PET/CT Frequently Asked Questions

General

Q: Is FDG PET specific for cancer?
A: No, it is a marker of metabolism. In general, any disease that causes increased metabolism can result in increased FDG uptake and mimic malignancy.

Q: What examples of benign etiologies can cause increased FDG activity?
A: Physiologic processes, infections, inflammation, and granulomatous diseases.

Q: What factors will affect FDG uptake?
A: Blood glucose and insulin levels, FDG uptake time, and other variables, such as recent exercise and brown fat activity.

Q: Why are patients asked to fast?
A: To decrease blood glucose and insulin levels that will result in more uptake in tumors as well as decrease the amount of cardiac activity present on a scan. When patients fast longer than a few hours, the myocardium will begin to utilize fatty acids rather than glucose (and FDG) for generating energy.

Q: What is an attenuation correction artifact?
A: These are artifacts that are observed only on the attenuation corrected PET images. They are not observed on non-attenuation corrected images. These are seen less frequently on current scanners. These are caused during the attenuation correction process that uses the CT on PET/CT scanners and occur in areas of high attenuation material with high Hounsfield numbers. Examples of materials that reportedly cause attenuation correction artifacts are orthopedic devices, chemotherapy ports, dense barium, and dental amalgam.

Q: Is it possible to scan diabetic patients?
A: Yes. However, it is important to have their glucose levels at close to normal levels. At the time of scheduling the diabetic patient for the PET/CT scan, it should be confirmed that the patient's blood glucose level will be less than 200 mg/dl at the time of the FDG administration. The patient should not have received regular insulin within 4 hours of the time of the FDG administration. If the patient arrives at the PET facility and the blood glucose is above a certain level (for example, above 200mg/dl), some centers reschedule the patient. If it is not convenient to reschedule the patient, some centers go ahead and do the study. A caveat should appear in the report that the study may be less accurate because of the abnormal blood sugar level. Oral therapies and long acting insulin can usually be continued; however, some patients cannot continue the oral diabetic therapy and fast for 4 hours without becoming hypoglycemic.
Q: Should I use SUVs to make a diagnosis and what is the cutoff for malignancy?
A: Standardized Uptake Values should NOT be used to determine whether a lesion is benign or malignant. Making a diagnosis requires integrating any relevant clinical information with the findings from both the CT and PET portions of the exam, which includes the amount of activity present (i.e., SUV).

Lung Cancer

Q: Are PET and/or PET/CT useful in the evaluation of patients with lung cancer and/or solitary pulmonary nodules?
A: Yes. Diagnosis, initial staging, restaging, and detection of recurrence are covered indications by CMS and almost all third party payers. CMS has recently changed the terminology of coverage to: initial treatment strategy (diagnosis and initial staging) and subsequent treatment strategy (restaging, detection of recurrence, and treatment monitoring).

Q: What is the smallest pulmonary nodule that can be detected on PET or PET/CT?
A: It depends on the scanner being used, the scanning protocol employed, and amount of FDG in the lesion being imaged. Most PET and PET/CT scanners have an intrinsic resolution around 6mm but the reconstructed image resolution is larger than that. In general, longer uptake times and longer scan times may improve the sensitivity of detecting smaller lesions. The more metabolically active a malignancy is, the smaller the lesion PET can detect.

Q: What qualifies as a “solitary pulmonary nodule”?
A: Any patient with a nodule or mass in the lung that is considered to be “indeterminate” for cancer on other imaging modalities can be sent for evaluation by PET or PET/CT. However, patients with micronodules (<4mm) generally should not be sent for PET or PET/CT evaluation because they are below the levels of resolution of current PET scanners. High-risk patients with nodules less than 6mm would probably be better followed with CT. Between 6mm and 10mm, either PET or CT could be used to evaluate the nodule. Once 10mm or larger, the best diagnostic option is PET or PET/CT.

Q: Do insurance companies pay for the evaluation of all patients with lung cancers?
A: No, the current recommended covered indications for lung cancer are non-small cell lung carcinomas (NSCLC). Recently, CMS began coverage for initial treatment strategy for almost all cancers and that includes small cell lung cancer and mesothelioma.

Q: Are there any lung malignancies with little or no FDG uptake that may be falsely negative on PET?
A: Yes, there are a few relatively or absolutely non-FDG-avid lung malignancies, including bronchioloalveolar cell cancer, some other well-differentiated adenocarcinomas and carcinoïd tumors.

Q: Is FDG PET and/or PET/CT better than CT for evaluating the mediastinum in patients with newly diagnosed lung cancer?
A: Yes, several studies, including three meta-analyses, have all shown FDG PET to be superior to CT in evaluating mediastinal lymph nodes.

Q: Why is combined PET/CT better for patients who may undergo radiation therapy?
A: Traditionally, radiation oncologists have used CT performed on an immobilization pallet to do their planning. Most of the software programs now have fusion capabilities and can import both PET and CT data sets to get a more accurate assessment (both anatomical and functional) of tumor extent and location.
Q: How long should I wait to re-scan a patient who has had radiation therapy to the lung for lung cancer?
A: Radiation pneumonitis commonly occurs after radiation therapy to the lung. The radiation pneumonitis is FDG-avid and can persist for years after therapy. Thus, the combination of the information from the PET and CT scans must be used in these patients to differentiate radiation pneumonitis from recurrent tumor.

