PET/CT in Gastroesophageal Cancer

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Outline

- **Background**
- **Gastric cancer characteristics**
- **Staging**
  - Primary tumor
  - Lymph node disease
  - Distant metastases
  - Synchronous primary tumor
- **Treatment Response Assessment**
- **Disease Recurrence**
- **Prognosis**

Background

- 7.4 new cases of gastric cancer per 100,000 per year in the US
- 15th leading cause of cancer death
- Lifetime risk: 0.9%
- New cases in 2016: 26,370
- Number of deaths: 10,730
- 5 year survival rate: 30.4% (66.9% in localized disease; 30.9% in regional disease; 5.0% in distant disease)

Pathology

- Majority arise from gastric mucosa and are classified as:
  - Adenocarcinomas.
  - Lymphoid tissue
  - Neuroendocrine cells
  - The muscular layers of the stomach wall
- Most are sporadic. True hereditary cancers are rare.

PET/CT in Gastric Cancers

- **^{18}F-FDG** PET/CT has been evaluated in the:
  - Staging
  - Treatment response evaluation
  - Recurrence detection
  - Follow-up and prognosis
- **^{18}F-Fluorothymidine (FLT)** – can be useful in tumors without or low FDG activity

Imaging Protocol

Patient

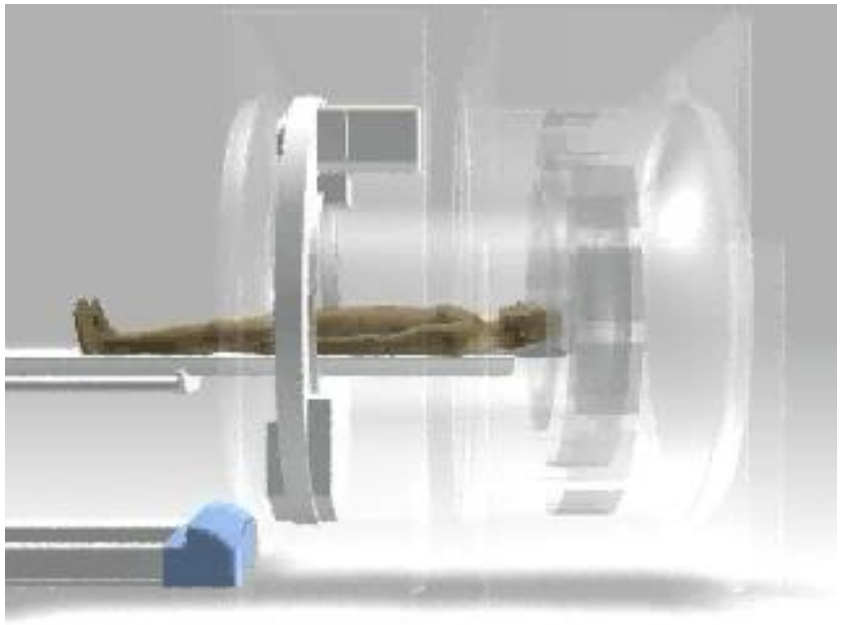
- Fast 4 hrs prior to exam
- Inject tracer
- Start scan 60 min later

CT

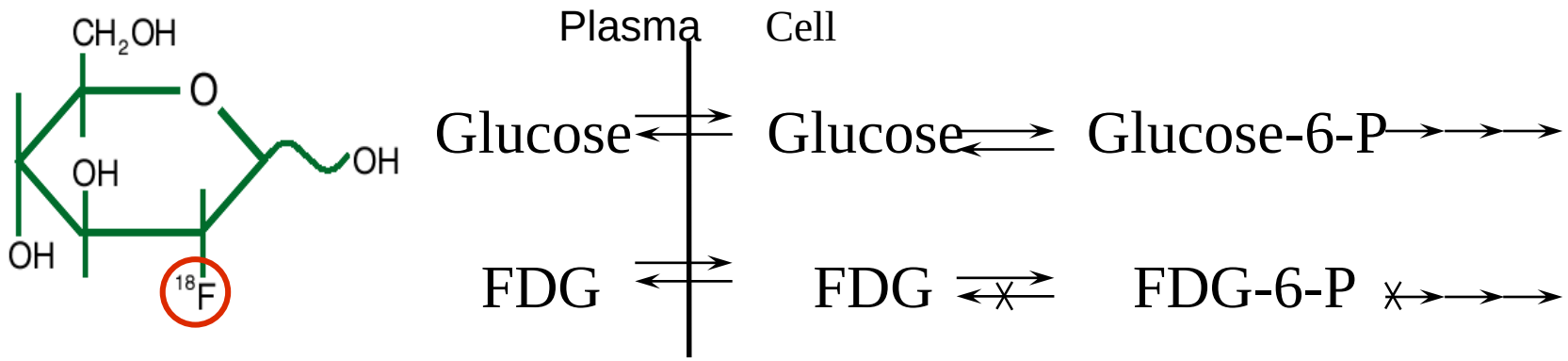
- Topogram (scout)
- CT scan (1 min)

PET

- Brain (10 min)
- Heart (10 min)
- Body (20 min)



PET Tracer: FDG

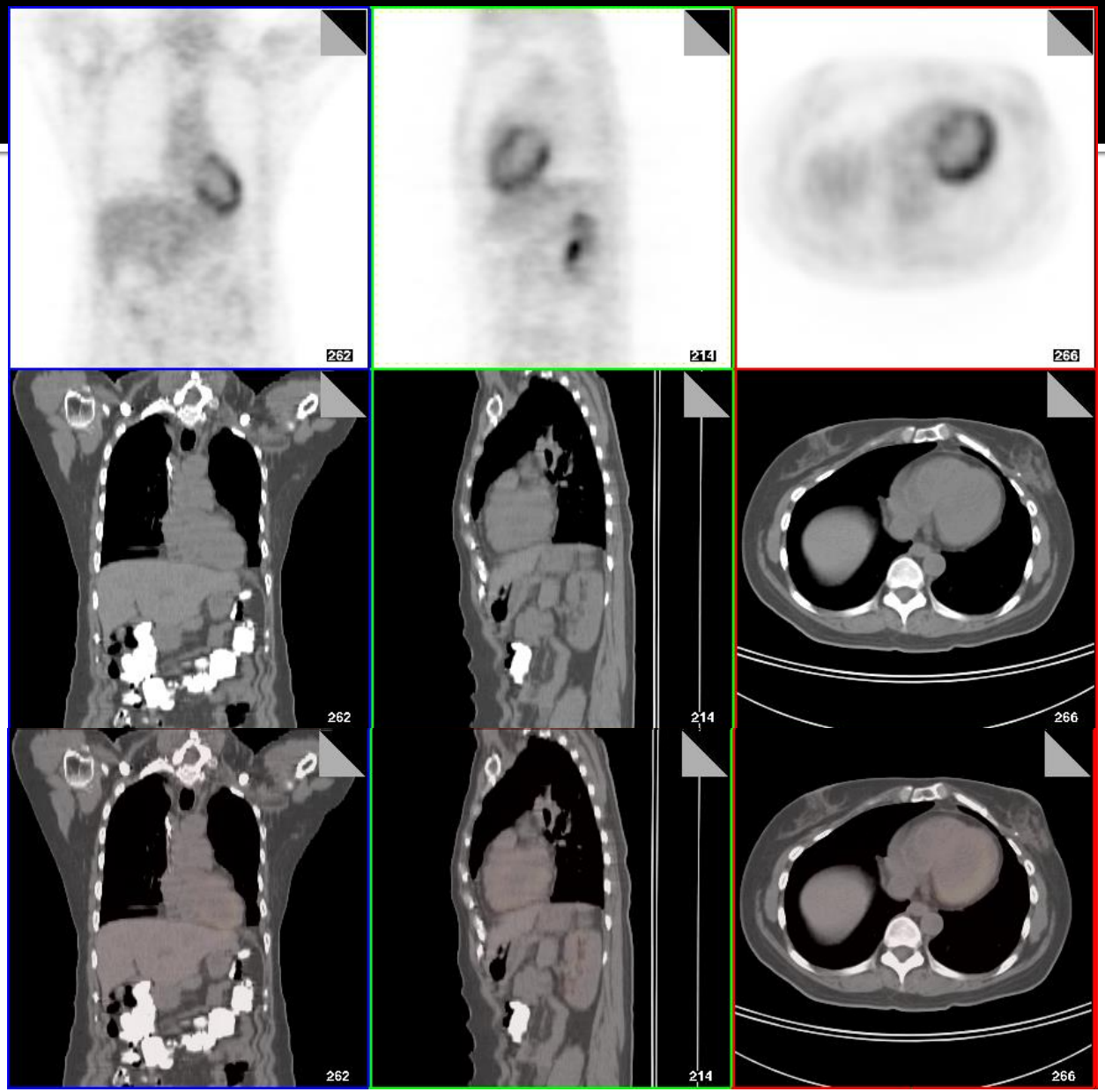


18F-fluorodeoxyglucose (FDG) is taken up by cells proportionate to their metabolic rates

