Staging NSCLC

18 FDG PET-CT

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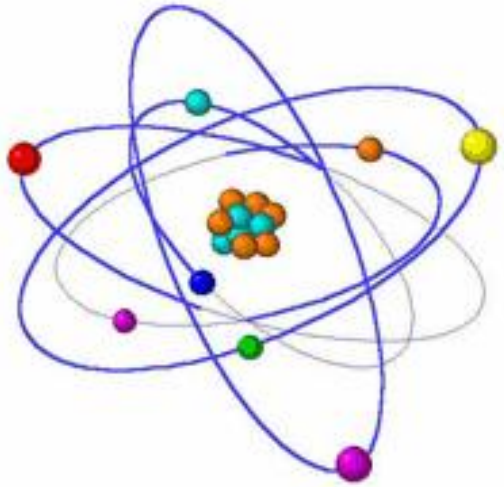
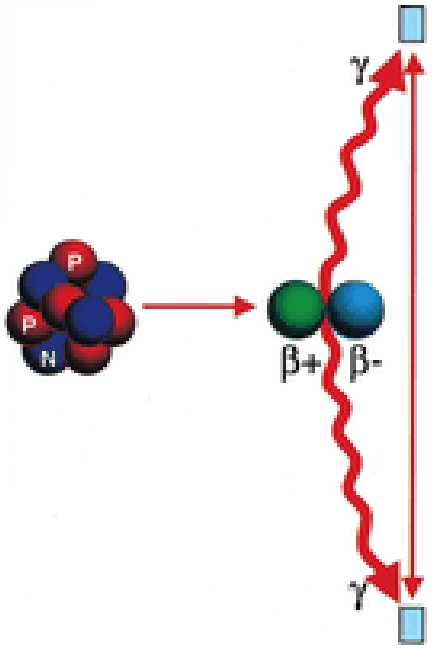
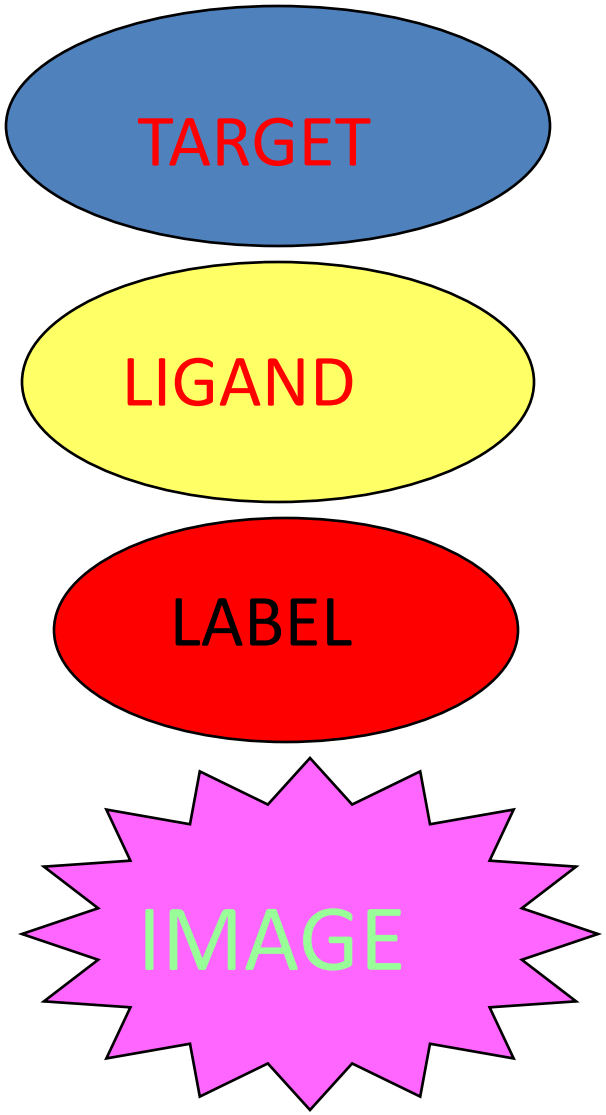
RADIOISOTOPE

- DIAGNOSTIC
- THERAPEUTIC






TARGET
LIGAND
LABEL
IMAGE

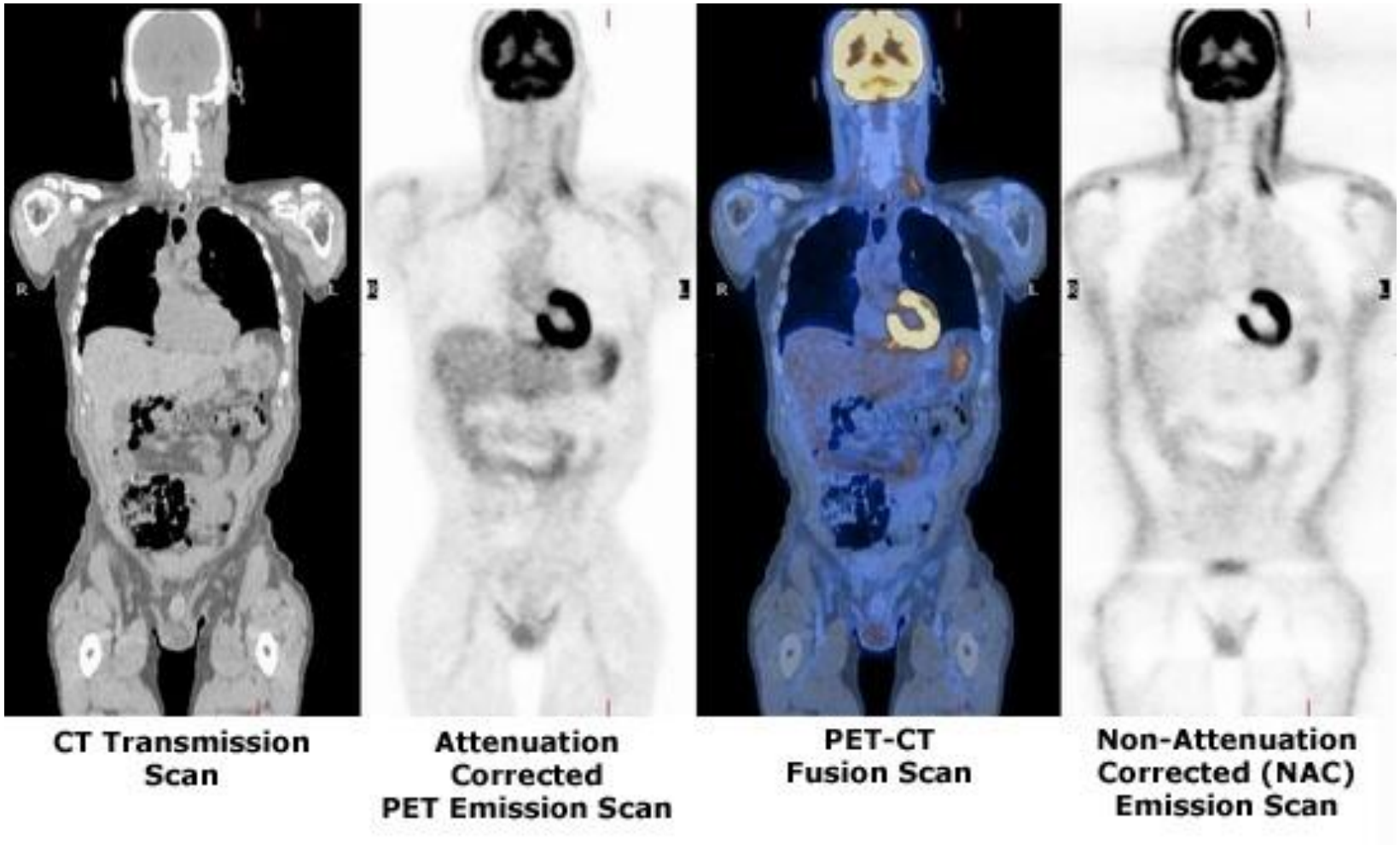
POSITRON EMITERS

- F-18
- C-11
- N-13
- O-15
- Ga-68
- Rb-82

Radiophamaceuticals

- Glucose 18-FDG
- Aminoacid C-11-MET
- Nucleotide 18-FLT
- Oxygen O-15-H2O
- Hormones 18-F-ESTROGEN
- Receptor analogue Ga-68-Octreotide
- Hypoxic Marker 18-F-MISO
- Neurotransmitters 18-FDOPA

CT



CT Transmission Scan

Attenuation Corrected PET Emission Scan

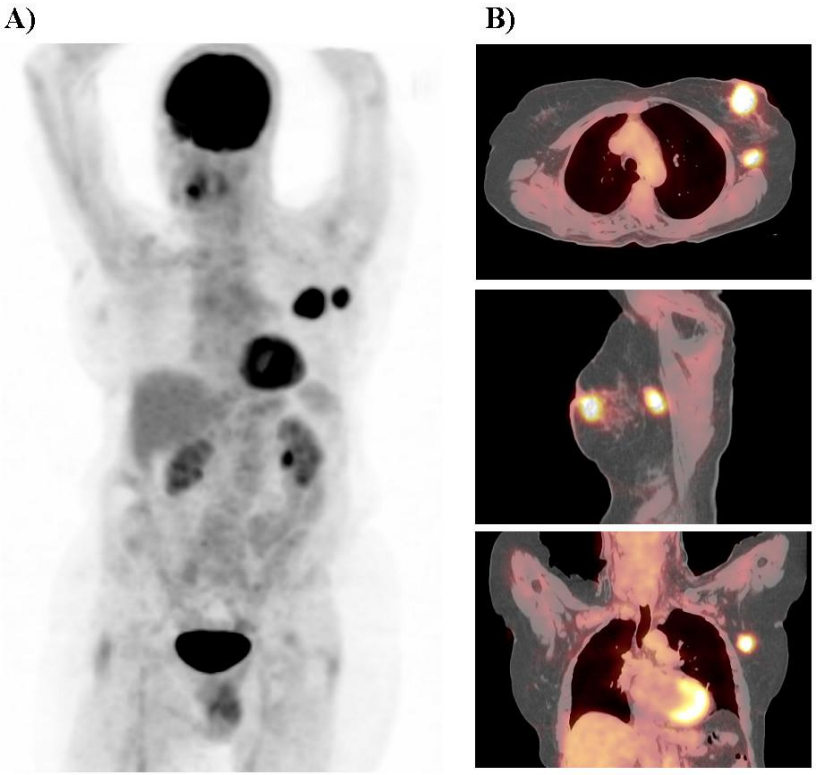
PET-CT Fusion Scan

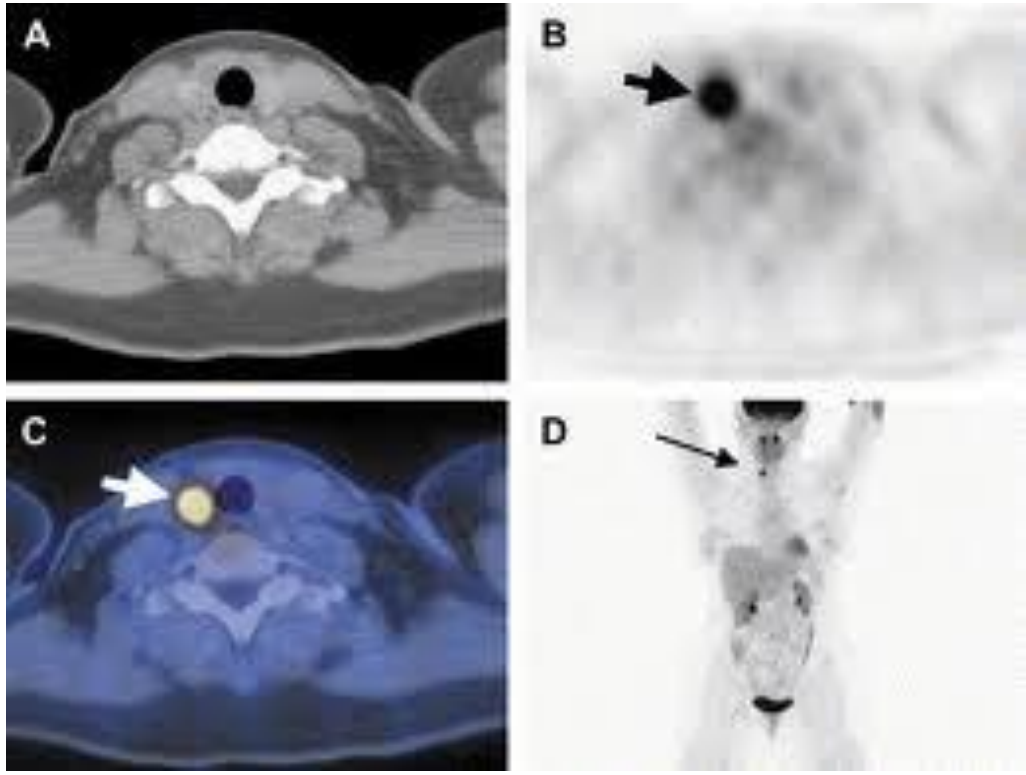
Non-Attenuation Corrected (NAC) Emission Scan

