“FDG PET/CT in Lung Cancer”
Read with the experts

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HOW TO SPEAK TEXAN

HEAVEN | BANK | LUXURY CAR
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STATE BIRD | INSURANCE | OL' GLORY
DIVORCE | | GOURMET COOKING
| HELL | PICKLE | TOUPEE
| | CHAMPAGNE | ???
HOUSE PET | | FORMAL ATTIRE
Patient with suspected lung cancer presents with left sided chest pain
What is the T stage of this patient?

A) T2a
B) T2b
C) T3
D) T4
What is the T stage of this patient?

A) T2a
B) T2b
C) T3 *
D) T4
Modified Hammar Classification of Visceral Pleural Invasion (VPI) for lung cancer

If a tumor invades beyond the elastic layer it is PL1. Tumors that invade to the pleural surface are PL2 and those that invade into any component of the parietal pleura are PL3. PL1 or PL2 indicate VPI and are a T2 descriptor. PL3 indicates invasion of the parietal pleura and is a T3 descriptor.
If tumor is identified only in the left chest and no nodal or extra-thoracic disease is identified.
What is the stage of this patient?

A) IIB
B) IIIA
C) IIIB
D) IV
What is the stage of this patient?

A) IIB*
B) IIIA
C) IIIB
D) IV
T3

- Tumor > 7cm, Direct invasion:
  - chest wall
  - diaphragm, phrenic nerve
  - mediastinal pleura, parietal pericardium
  - main bronchus < 2cm to carina
  - Atelectasis/pneumonitis of entire lung
  - Separate tumor nodule/s in same lobe
EVERYTHING'S BIGGER IN TEXAS

It ain't braggin if it's true.
Superior sulcus tumor in a 56-year-old man with sensory loss in the region of the left ulnar nerve distribution and with hoarseness.
Superior sulcus tumor in a 56-year-old man with sensory loss in the region of the left ulnar nerve distribution and with hoarseness.
SST invading the fat above the apical pleura and encasing the subclavian artery (*). The upper \( (U) \) and middle \( (M) \) trunks of the brachial plexus are clearly separate from the mass, but the lower trunk has been encased and is no longer visible, which means that the tumor is not resectable.
What is the T stage of this patient?

A) T2a
B) T2b
C) T3
D) T4
What is the T stage of this patient?

A) T2a
B) T2b
C) T3
D) T4*
T4

• Tumor of any size that invades:
• mediastinum, heart, great vessels
• trachea, esophagus, vertebral body, carina
• malignant pericardial or pleural effusion
• Separate tumor nodule/s in a different ipsilateral lobe
FDG uptake by the arytenoid insertion of the right vocal cord

A) Metastatic
B) Vocal cord paralysis right side
C) Can’t tell need to biopsy
D) Vocal cord paralysis left side
FDG uptake by the arytenoid insertion of the right vocal cord

A) Metastatic
B) Vocal cord paralysis right side
C) Can’t tell need to biopsy
D) Vocal cord paralysis left side*
FDG uptake by the right adrenal gland

A) Likely metastatic
B) Likely physiologic
C) Can’t tell if malignant or benign
D) Related to vocal cord paralysis
FDG uptake by the right adrenal gland

A) Likely metastatic*
B) Likely physiologic
C) Can’t tell if malignant or benign
D) Related to vocal cord paralysis
Utility of PET/CT in differentiating benign from malignant adrenal nodules.

- 112 adrenal nodules in 96 patients.
- Adrenal nodules (+) if average SUV > the liver.
- 25 / 30 malignant nodules had (+) PET
- 12 / 82 benign nodules were (+) PET
- Sensitivity of 83.3% and Specificity of 85.4%.
- 4/5 malignant nodules with (+) PET had previous therapy.
- PPV was 67%, and the NPV was 93%.
- Adrenal masses that are not FDG avid are likely benign.
- Significant false-negative rate in patients being treated.
- A considerable # of benign nodules have FDG activity.

58-y/o NSCLC, CT showed 2.5-cm right adrenal low-attenuation lesion -19 HU

(C) 8 months later shows new focal FDG uptake in the right adrenal (SUV, 7.3) consistent with interval development of metastatic disease (arrow).
What is the stage of this patient?

A) IIB
B) IIIA
C) IIIB
D) IV
What is the stage of this patient?