PET

CT

PET/CT



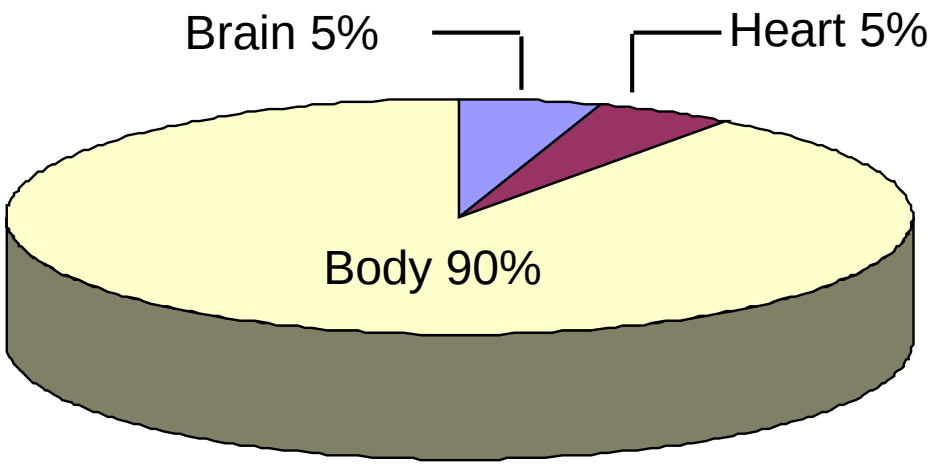
FDG 15 mCi
Bed 1 min

KVs 130 kV
mAs 75 mA
Slice 5 mm

H.S., 077-64-28

Applications of PET-CT

- epilepsy
- tumor
- dementia

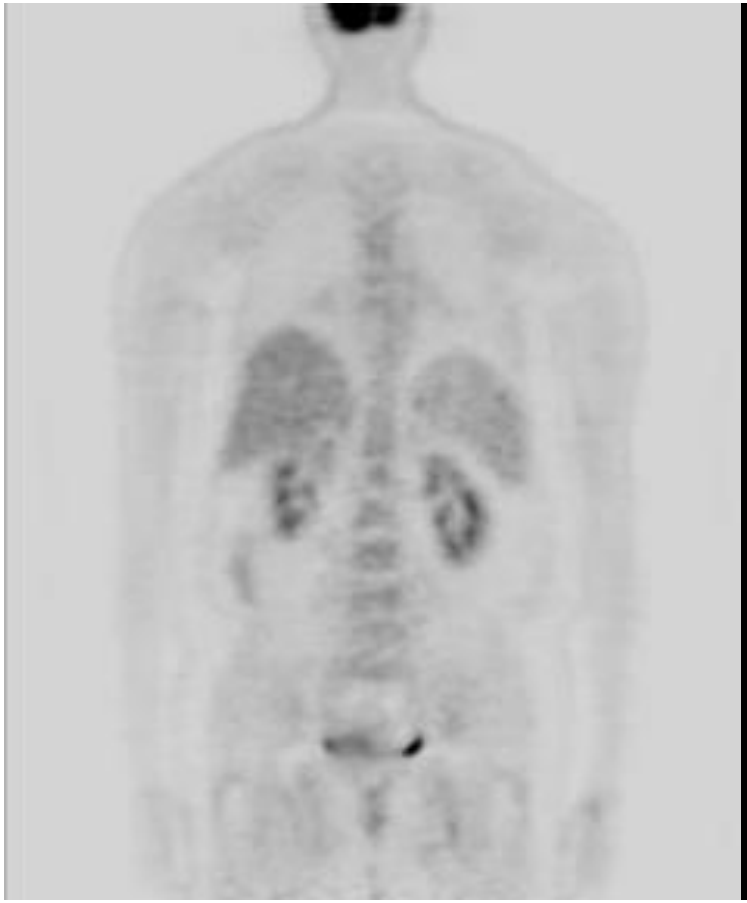


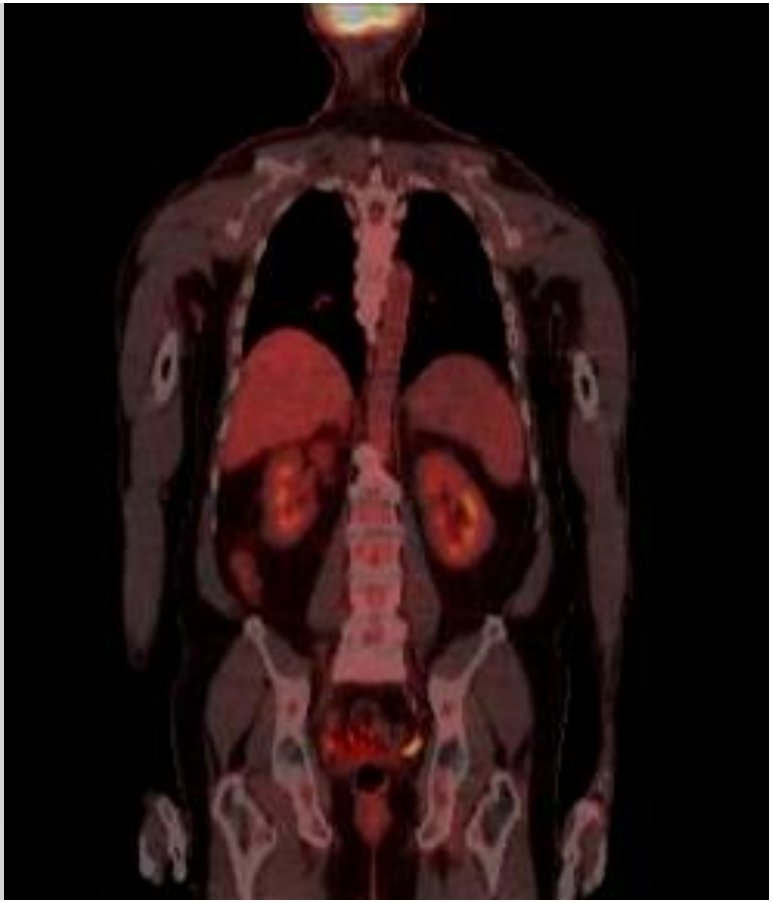
1.5 million exams performed annually

- perfusion
- viability

- tumor
- infection
- bone

Normal PET - CT Body Scan

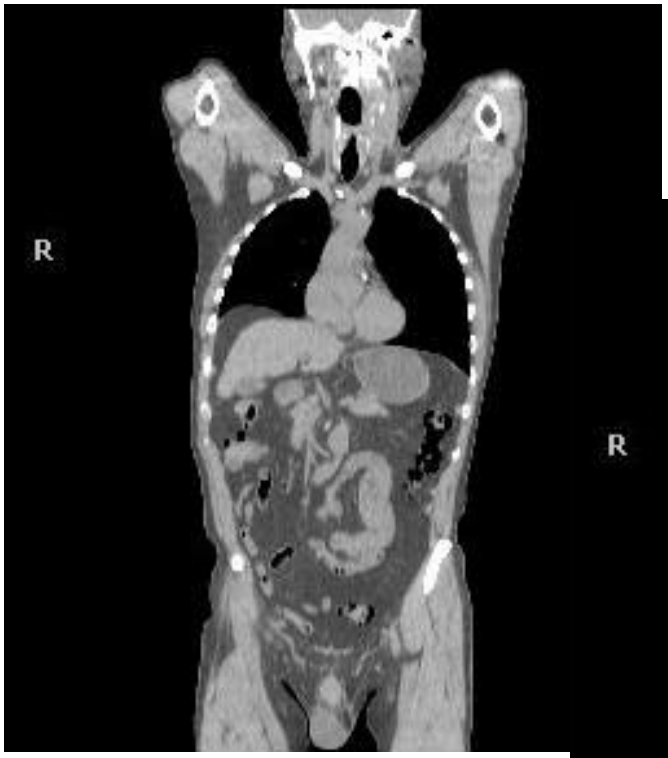




Normal PET/CT scan

QuickTime™ and a
decompressor
are needed to see this picture.

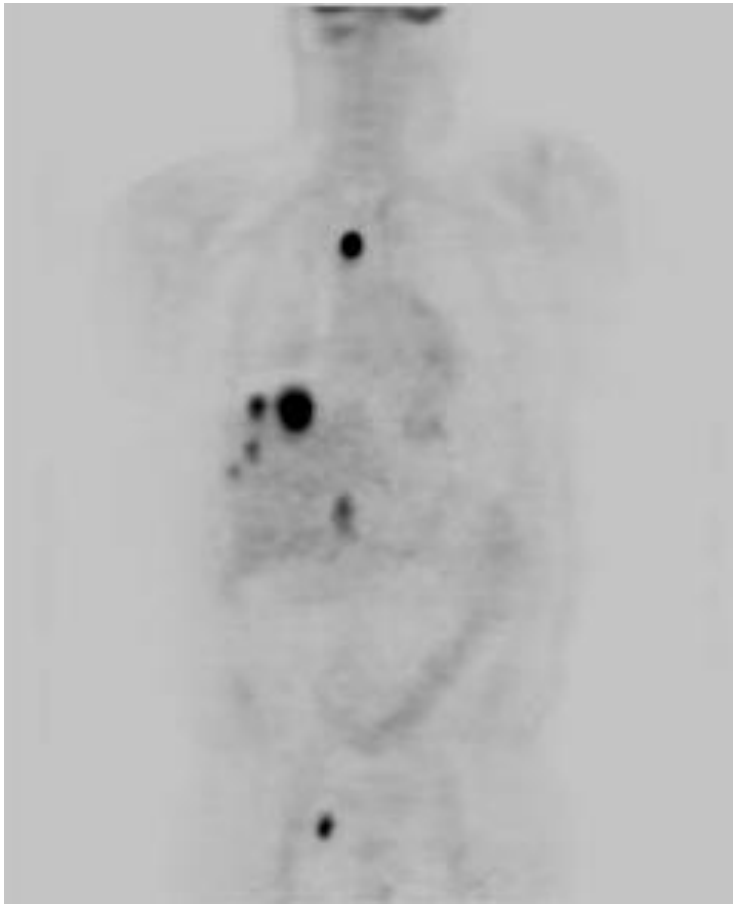
PET

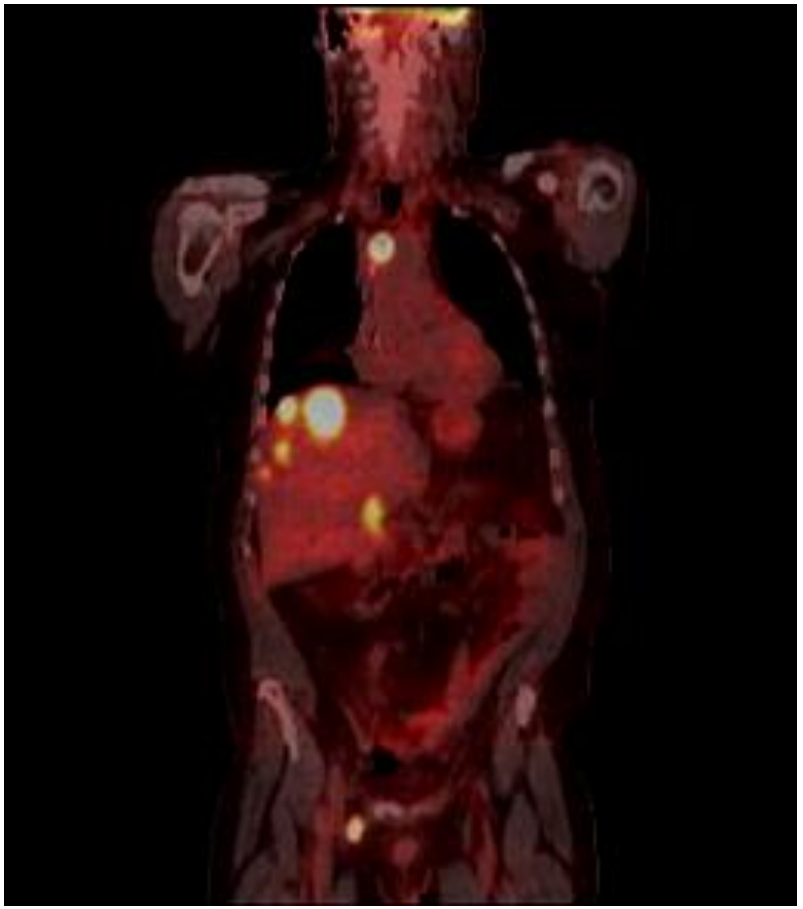


CT

PET/CT

Abnormal PET - CT Body Scan





Staging

- Primary tumor evaluation, locoregional and distant lymph node involvement, distant metastases
- Accurate staging and thereby impact on management
- Change in stage in 28.9% gastric adenocarcinoma patients
- Of those who were upstaged 64.5% developed progressive disease
- In patients with primary gastric lymphoma – change in stage in up to 35% of patients

Primary Tumor

- No significant difference in SN and SP between CECT and 18F-FDG PET/CT
- Level of FDG activity in the primary tumor and lymph nodes may predict non-curative resection (p=0.001)

- SUV: Standard Uptake Value

$$\mathrm{SUV}\left(\mathrm{g/ml}\right)=\frac{\text{activity concentration}\left(\mathrm{kBq/ml}\right)}{\text{administered activity}\left(\mathrm{MBq}\right)\Big/\text{weight}\left(\mathrm{kg}\right)}.$$

Primary Tumor peak-SUV

- Primary tumor peak-SUV associated with:
  - Age (p=0.009)
  - Tumor depth (p<0.001)
  - Size (p<0.001)
  - LN metastases (p<0.001)
- SUV-max higher in:
  - T3/T4 tumors in comparison to T1/T2 tumors (9.0 vs. 3.8, p<0.001)
  - Distant metastases vs. no metastases (9.5 vs. 7.7, p=0.018)
  - Stage III/IV vs. stage I/II (9.0 vs. 4.7, p=0.017)

- **Differentiating lesions with FDG uptake?**
  - Dual-time point imaging at 1 and 2h after injection has been evaluated
  - 85% with **increased** SUVmax had a **malignant** lesion
  - 90% with **decreased** SUVmax had a **benign** lesion ($p<0.001$)

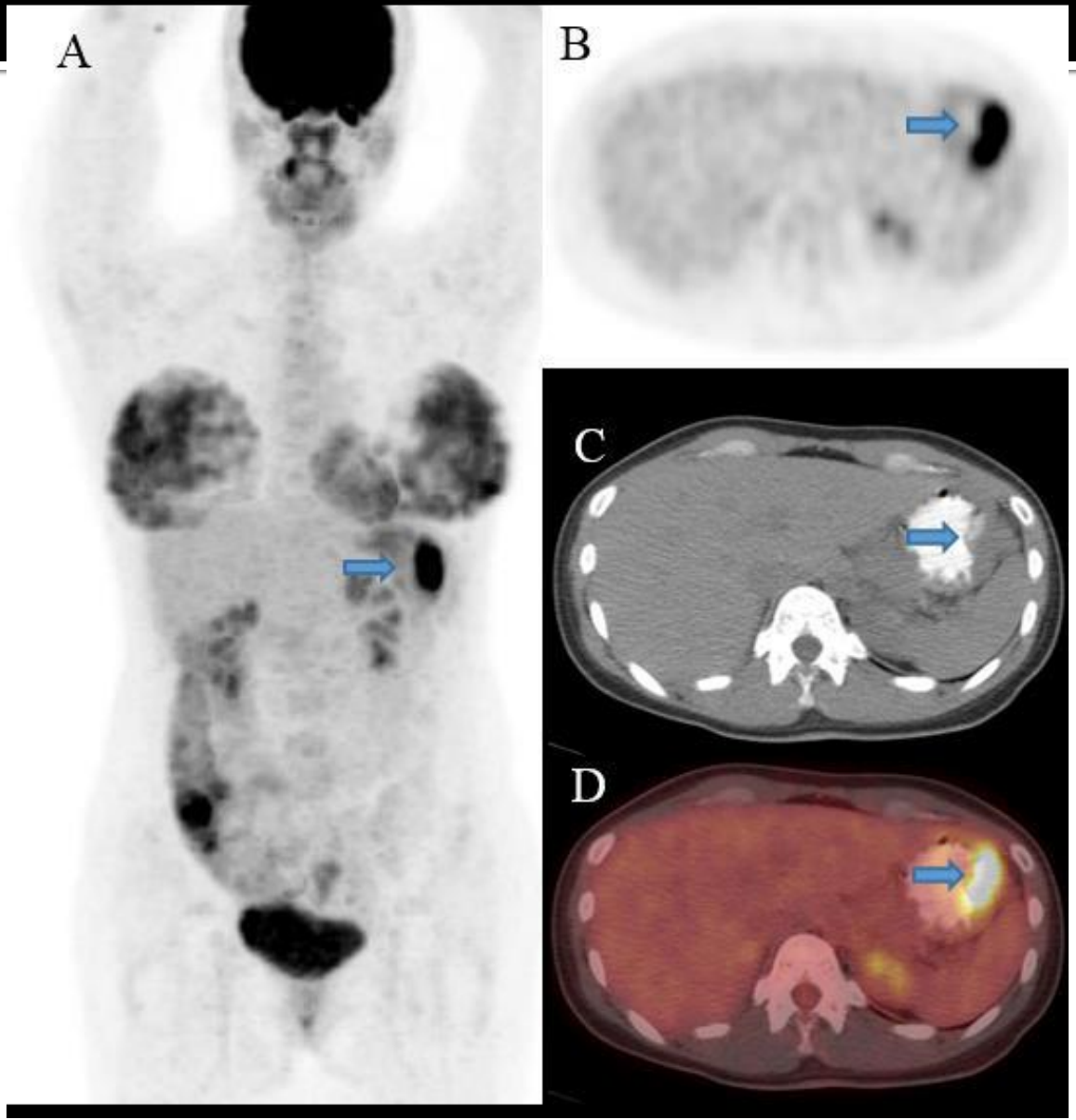
- **Differentiating tumors based on their histopathology**
  - Aggressive NHL exhibits **higher SUVmax** than gastric adenocarcinoma ($p<0.05$)
  - **Pattern of FDG uptake** may help differentiate gastric cancer from lymphoma