CT in PET-CT

- NAC-AC IMAGE
- REDUCES TIME OF ACQUISITION
- LOCALIZATION

CT



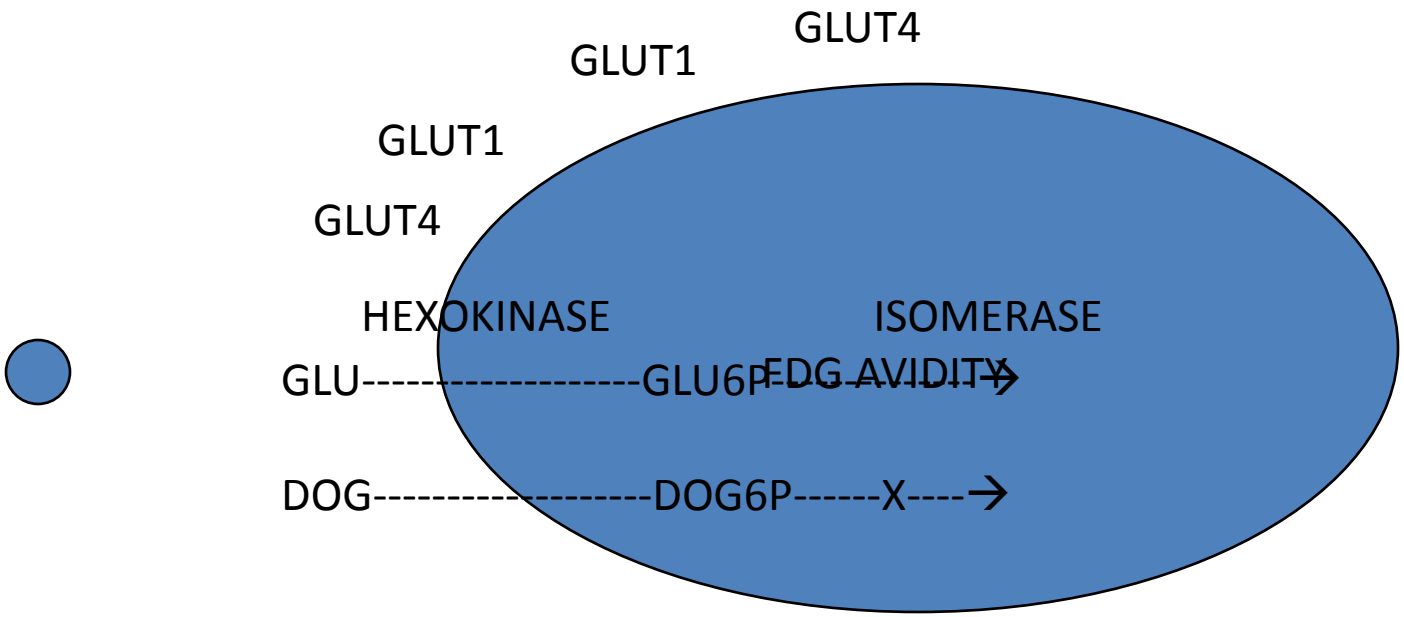


CT in PET-CT

- LOW DOSE CT vs PROPER mAs .
- Contrast—Phases.
- Breath Hold,HR
- Requirement.
- TIME FRAME –LAST CECT.

18-FDG PET-CT

CANCER CELL GLUCOSE METABOLISM



FDG AVIDITY

- SPN
- NSCLC STAGING
- RADIOTHERAPY PLANNING

- Evaluation of treatment response .
- Restaging and recurrence.

Integrated PET/CT Systems: Protocols

- Field of view: base of skull to mid-thigh
- When clinical relevant
  Include extremities and/or brain
  Limited field of view for SPN
- Patient positioning:
  Arms-up
  Optimal CT protocols:

mAs?

IV contrast ?

Breathing pattern ?

TNM

- A vital guide to determine treatment and prognosis.
- Correlates disease status with treatment strategy.
- Facilitates information exchange between multiple centers .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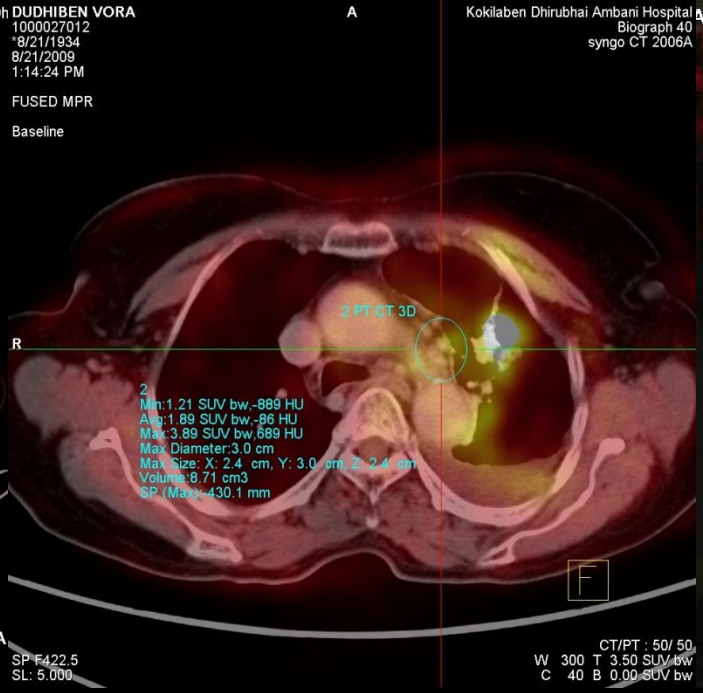
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syngo CT 2006A
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2
Min:1.21 SUV bw,-889 HU
Avg:1.89 SUV bw,-86 HU
Max:3.89 SUV bw,689 HU
Max Diameter:3.0 cm
Max Size: X: 2.4 cm, Y: 3.0 cm, Z: 2.4 cm
Volume:8.71 cm3
SP (Max):-430.1 mm
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A
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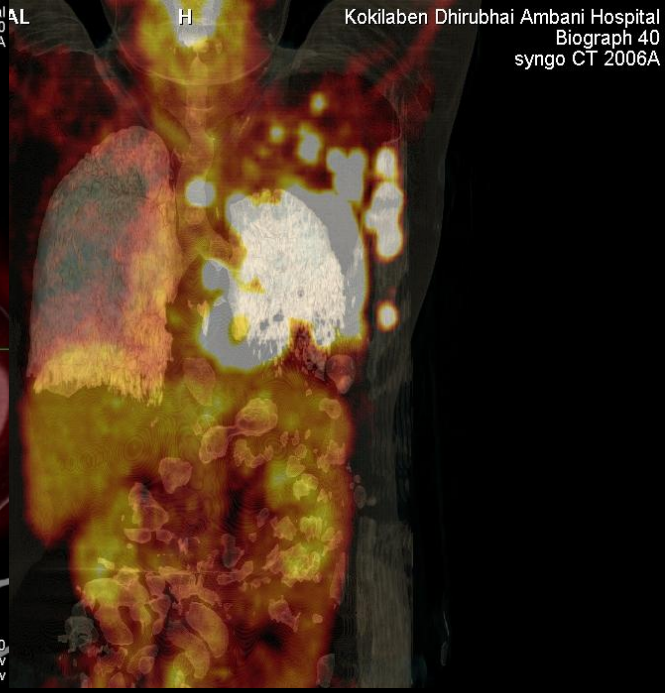
C 40 B 0.00 SUV bw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CT/PT : 50/ 50
W 300 T 4.98 SUV bw
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AJCC 7 –TNM CHART

Definitions

Primary Tumor (T)

- **TX** Primary tumor cannot be assessed, or tumor proven by the presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy
- **T0** No evidence of primary tumor
- **Tis** Carcinoma in situ
- **T1** Tumor 3 cm or less in greatest dimension, surrounded by lung or visceral pleura, without bronchoscopic evidence of invasion more proximal than the lobar bronchus (for example, not in the main bronchus)[1]
- **T1a** Tumor 2 cm or less in greatest dimension
- **T1b** Tumor more than 2 cm but 3 cm or less in greatest dimension
- **T2** Tumor more than 3 cm but 7 cm or less or tumor with any of the following features (T2 tumors with these features are classified T2a if 5 cm or less): involves main bronchus, 2 cm or more distal to the carina; invades visceral pleura (PL1 or PL2); associated with atelectasis or obstructive pneumonitis that extends to the hilar region but does not involve the entire lung
- **T2a** Tumor more than 3 cm but 5 cm or less in greatest dimension
- **T2b** Tumor more than 5 cm but 7 cm or less in greatest dimension
- **T3** Tumor more than 7 cm or one that directly invades any of the following: parietal pleural (PL3), chest wall (including superior sulcus tumors), diaphragm, phrenic nerve, mediastinal pleura, parietal pericardium; or tumor in the main bronchus less than 2 cm distal to the carina[1] but without involvement of the carina; or associated atelectasis or obstructive pneumonitis of the entire lung or separate tumor nodule(s) in the same lobe
- **T4** Tumor of any size that invades any of the following: mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, carina, separate tumor nodule(s) in a different ipsilateral lobe

Distant Metastasis (M)

- **M0** No distant metastasis
- **M1** Distant metastasis
- **M1a** Separate tumor nodule(s) in a contralateral lobe, tumor with pleural nodules or malignant pleural (or pericardial) effusion[2]
- **M1b** Distant metastasis (in extrathoracic organs)

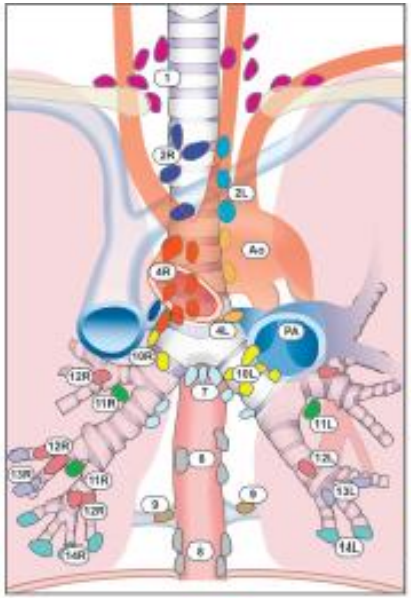
Notes

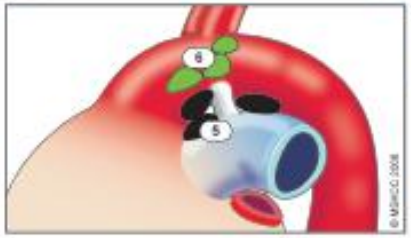
ANATOMIC STAGE/PROGNOSTIC GROUPS			
Occult Carcinoma	TX	N0	M0
Stage 0	Tis	N0	M0
Stage IA	T1a	N0	M0
	T1b	N0	M0
Stage IB	T2a	N0	M0
Stage IIA	T2b	N0	M0
	T1a	N1	M0
	T1b	N1	M0
	T2a	N1	M0
Stage IIB	T2b	N1	M0
	T3	N0	M0
Stage IIIA	T1a	N2	M0
	T1b	N2	M0
	T2a	N2	M0
	T2b	N2	M0
	T3	N1	M0
	T3	N2	M0
	T4	N0	M0
	T4	N1	M0
Stage IIIB	T1a	N3	M0
	T1b	N3	M0
	T2a	N3	M0
	T2b	N3	M0
	T3	N3	M0
	T4	N2	M0
	T4	N3	M0
Stage IV	Any T	Any N	M1a
	Any T	Any N	M1b

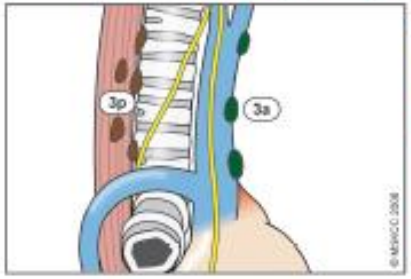
N

Regional Lymph Nodes (N)

- **NX** Regional lymph nodes cannot be assessed
- **N0** No regional lymph node metastases
- **N1** Metastasis in ipsilateral peribronchial and/or ipsilateral hilar lymph nodes and intrapulmonary nodes, including involvement by direct extension
- **N2** Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s)
- **N3** Metastasis in contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s)







Supraclavicular zone

- **1** Low cervical, supraclavicular, and sternal notch nodes

Superior Mediastinal Nodes

Upper zone

- **2R** Upper Paratracheal (right)
- **2L** Upper Paratracheal (left)
- **3a** Pre-vascular
- **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

N_1 Nodes

Hilar/Interlobar zone

- **10** Hilar
- **11** Interlobar

Peripheral zone

- **12** Lobar
- **13** Segmental
- **14** Subsegmental

T

- CECT mainly

- PET
- BENIGN & MALIGNANT PLEURAL EFFUSION

--90 % ACCURACY.

