate tumour nodule(s)

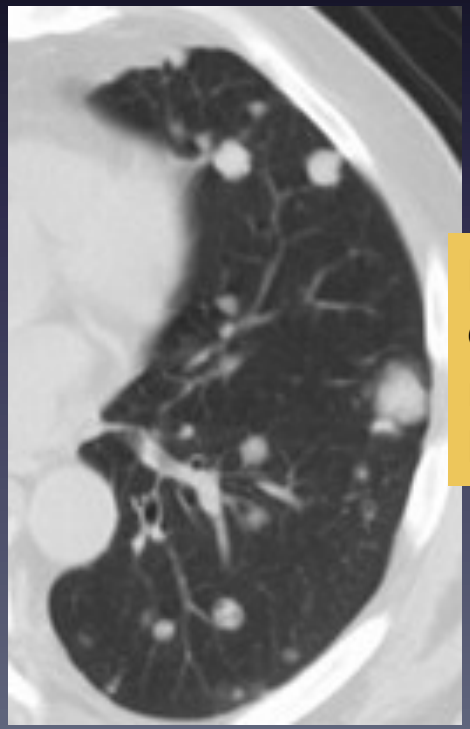
Malignant pleural effusion/nodule(s)

Malignant pericardial effusion/nodule(s)



Single contralateral metastasis M1a

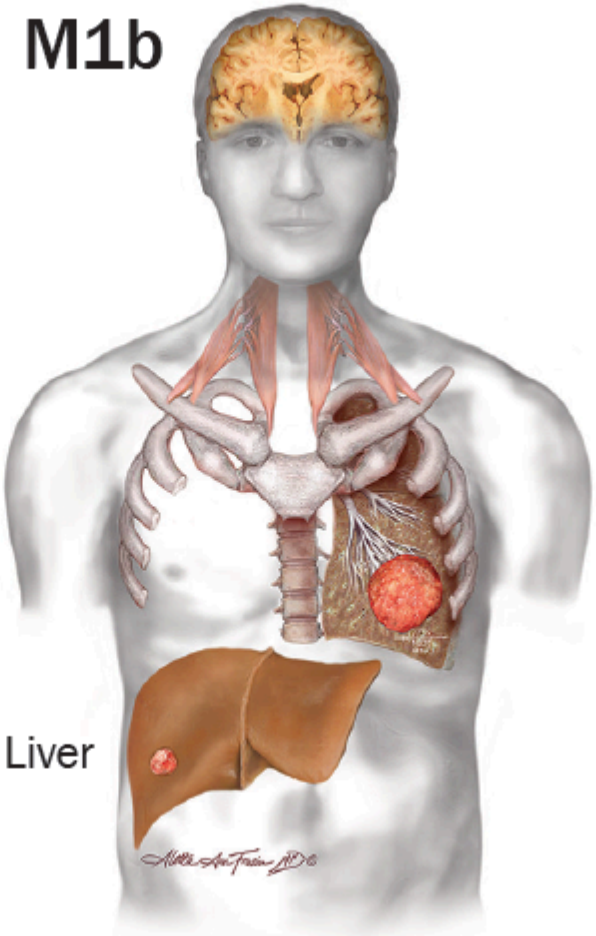




Multiple contralateral metastasis M1a

Consider if separate primary tumour? Different growth rate, metabolic marker or appearance? Each has own T stage.