Pattern of FDG uptake

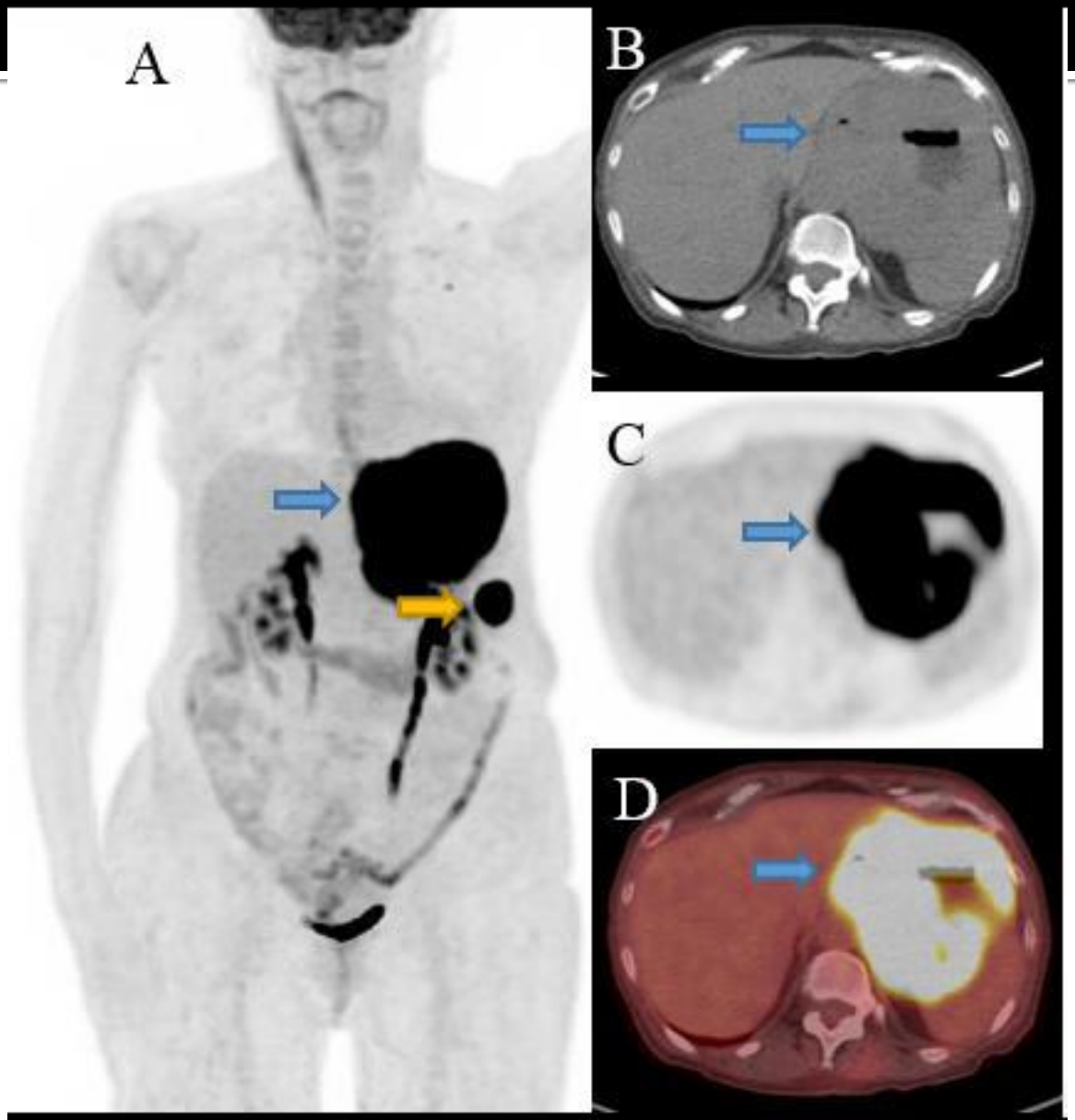
- **Type I**: Diffuse thickening of the gastric wall with increased FDG uptake of more than 1/3rd of the stomach
- **Type II**: Segmental thickening of the gastric wall with increased FDG uptake involving less than 1/3rd of the stomach
- **Type III**: Local thickening with focal FDG uptake

- **Gastric lymphoma: Type I and II**
- **Gastric Adenocarcinoma: Type II and III**
- The incidence of the involvement of more than one region of the stomach was higher in gastric lymphoma