- TUMOR VS ATELECTASIS /POST OBSTRUCTIVE PNEUMONITIS →

RT PLANNING

- SUV ---PROGNOSTIC INDICATOR

N

- CT/MRI----size criteria >1 cm.

	Sv	Sp
CT	45%	80%
PET	80%	95%

PPV of FDG avid mediastinal node 65%

Biopsy confirmation before surgical treatment is denied.

High negative predictive value.

M

- PET superior to conventional modalities .
- Unexpected mets outside thorax in 6 -20%

----RP and Pelvic nodes, Soft tissue, Small adrenal mets.

- Adrenal lesions –higher accuracy than CT.
- Bone—higher Sv & Sp than bone scan.
- Overall---Unsuspected mets 10-14%.

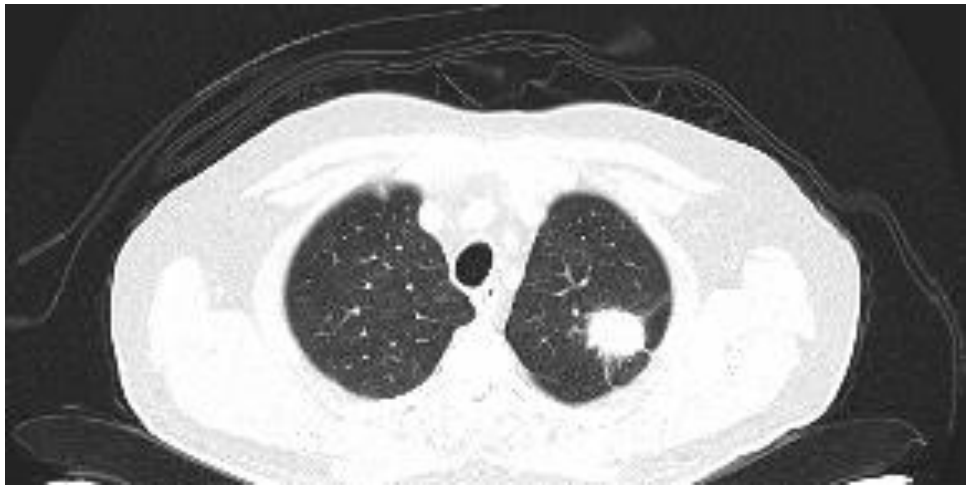
Significant change in management ---20 -50%

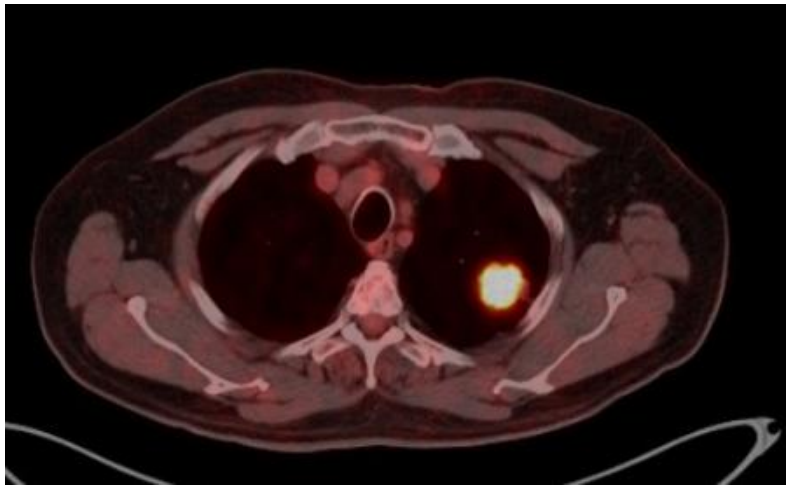
Reduction in futile thoracotomies.

Brain metastasis

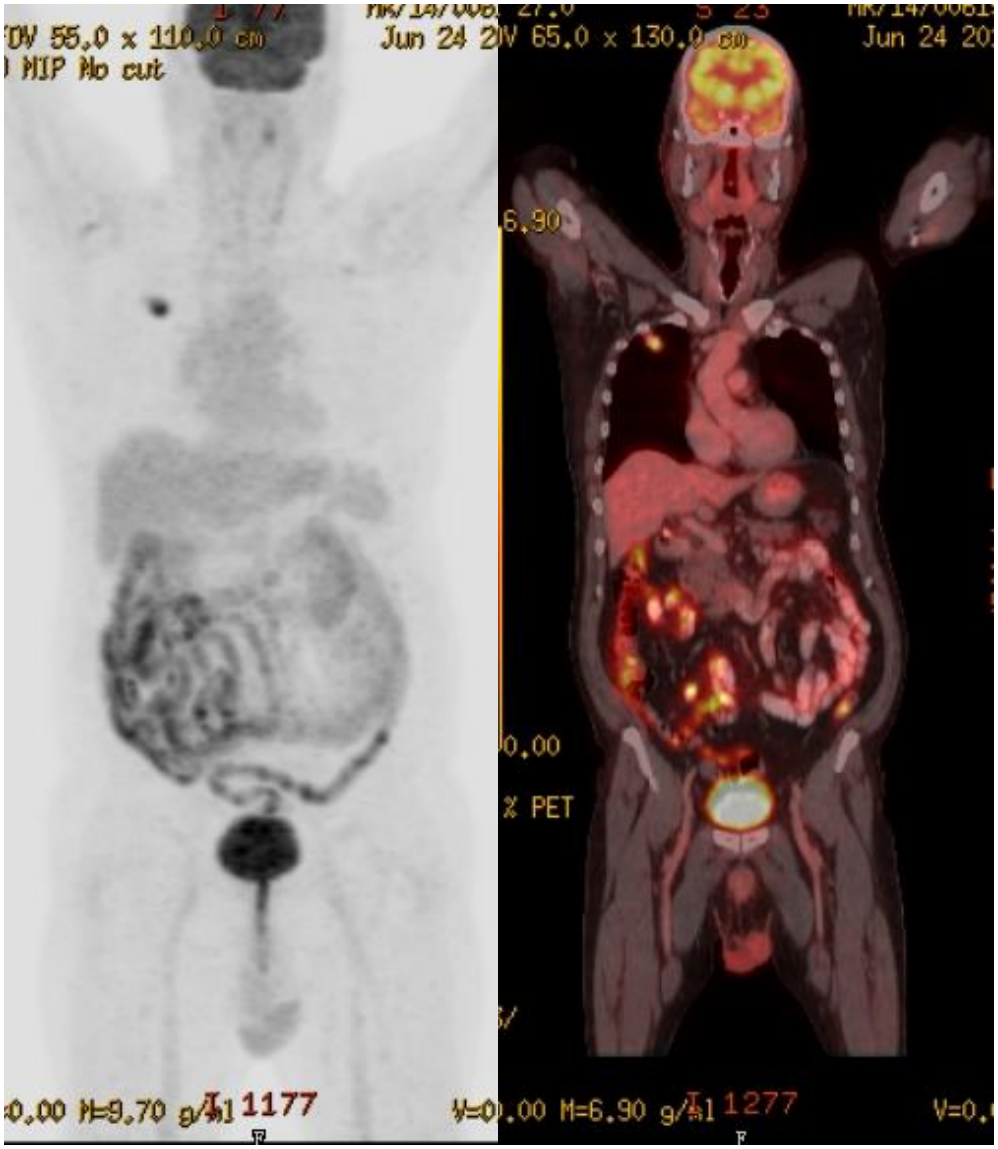
- Physiological FDG uptake in the brain .
- Tiny deposits may be missed .
- MRI modality of choice.

