

AMSER Case of the Month: May 2020

61 year-old woman with history of lung cancer (s/p chemo + radiation) who now presents for staging after tumor recurrence

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Patient Presentation

- HPI:
 - 61 year-old female former smoker with history of COPD and NSCLC (T4N0M0) s/p chemo + radiation who now presents for 6 mo follow-up s/p starting immunotherapy for lung cancer recurrence
- PMH: COPD, microangiopathic hemolytic anemia, chronic heart failure
- Medications: Albuterol inhaler, budesonide-folmeterol inhaler, omeprazole 40mg daily, prednisone 10mg daily, umeclidinium bromide inhaler
- Allergies: Penicillin
- Oncology history:
 - Carboplatin/paclitaxel + radiation therapy twelve months ago
 - Carboplatin/vinorelbine + radiation eight months ago
 - CT imaging showed lesions concerning for progression
 - Initiated pembrolizumab (anti-PD1) six months ago

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 1: Noninvasive initial clinical staging of non-small-cell lung carcinoma.

Procedure	Appropriateness Category	Relative Radiation Level
CT chest with IV contrast	Usually Appropriate	☼☼☼
FDG-PET/CT skull base to mid-thigh	Usually Appropriate	☼☼☼☼
MRI head without and with IV contrast	Usually Appropriate	○
CT chest without IV contrast	Usually Appropriate	☼☼☼
CT abdomen and pelvis with IV contrast	May Be Appropriate	☼☼☼
CT head with IV contrast	May Be Appropriate	☼☼☼
CT head without and with IV contrast	May Be Appropriate	☼☼☼
MRI abdomen without and with IV contrast	May Be Appropriate	○
MRI chest without and with IV contrast	May Be Appropriate	○
MRI head without IV contrast	May Be Appropriate	○
Bone scan whole body	May Be Appropriate	☼☼☼
CT abdomen and pelvis without and with IV contrast	May Be Appropriate	☼☼☼☼
CT abdomen and pelvis without IV contrast	May Be Appropriate	☼☼☼
MRI abdomen without IV contrast	May Be Appropriate	○
CT head without IV contrast	Usually Not Appropriate	☼☼☼
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest without and with IV contrast	Usually Not Appropriate	☼☼☼
Radiography chest	Usually Not Appropriate	☼

This imaging modality was ordered by the oncologist

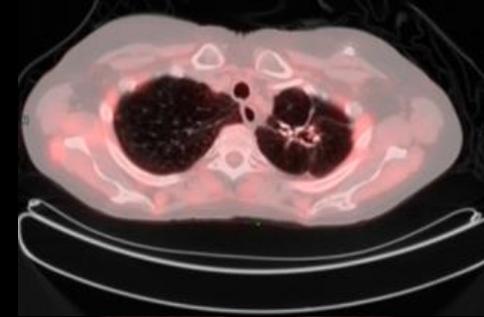
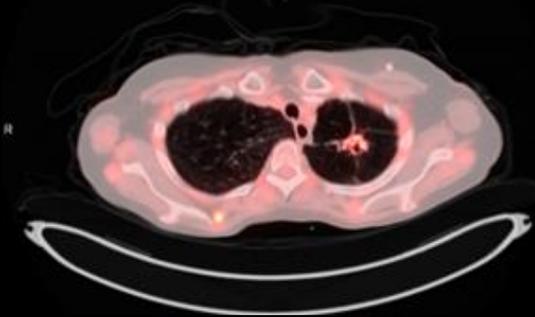


Findings 1: (unlabeled)

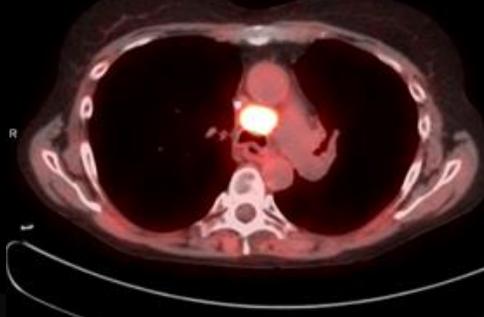
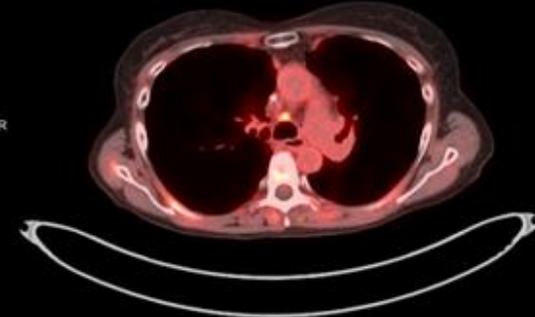
Pre-treatment