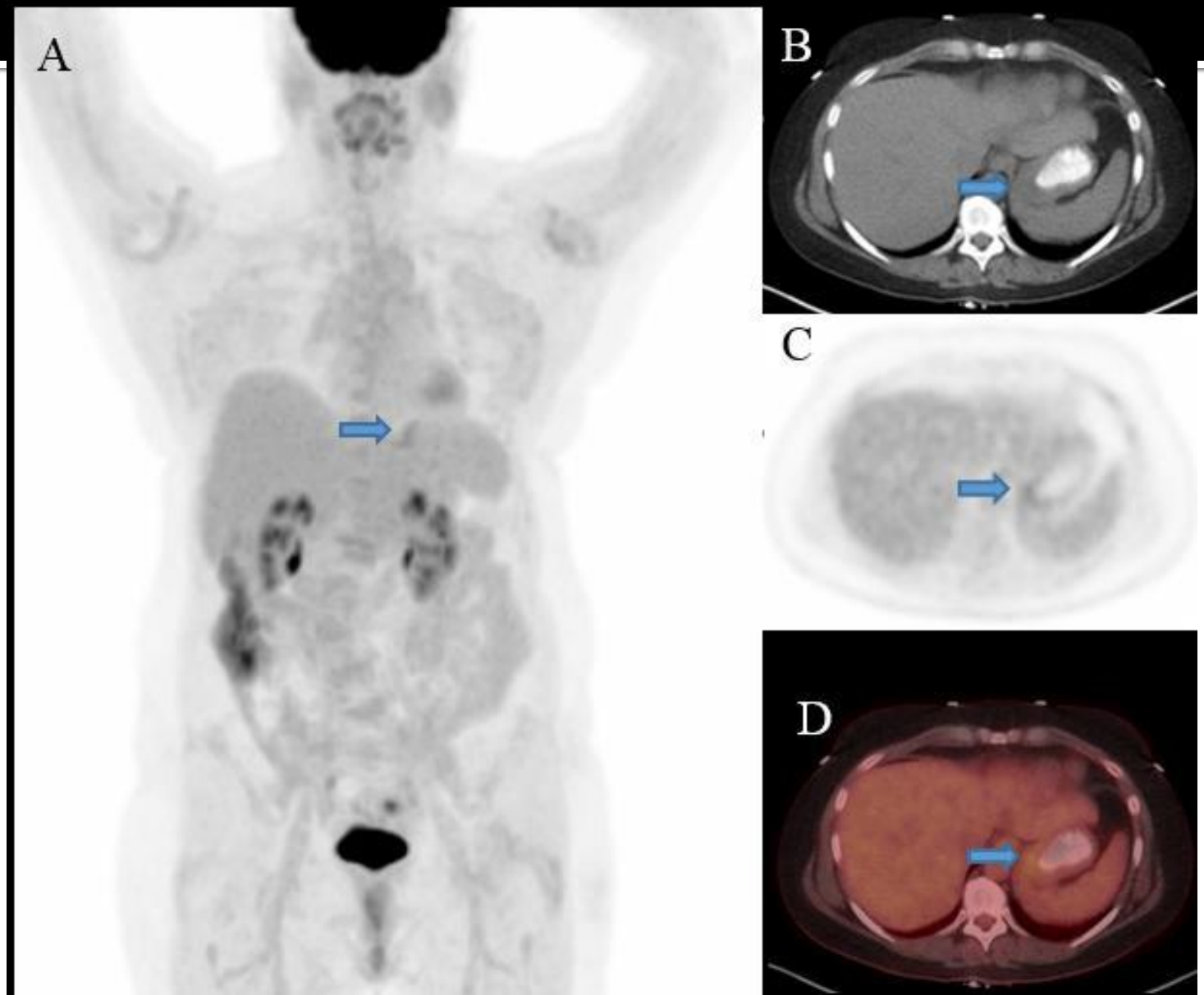
Case example



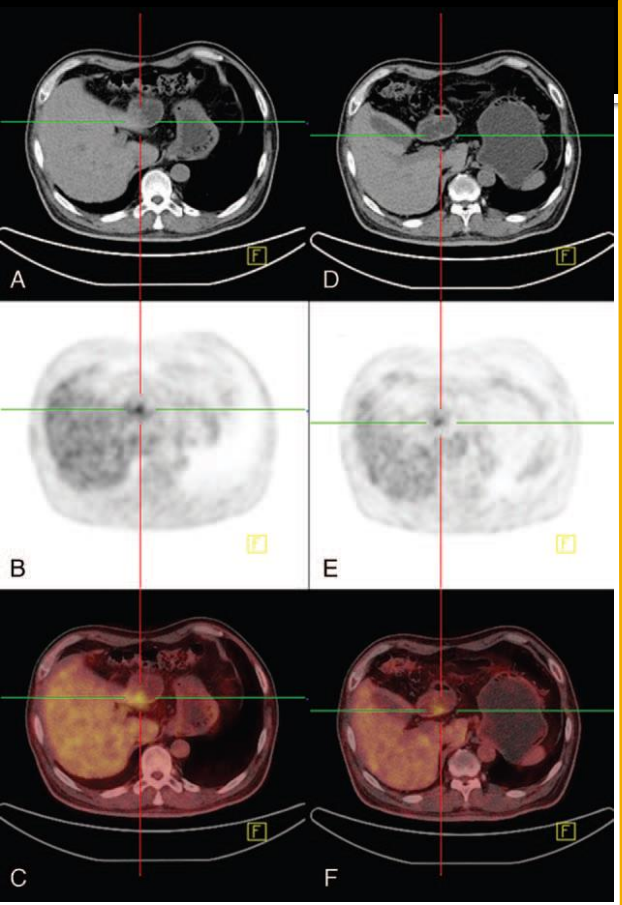
Case Example



Case Example



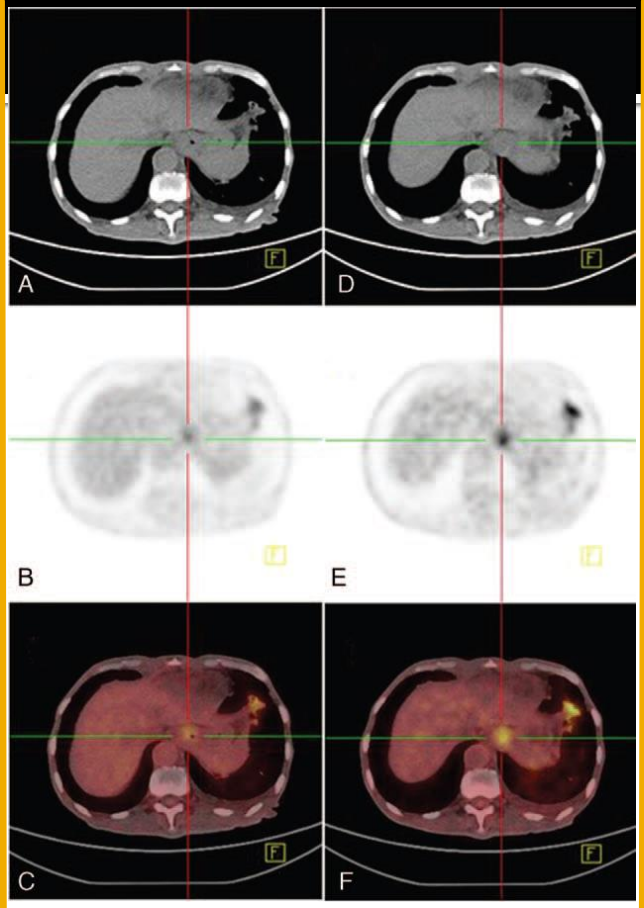
Dual time PET/CT



S1 was 5.2

S2 was 4.7

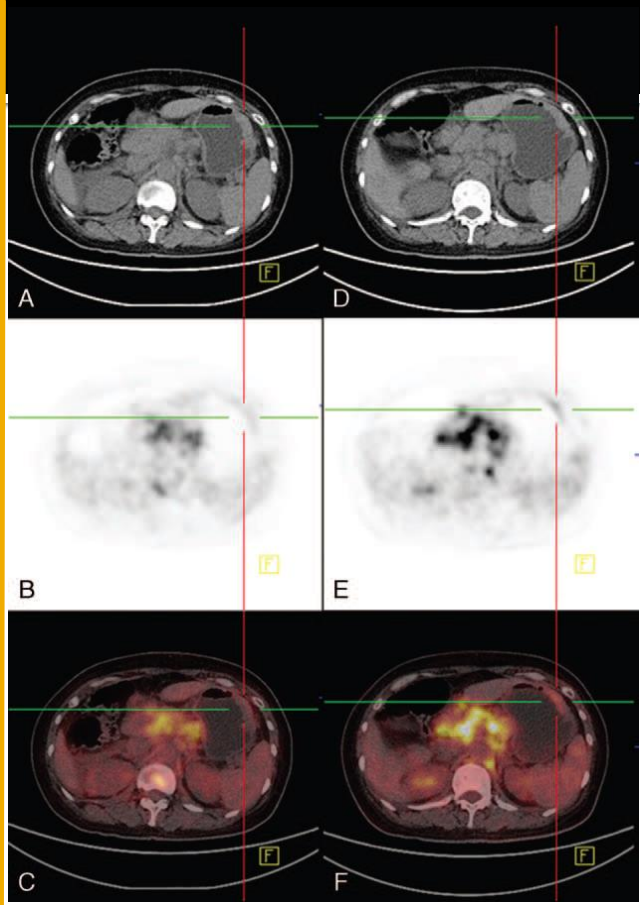
Superficial gastritis



S1 was 4.2

S2 was 5.5

Moderately differentiated tubular adenocarcinoma of the cardia

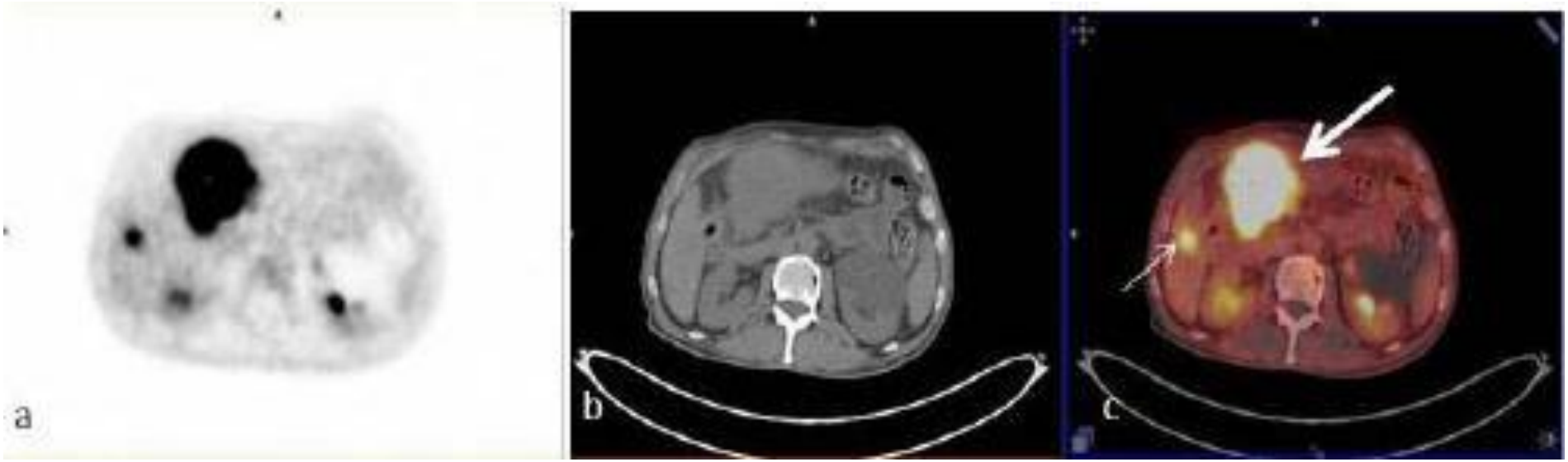


S1 1.9

S2 3.8

Poorly differentiated tubular adenocarcinoma of the greater curvature

Primary gastric tumor



- Transaxial PET (a), CT (b) and fusion (c) images of ^{18}F-FDG PET/CT Study Showed primary gastric tumor located in antrum (thick arrow, c) and metastatic foci of FDG uptake in liver (thin arrow, c).

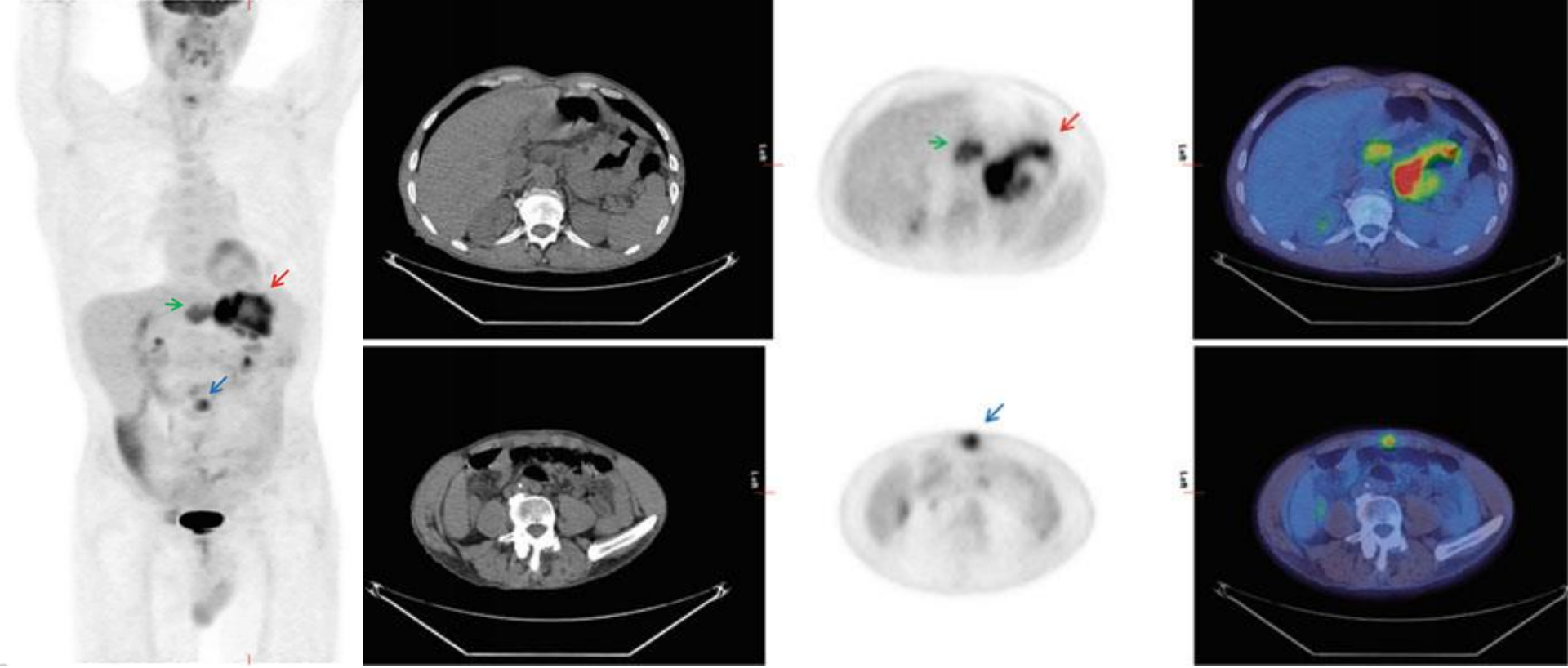
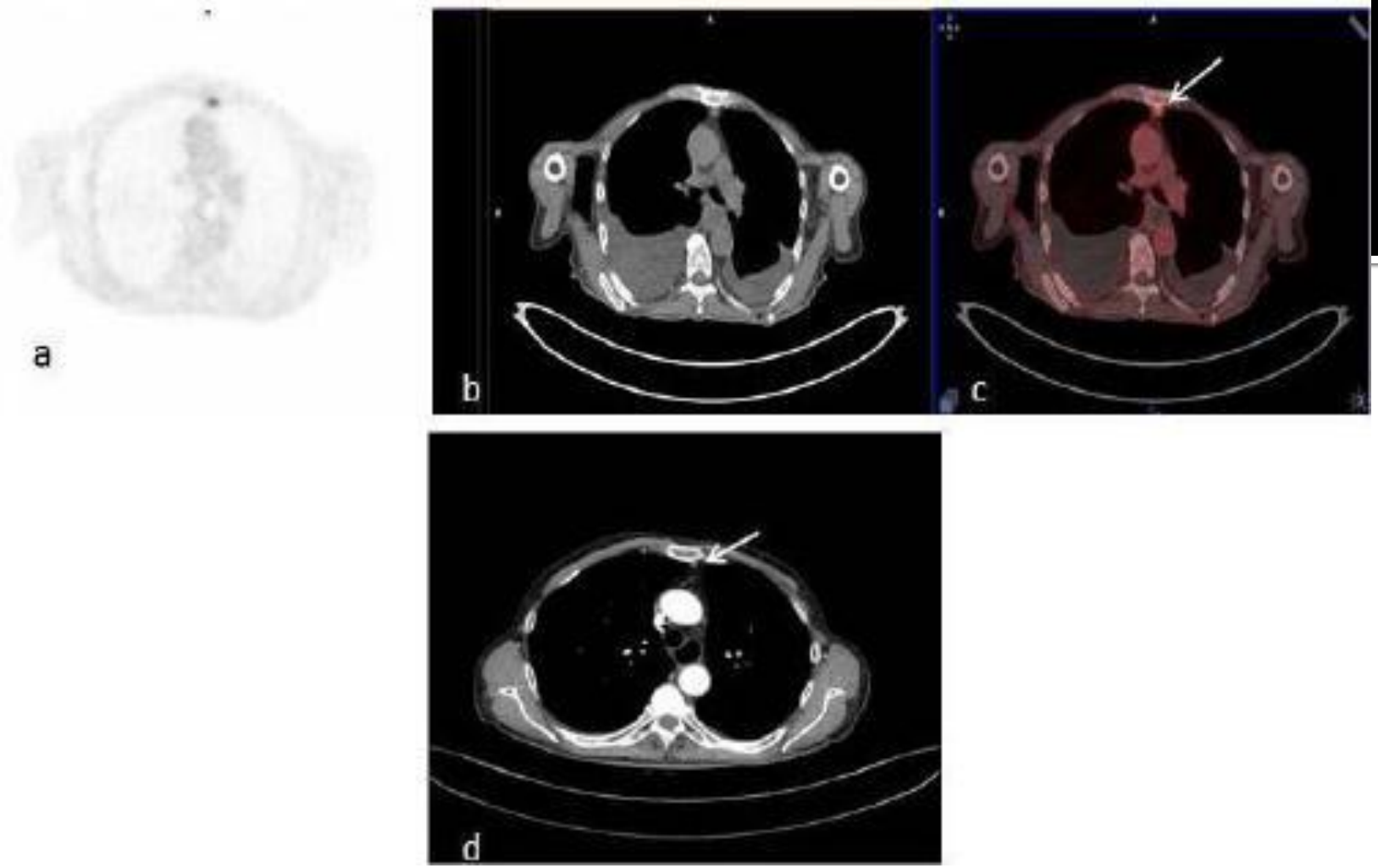


Fig. 10.20 (**a**) MIP image; (**b** , **c**) axial images of low-dose CT, PET and fused PET-CT. There is intensely increased tracer uptake (SUV max = 7.1) within the large gastric tumour centred on the lesser curve of the stomach (**a** , **b** , *red arrow*). There are FDG-avid left gastric nodes (**a** , **b** *green arrow*). In the midline anterior abdominal wall, there is a focus of high uptake (**a** , **c** *blue arrow*) corresponding to soft tissue thickening on the CT component

Lymph node metastases

- May have a higher SP and PPV in the detection of LN metastases than CECT
- No significant difference in the detection of regional LN metastases
- Significantly **better** patient-based SN, SP and accuracy for **distant** LN metastases
- **Improvement in SN** ($p<0.005$) and regional **LN** metastases detection ($p<0.01$) with regional PET/CT over gastric area performed 80min after injection with **water gastric inflation**

Study	Modality	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Accuracy
Yang et al (2008)	CT	60.5%	83.3%	82.1%	62.5%	70.6%
	PET/CT	31.0%	97.2%	92.9%	54.7%	61.5%
Kim et al (2011) Regional LN metastases	CECT	75.0%	92.0%	98.0%	42.0%	77.0%
	PET/CT	41.0%	100.0%	100.0%	26.0%	51.0%
Namikawa et al (2014)	PET/CT	64.5%	85.7%	90.9%	52.2%	71.1%
Park et al (2014) Regional LN metastases	CECT	51.0%	79.0%			64.0%
	PET/CT	34.0%	88.0%			58.0%
Filik et al (2015)	CECT	83.3%	75.0%	87.5%	66.6%	80.0%
	PET/CT	64.7%	100.0%	100.0%	57.1%	76.0%
Altini et al (2015)	CECT	70.83%	61.90%	68.0%	65.0%	66.66%
	PET/CT	58.33%	95.24%	93.33%	66.67%	75.55%
Kawanaka et al (2016) Distant LN metastases	CECT	45.9%	98.0%			75.6%
	PET/CT+CECT	67.6%	100.0%			86.0%
Kawanaka et al (2016) Regional LN metastases	CECT	84.0%	70.0%			82.4%
	PET/CT+CECT	80.0%	70.0%			78.8%



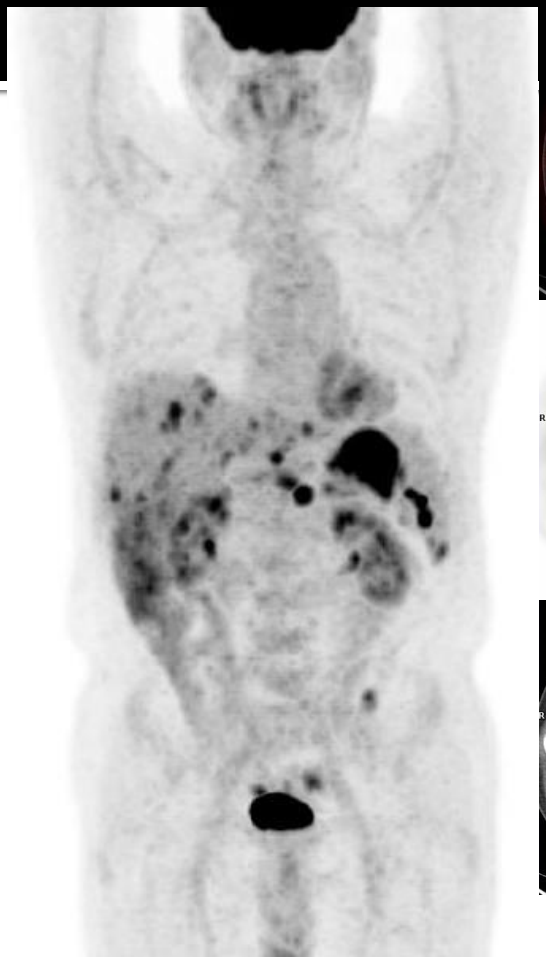
- Transaxial PET (a), CT (b) and fusion (c) images of 18F-FDG PET/CT.
- Metastatic left parasternal lymph node showing FDG uptake was reported as disease involved (c, arrow).
- Same lymph node measuring 8 millimeters short-axis diameter, was not recognized as metastatic with contrast enhancement CT (d, arrow).