SPN - ACTIVE

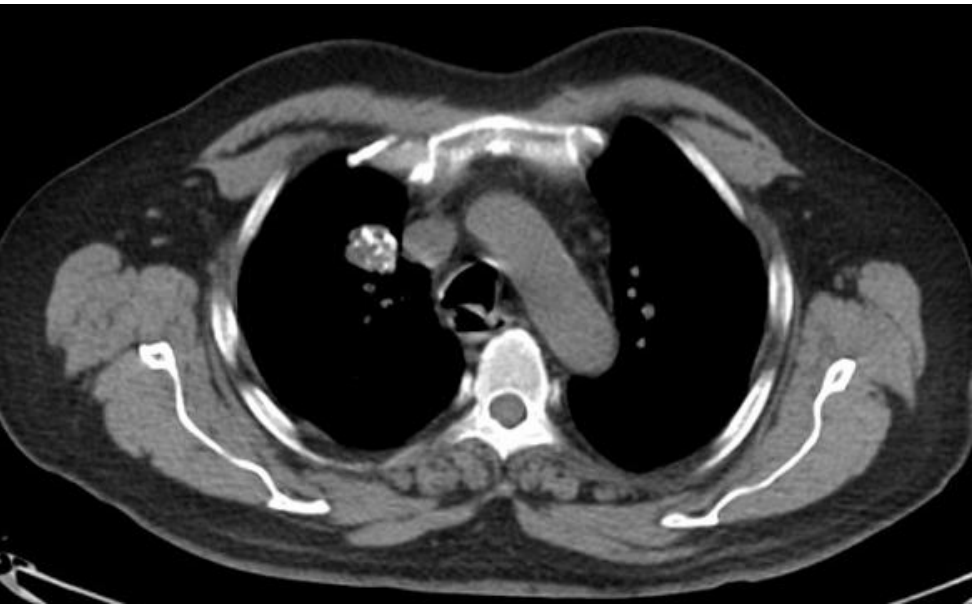


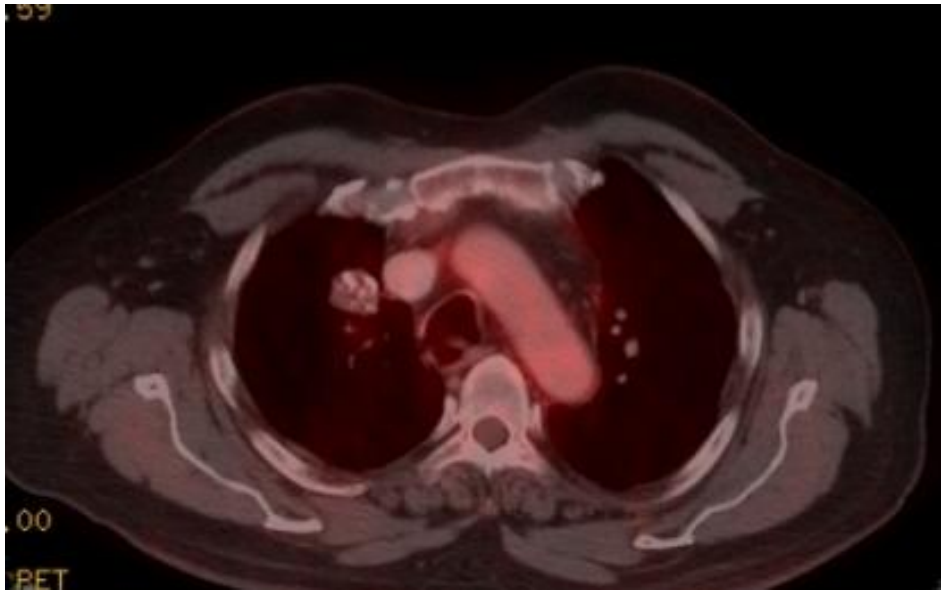


SPN - active

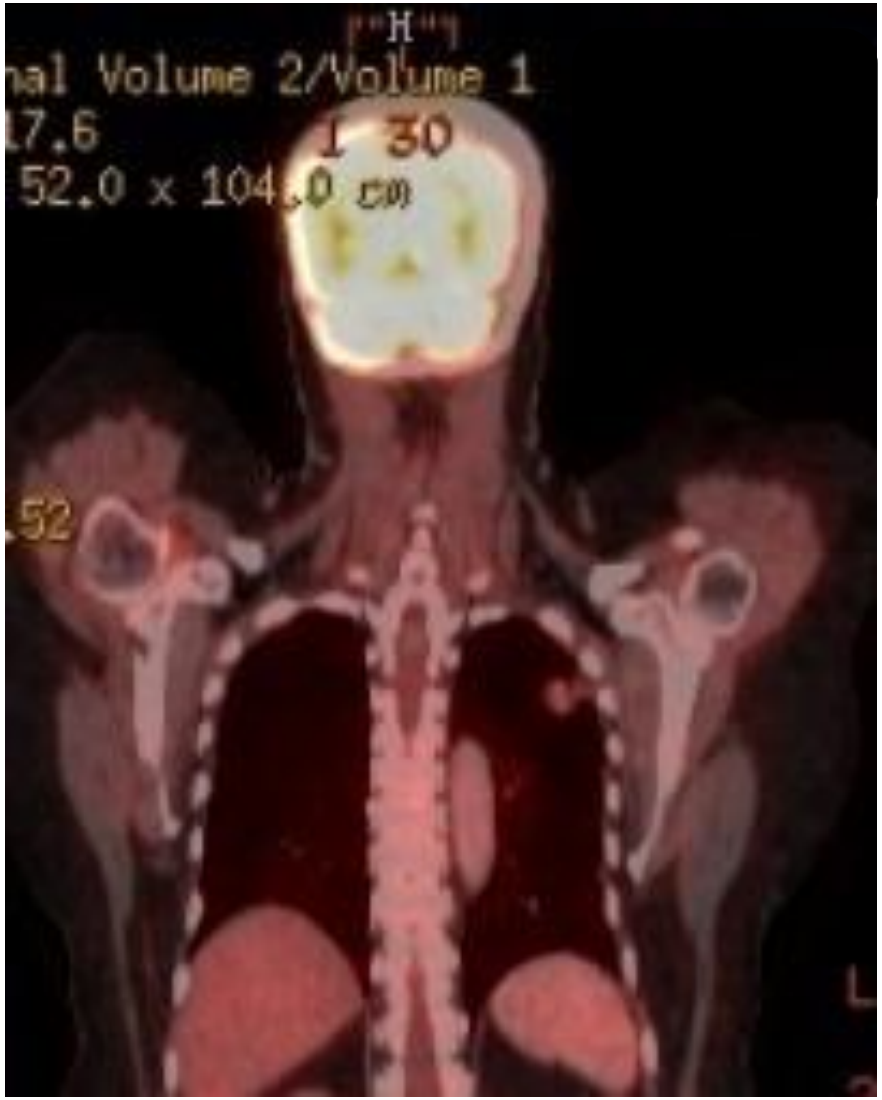

55.0 x 110.0 cm
MIP No cut
Jun 24
65.0 x 130.0 cm
Jun 24
6.90
0.00
% PET
0.00 M=9.70 g/ml 1177
V=0.00 M=6.90 g/ml 1277

SPN - INERT

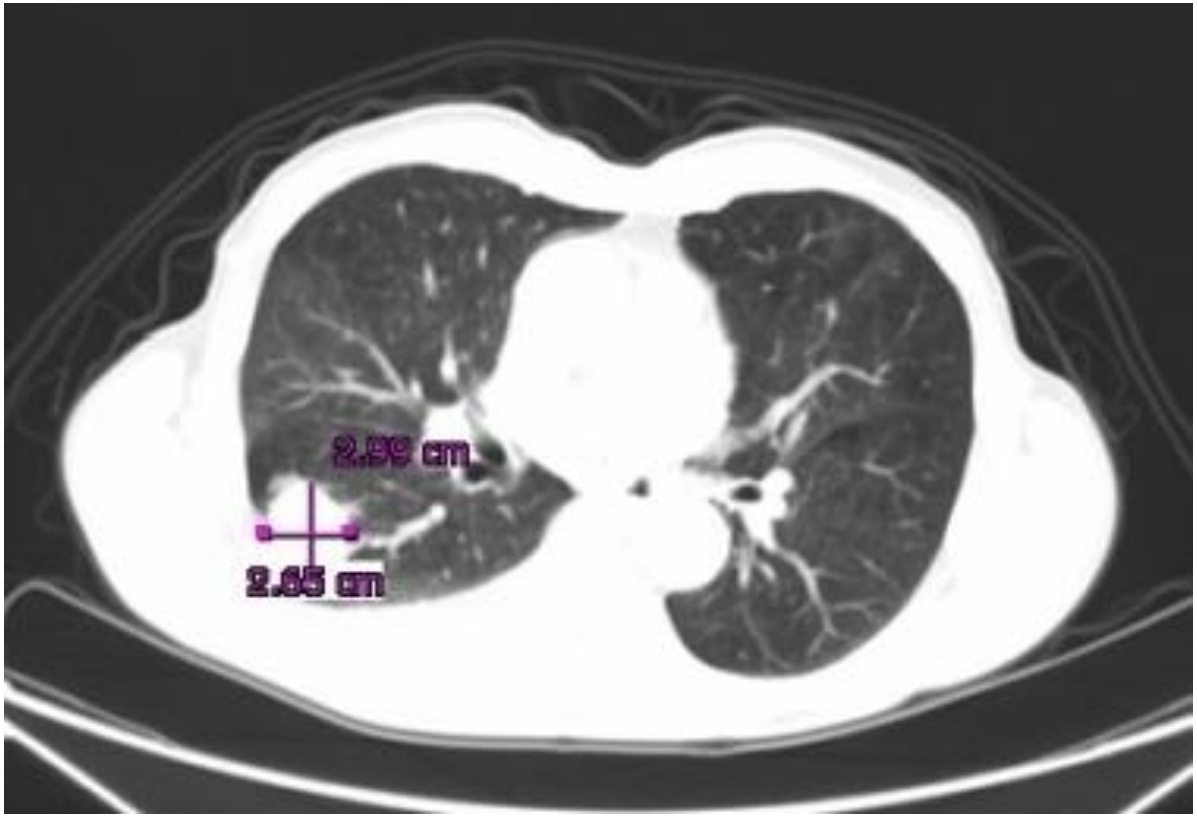


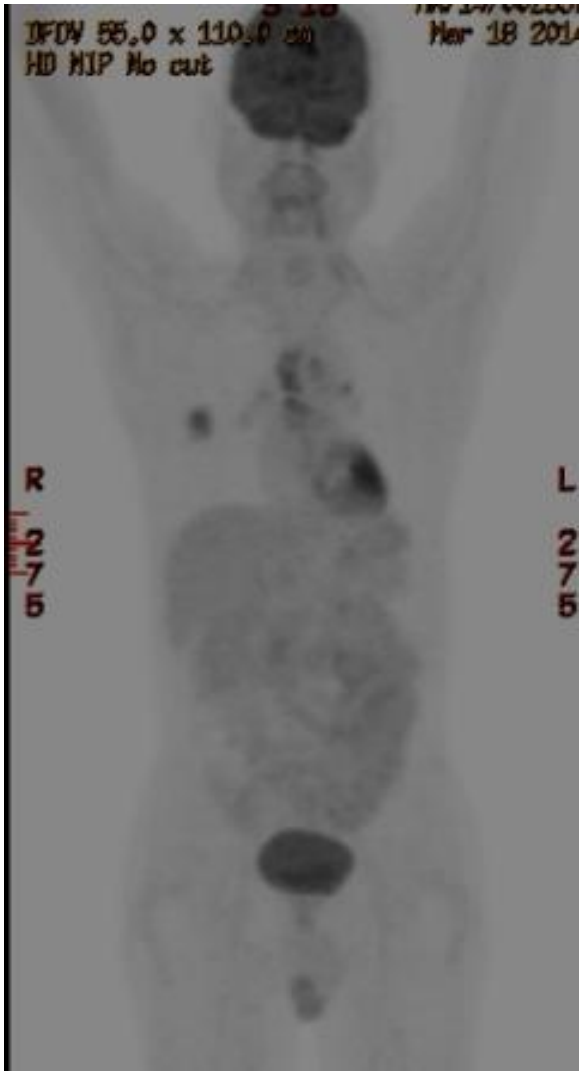


SPN – low activity (BAC)

