

A Medical Oncologist's Guide to PET at The Brooklyn Hospital Center

PET/CT is more sensitive than CT and bone scan for most aggressive solid tumor types and lymphoma. Therefore, any time there is a moderate to high probability for M disease, PET/CT is the favored technology. Additionally when the N status of a patient is difficult to assess – surgically internal mammary lymph nodes, mediastinal lymph nodes, retroperitoneal nodes – PET/CT will be more sensitive than CT.

Caveats

These are special circumstances that should be considered when using PET for staging:

- **Lymphomas:** MALT B cell lymphomas, CLL (unless assessing the risk for Richter's transformation). Small lymphocytic low grade tumors may have lower sensitivities compared with more aggressive lymphoma subtypes.
- **Sensitivity in the thorax:** Diagnostic CT of the chest to assess for small pulmonary nodules will be more sensitive than PET/CT due to the partial volume effect of PET. So a complete staging study should include a diagnostic CT of the chest in those cancers that could spread to the lungs.
- **Sensitivity in the brain:** Due to the fact that the brain is an obligate glucose metabolizer, the sensitivity of PET/CT in the brain to detect metastatic disease is rather low. If the clinician wants a sensitive method to assess metastatic disease, anatomical-based imaging should be considered.
- **Bone scan versus PET/CT:** There are a few diseases that may spread to the bone in a pure osteoblastic fashion (breast and prostate cancer specifically). If the PET is negative in the osseous structures a bone scan should be considered to complete the evaluation.
- **Mucinous carcinomas:** Other tumor types that may have lower sensitivity compared to their more solid counterparts are the mucinous cancers or other acellular tumor types: specifically mucinous colon cancers or clear cell ovarian cancers.

Response to Therapy

With respect to PET/CT there are a few considerations, we tend to think of lymphomas different than solid tumors and solid tumors can further be broken down into the neoadjuvant assessment and those solid tumors that have metastasized and are undergoing systemic chemotherapy response assessments.

Lymphoma: Earlier assessment is better than delayed assessment. We usually recommend an assessment after one to two cycles of chemotherapy. After the fourth cycle you begin to lose sensitivity and therefore the negative predictive value of PET/CT. The one caveat would be in those lymphomas where the staging study is negative as described above. The response criteria is normal, minimal residual uptake and a positive study. Positive studies portend a poor prognosis regardless of the degree of positivity, however, there will be a spectrum of positive studies ranging from progression to dramatic response from baseline but still positive.

Solid Tumor Types

Metastatic disease: The typical timing sequence here will be after two to three cycles of systemic chemotherapy. The additional cycle timing is due to the fact that most tumors respond to cytotoxic chemotherapy at a slower rate compared to alternate chemotherapies (lymphoma). The degree of response does provide some prognostic value and a clear progression of disease will provide data necessary to consider a change in therapy.

Neoadjuvant response assessment: There are two considerations when using FDG PET/CT to assess response in the patient undergoing neoadjuvant therapy. First, in those patients who are clinically responding to systemic chemotherapy/radiation, most clinicians would use PET/CT after the completion of therapy to gain prognostic data prior to surgical management. Second, in those patients who have clinical signs or symptoms of early progression, PET/CT should be considered earlier – after two to three cycles, as a progressive study will lead to considerations of alternate therapy.

Bone dominant or bone exclusive disease a consideration:

In patients with bone exclusive disease the response assessment with PET/CT will have to be performed off of bone marrow stimulants (GCSF or other agents) as performance on these medications will preclude an accurate assessment. PET/CT should be done at least three weeks after the last doses of medications.

Restaging

Order PET/CT on patients with a suspicion of recurrent disease based on symptoms, tumor markers, laboratory evaluation or other imaging procedures and a history of any FDG avid tumor (aggressive, solid) or lymphoma. In addition to PET/CT, the following scans should be considered:

- A DX CT of the chest to assess for small pulmonary nodules
- For pancreatic, breast, rectal and colon cancers a multiphase CT with oral and IV contrast of the liver
- For colon, rectal, pancreatic, cervical, ovarian and endometrial cancers, a DX CT of the abdomen and/or abdomen/pelvis with oral and IV contrast
- For breast cancer, when there is a negative PET/CT, a bone scan may add sensitivity to detect osteoblastic metastatic disease

Surveillance

There is literature supporting PET/CT surveillance for head, neck, colon and rectal cancers. There is a developing body of literature for certain lung cancer patients. For all other tumors the surveillance data is sparse but consistent with a predictable time frame of PET/CT positive lesions relative to CT of about six to nine month lead time of diagnosing recurrence. The frequency of surveillance should be based on the risk of the patient and the ability to influence management.

Head and Neck Cancer

Order PET/CT with DX CT of the neck with IV contrast, and DX CT of the lung on T3No or above. Repeat every three to six months for two to three years after therapy has been completed.

Colon and Rectal Cancer

Order PET/CT with DX CT of the chest and liver or abdomen or abdomen/pelvis with oral and IV contrast on T3No or above. Consider multiphase liver imaging. Repeat every three to six months for two to three years after therapy has ended. After two to three years the rate of recurrence is low so the surveillance may be stopped or lengthened in interval.

Lung Cancer

Order PET/CT with DX CT of the chest on Stage II or above. Repeat every three to six months for two to three years in patients where finding disease recurrence would impact clinical management - salvage surgery, proton therapy, cyberknife or alternate therapy.

Lymphoma

For any metabolically active lymphoma patient at high risk for recurrent disease, PET/CT will be more sensitive than anatomically - based strategies of CT scanning. Addition of oral and IV contrast is a consideration if a complete anatomical evaluation is desired by the clinician.



The Brooklyn Hospital Center

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