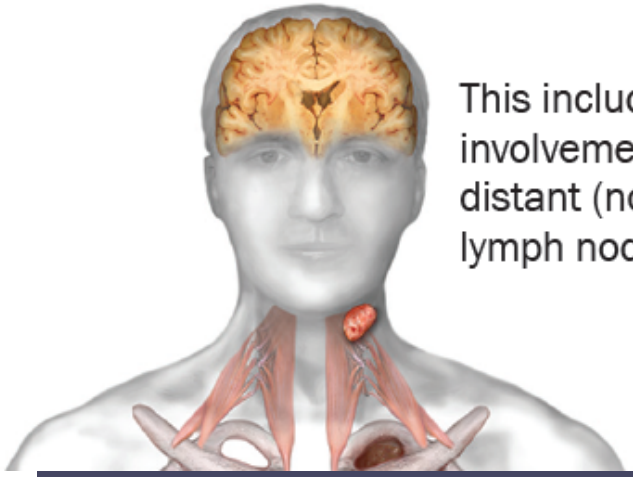
M1b



Single extrathoracic metastasis

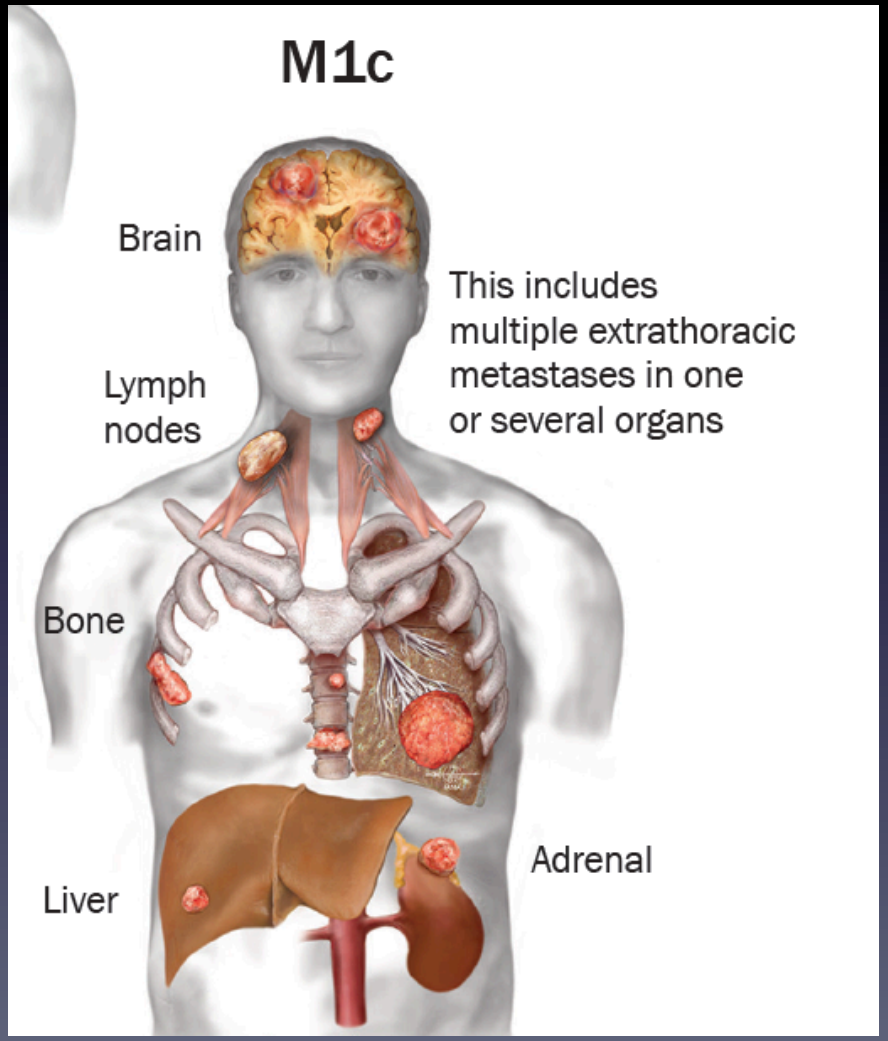
Liver

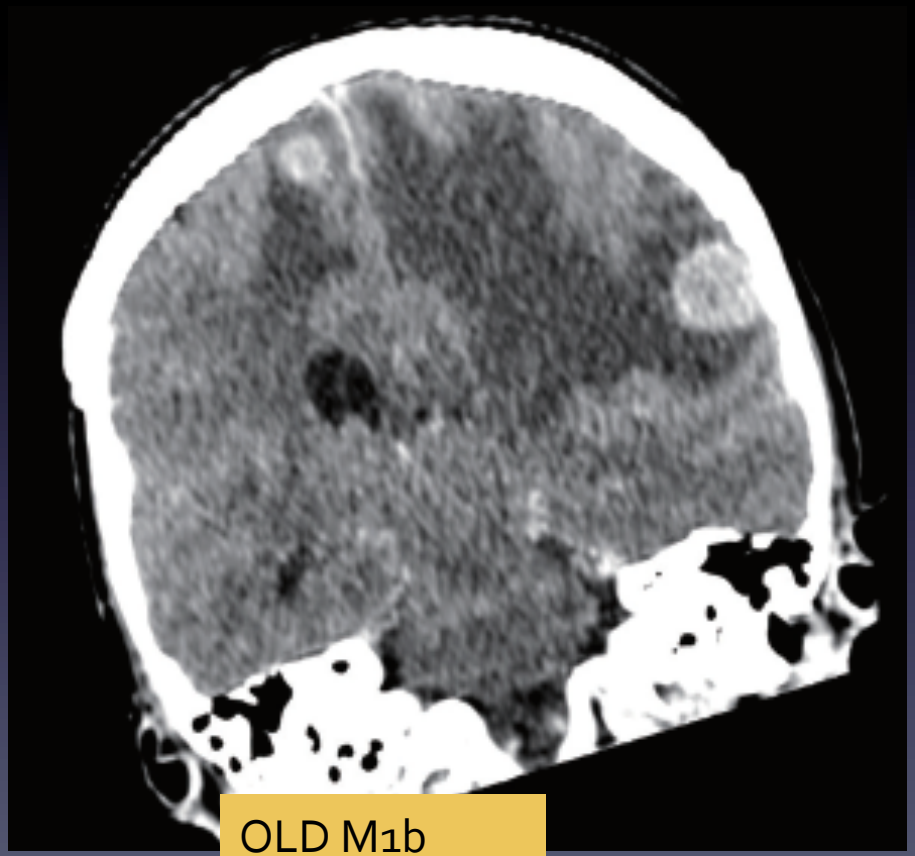
M1b



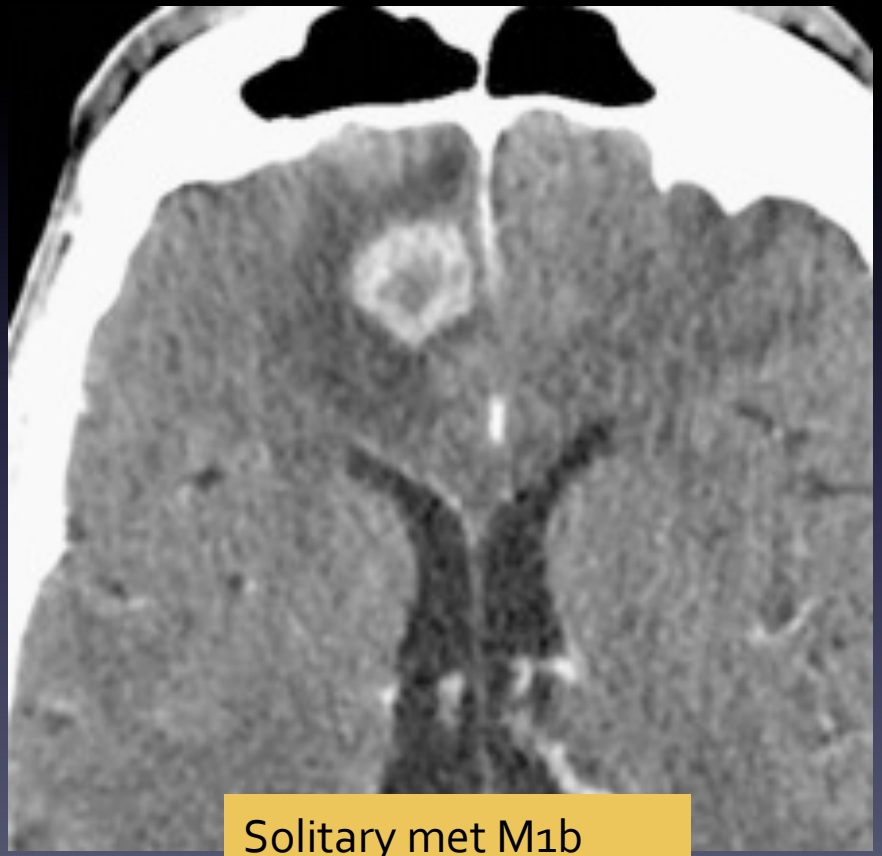
This includes involvement of a single distant (non-regional) lymph node

IASLC


M1c
Brain
Lymph nodes
Bone
Liver
Adrenal
This includes multiple extrathoracic metastases in one or several organs