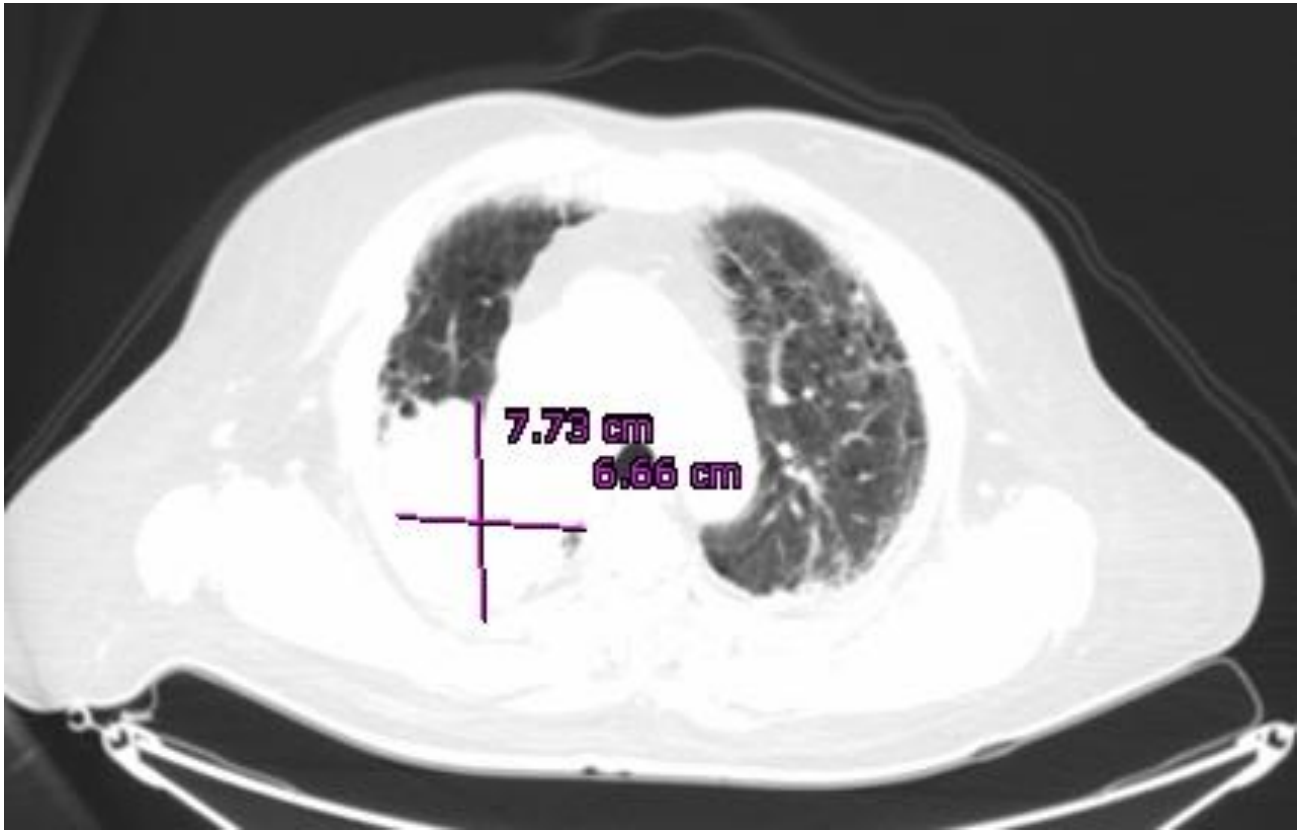


T1b

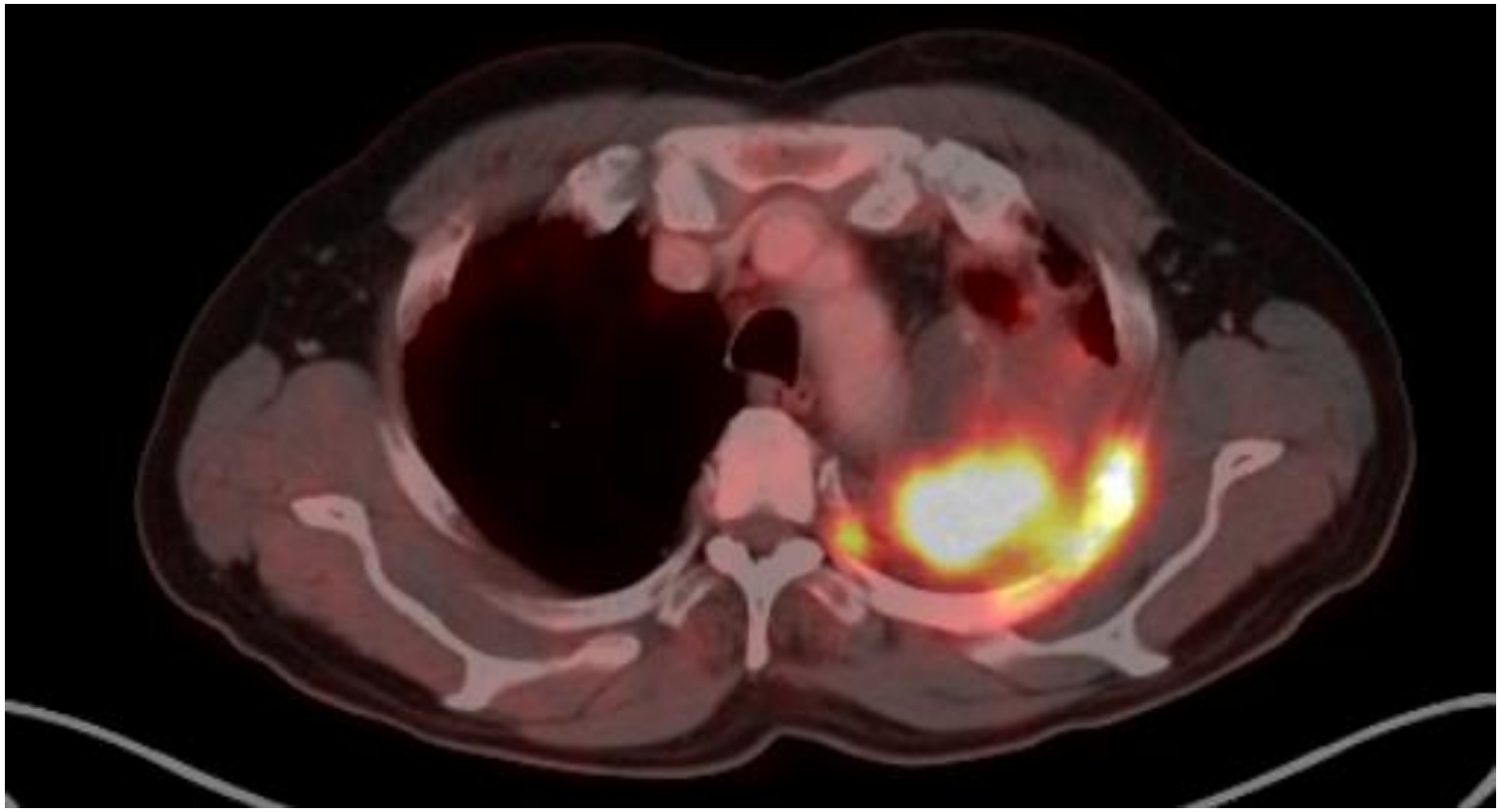




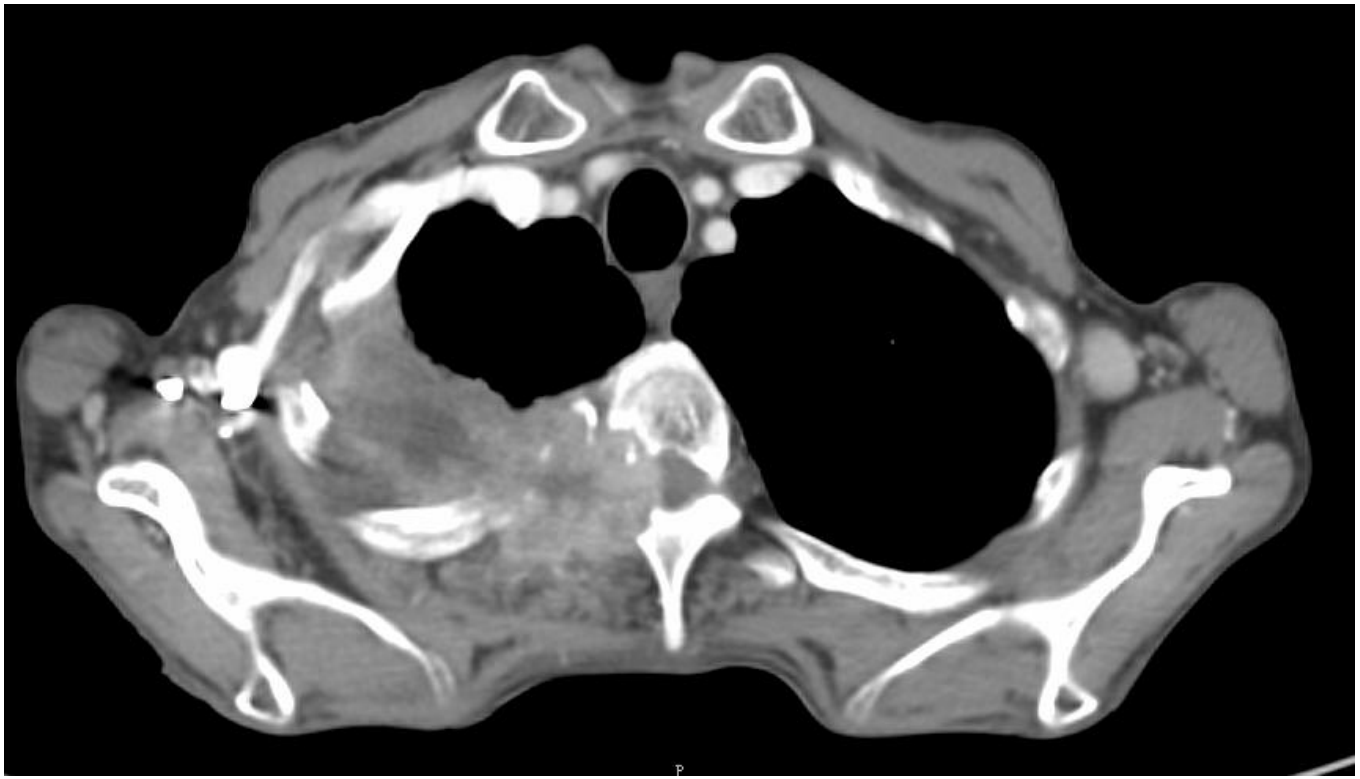
T3



T3 – chest wall

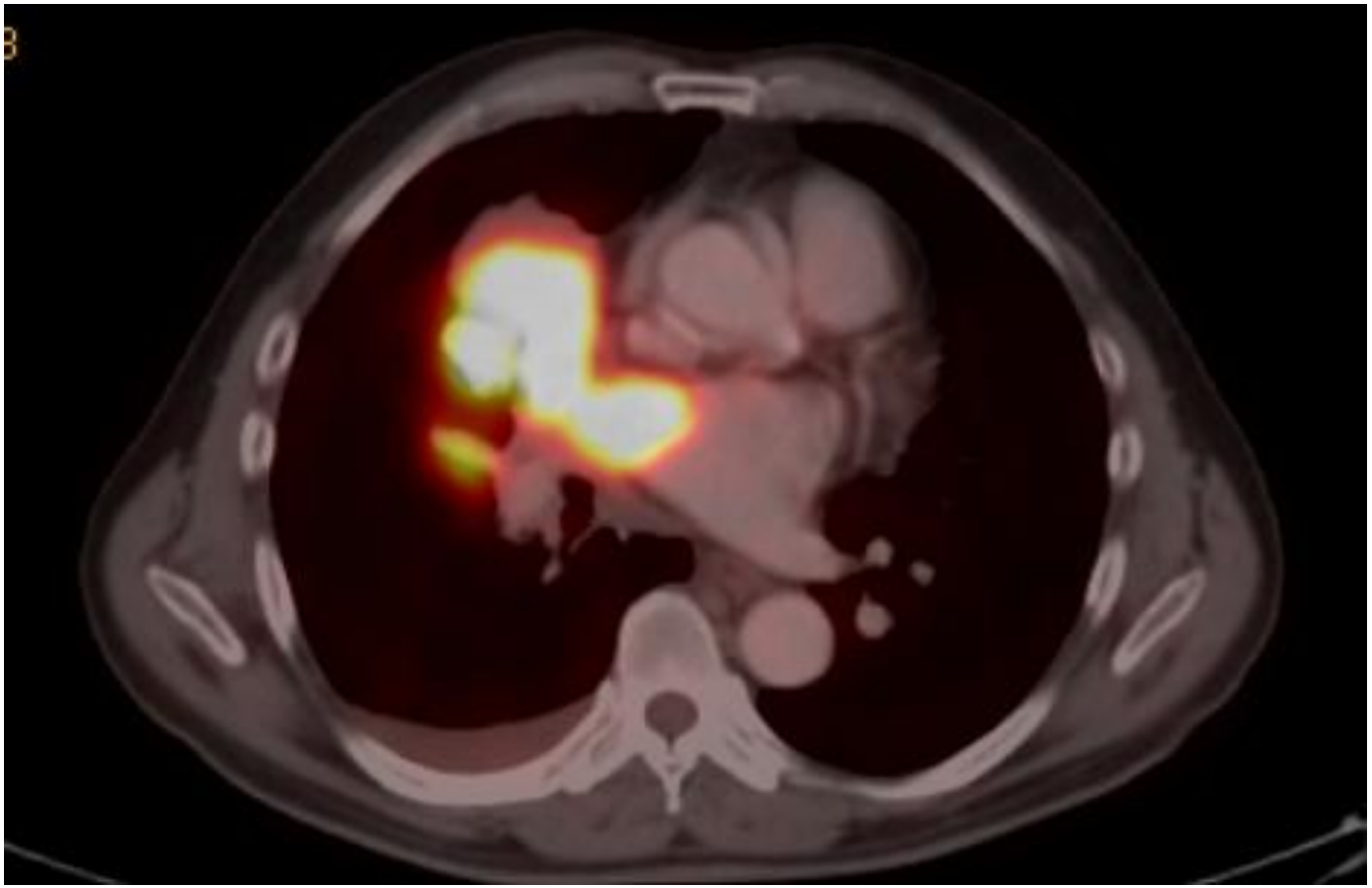


T4 vertebral body

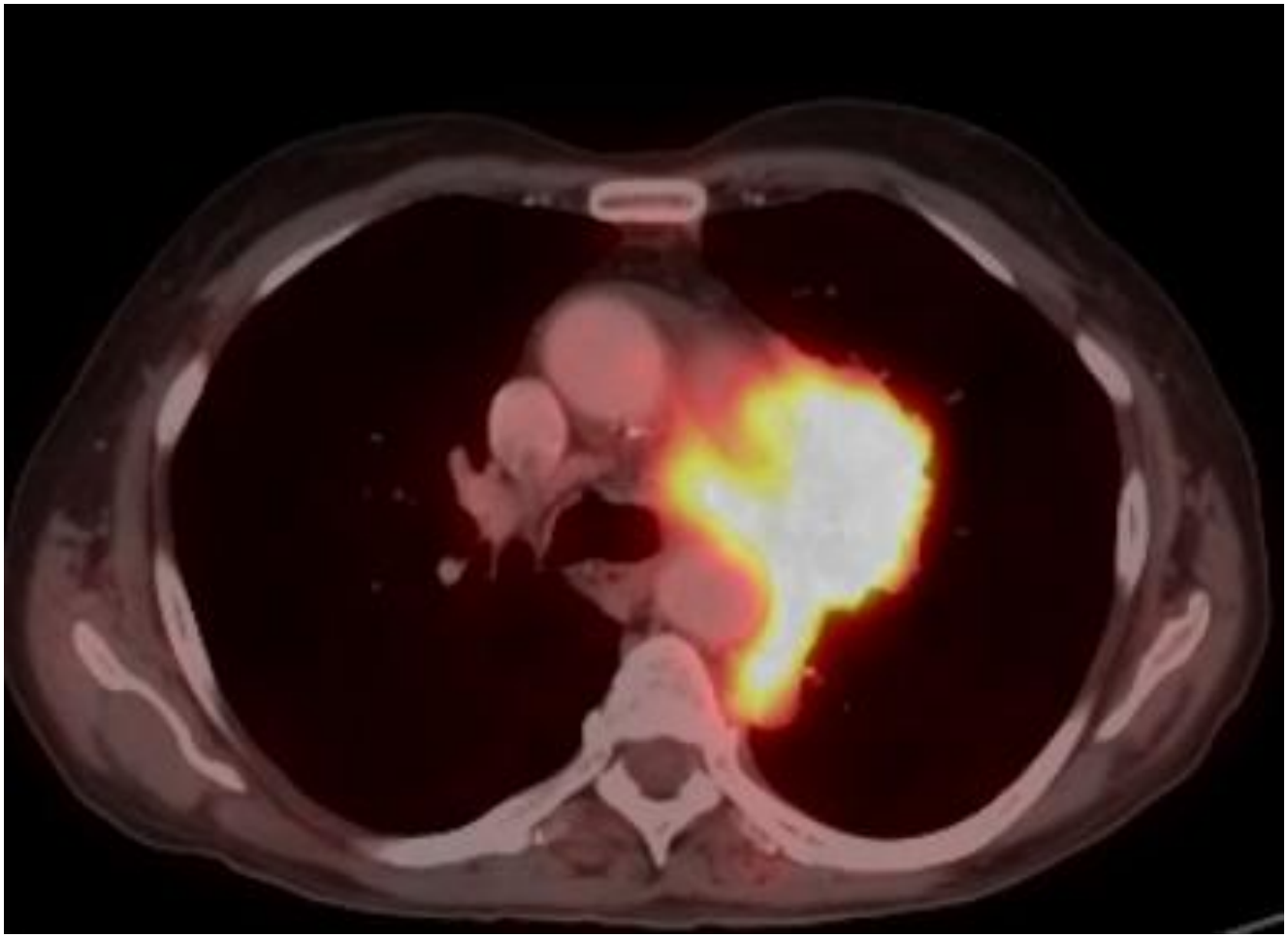


T4 SVC

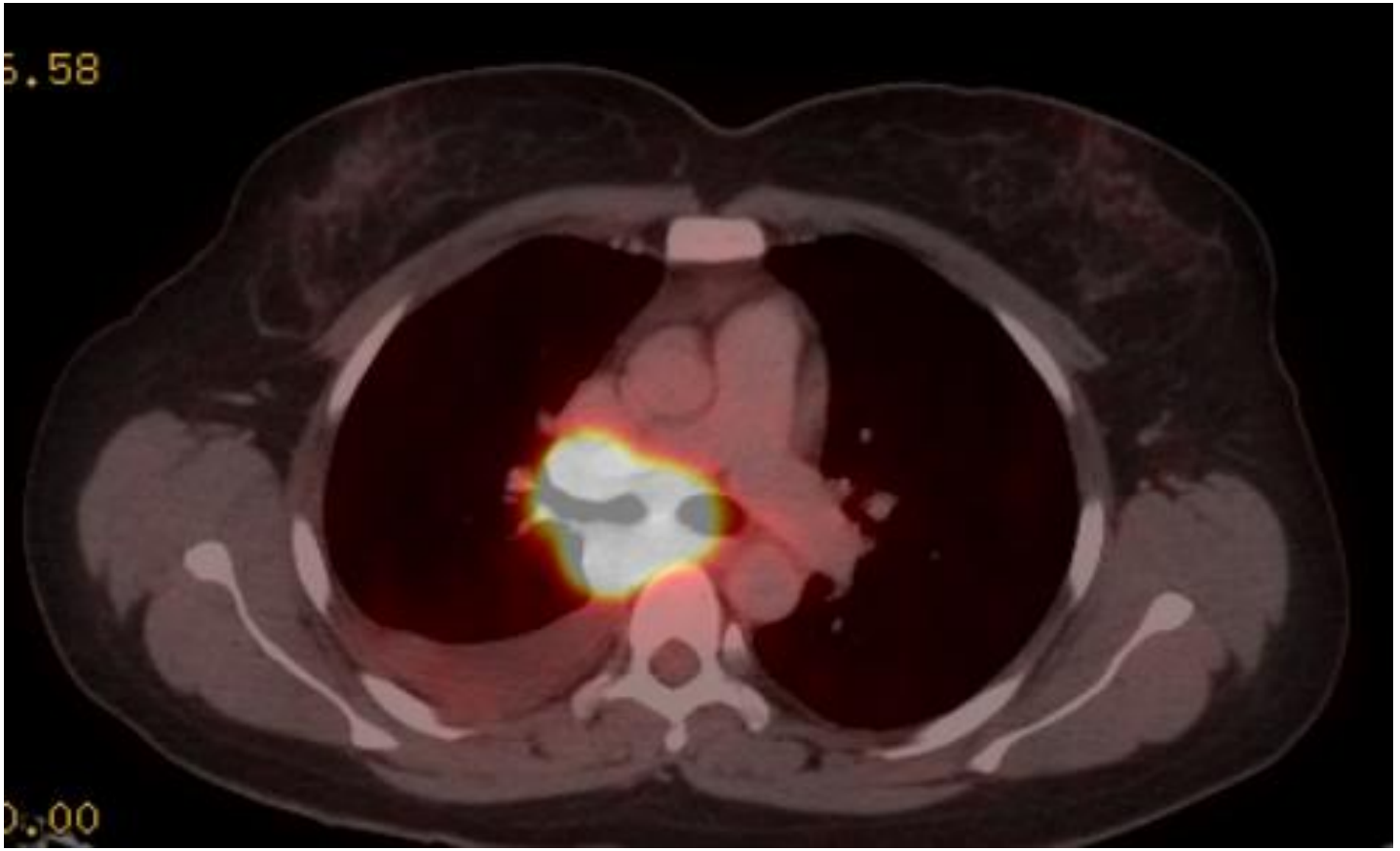