Lymphoma

Q: Are PET and/or PET/CT useful in the evaluation of patients with lymphoma?
A: Yes. Both initial and subsequent treatment strategies are covered indications by CMS and almost all third party payers.

Q: Are both Hodgkin’s and Non-Hodgkin’s lymphoma (NHL) covered?
A: Yes.

Q: Are PET and/or PET/CT helpful for assessing response to a particular chemotherapeutic regimen?
A: Yes, particularly for high-grade lymphomas. Under the subsequent treatment strategy category, response assessment is now covered by CMS.

Q: When is PET or PET/CT useful for evaluating response to therapy?
A: It depends on what question is being asked. There are generally two ways to assess response to therapy. The first uses PET or PET/CT after the first or second cycle of therapy (referred to as therapy monitoring) and second uses a scan performed approximately 1 month after completing chemotherapy (known as restaging). Both of these are now covered by CMS as part of subsequent treatment strategy.

Q: Must I wait a month after completing chemotherapy to assess a response to therapy?
A: No, as noted in the response to the previous question, response to therapy can be evaluated after one or two cycles or at the completion of therapy. The one-month wait after chemotherapy permits a full response, but response is usually complete before the end of one month.

Q: Many of my patients are on marrow-stimulating agents such as Epogen or Neupogen due to low cell counts; can I scan a patient who is taking one of these medications?
A: Yes, but evaluation of the marrow for potential lesions will be limited because of the large amount of FDG uptake that occurs in the bone marrow. Depending on the agents used, these effects generally subside 2-4 weeks after discontinuing them.

Q: If there is a reduction in FDG uptake from the original scan, is this patient considered a responder?
A: Generally, responders will have no FDG uptake above background on follow-up scans, whereas patients with no change or decreases in FDG typically are classified as non-responders.

Melanoma

Q: Are PET and/or PET/CT useful in the evaluation of patients with melanoma?
A: Yes. All indications except regional nodal staging are covered by CMS and almost all third party payers.

Q: Should all patients with melanoma be referred for a staging PET or PET/CT study?
A: No. Most studies suggest that the most appropriate patient population to refer for staging PET or PET/CT are those with stage III or stage IV disease, which are generally with disease in lymph nodes at the time of sentinel node biopsy.
Q: Are PET and/or PET/CT useful for evaluating the primary lesion?
A: No. Because almost all melanoma is cutaneous and easily accessible, PET and/or PET/CT are not performed to evaluate the primary lesion.

Q: How helpful are PET and/or PET/CT for restaging?
A: They are very helpful, particularly in patients with subtle soft-tissue metastases.

Q: Do I need to scan the entire body or just skull base to mid-thigh?
A: Several studies have documented that skull base to mid-thigh imaging is all that is needed if the patient did not have the primary lesion outside that area and if the patient has no evidence of disease outside of that area.

Q: Is melanoma FDG-avid?
A: Yes, it is probably the most FDG-avid tumor cell type. There are no reported cases of a non-FDG avid melanoma.

Breast Cancer

Q: Are PET and/or PET/CT useful in the evaluation of patients with breast cancer?
A: It is not useful for diagnosis of primary breast cancer or local nodal staging (lymphoscintigraphy is the preferred procedure for local nodal staging). It is indicated for initial staging in patients who have high-risk breast cancers and in patients with positive sentinel node biopsies. It is also useful in subsequent treatment strategy to monitor therapy and detect recurrence.

Q: What percentage of primary breast lesions will not be detected by FDG PET?
A: Up to 40% of primary tumors <2cm will show minimal FDG uptake and may be interpreted falsely negative using FDG PET.

Q: Is FDG PET good for assessing the status of axillary lymph nodes?
A: In general, FDG PET using the current scanner technology is not good at evaluating for microscopic disease within the axillary lymph nodes. However, the positive predictive value is very high, so if nodes have FDG uptake they are likely malignant, but many will not be seen. Lymphoscintigraphy is the preferred procedure for evaluating axillary nodal involvement.

Q: Is there enough evidence in the literature to show that FDG PET can accurately replace bone scanning to evaluate the osseous structures?
A: No, there is overlap between lesions seen on PET and traditional bone scanning. Currently, the evidence suggests the modalities are complementary, but FDG PET will miss several bone lesions that will be detected by bone scanning and vice versa. Sclerotic bone metastases are less accurately detected on PET imaging than bone imaging.

Q: What types of primary breast lesions tend to have little or no FDG uptake?
A: Smaller lesions (less <2cm), lower grade tumors, and mucinous tumors.

Q: Why is combined PET/CT better for patients who may undergo radiation therapy?
A: Traditionally, radiation oncologists have used CT performed on an immobilization pallet to do their planning. Most of the software programs now feature fusion capabilities and can import both PET and CT data sets to facilitate a more accurate assessment (both anatomical and functional) of tumor extent and location.
Colorectal Cancer

Q: Are PET and/or PET/CT useful in the evaluation of patients with colorectal carcinoma?
A: Yes. Initial and subsequent treatment strategies are covered indications by CMS and almost all third party payers.