A) IIB
B) IIIA
C) IIIB
D) IV*
Anatomy of the superior sulcus divided into anterior, middle, and posterior compartments by the scalene muscles. The anterior compartment contains the subclavian vein; the middle compartment (interscalene triangle) contains the subclavian artery and its branches, as well as the trunks of the brachial plexus; and the posterior compartment contains the costovertebral groove, the roots of the brachial plexus, and the stellate ganglion.
Sagittal T1-weighted MR image of the superior sulcus shows the courses of the C5 through T1 nerve roots laterally and inferiorly from the neurovertebral foramina. The T1 nerve root is located inferior to the neck of the first rib (R)
Clinical Summary

- Patient presented with a middle lobe opacity suspicious for lung cancer.
- FDG PET CT requested for staging.
Low grade FDG uptake in right middle lobe consolidation.
What is your impression of the right middle lobe consolidation?

a) RML malignancy
b) RML pneumonia
c) Cannot distinguish RML pneumonia from malignancy
d) Pulmonary metastasis from thyroid cancer
What is your impression of the right middle lobe consolidation?

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b) RML pneumonia
c) Cannot distinguish RML pneumonia from malignancy
d) Pulmonary metastasis from thyroid cancer
The tumor formerly known as “BAC”

- **Adenocarcinoma in situ** (<3 cm, solitary, pure lepidic growth; formerly BAC),
- **minimally invasive adenocarcinoma** (<3 cm with predominant lepidic growth and ≤5-mm invasion),
- **invasive adenocarcinoma**, and variants of invasive adenocarcinoma.

Pathology after surgery

• Right middle lobectomy:
• Multifocal well differentiated adenoca with papillary features and bronchoalveolar pattern.
• 0/8 nodes negative
FDG avid low density nodule in the right lobe of the thyroid gland. A lymph node with FDG uptake noted below left lobe of the thyroid.
What is your impression of the uptake in the right neck?

• A) Metastases from lung primary to the thyroid gland and right cervical node.
• B) Consideration of Thyroid primary with nodal metastasis can be evaluated with sonography
• C) Benign thyroid adenoma and right cervical inflammatory adenopathy.
• D) de Quervain (subacute) thyroiditis with right cervical inflammatory adenopathy.
What is your impression of the uptake in the right neck?

• A) Metastases from lung primary to the thyroid gland and right cervical node.
• B) Consideration of Thyroid primary with nodal metastasis can be evaluated with sonography*
• C) Benign thyroid adenoma and right cervical inflammatory adenopathy.
• D) de Quervain (subacute) thyroiditis with right cervical inflammatory adenopathy.
Pathology after surgery

• Total thyroidectomy:
• 2.2 cm papillary thyroid ca extending to soft tissue.
• Right Neck Dissection – 4/64 lymph nodes (+)
Discussion

• Incidental FDG avid focal nodules in the thyroid gland could represent a malignancy in about a third of these findings.
• Ultrasound evaluation with biopsy may be necessary to verify either a benign thyroid nodule or cancer.
Prevalence of malignant incidental thyroid nodules on FDG PET

- 55,160 patients with 571 patients (1%) having an unexpected focal abnormality
- Confirmed Dx: 200 (62.1%) benign, 107 (33.2%) malignant, 15 (4.7%) indeterminate
- Papillary thyroid ca 82.2% most prevalent.
- mean max SUV for 73 benign lesions was 4.6+/-2.1, and for the 52 malignant lesions was 6.8+/-4.6 (P<0.001).

I'm from Texas, and one of the reasons I like Texas is because there's no one in control.
Willie Nelson
A 61-year-old man with a 4-month history of cough. CT scan shows a left upper lobe mass and right paratracheal adenopathy.
What is your impression of the contralateral paratracheal adenopathy?

A) Possibility of malignant adenopathy should be considered.

B) Chronic inflammatory adenopathy.

C) Sarcoidosis

D) Negative FDG in lymph node indicates absence of malignancy in this site.
What is your impression of the contralateral paratracheal adenopathy?

A) Possibility of malignant adenopathy should be considered.*
B) Chronic inflammatory adenopathy.
C) Sarcoidosis
D) Negative FDG in lymph node indicates absence of malignancy in this site.
A 61-year-old man with a 4-month history of cough. CT scan shows a left upper lobe mass and right paratracheal adenopathy.