T4 - Heart



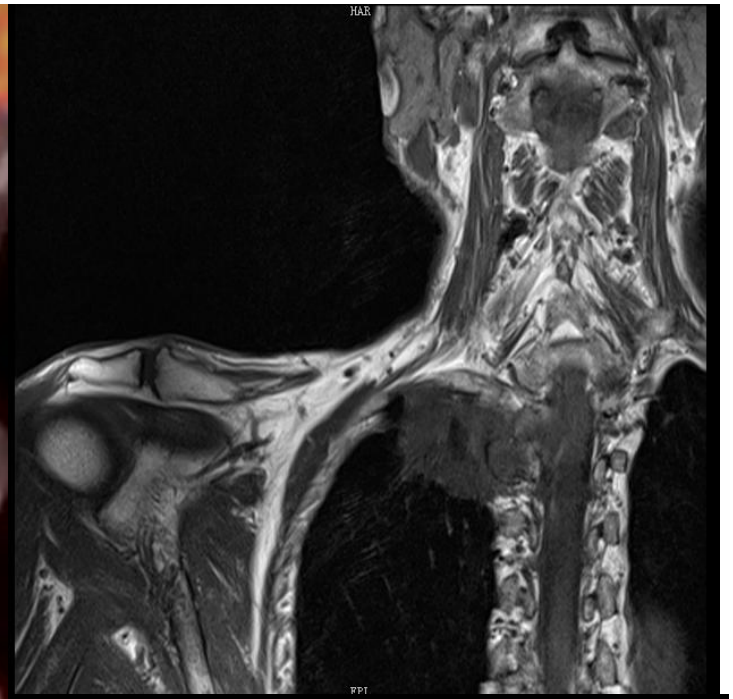
T4 – Aorta Encased

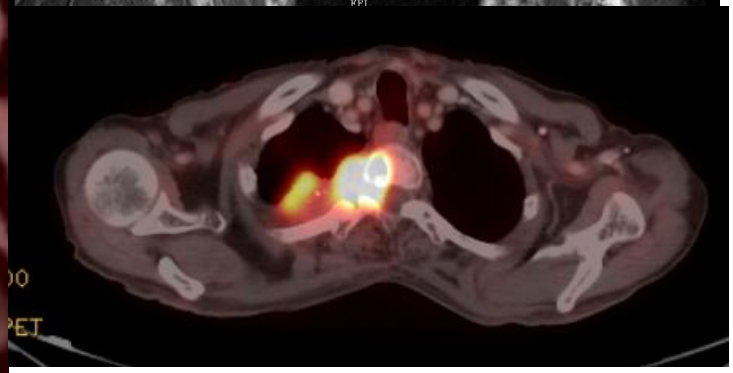


T4 - Carina



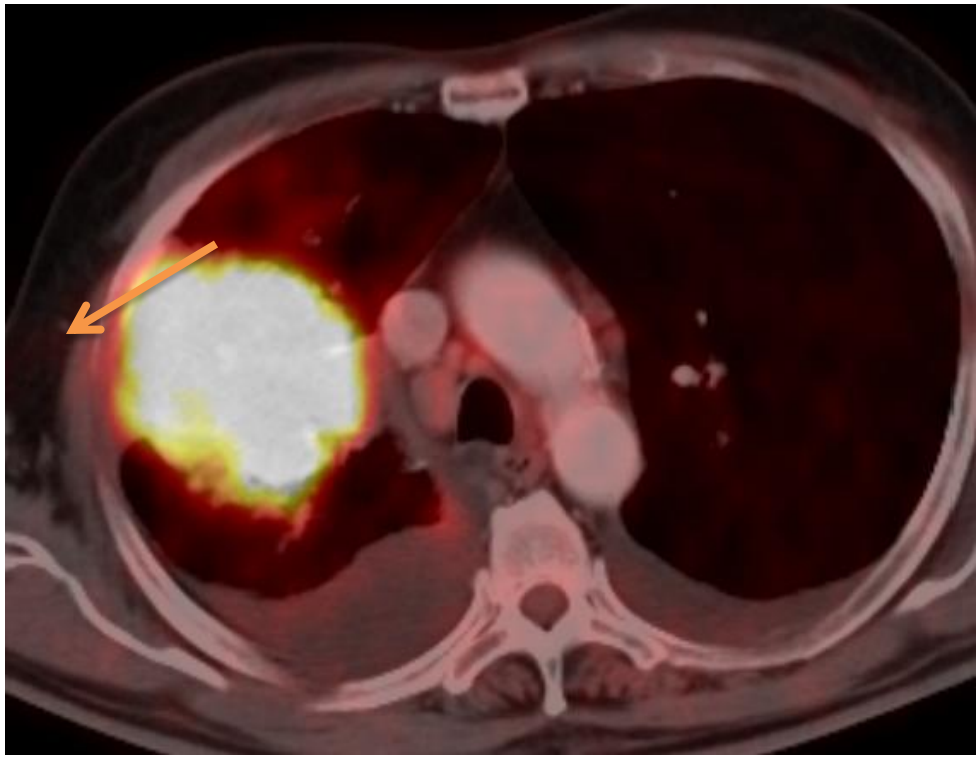
Pancoast



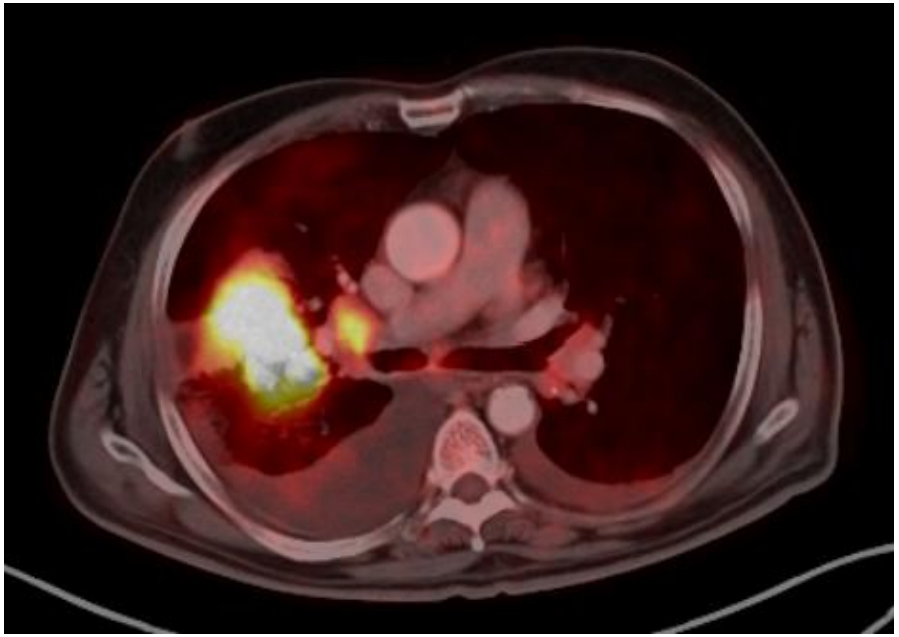


Enlarged non FDG avid node

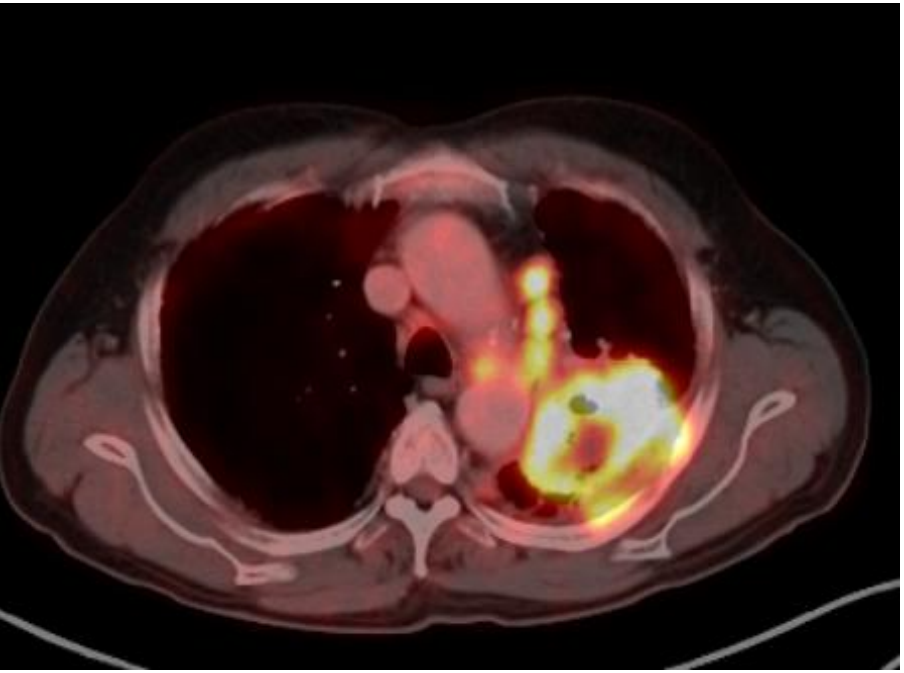