Post-treatment

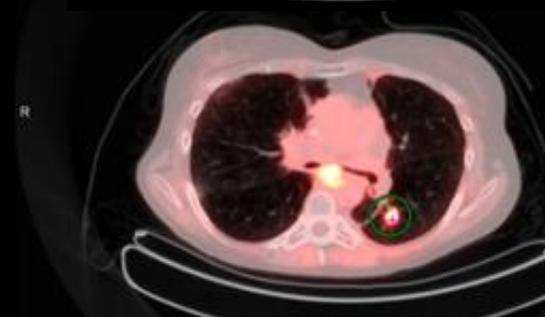
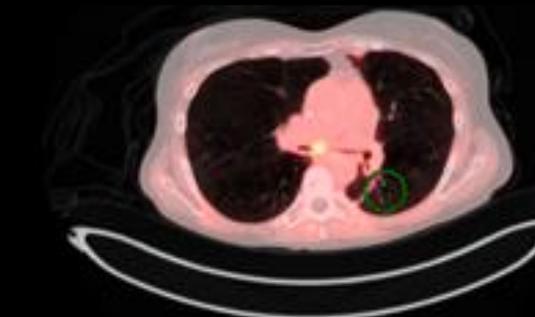
Axial Image 1



Axial Image 2



Axial Image 3

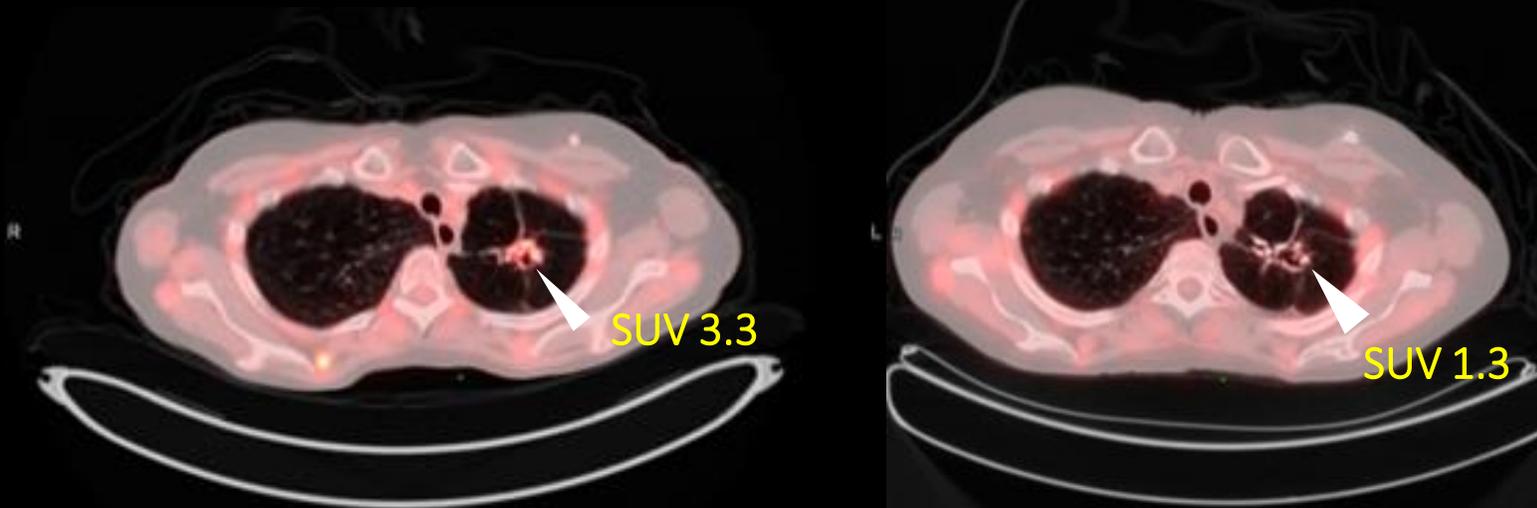


Findings 1: (labeled)