Mediastinoscopy confirmed N3 (contralateral nodal) disease from the primary lung cancer and the patient was treated palliatively. A negative PET scan does not preclude biopsy of enlarged mediastinal lymph nodes.
Clinical Summary

• Newly diagnosed Left upper lobe lung cancer with left upper lobe bronchus obstruction.

• FDG PET/CT performed for radiotherapy planning.
Left upper lobe lung primary and right upper lobe FDG avid lesion
Tree in bud appearance in right upper lobe
What is your diagnosis of the FDG avid RUL nodules?

A) Findings typical for atypical mycobacterial infection.

B) Findings typical for lymphangitic carcinomatosis.

C) Findings typical for multifocal well differentiated adenocarcinoma of the lung.

D) Findings typical for pulmonary sarcoidosis.
What is your diagnosis of the FDG avid RUL nodules?

A) Findings typical for atypical mycobacterial infection.*

B) Findings typical for lymphangitic carcinomatosis.

C) Findings typical for multifocal well differentiated adenocarcinoma of the lung.

D) Findings typical for pulmonary sarcoidosis.
Tree in bud appearance in right upper lobe typical for atypical mycobacterial infection
DIAGNOSIS
No evidence of malignancy
Granulation tissue and chronic inflammation consistent with organizing pneumonia

SUPPLEMENTAL REPORT
A GMS stain, performed over a Pap-stained smear, is negative for Pneumocystis and fungal forms. There is no change in the diagnosis.

BAL – grew MAI- therapy with azithromycin, ciprofloxacin, and ethambutol.
Patient with NSCLC with hematogenously disseminated lung metastases. RUL primary (M) and multiple discrete sharply margined nodules.
Patient with NSCLC and lymphangitic carcinomatosis. CT shows thickening of interlobular septa and peribronchovascular interstitium and visualization of the polygonal shape of the secondary pulmonary lobules.
Patterns of Tumor Spread
Lung Cancer

• Incidence of hematogenously disseminated metastases is related to cell type.
• Hematogenous dissemination occurs late with SCC.
• Hematogenous dissemination is high with invasive adenocarcinoma, large cell ca, and small cell ca and low with localized/indolent adenocarcinoma.
• Lymphatic dissemination of metastasis occurs late with SCC and early and frequently in patients with invasive adenocarcinoma, large cell carcinoma, and SCLC.
• Lymphatic pathways explaining the likely pattern of spread of mediastinal nodal metastases based on the lobar location of the primary tumor are unreliable.
Clinical Summary

• Physician with suspected lung cancer
• He had lung biopsy the day before
• Had complaints of shortness of breath after the PET/CT scan
FDG avid right lung mass
Pneumothorax
Clinical Summary

52 year old patient with CNS high grade B-cell lymphoma, previously treated with chemotherapy referred for restaging.
What is your impression of the uptake in crico-arytenoid muscles and the diaphragm?

A) Lymphoma
B) Inflammation or lymphoma
C) Inflammation
D) Variant uptake
What is your impression of the uptake in crico-arytenoid muscles and the diaphragm?

A) Lymphoma
B) Inflammation or lymphoma
C) Inflammation
D) Variant uptake*
Answer: Variant uptake caused by singultus

- Patient had chronic hiccups, for 2 weeks.

- Continued to have hiccups during the uptake phase following FDG injection and PET/CT scanning.
Teaching points

• FDG uptake is increased in muscles contracting during the uptake phase.

• History is important, including the patient conditions during the period following FDG injection and during image acquisition.
EVERYTHING'S BIGGER IN TEXAS

It ain’t braggin if its true.
QUEEN B!
Beyoncé
RULES THE WORLD

GABRIELLE
GIFFORDS
FIGHTING FOR
GUN CONTROL

PHOEBE
PHILO
THE WOMAN
BEHIND
THE CULT OF
CÉLINE

NEW LOOKS
FOR NIGHT
SIMPLE, SLEEK
ELEGANCE

SENSITIVITY
TRAINING
HOW TO
REPAIR
WINTER-
 DAMAGED
SKIN

618 PAGES OF
SPRING
SURPRISES

STRONG AND
SEXY SUITS
SHOCKINGLY CHIC
ACCESSORIES
CLASSICS REMIXED