Enlarged non FDG avid node

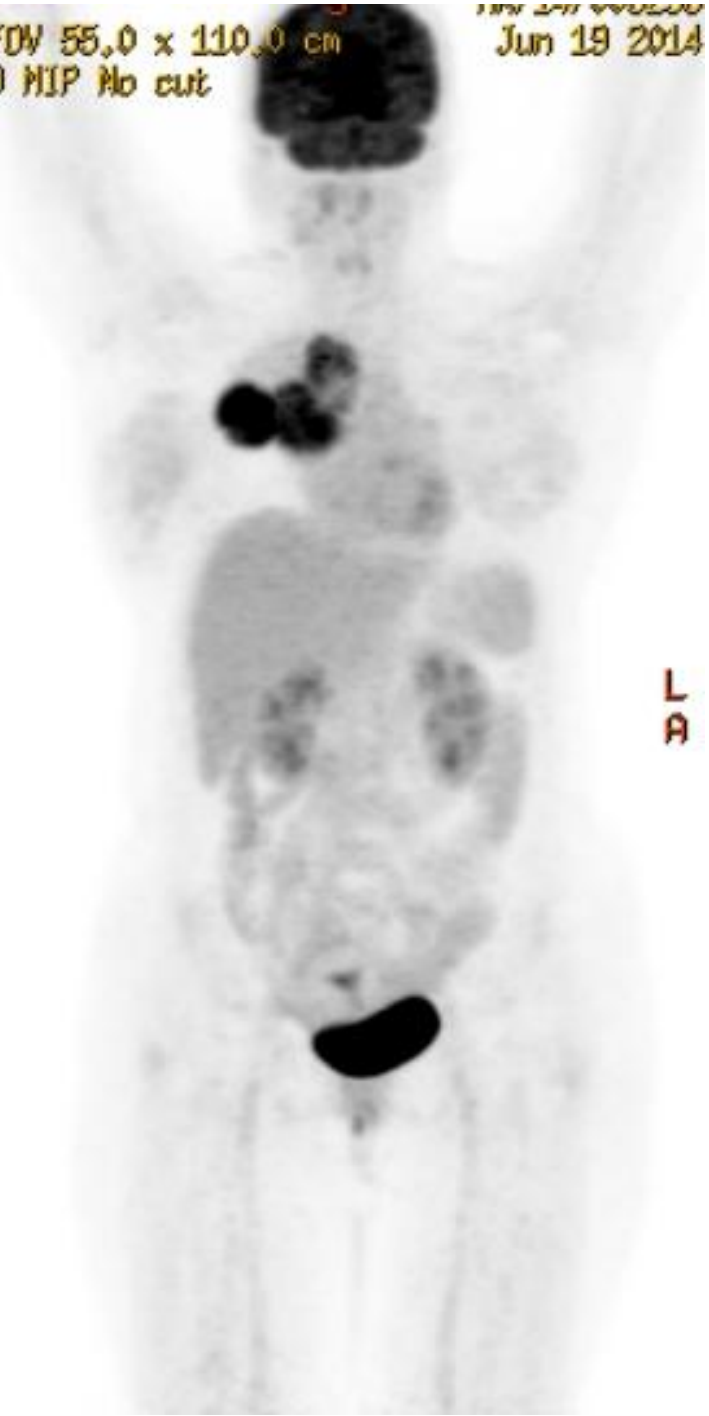


N1

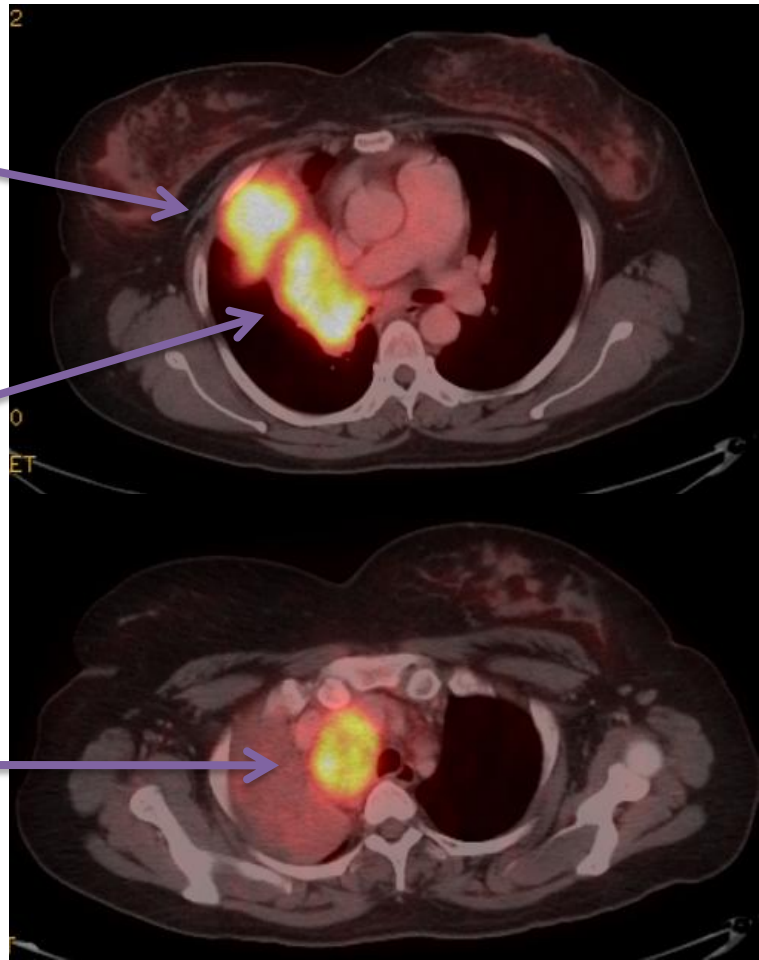


N2 –Ipsilateral mediastinal node including subcarinal node

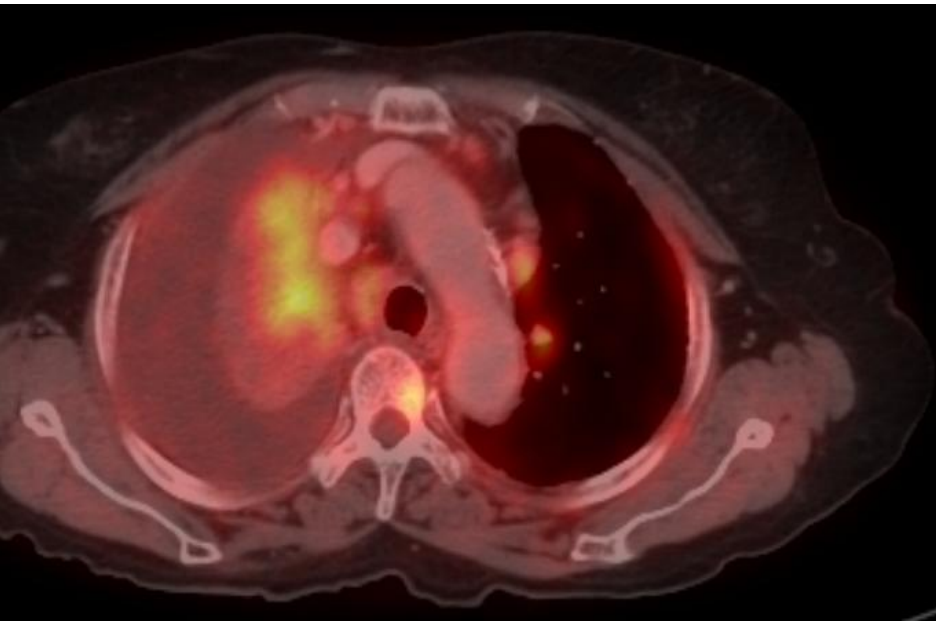


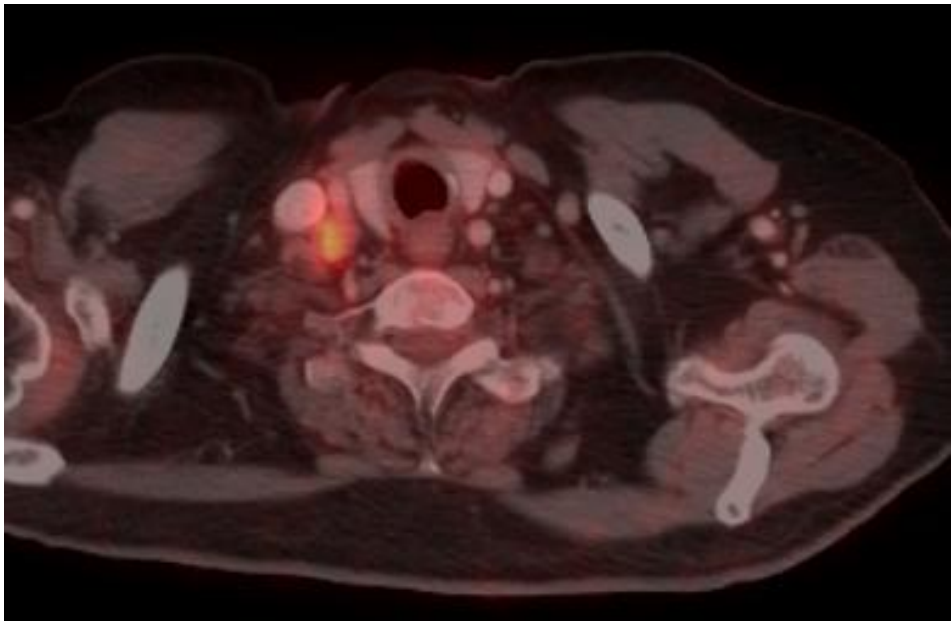


N2

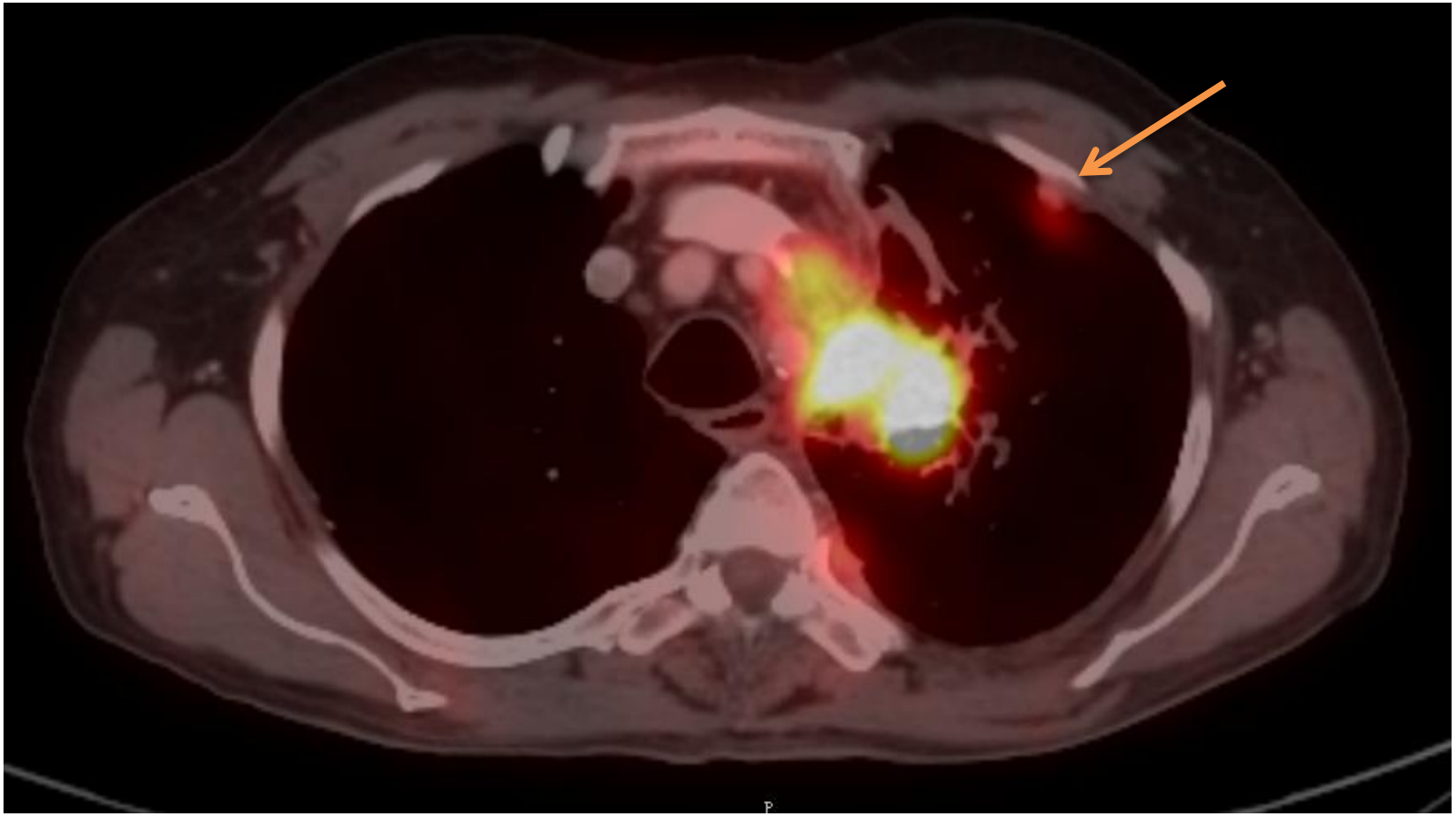