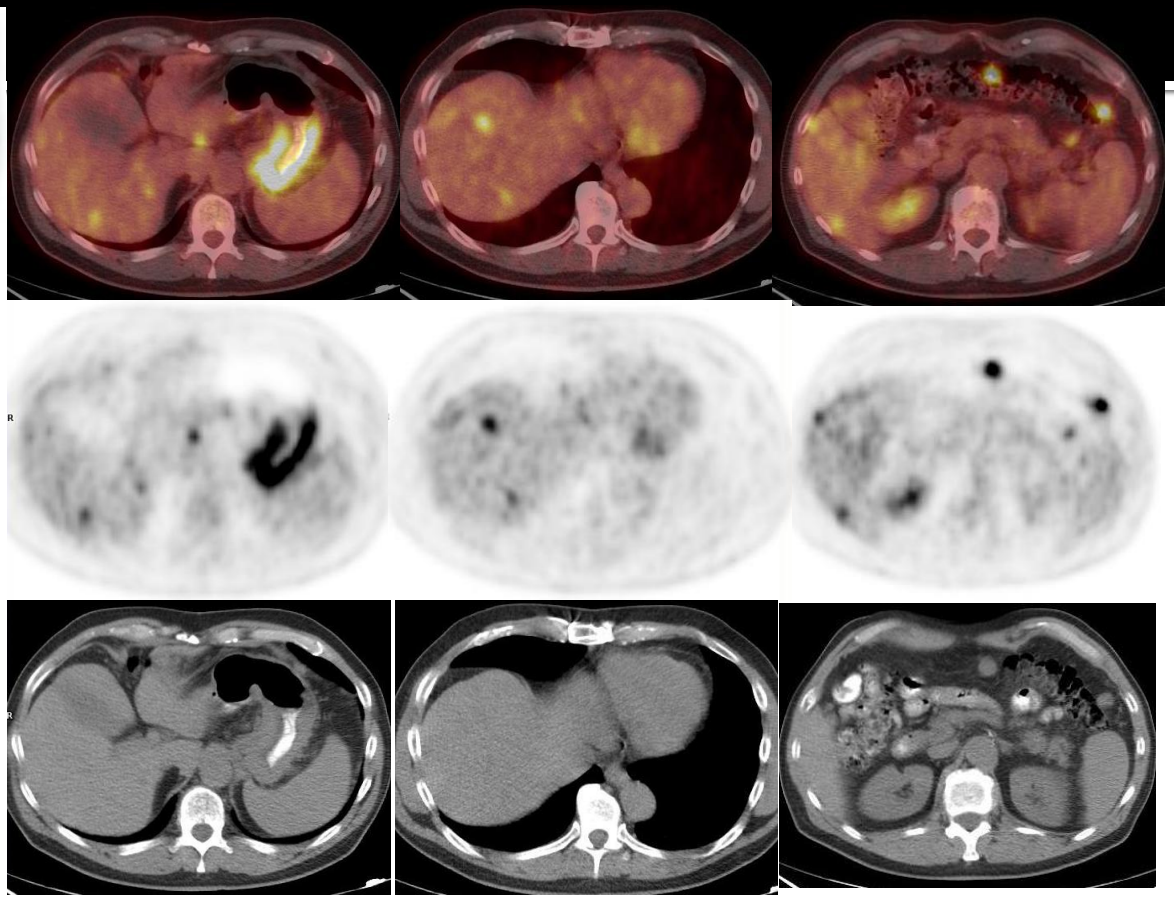
Detection of synchronous primary cancers

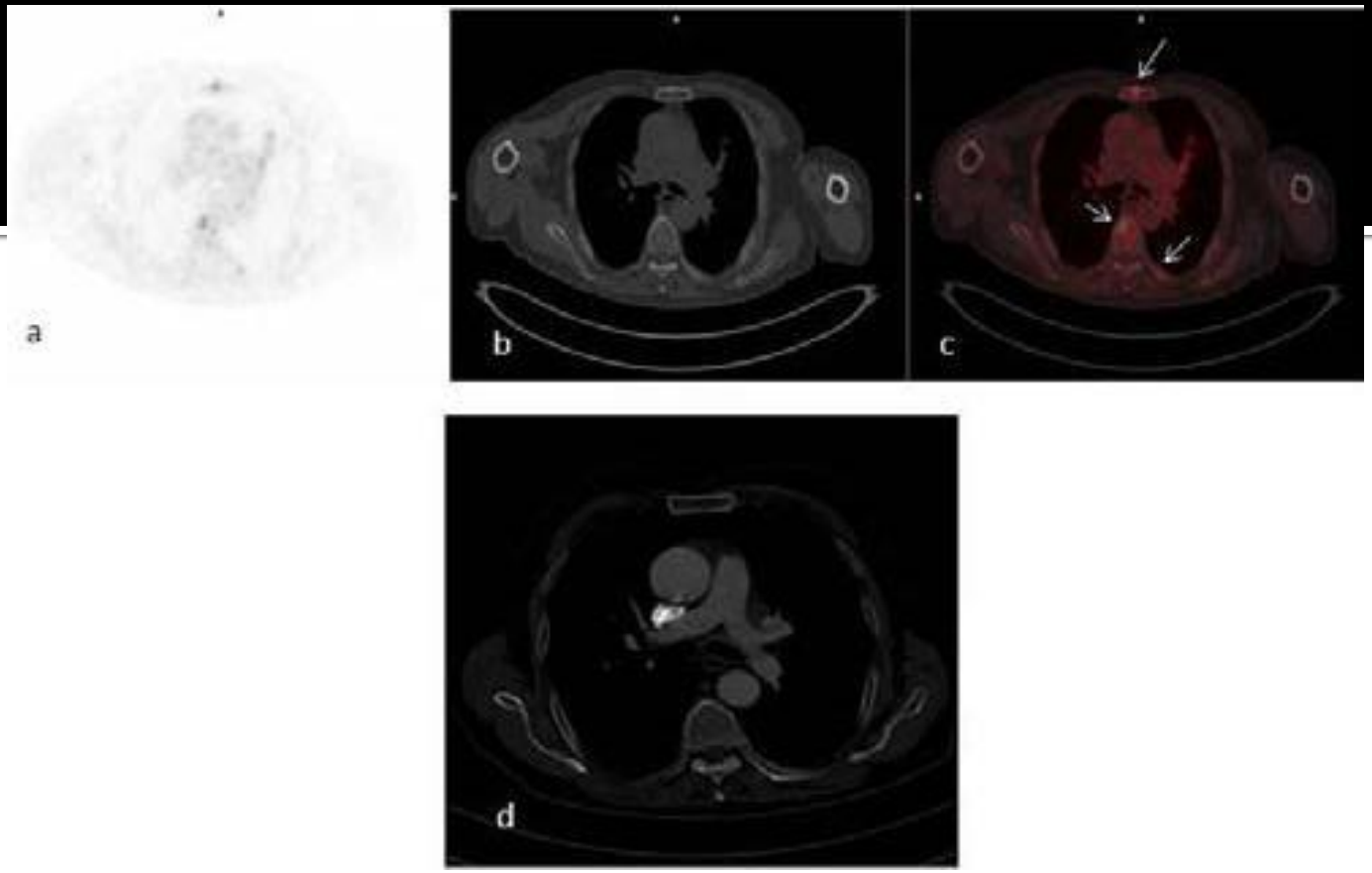
- High diagnostic accuracy in detecting a synchronous colorectal cancer in 4.7% patients

Distant metastases

- Can detect **occult metastases in 10%** patients
- Addition of 18F-FDG PET/CT to the standard evaluation resulted in an estimated **cost savings of USD 13000** per patient
- High SN, PPV and accuracy in detecting bone metastases, comparable to bone scan
- 15.0% of solitary bone metastases positive only on PET/CT







- Transaxial PET (a), CT (b) and fusion (c) images of 18F-FDG PET/ CT study of 81 years-old male patient.
- Metastatic bone lesions in sternum and thoracal vertebra showing FDG uptake were observed with 18F-FDG PET/CT (arrows, c).
- Contrast enhancement CT missed these metastatic deposits in bones (d).

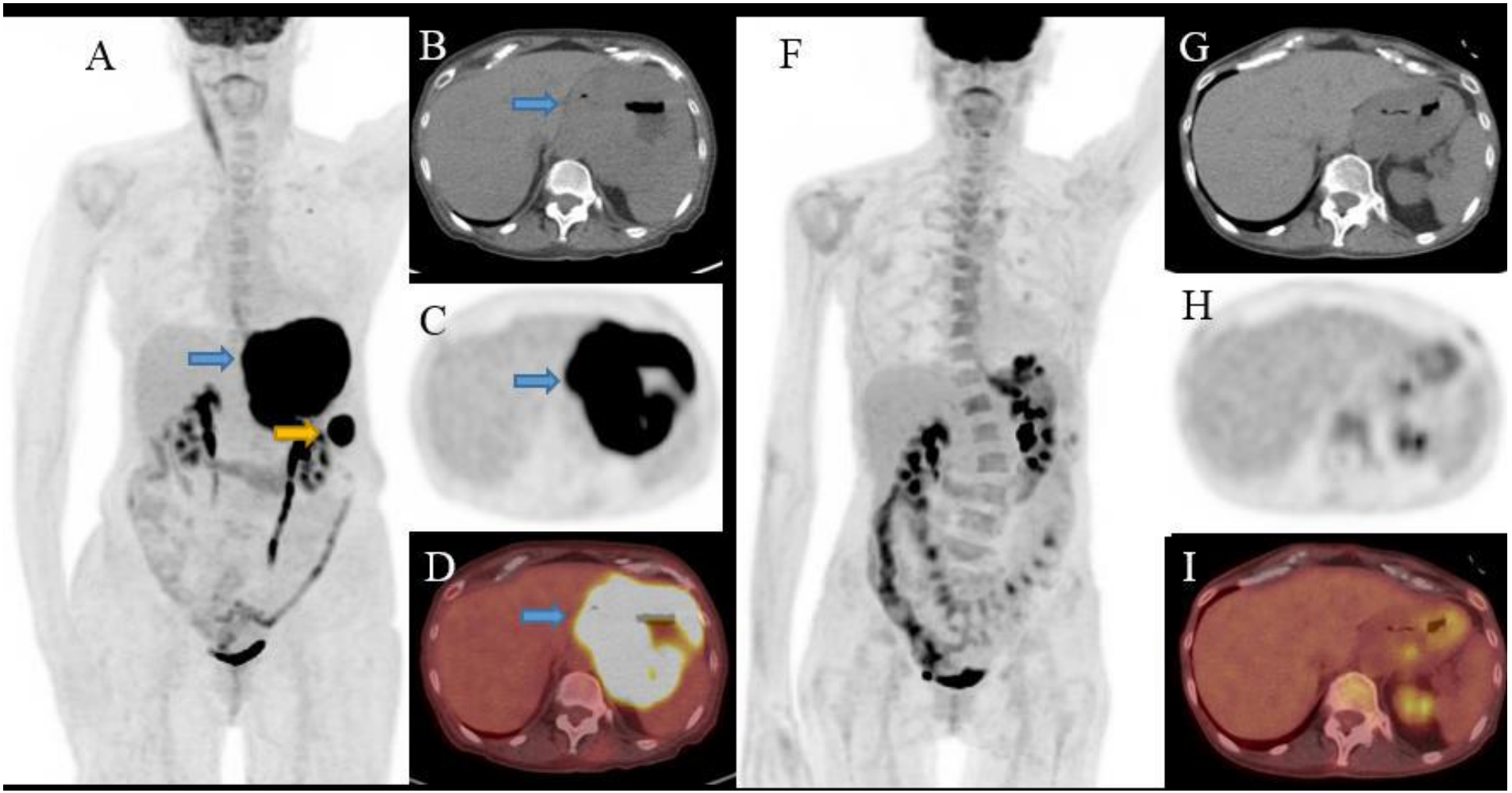
Treatment Response Assessment

- Small study evaluating tumor to liver ratio demonstrating a wide spectrum of response with a 22% median reduction.