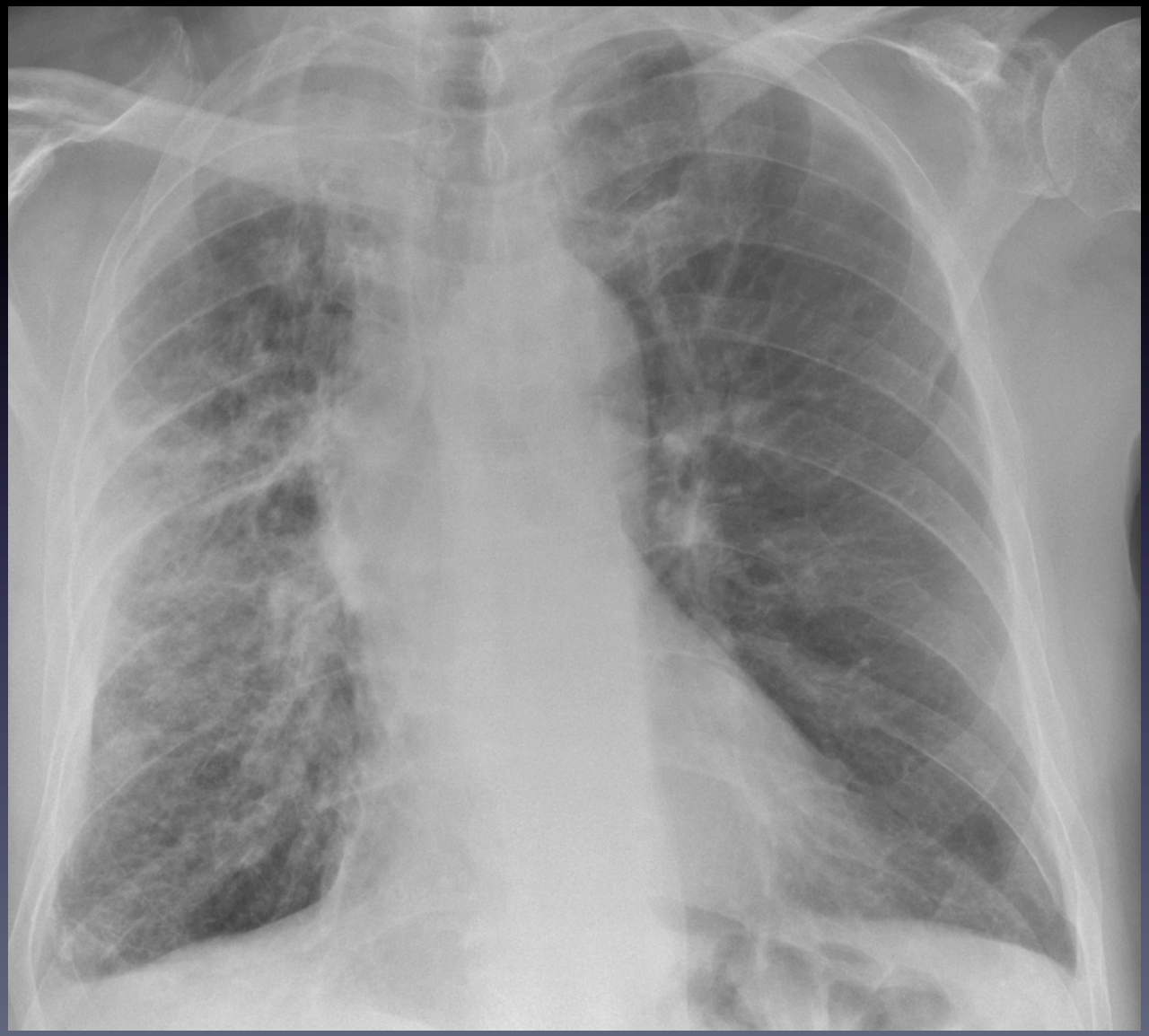


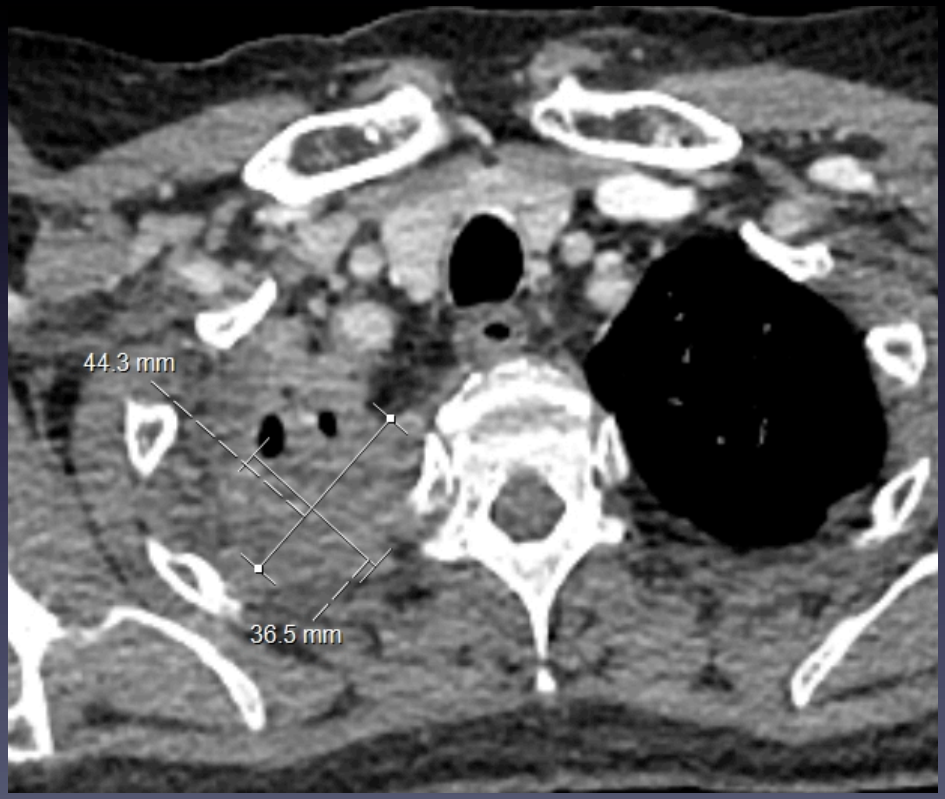
OLD M1b
NEW M1c



Solitary met M1b
Implications for Mx

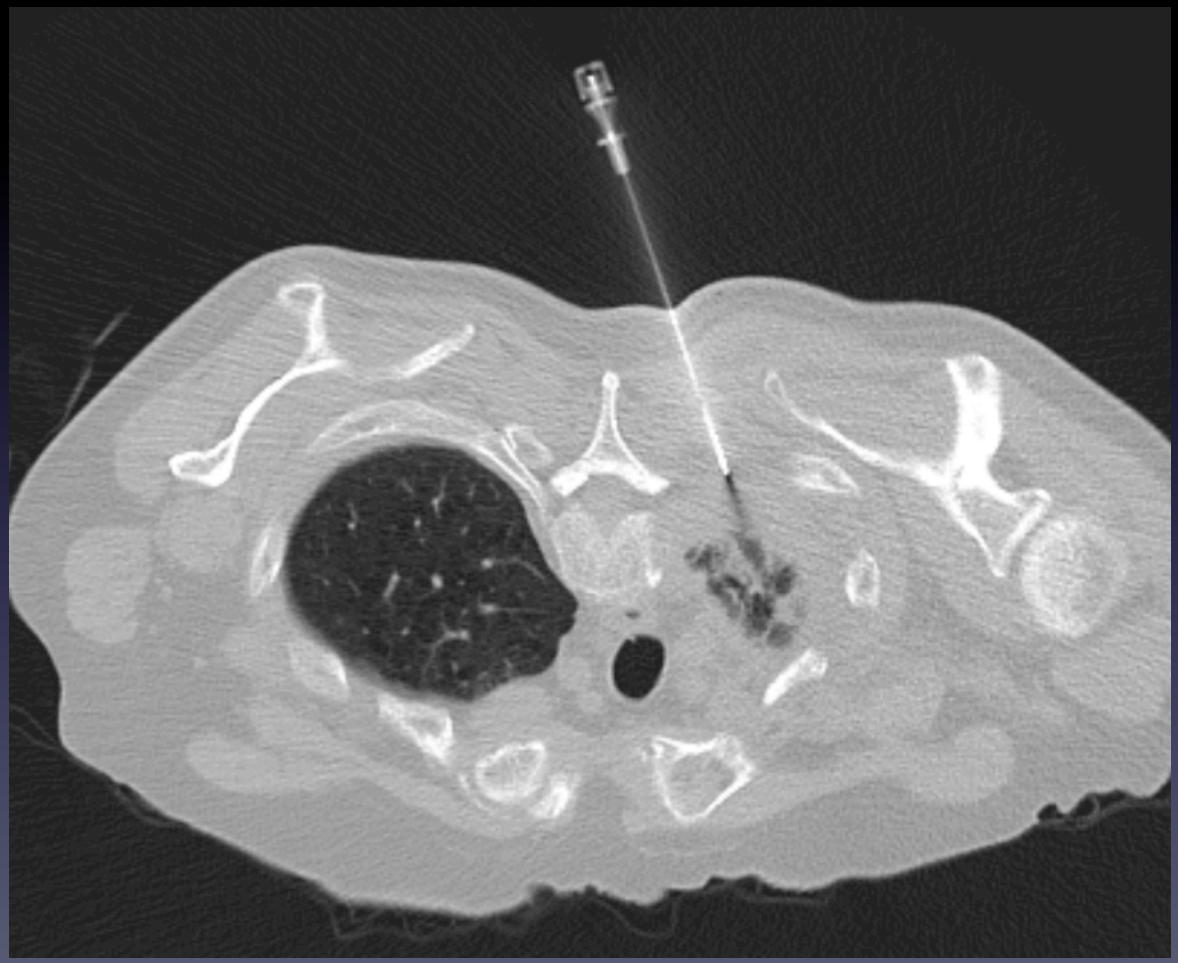
Case 2




44.3 mm
36.5 mm


22.4 mm


13.0 mm



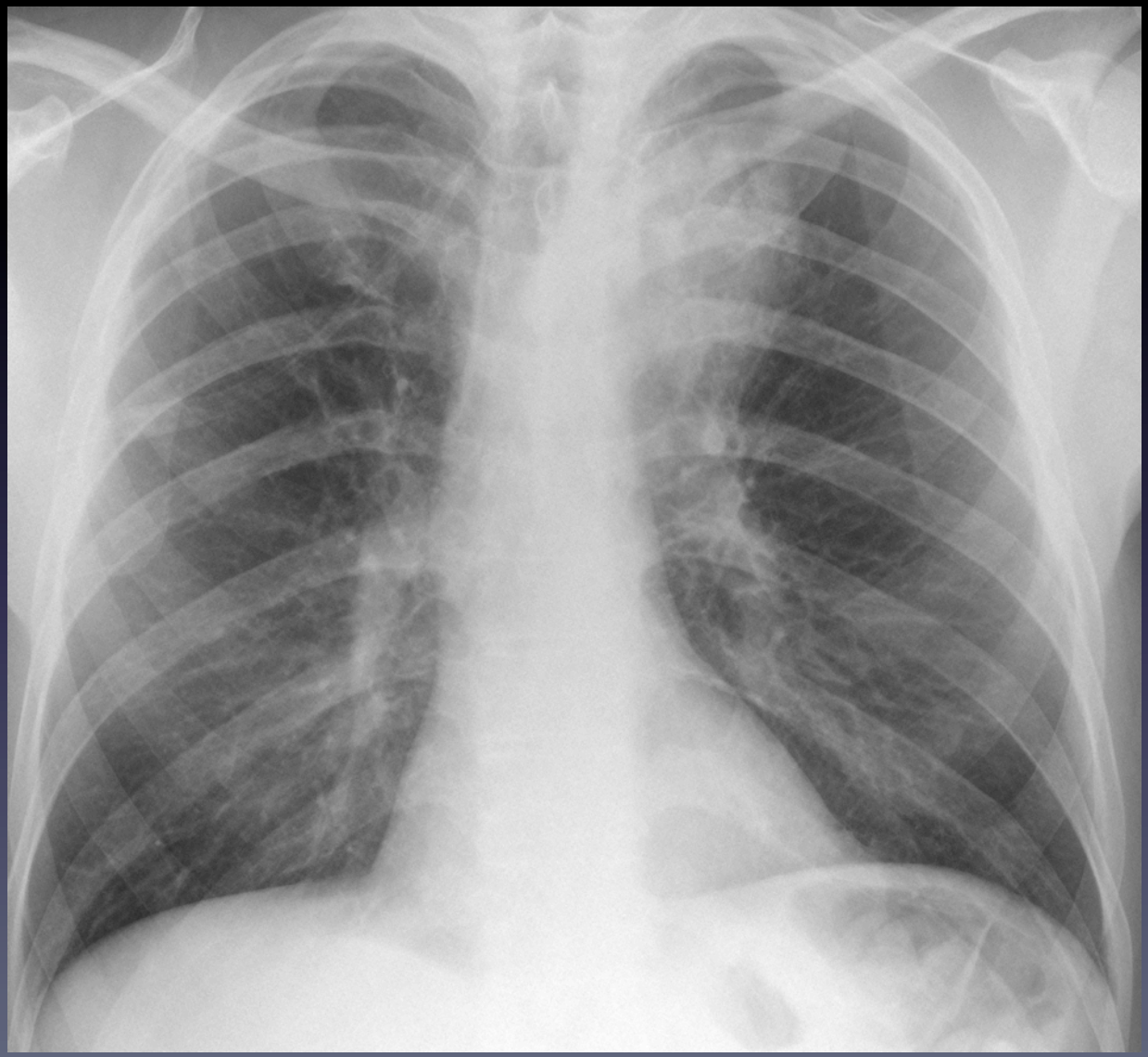
Case 2

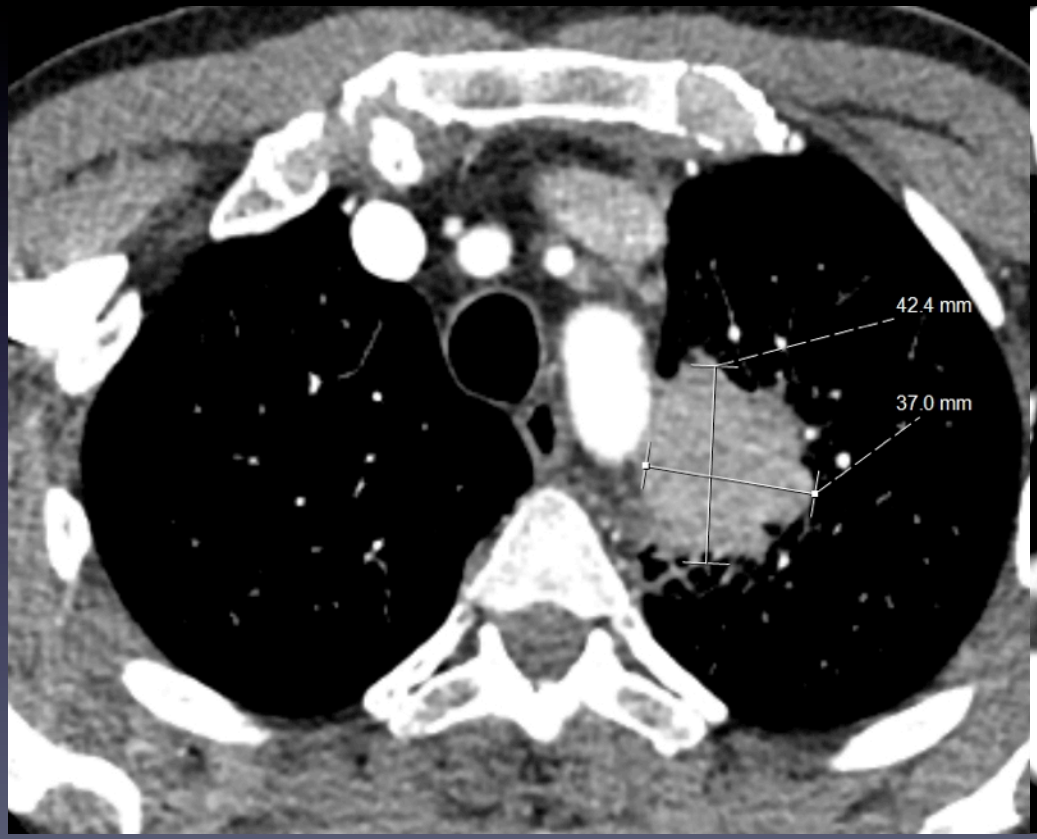