Pre-treatment

Post-treatment

Image 1



Post-treatment findings

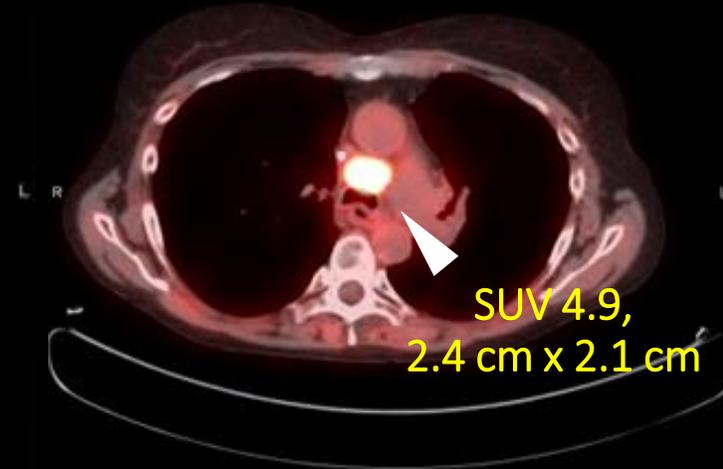
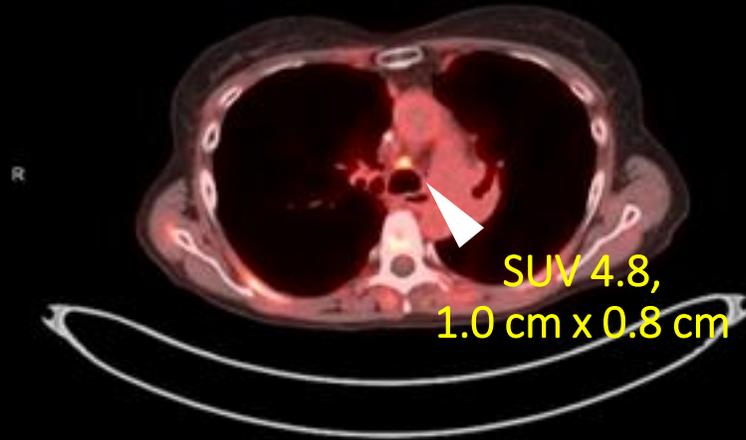
- Stable previously irradiated tumor in left upper lobe with decreased FDG uptake

Findings 1: (labeled)

Pre-treatment

Post-treatment

Image 2



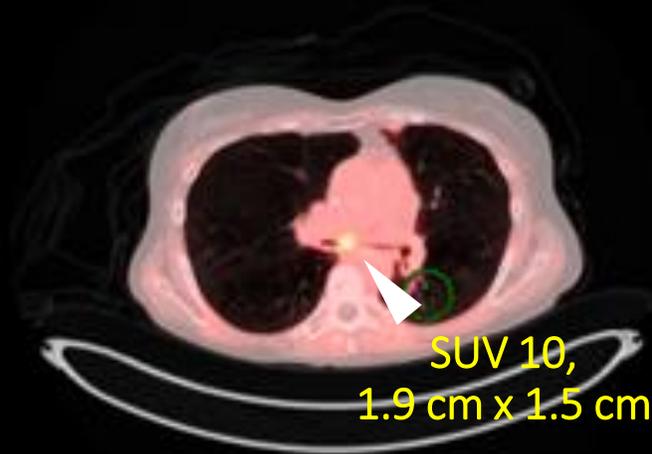
Post-treatment findings

- Enlarged FDG-avid pretracheal lymph node

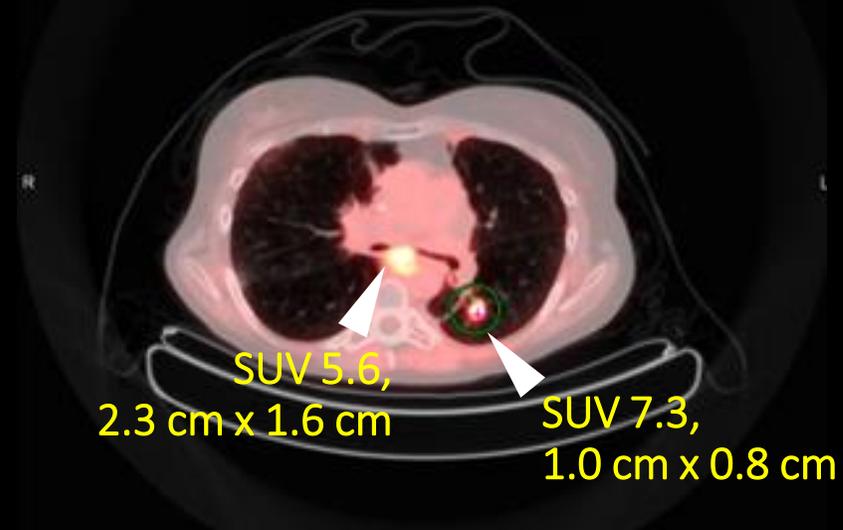
Findings 3: (labeled)