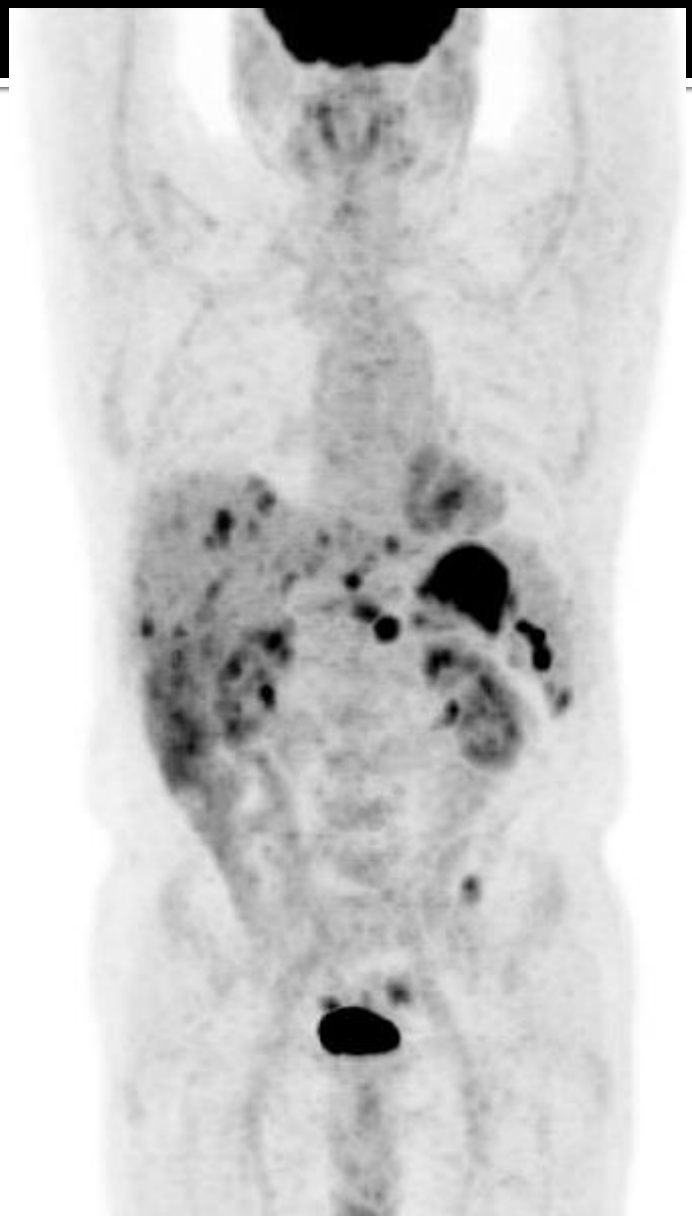
- 30% reduction correlated with improvement in symptoms and anatomic imaging

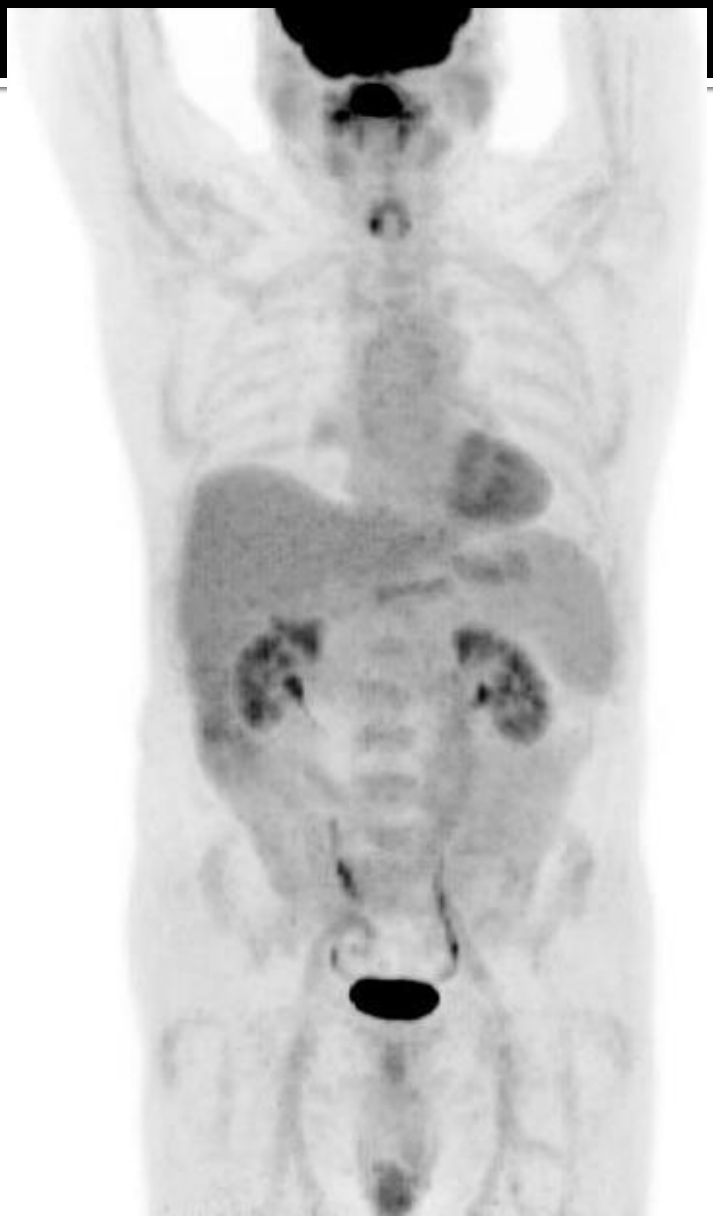
- Short survival associated with increased tumor to liver ratio

Treatment Response Assessment
Case Example



Treatment Response Assessment





Detection of Recurrence

- Diagnostic accuracy **higher in FDG-avid tumors** and in non-anastomosis site recurrence
- After surgical resection the SN, SP: 86%, 88%
- PET/CT performance equal to or higher than CECT
- Higher diagnostic accuracy in peritoneal carcinomatosis

Detection of Recurrence

• FDG uptake of tumor at baseline predicts recurrence (24-mo RFS) in patients with adenocarcinoma (p=0.0001).

- Marginally significant in SRRC and mucinous carcinoma (p=0.05)

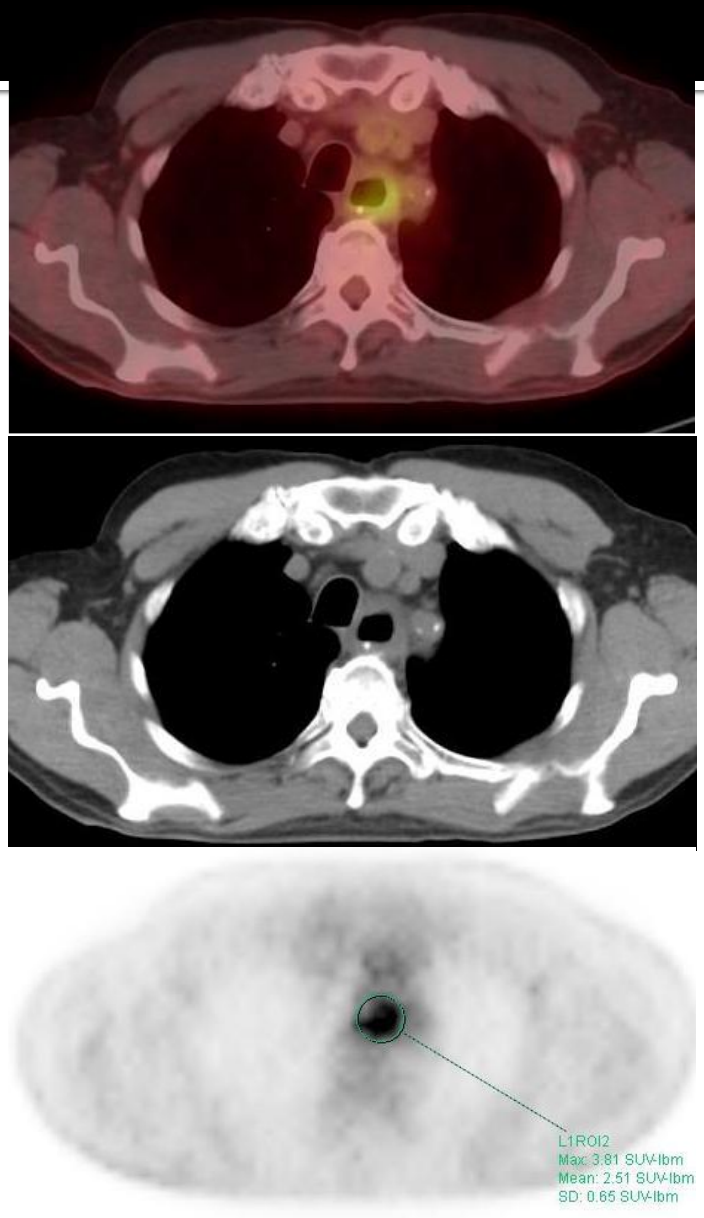
• **Diagnostic accuracy lower in local recurrence as compared to liver (p=0.012) and bone (p=0.012)**

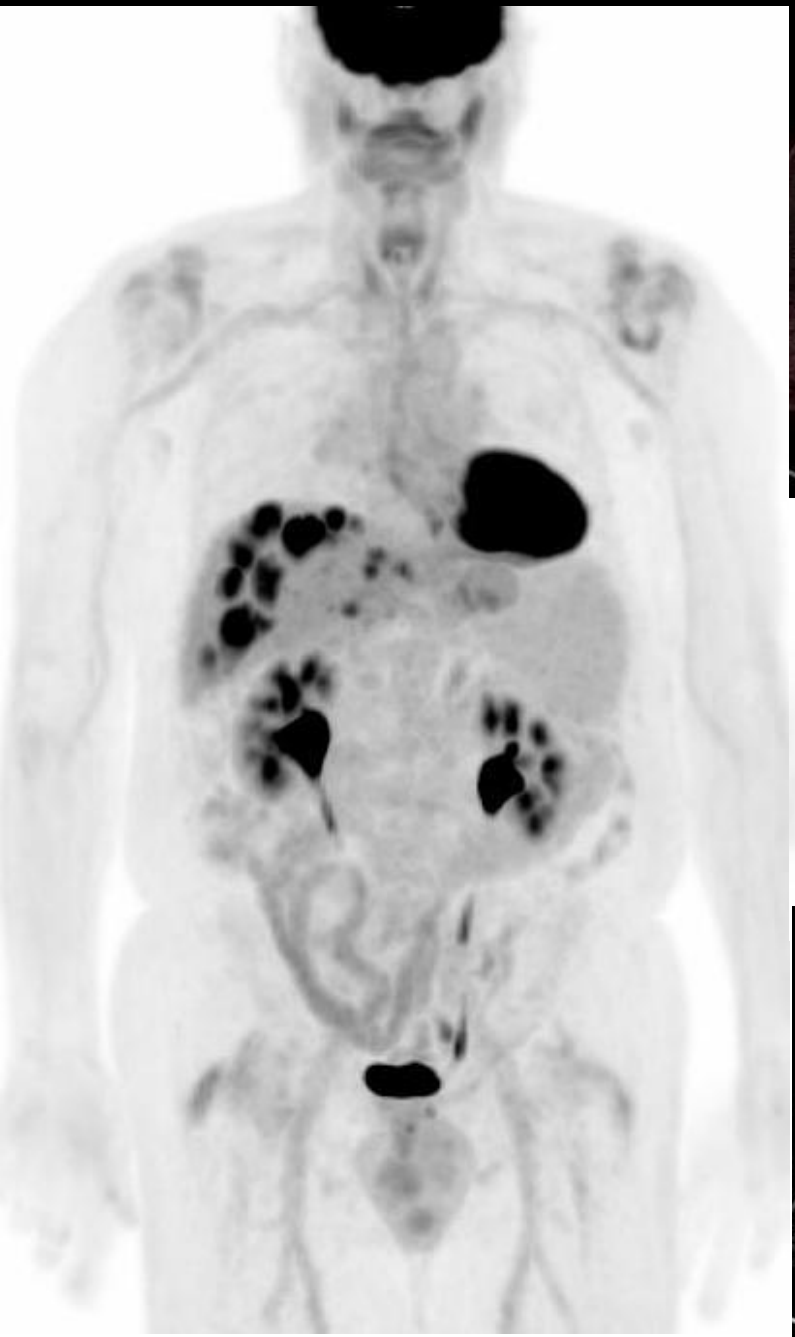
• Cautious interpretation to be considered when **FDG uptake at anastomotic sites** noted and may persist over several follow-up scans.