- Differential?
- Staging

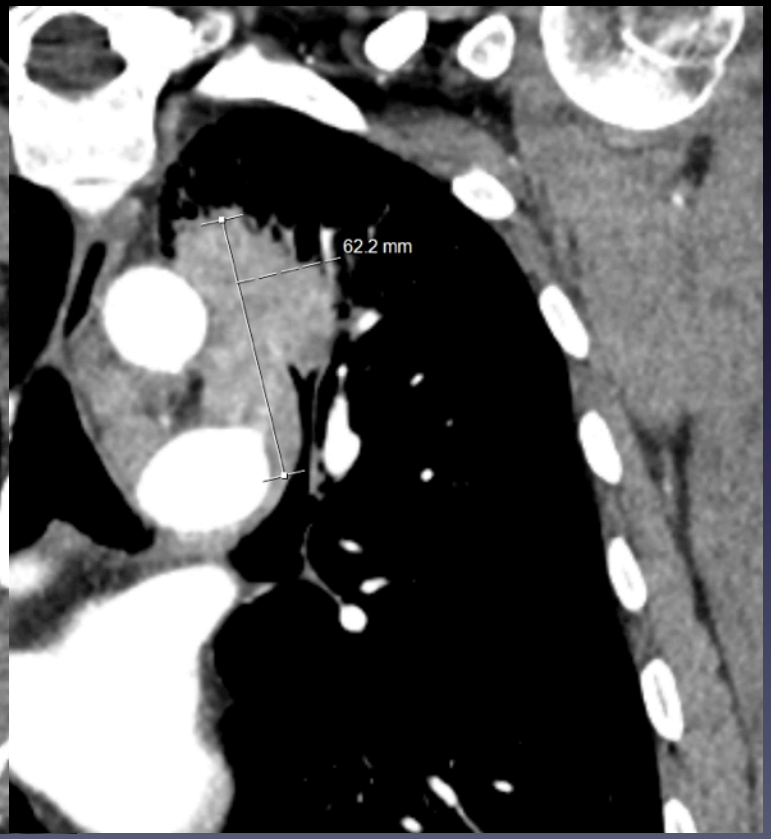
Case 2

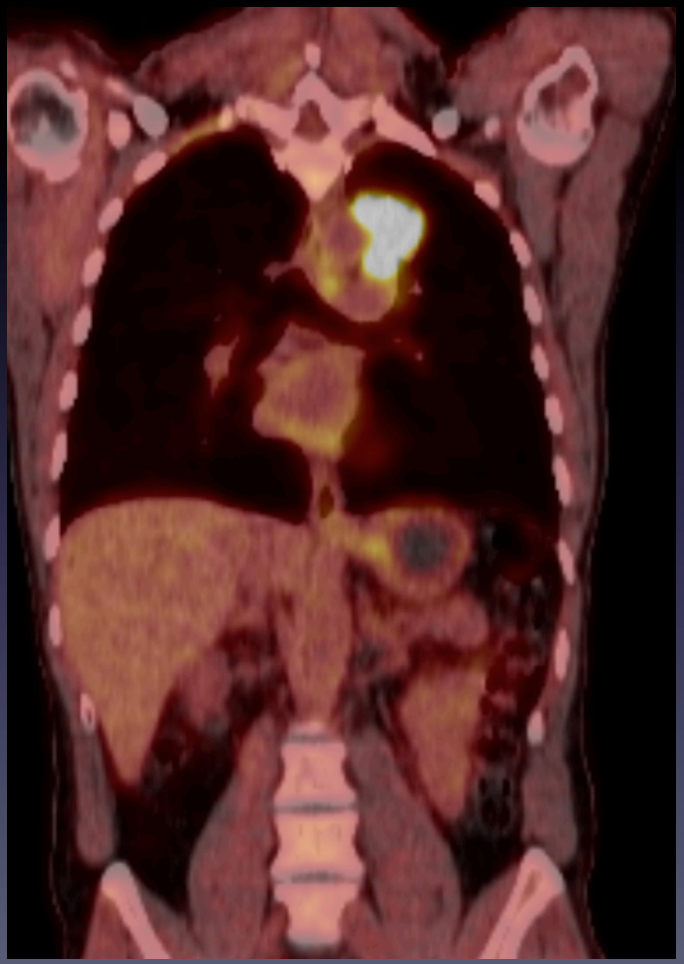
- Bx: Adenocarcinoma
- R apical mass max 4.5cm T2b likely visceral pleural involvement but no further chest wall invasion
- R hilar node 13mm N1
- Metastatic pleural thickening M1a
- Lymphangitis Ly