Q: Are FDG PET and/or PET/CT recommended for screening?
A: No, although incidental colorectal lesions are sometimes identified on PET and PET/CT, the study is not accurate enough to detect small lesions early. There are too many false positives for the exam to be helpful for screening.

Q: Is PET or PET/CT good for evaluating regional lymph node metastases?
A: Local nodal involvement is not accurately detected by PET or CT.

Q: Is FDG PET or PET/CT helpful for staging patients?
A: Yes. Although it is not highly sensitive for locoregional lymph node involvement, FDG PET and PET/CT have been shown to be very helpful in evaluating the liver and other distant areas of potential metastatic disease that alters the surgical approach/management of patients by showing unsuspected metastatic disease.

Q: Are there any colorectal malignancies with little or no FDG uptake?
A: Yes, well-differentiated mucinous adenocarcinomas are not very FDG-avid.

Q: Are PET and PET/CT helpful in restaging patients with colorectal cancer?
A: Yes, the modalities are very sensitive and specific for evaluating the colonic anastomosis, for differentiating post-surgical presacral soft tissue from tumor, and for detecting occult disease in patients with a rising CEA level.

Q: Are PET and/or PET/CT helpful for evaluating patients who have undergone radiofrequency ablation (RFA) of liver metastases?
A: Yes, both are very helpful for detecting residual/recurrent tumor after RFA. Patients should not be referred within 4 weeks of receiving RFA to avoid inflammatory FDG uptake at the site. PET/CT offers the added advantage of being able to localize precisely small areas of residual or recurrent disease.

Esophageal Cancer

Q: Are PET and/or PET/CT useful in the evaluation of patients with esophageal cancer?
A: Yes. Initial and subsequent treatment strategies are covered indications by CMS and almost all third party payers.

Q: How good are FDG PET and/or PET/CT at evaluating the primary tumor?
A: PET is not generally used to diagnose esophageal cancer; it is usually diagnosed at the time of endoscopy. In most patients referred for initial staging, the primary cancer is seen.

Q: Are PET and/or PET/CT helpful for evaluating locoregional lymph node involvement?
A: PET and PET/CT are not as sensitive for detecting locoregional lymph node involvement in patients with esophageal cancer as some other malignancies such as head and neck cancer. The power of PET and/or PET/CT is in the specificity, so that the presence of abnormal lymph nodes usually is associated with metastatic lymph node involvement.
Q: How good are PET and/or PET/CT for evaluating the anastomosis following esophagectomy with a gastric pull-up?
A: PET and/or PET/CT are generally very good for evaluating the anastomosis.

Q: How good are FDG PET and/or PET/CT for differentiating scar and post treatment changes from recurrent/residual cancer?
A: By definition, scar is dead tissue and should have NO FDG uptake. These modalities are very useful for this purpose.

Head and Neck Cancer and Thyroid Cancer

Q: Are PET and/or PET/CT useful in the evaluation of patients with head and neck cancer?
A: Yes. Initial and subsequent treatment strategies are covered indications by CMS and most third party payers for head and neck cancers.

Q: Are PET and/or PET/CT useful in the evaluation of patients with thyroid cancer?
A: Yes, for certain applications. Generally PET and PET/CT are not indicated for evaluating the primary tumor or for staging well-differentiated thyroid tumors. While many of these tumors are radioiodine avid, they tend to be non-FDG-avid. Over time, as these tumors dedifferentiate into more aggressive tumor types, they tend to become FDG-avid and lose their avidity for iodine. Therefore, the primary indication for PET and/or PET/CT in thyroid cancer is for the evaluation of patients’ status post-thyroidectomy with a rising thyroglobulin level (10 or greater) and a negative I131 study.

Q: Are FDG PET and/or PET/CT helpful for detecting the primary lesion in a patient with metastatic SCC of the neck?
A: Yes, FDG PET and PET/CT have been shown to have a sensitivity ranging from 26-40% for detecting the primary lesion in patients with “unknown primary” SCC of the neck. PET/CT features the added benefit of precise localization of lesions for biopsy.

Q: Are PET and/or PET/CT helpful for evaluating locoregional lymph node involvement?
A: Yes, several studies have shown their utility in assessing not only ipsilateral lymph node involvement, but also for detecting contralateral lymph node metastases.

Q: How should I position the arms of patients being evaluated for head and neck cancer with PET/CT?
A: Typically, patients with malignancies in the chest, abdomen, and pelvis are scanned with arms up to avoid beam-hardening artifacts on the CT portion of the exam. For patients with head and neck malignancies, consideration should be given to either performing a separate CT with the arms down or to scan these patients with arms down.

Q: How good are FDG PET and/or PET/CT for differentiating scar and post-treatment changes from recurrent/residual cancer?
A: By definition, scar is dead tissue and should have NO FDG uptake, while SCC of the head and neck is almost always FDG-avid. These modalities are very useful for this purpose.