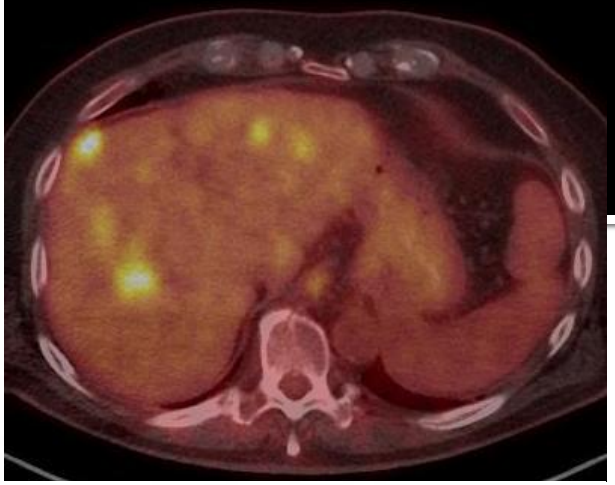
Detection of Recurrence

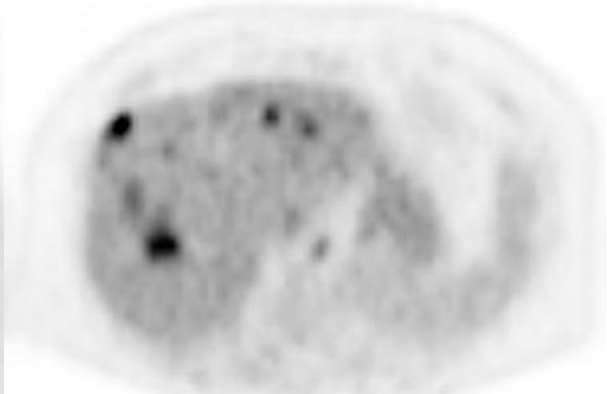
Study	Type of study	SN	SP	PPV	NPV	Accuracy	PLR	NLR
Park et al (2009)	Retrospective (n=105)	0.75	0.77	0.89	0.55	0.75		
Nakamoto et al (2009)	Retrospective (n=92)	0.86	0.94	0.96	0.79	0.89		
Sim et al (2009)	Retrospective (n=52)	0.68	0.71	0.86				
Kim et al (2011)	Retrospective (n=139)	0.54	0.85			0.78		
Lee et al (2011)	Retrospective (n=89)	0.43	0.60	0.29	0.78	0.57		
Wu et al (2012)	Meta-analysis (n=526)	0.78	0.82				3.52	0.32
Zou et al (2013)	Meta-analysis (n=500)	0.86	0.88				17.0	0.16
Cayvarli et al (2014)	Retrospective (n=130)	0.91	0.62	0.85	0.75	0.82		
Lee et al (2014)	Retrospective (n=46)	1.00	0.88	0.44	1.00			
Li et al (2016)	Meta-analysis (n=828)	0.85	0.78				3.9	0.19

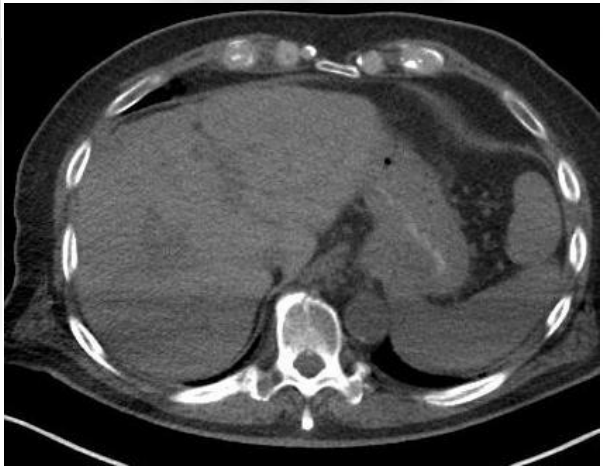
Detection of Recurrence











Prognosis

- SUVmax of primary tumor >8 significant predictor of OS (p=0.048)
- SUVmax >5.74 poor prognostic predictor of PFS (p=0.034, HR 3.6)
- TLG was a significant predictor of OS (p=0.047) and time to metastasis (p=0.02)
- SUVpeak and max/liver ratio significantly unfavorable for RFS (p<0.05)
- SUVmax of nodal disease measure pre-operatively was an independent risk factor for RFS (p<0.0001) and OS (p<0.0001)
- Δ%SUVmax ≥70% predicted histopathological tumor response (p=0.047)

Prognosis

- **30% tumor size reduction was associated with a 50% SUVmax reduction ($p<0.001$).**
- Better OS and PFS in patients with both tumor size and SUVmax reduction than in patients with either size or SUVmax reduction only (OS, $p=0.003$; PFS, $p=0.038$)

Park et al. Prospective evaluation of changes in tumor size and tumor metabolism in advanced gastric cancer undergoing chemotherapy: association and clinical implication. J Nucl Med. 2016 Nov 10. pii: jnumed.116.182675. doi: 10.2967/jnumed.116.182675

FDG-PET Applications in Esophageal Ca

- PET has not been used as a primary screening method for esophageal carcinoma

- The vast majority of primary esophageal cancers that are first diagnosed by other methods are detectable by [18F]-FDG PET, with sensitivities in the 90% to 100% range for T2 to T4 tumors.

False Negative FDG PET/CT

- Small tumor volume
  - Stage T1 primary lesions
- Some adenocarcinomas of the gastric cardia demonstrate only low FDG uptake
  - False negative on FDG PET even at advanced tumor stages
  - Likely related to their growth pattern and mucin production

Detection of Early GEJ Cancer by FDG PET

- Diagnostic challenges in esophageal cancer include determining whether there is abnormal or physiologic uptake at the GE junction.
- There may be some uptake in this location normally, so detecting small esophageal cancers can be problematic as they can be lost in the normal spectrum of mild FDG uptake in the distal esophagus.
- For these reasons, it is probable that early low-volume esophageal cancer can be much more easily detected by direct visualization using an endoscope or by careful barium studies than by PET.

TABLE 8.13.1 Tumor, Node, Metastasis Staging System for Esophageal Cancer

PRIMARY TUMOR (T)	
Tis	Carcinoma *in situ*
T1	Tumor invades lamina propria or submucosa
T2	Tumor invades muscularis propria
T3	Tumor invades adventitia
T4	Tumor invades adjacent structures
REGIONAL LYMPH NODES (N)	
N0	No regional lymph node metastasis
N1	Regional lymph node metastasis
DISTANT METASTASIS (M)	
M0	No distant metastasis
M1	Distant metastasis (including metastasis in nonregional lymph nodes)[a]
	Tumors of the lower thoracic esophagus
M1a	Metastasis in celiac lymph nodes
M1b	Other distant metastasis
	Tumors of the midthoracic esophagus
M1a	Not applicable
M1b	Nonregional lymph nodes or other distant metastasis
	Tumors of the upper thoracic esophagus
M1a	Metastasis in cervical lymph nodes
M1b	Other distant metastasis

[a]regional lymph nodes: Cervical esophageal tumor: scalene, internal jugular, upper cervical, periesophageal, supraclavicular, cervical not otherwise specified. Intrathoracic esophageal tumor: tracheobronchial, superior mediastinal, peritracheal, carinal, hilar, periesophageal, perigastric, paracardial, mediastinal not otherwise specified.

(From American Joint Committee on Cancer: *AJCC cancer staging manual*, 6th ed. New York, NY: Springer, 2002, with permission.)

TABLE 8.13.2 American Joint Committee on Cancer Stage Groupings

Stage	T	N	M
0	Tis	N0	M0
I	T1	N0	M0
IIA	T2	N0	M0
	T3	N0	M0
IIB	T1	N1	M0
	T2	N1	M0
III	T3	N1	M0
	T4	Any N	M0
IV	Any T	Any N	M1
IVA	Any T	Any N	M1a
IVB	Any T	Any N	M1b

(From American Joint Committee on Cancer: *AJCC cancer staging manual*, 6th ed. New York, NY: Springer, 2002, with permission.)

Locoregional Nodal Detection

- Is dependent on:
  - Volume of tumor in the metastasis
  - Intensity of tracer uptake in the lesion
  - Background tracer activity
  - The injected dose of radiotracer
  - Performance and resolution of the scanner
  - Interpretation criteria

Node Assessment by CT: + or -

- Size
- The larger the node, the more likely it is to represent a node involved by cancer
- The optimal cutoff size for "positive or negative" nodes is not clear in esophageal cancer

Locoregional LN Metastasis

- Both PET and CT can fail to detect small metastases of esophageal cancer to locoregional lymph nodes.
- Lesions smaller than 5 mm are not usually detected on PET with FDG, which is consistent with other detection challenges encountered with current FDG PET technology.
- To achieve high sensitivity with CT, small lymph nodes must be called positive.
  - For example, 5-mm and larger nodes may be called abnormal in some CT studies, whereas others may choose a 10-mm cutoff.
  - The smaller the cutoff for node size, the more likely cancer will be detected, but at the price of a lower specificity.
- This results in a considerable range in the sensitivity and specificity of PET for assessing tumor involvement in regional lymph nodes and an even greater range in accuracy of CT.

TABLE 8.13.3 **Diagnostic Accuracy of Fluorodeoxyglucose- PET and CT for Detection of Locoregional Lymph Node Metastases (N stage)**

Authors (ref.)	Year	No. of Patients	Histology (adeno/ squamous/ other)	Prevalence (%)	FDG PET		CT	
					Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
Block et al. (13)	1997	58	34/22/2	51	58	87	71	79
Choi et al. (49)	2000	48	0/48/0	58	81	88	41	100
Flamen et al. (15)	2000	74	53/21/0	55	28	90	55	82
Meltzer et al.(16)	2000	47	37/10/0	74	41	83	87	14
Yoon et al. (50)	2003	81	0/81/0	48	64	69	31	86
Kneist et al. (51)	2003	58	31/27/0	44–59[a]	6–42[a]	94–100[a]	67–73[a]	73–80[a]
Heeren et al. (52)	2004	71	62/12/0	66	55	71	44	90
Kato et al. (53)	2005	149[a,b]	7/134/8	52	55	90	48	79
Yuan et al. (35)	2006	45[c,d]	0/45/0	21	82 94[c]	87 92[c]	ND	ND

FDG PET/CT in lymph node metastasis assesment

- Not exceptionally sensitive (30% to 80%)
- But it has a high specificity (80% to 90%)
- A pooled sensitivity and specificity of FDG PET of 51% and 84%, respectively.
- CT sensitivity/specificity pairs range from (31% to 86% to 87% to 14%), meaning CT can be either very insensitive or reasonably specific (although not as specific as PET) or very sensitive and extremely nonspecific.
- PET is an equivalent or more accurate method for nodal staging than CT.

EUS

- More sensitive (70% to 80%) than either PET or CT for staging regional nodes
- Specificity (70% to 80%)
- Valuable for assessing tumor size and depth of invasion.
- The diagnostic accuracy of EUS for differentiation of stages T1 and T2 from stages T3 and T4 was 91%
- There are no data showing that PET or CT is accurate in evaluating the primary tumor stage of esophageal cancers.

EUS (2)

- Neither can resolve the individual layers of the esophageal wall that form the basis of the T-staging system.
- A disadvantage of EUS is its operator dependency.
- EUS may be technically impossible if the tumor causes a stenosis that cannot be passed by the endoscope
- There is some interest in using minimally invasive surgical techniques for staging esophageal cancer.
- Specifically, sentinel node dissection is currently being evaluated as a minimally invasive technique to improve lymph node staging

SYSTEMIC METASTASES

- PET has been more accurate than other conventional diagnostic methods in detecting organ metastases or nonregional lymph node metastases
- Nonregional lymph node metastases are considered as M1 disease in esophageal cancer.
- Sensitivity of FDG PET for detection of M1 disease of 67%
- Specificity of 97%
- The sensitivity and specificity of CT have been consistently lower than of PET

TABLE 8.13.4 **Diagnostic Accuracy of Fluorodeoxyglucose PET for Detection of Distant Metastases (M stage)**

Authors (ref.)	Year	No. of Patients	Histology (adeno/ squamous/ other)	Prevalence (%)	FDG PET		CT	
					Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
Block et al. (13)	1997	58	34/22/2	36	65	97	20	ND
Flamen et al. (15)	2000	74	53/21/0	46	74	90	41	83
Meltzer et al. (16)	2000	47	37/10/0	22	70	92	57	66
Rasanen et al. (54)	2003	42	0/42/0	36	47	89	33	96
Kneist et al. (55)	2004	81[a]	40/41/0	74	38	89	63	11
Heeren et al. (52)	2004	74	62/12/0	36	78	98	37	87
Bar-Shalom et al. (34)	2005	32[b]	25/7/0	68	100	54	ND	ND
					100[c]	69[c]		

False Negative FDG PET

- Very small (a few millimeters) lung metastases are detected better by CT than by PET
- It is also probable that brain metastases are less well seen with FDG PET than with CT or MRI, as is the case in lung cancer imaging.

Bone metastases

- The relative performance of PET versus bone scans in the detection of bone metastases is only reported to a limited extent.
- FDG PET was shown to be more sensitive than bone scans for detection of bony metastases.
- The higher sensitivity was due to correct visualization of lytic metastases that were false negative on bone scans.
- PET is recommended as an initial staging procedure for esophageal cancer.