Case 3



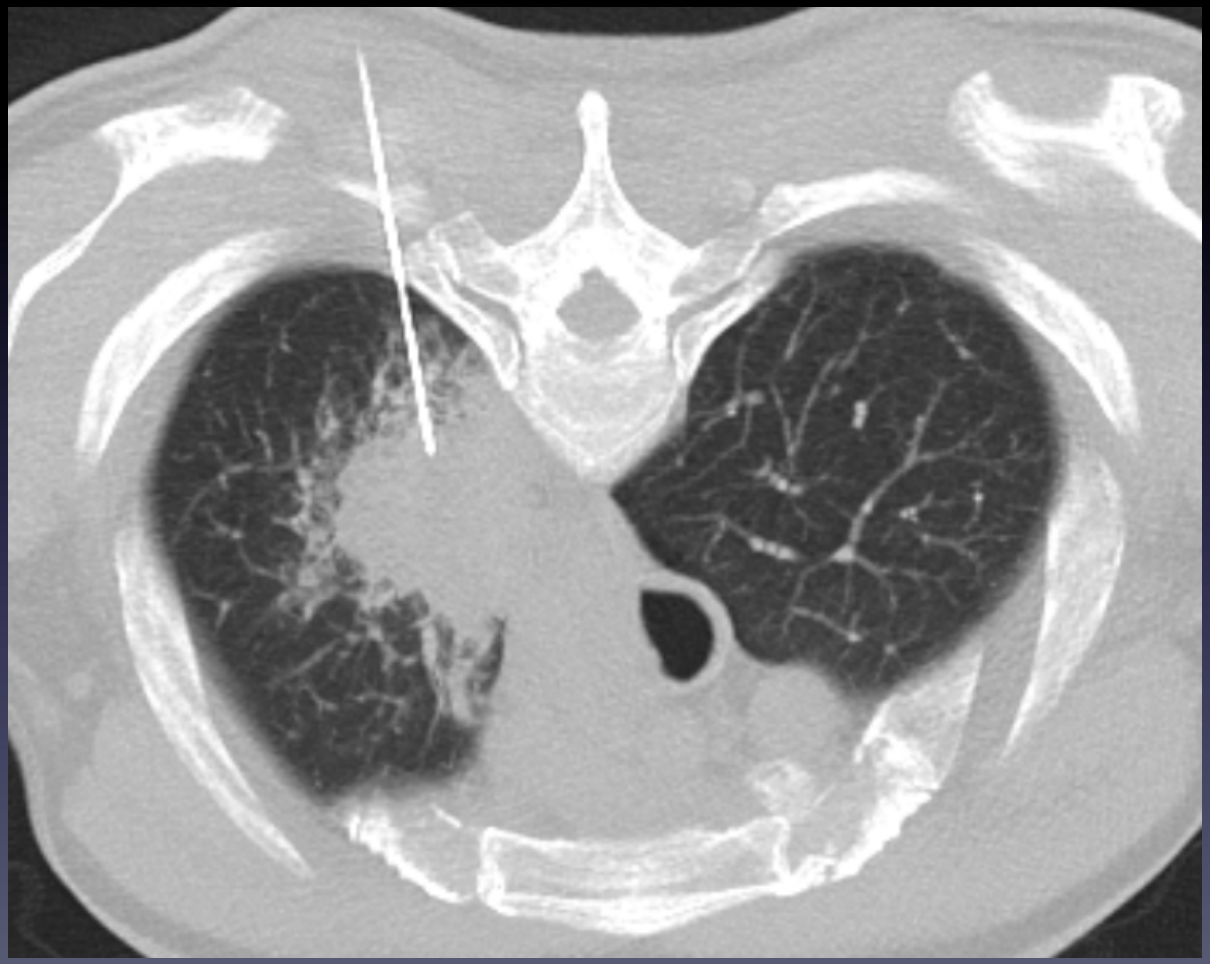

42.4 mm
37.0 mm


62.2 mm



Mass SUV 10

Nodes SUV 5



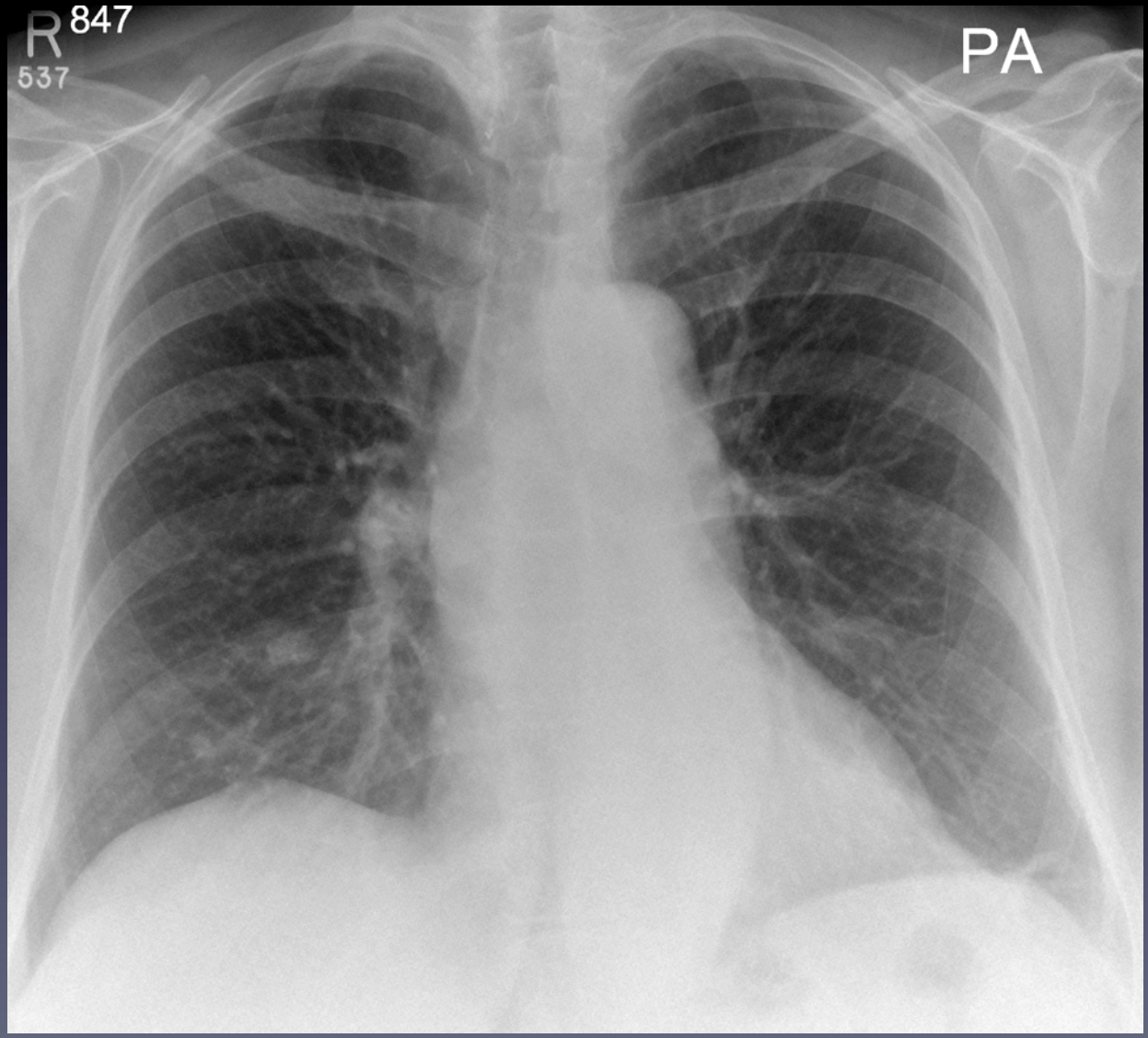
Case 3

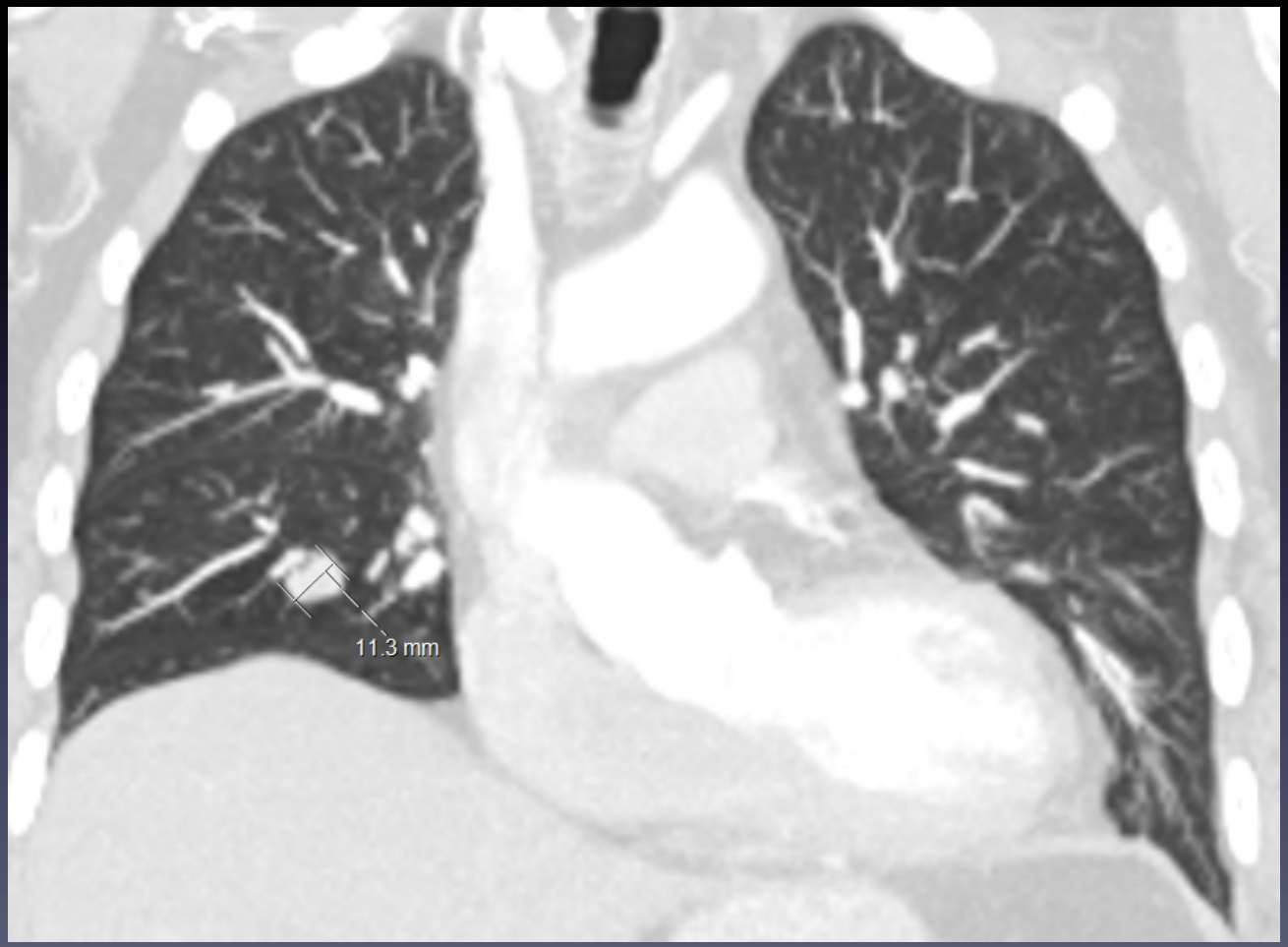
- Staging

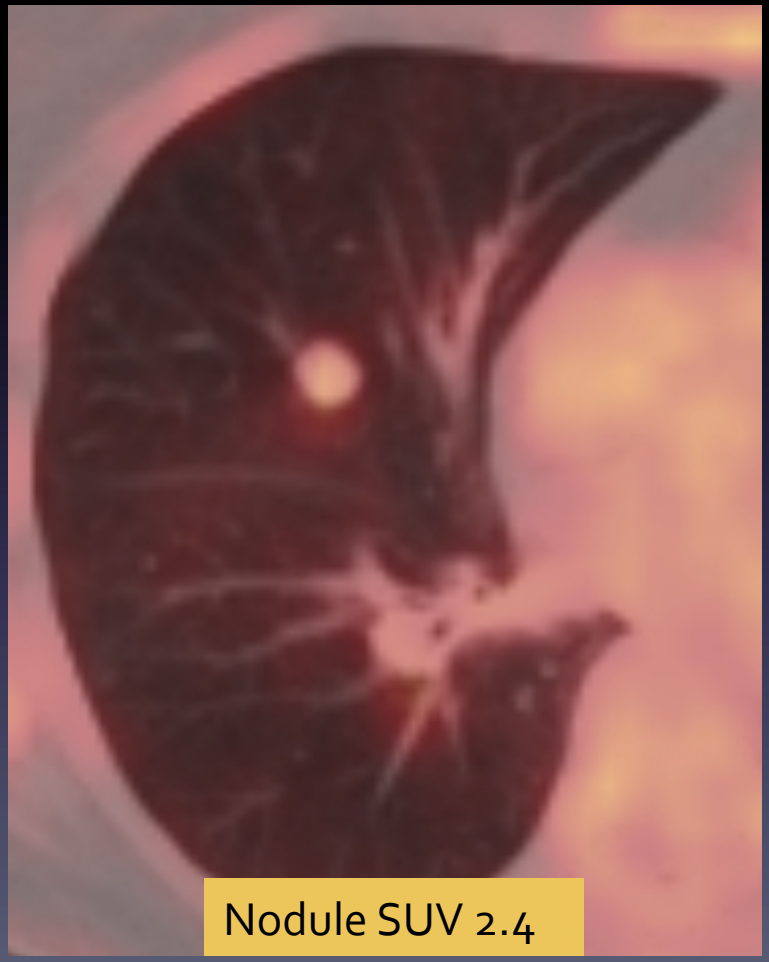
Case 3

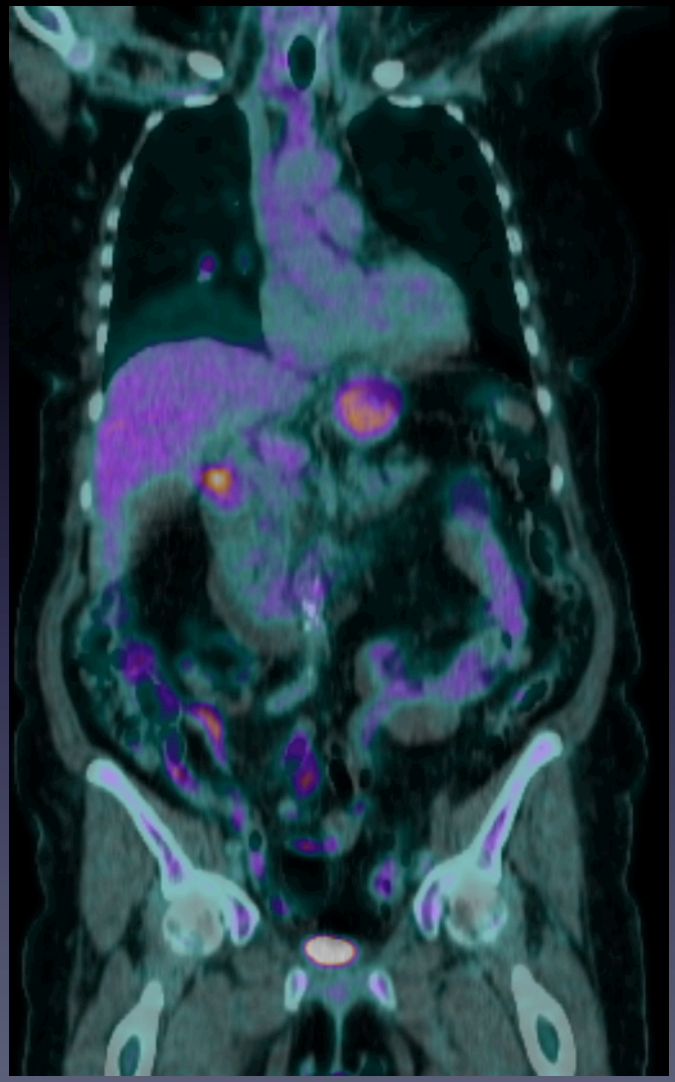
- Adenocarcinoma
- Mediastinal invasion T_4
- N_2 nodes on PET
- M_0