N3

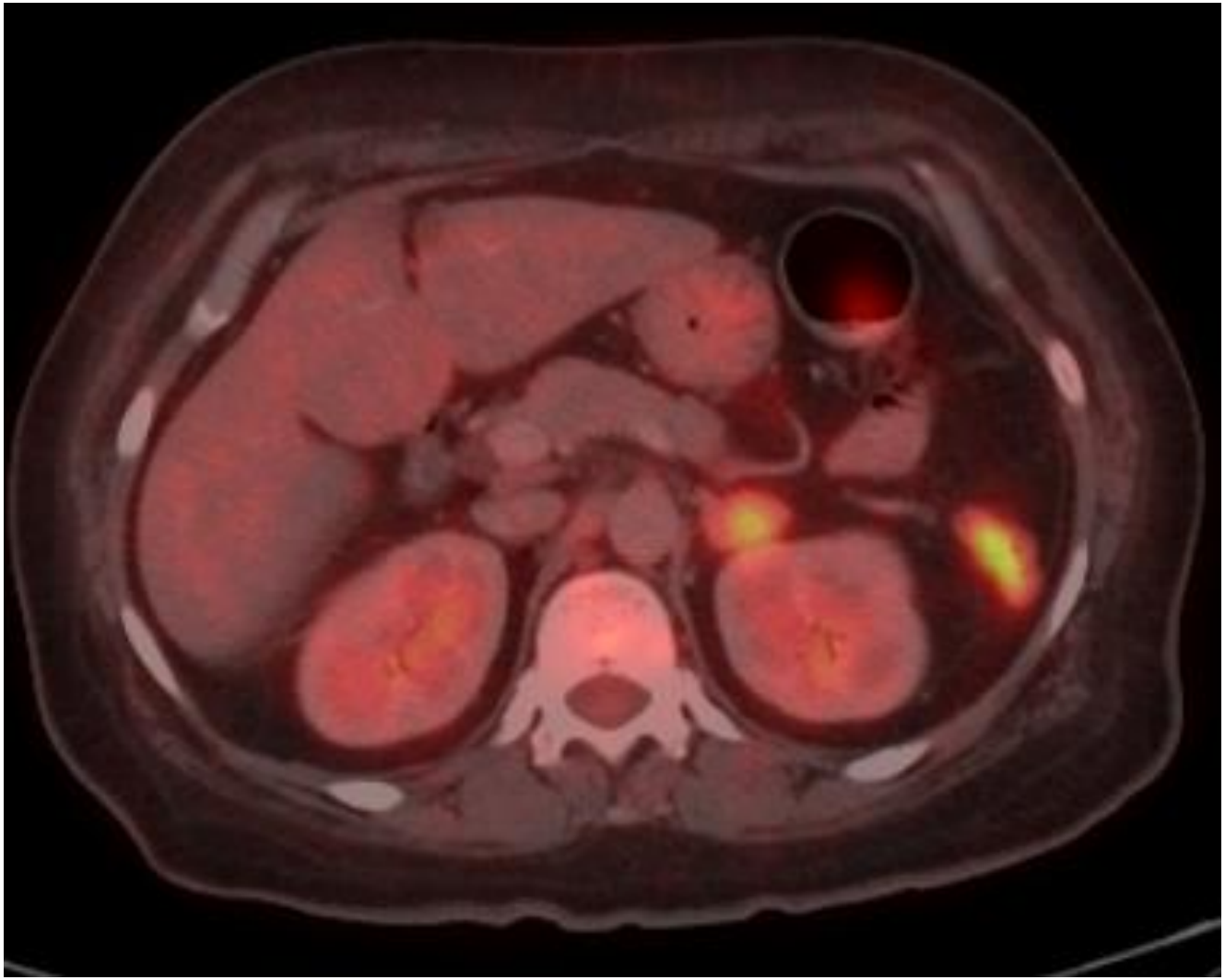




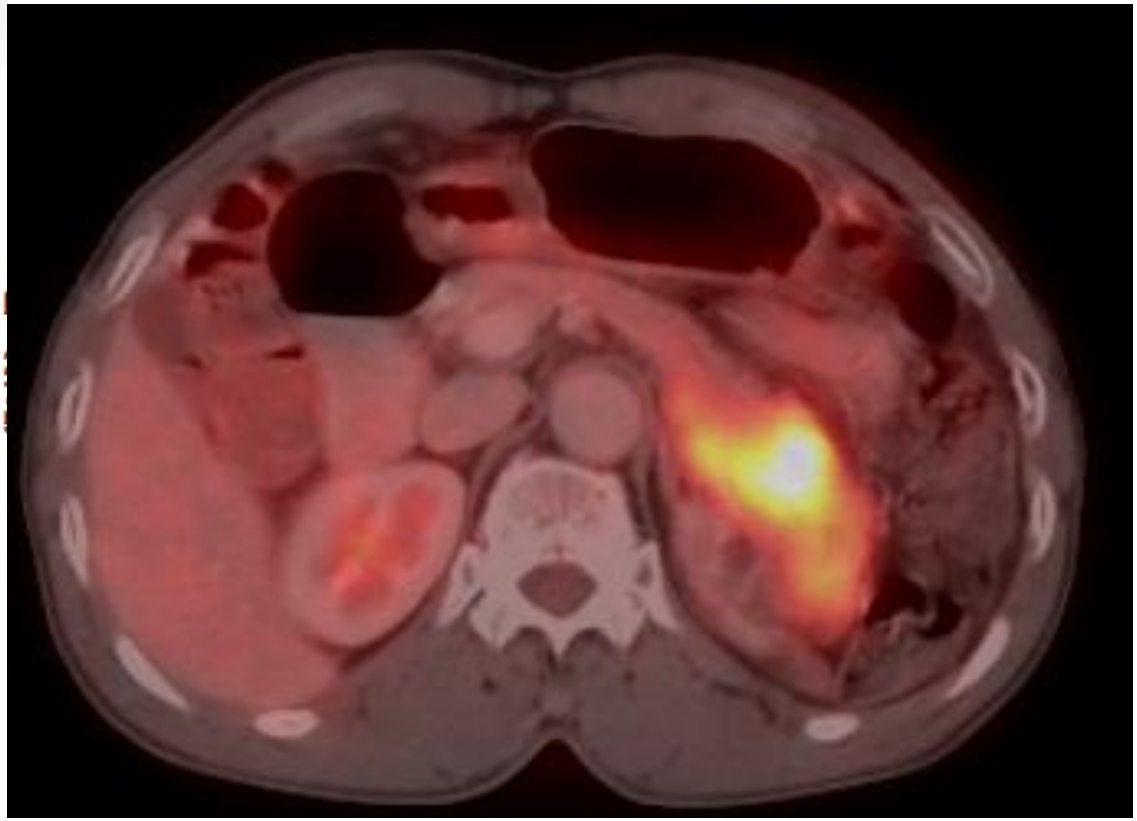
M1a – pleural nodule



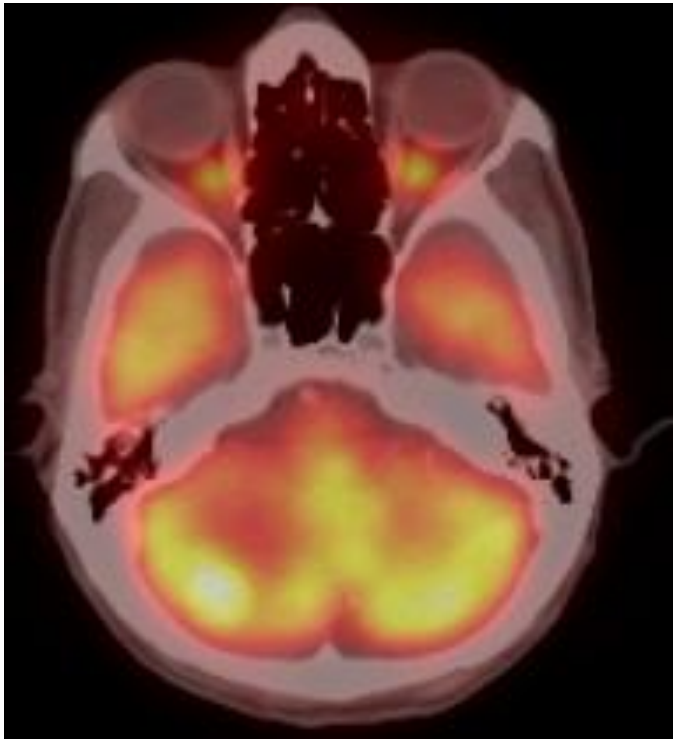
Adrenal



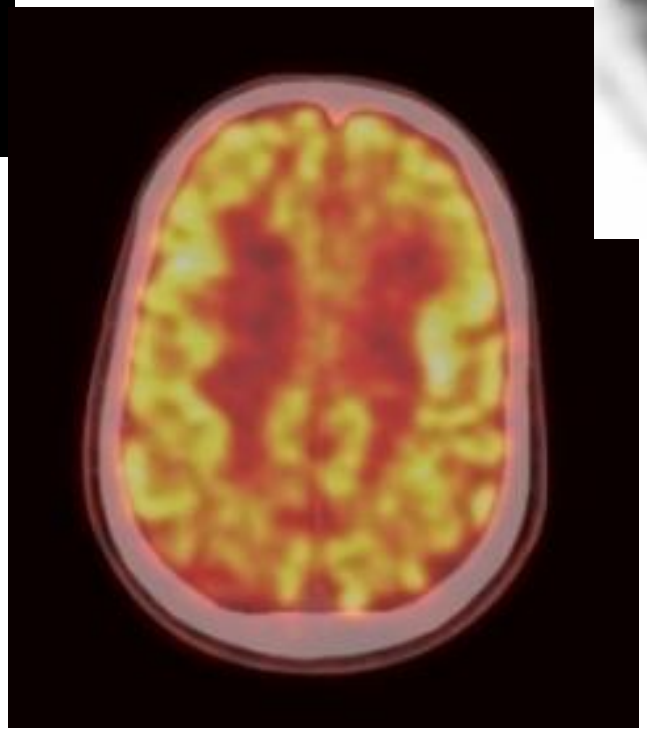
Pancreas

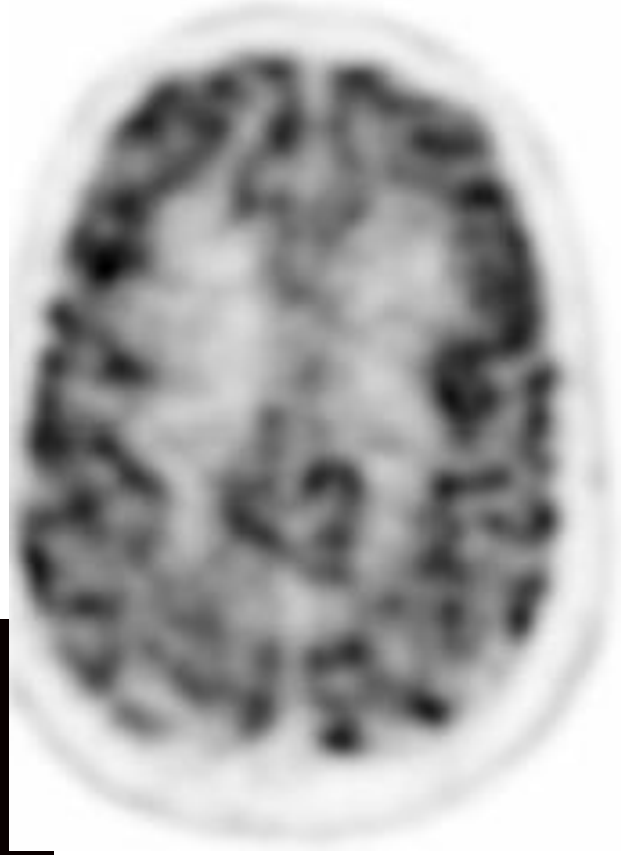


Brain



Brain





Brain mets - PET-CT/MRI