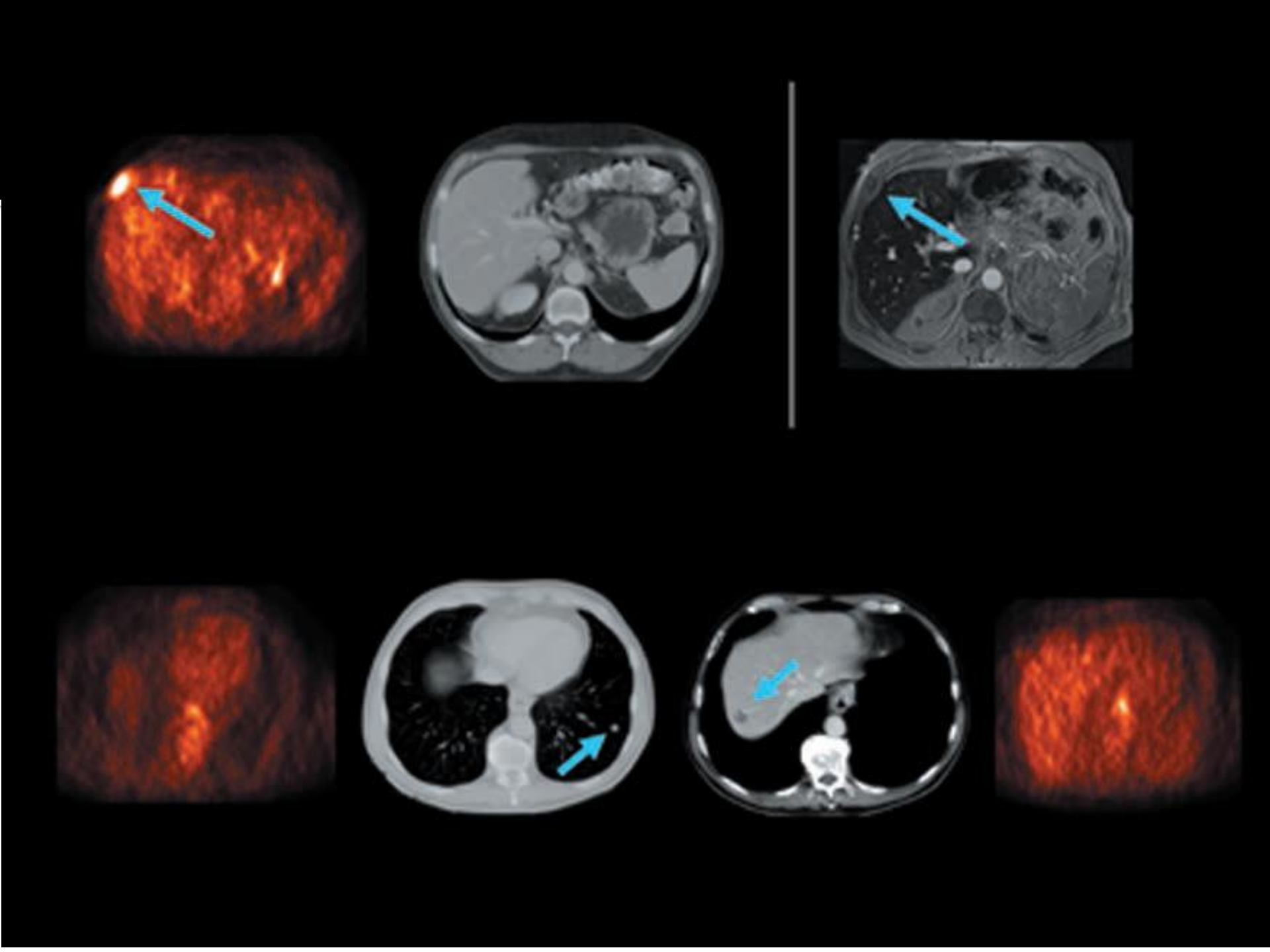
DETECTION OF RECURRENT DISEASE

- **False-positive in:**
  - **Benign strictures after dilation**
- **PET was very sensitive:**
  - **PET: sensitivity, specificity, and accuracy of 100%, 57%, and 74% for PET, respectively,**
  - **CDMs: 100%, 93%, and 96%, respectively**

Systemic metastases

- PET
  - Sensitivity, specificity, and accuracy: 94%, 82%, and 87%, respectively
- CDMs
  - 81%, 82%, and 81%, respectively

- The accuracy rates in these patients were comparable, PET provided additional information in about 27% of patients
- The high sensitivity of PET for detection of recurrent esophageal cancer was confirmed
  - sensitivity, specificity, and accuracy of FDG PET for detection of recurrent esophageal cancer were 96%, 68%, and 82%, respectively.
- PET had a higher sensitivity for detection of bony metastases than CT, but it was less sensitive for detection of pulmonary metastases.



Staging of esophageal cancer by fluorodeoxyglucose (FDG) PET and CT

- A: Bony metastasis of esophageal cancer. A right-sided rib lesion demonstrates intense FDG uptake without a corresponding abnormality on CT. Four months later a magnetic resonance image confirmed the presence of a metastatic lesion.

- B: A patient with esophageal cancer and a right-sided pulmonary nodule as well as a hypodense liver lesion. Both are suspicious for metastatic disease on CT, but are negative on FDG PET. Further diagnostic work-up and clinical follow-up revealed a granuloma and a liver hemangioma.

ASSESSING RESPONSE TO THERAPY

- FDG PET was a sensitive test to detect tumor response (i.e., the absence or marked reduction of the number of viable tumor cells).
- The specificity for assessment of tumor response was relatively low and quite variable (26% to 88%).
- The variability of the reported specificities is likely related to the fact that different studies used different definitions for a histopathologic response.
- Although some studies defined histopathologic response by complete absence of viable tumor cells, other used "less than 10% viable tumor" cells or "microscopic residual disease" as criteria. Different criteria were also applied for the evaluation of the FDG PET scans

ASSESSING RESPONSE TO THERAPY (2)

- The lower than perfect accuracy for assessment of tumor response reflects the inability of FDG PET to detect small amounts of residual tumor tissue.
- Almost all tumors with 10% or less viable tumor cells and a significant fraction of tumors with 10% to 50% viable cells are negative on FDG PET.
- A negative PET scan after completion of therapy does not rule out residual tumor tissue, and surgery cannot be avoided in these patients.
- A positive PET scan after chemoradiotherapy appears to be a relatively specific marker for macroscopic residual tumor tissue and is associated with a poor prognosis

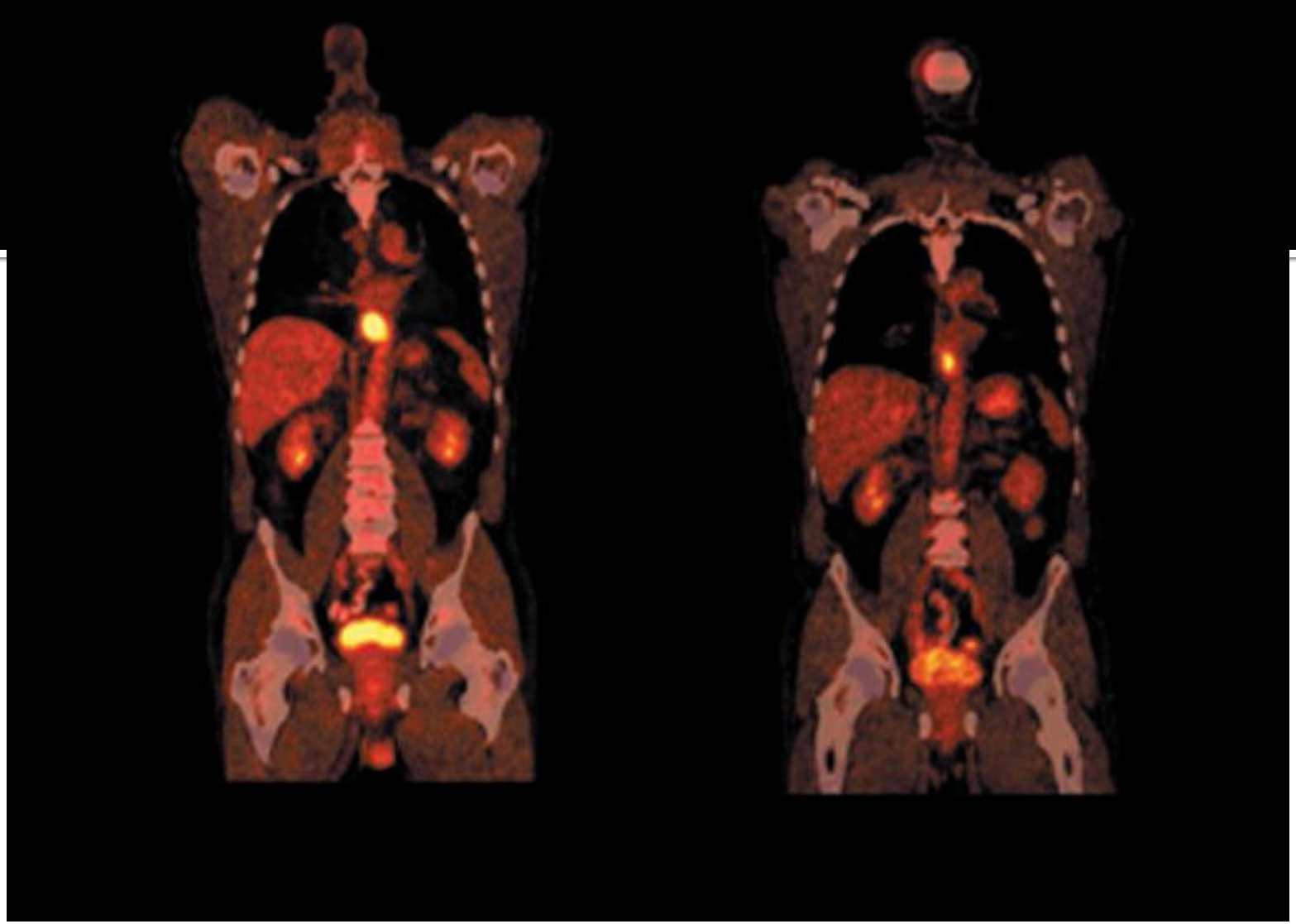
TABLE 8.13.5 Assessment of Tumor Response and Patient Survival after Completion of Therapy

				Response Assessment			Patient Survival (mo)		
Authors (ref.)	Year	No. of Patients	PET Criterion	Gold Standard	Sensitivity (%)	Specificity (%)	PET Responder	PET Nonresponder	*P* Value
Brucher et al. (56)	2001	27	ΔSUV >52%	<10% viable tumor cells	100	55	22	7	.001
Flamen et al. (57)	2002	36	Visual	Down-staging	82	71	16	6	.005
Downey et al. (58)	2003	17	ΔSUV >60%	ND	ND	ND	>50	30	.08
Swisher et al. (59)	2004	84	SUV <4	0% viable tumor cells	95	26	>24	15	.01
Wieder et al. (60)	2004	38	ΔSUV > 52%	<10% viable tumor cells	89	57	ND	ND	ND
Cerfolio et al. (61)	2005	48	Visual	0% viable tumor cells	87	88	ND	ND	ND
Duong et al. (62)	2006	53	Visual	ND	ND	ND	>30	9	<.001
Levine et al. (63)	2006	31	ΔSUV >40%	Microscopic residual disease	92	52	ND	ND	ND

ND, not determined; SUV, standard uptake value.

TABLE 8.13.6 Prediction of Tumor Response Early in the Course of Therapy

				Response Prediction			Patient Survival (mo)		
Authors (ref.)	Year	No. of Patients	PET Criterion	Gold Standard	Sensitivity (%)	Specificity (%)	PET Responder	PET Nonresponder	*P* value
Weber et al. (31)[a]	2001	40	ΔSUV >35%	<10% viable tumor cells	89	75	>50	19	.04
Wieder et al. (60)[b]	2004	38	ΔSUV >30%	<10% viable tumor cells	93	88	>30	18	.01
Ott et al. (32)[a]	2006	65	ΔSUV >35%	<10% viable tumor cells	82	78	>50	18	.01
Westerterp et al. (64)[c]	2005	26	ΔSUV >31%	<10% viable tumor cells	75	75	ND	ND	ND



- FIGURE 8.13.2. Early assessment of tumor response by fluorodeoxyglucose (FDG) PET/CT in a patient with locally advanced distal esophageal cancer. The tumor demonstrates intense FDG uptake prior to therapy (day 0).
- The FDG uptake decreases markedly on day 14 of the first chemotherapy cycle. Quantitatively tumor FDG uptake decreased from a standard uptake value of 9.2 to 4.2

RADIATION TREATMENT PLANNING

- FDG PET can change radiation treatment fields by detection of lymph node metastases and better delineation of the longitudinal extent of the primary tumor, particularly in the region of the esophagogastric junction.

- In one study FDG-avid disease was found outside of the gross target volume defined by CT in 11 of 18 patients (69%).

SUMMARY (1)

- PET with FDG is an accurate method for noninvasive detection of primary esophageal cancer, but endoscopy and EUS are more reliable methods for characterizing the size and local invasiveness of the untreated primary tumor.

- FDG PET is generally more specific than CT and is somewhat superior to CT in accuracy, but it can fail to detect small nodal metastases in many instances, especially those near the esophagus.

SUMMARY (2)

- EUS in skilled hands may be superior to PET for assessing locoregional periesophageal metastases to lymph nodes.
- FDG PET is superior to other imaging methods for detecting systemic metastatic disease.
- Data to date on assessment of response to treatment suggest PET provides an early and quite accurate readout of the efficacy of therapy.

SUMMARY (3)

- PET is incapable of detecting residual microscopic disease at the conclusion of treatment due to resolution limitations.
- Where directly compared,PET/CT has proven to be somewhat more accurate than PET alone.
- Tracers other than FDG, although of interest, have not demonstrated superiority to FDG in imaging this tumor.

Thanks For Your Attention