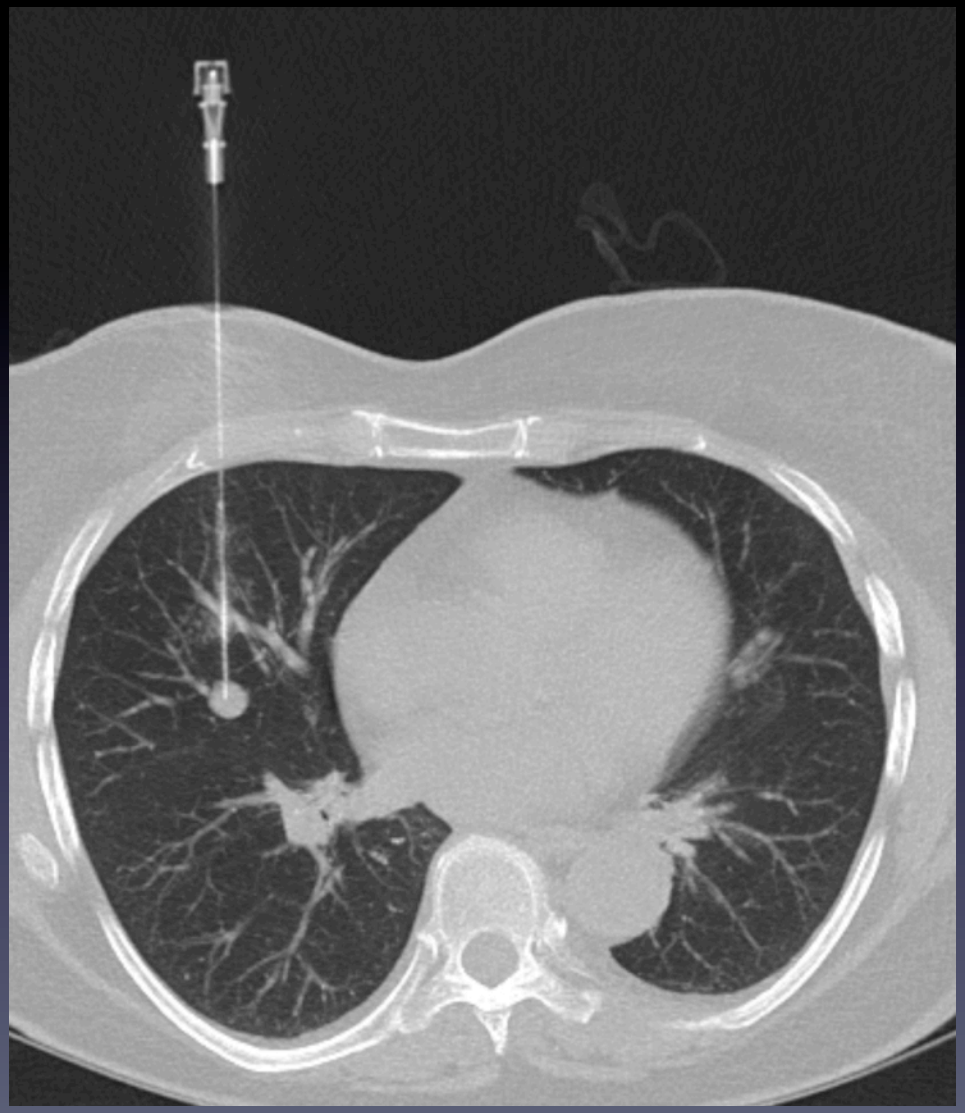
Case 4




11.3 mm


Nodule SUV 2.4





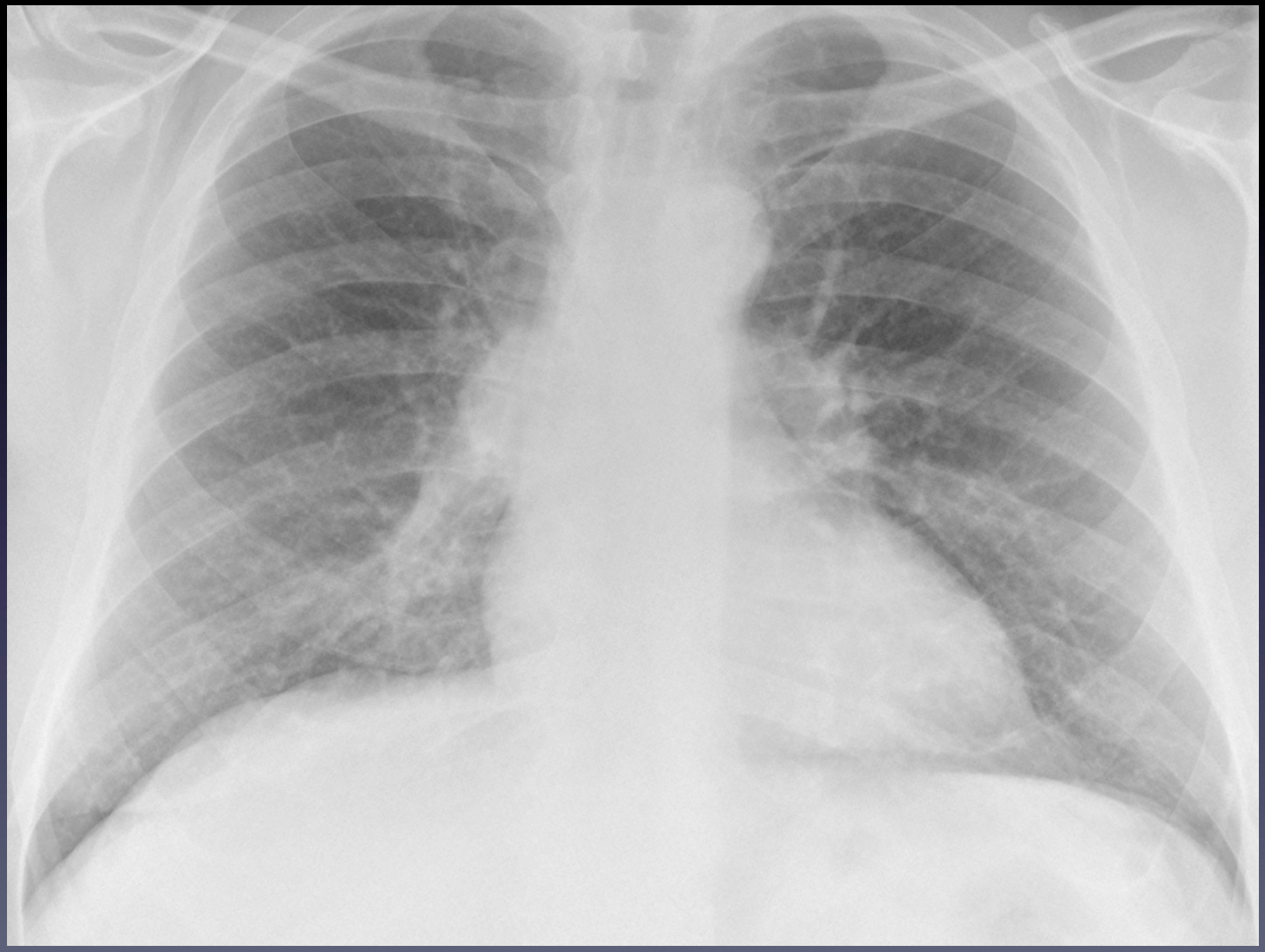
Case 4

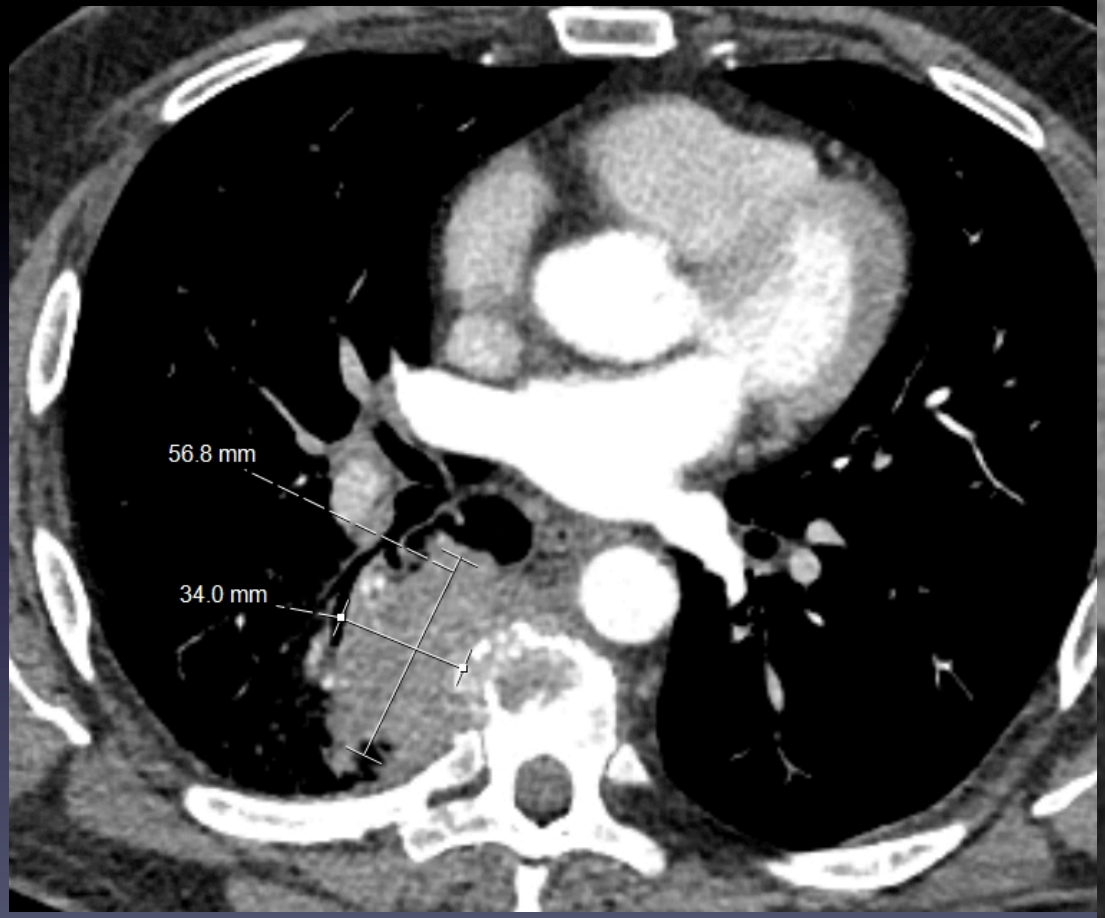
- Diagnosis
- Staging

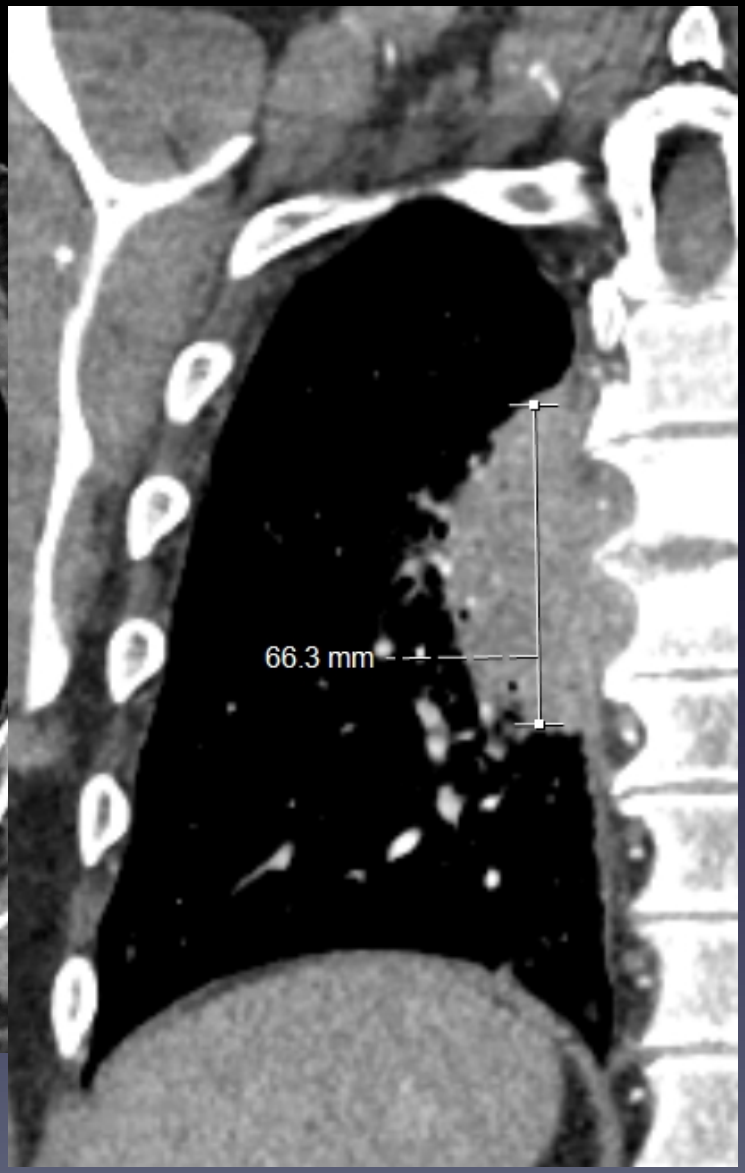
Case 4

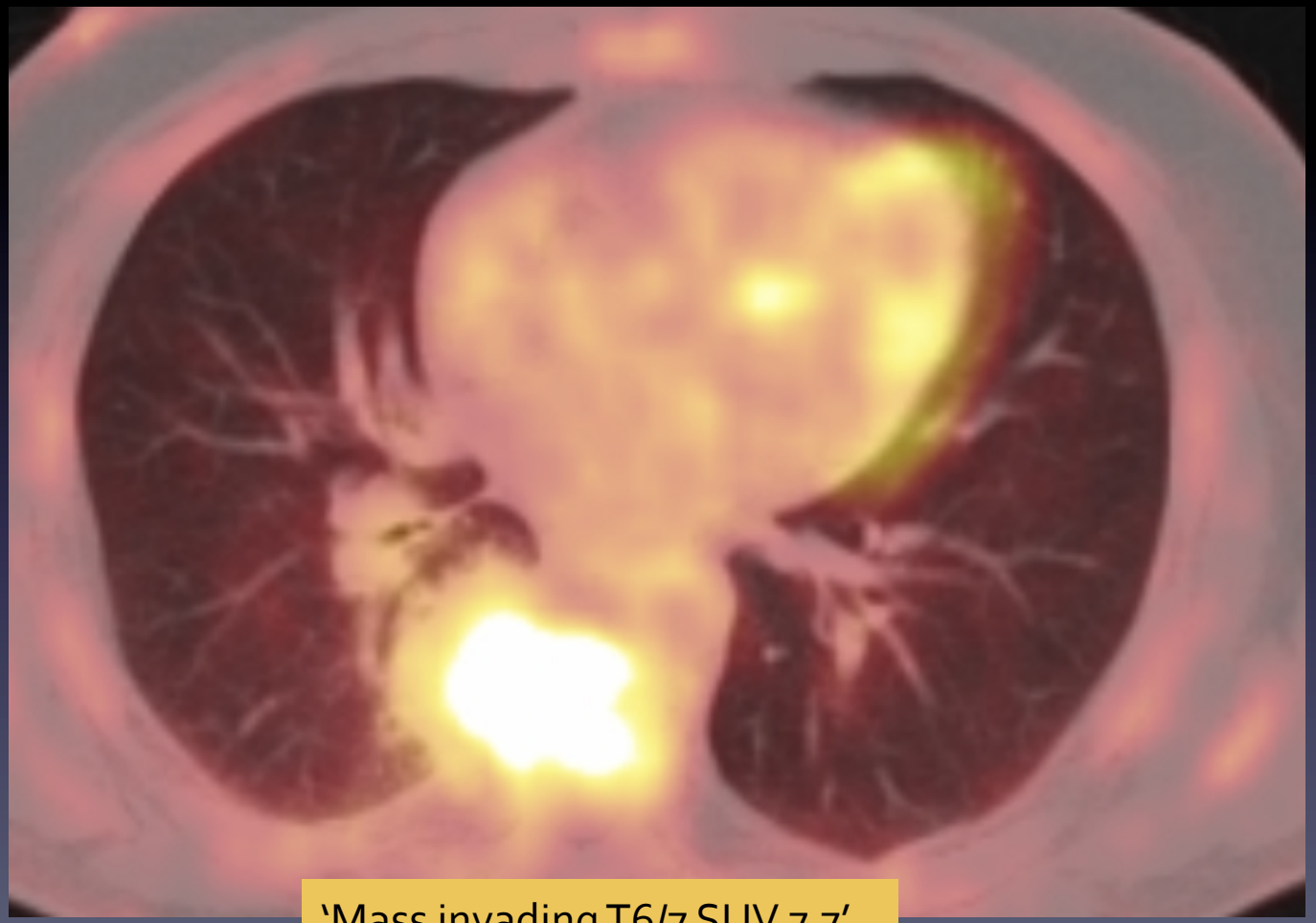
- Carcinoid
- T1b No Mo

Case 5

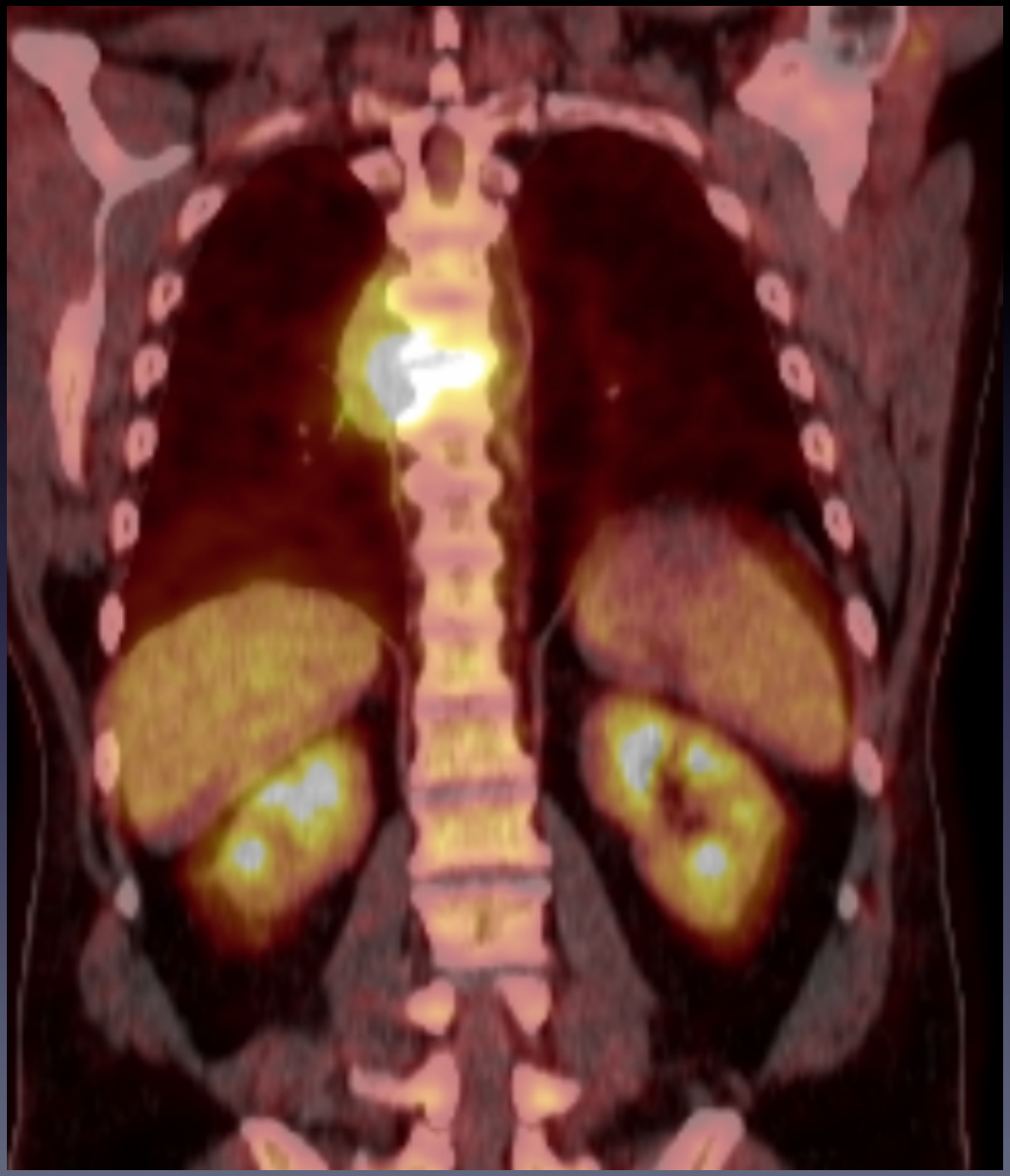


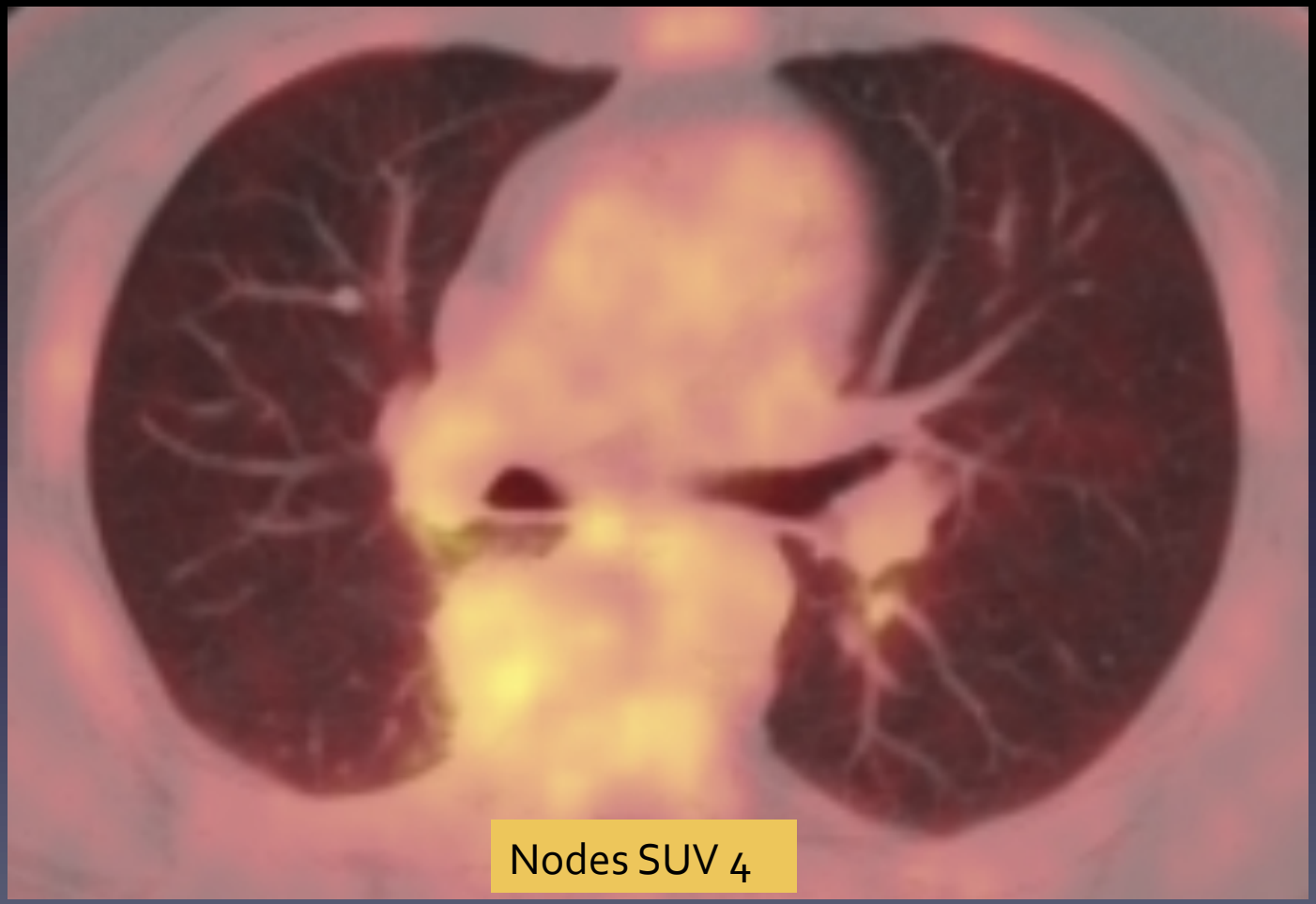

56.8 mm
34.0 mm

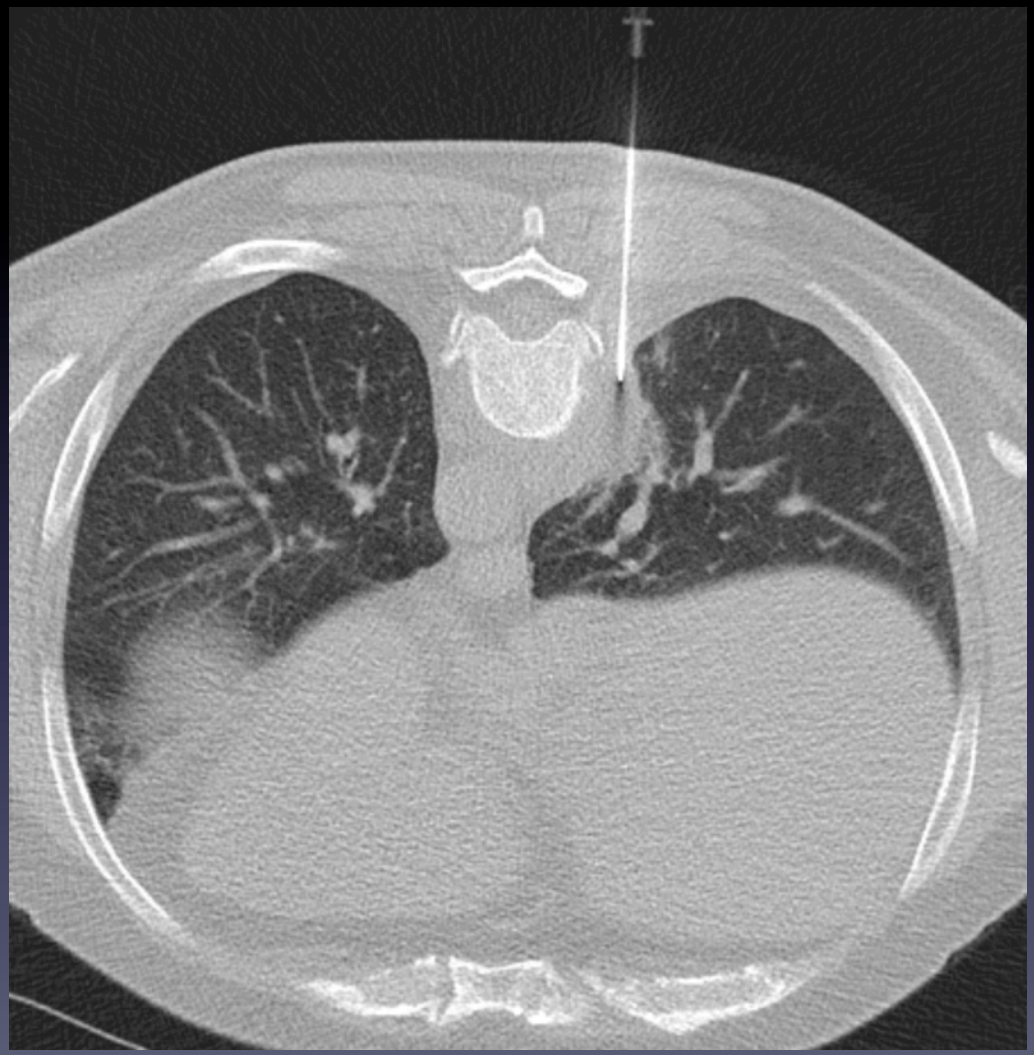

66.3 mm



‘Mass invading T6/7 SUV 7.7’




Nodes SUV 4



Case 5

- Staging