Image 3

Pre-treatment



Post-treatment



Post-treatment findings

- Enlarged FDG-avid subcarinal lymph node
- New lower left lobe lesion that is FDG avid

Differential Dx:

Cancer progression vs tumor pseudoprogression

Final Dx:

Tumor pseudoprogression s/p immunotherapy

- Immunotherapies (e.g. PD-L1 and CTLA4 checkpoint blockade and CART cells) can make disease look worse on interim scan
- This temporary phenomenon is called pseudoprogression (secondary inflammatory changes superimposed on the lesions)

Criteria for evaluating treatment response in cancer by CT/MR

- RECIST (Response Evaluation Criteria In Solid Tumors) remains a standard for evaluating tumor response to oncology
- RECIST was developed and validated for cytotoxic treatments in multi-lesion disease
- Classifying RECIST response requires measurement of target lesions, non-target lesions, and new growths

RECIST Response

RECIST Response	Target Lesion	Non-target Lesion	New lesions
Complete	Complete	Complete	No
Partial	Complete	Noncomplete	No
Partial	Complete	Not all evaluated	No
Partial	Partial	Nonprogressive	No
Partial	Partial	Not all evaluated	No
Stable	Stable	Nonprogressive	No
Stable	Stable	Not all evaluated	No
Progressive	Progressive	Any	Yes/No
Progressive	Any	Progressive	Yes/No
Progressive	Any	Any	Yes
Nonevaluable	Not all evaluated	Nonprogressive	No

Adapted from Chalian et al. *Radiographics* 2011.

Classifying pseudoprogression with immunotherapy by CT/MR

- Progressive disease on imaging after immunotherapy is 'unconfirmed progression'
- Treatment continues based on clinical status, and repeat imaging is needed to monitor response
- New immune-based RECIST (iRECIST) criteria are undergoing clinical evaluation

RECIST Response	iRECIST Criteria
Complete	Disappearance of all lesions
Partial	> 30% decrease in tumor burden OR >15% decrease in CT attenuation
Progressive	Unconfirmed: Complete or Partial
	Confirmed: Progressive
New lesions	Unconfirmed progressive
Stable	None of the above

Adapted from Beer L et al. *Magazine of European Medical Oncology* 2018.

Nuclear imaging of cancer has unique response criteria

- For nuclear imaging studies, PERCIST (PET Response in Solid Tumors) criteria is used for evaluating FDG-PET imaging
- Immunotherapy promotes glucose uptake in immune cells, mimicking disease progression on FDG-PET imaging – i.e. pseudoprogression
- Immune-PERCIST criteria have been proposed for interpreting FDG-PET images for patients on immunotherapy

Response	PERCIST Criteria
Complete	Visual disappearance of all metabolically active tumor
Partial	>30% decrease in SUL peak (at least 0.8 units in brightest lesion)
Progressive	>30% increase in SUL peak (at least 0.8 units)
	>75% increase in total lesion glycolysis
Stable	Does not meet other criteria

Adapted from Wahl RL et al. *J Nuc Med.* 2009.

References:

1. American College of Radiology. ACR Appropriateness Criteria for Noninvasive Clinical Staging of Primary Lung Cancer. Available at <https://acsearch.acr.org/docs/69456/Narrative/>. Accessed Jan 28 2020.
2. Chalian H et al. Radiologic assessment of response to therapy: comparison of RECIST Versions 1.1 and 1.0. *Radiographics*. 2011 Nov-Dec;31(7):2093-105.
3. Beer L, Hochmair M, and Prosch H. Pitfalls in the radiological response assessment of immunotherapy. *Memo*. 2018;11(2):138-143.
4. Wahl RL et al. From RECIST to PERCIST: Evolving Considerations for PET Response Criteria in Solid Tumors. *J Nucl Med*. 2009 May;50 Suppl 1:122S-50S.