- Diagnosis

Case 5

- T4 N2 M0

- Q: Why do miners need glasses?
- A: Tunnel vision…

Case 5

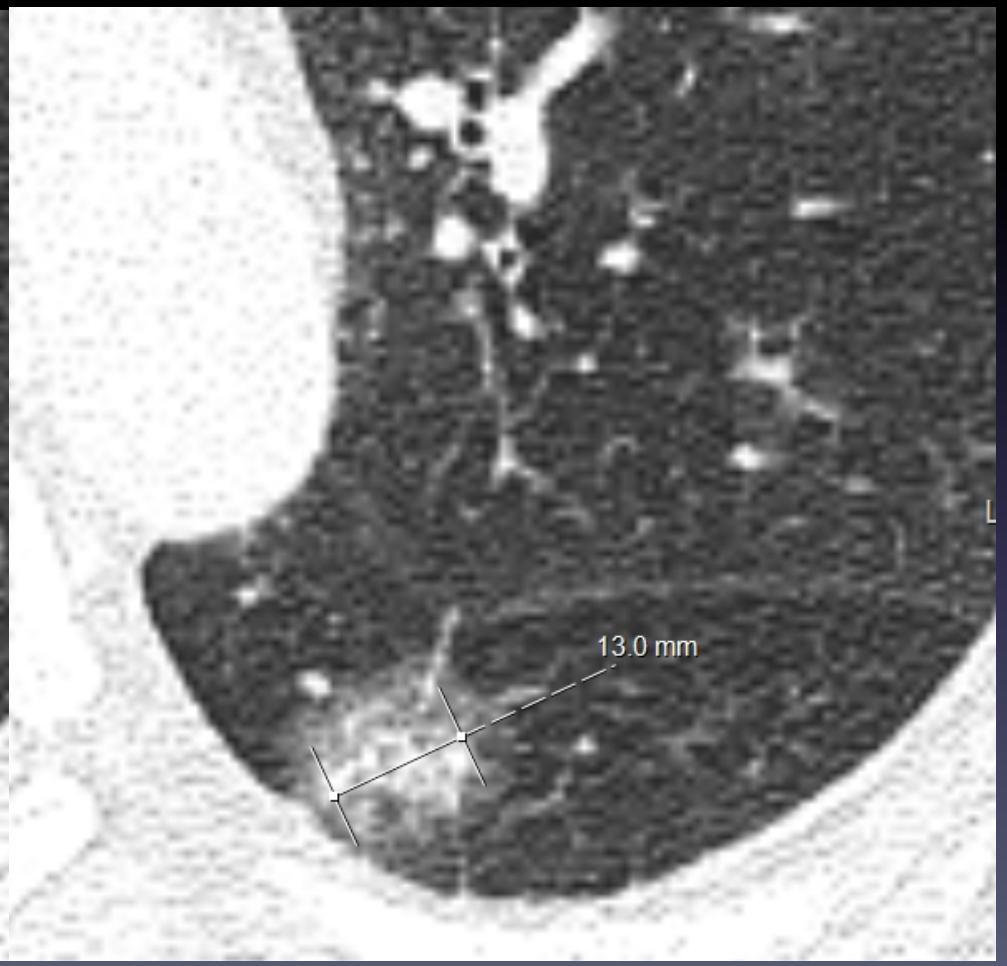
- Discitis

Case 6

Case 6

- T1(is) No Mo
- Bx - AIS

Case 7




9.1 mm

- Staging
- Diagnosis

- Multifocal adenocarcinoma spectrum disease
- Apical seg LLL imaging features of invasive adeno as solid component >5mm (MIA if <5mm)
- RLL lesion imaging features AIS
- T1b (2) No Mo

Summary

- Implications for T staging
  - Accurate tumour size measurement vital
  - Better prognosis for endobronchial tumours/those causing atelectasis
  - Worse prognosis for larger tumours
  - Better prognosis refinement and stratification
- Implications for adenocarcinoma spectrum disease
- Implications for M staging
  - Recognise extrathoracic oligometastatic disease

- TNM 9 is on the way in a couple of years!
- Better distinction between single and multiple pulmonary metastases
- Exploratory subgrouping (for future validation)
  - -N1a: Single N1
  - -N1b: Multiple N1
  - -N2a1: Single N2 (skip metastasis)
  - -N2a2: Single N2 + N1
  - -N2b: Multiple N2