

Imaging Breast Cancer

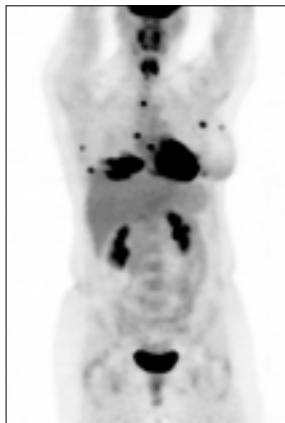
Role of PET and PET/CT in diagnosis and treatment

Although mammogram is the most commonly performed method of screening the breast, other imaging modalities such as ultrasound, magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET) may be used to provide additional information to better locate and define abnormal findings. Among these, PET, and more recently PET/CT, fills certain imaging needs that the other modes cannot meet.

Unlike diagnostic imaging studies such as CT, which show the anatomical structures, PET scans reveal metabolic activity in the body. Bright hot spots can indicate the presence of tumors, which metabolize excess glucose and take up more of the radiolabeled tracer used during PET scans than areas that do not metabolize excess glucose.

Along with lung cancer, lymphoma, and colorectal cancer, breast cancer is among the top indications for which a PET scan is ordered, according to **Ronald Van Heertum, MD**, Director, Columbia Kreitchman PET Center. Although PET is not commonly used to evaluate breast lesions at early stages, it is very useful for patients whose tumor markers in the blood are increasing, which may indicate recurrent disease. “Rising cancer markers suggest the likelihood of a new tumor, but they don’t tell where in the body a new tumor may be located,” Dr. Van Heertum says. “PET and PET/CT can be used in such situations to define the presence of a new tumor or confirm the location of a suspected tumor.”

CT scans can reveal the size of lymph nodes, and usually nodes larger than 10 mm are considered abnormal. But



1) PET



2) CT



3) fused PET/CT

These scans were taken in April 2007, before the patient underwent chemotherapy.

The patient shown in these scans underwent a lumpectomy to remove a cancerous growth in her right breast in 2006. In the spring of 2007, a tumor recurrence was suspected and she was referred for a PET/CT study.

The bright areas on the initial PET/CT study (figure 3) and dark areas on the PET study (figure 1) reveal extensive disease recurrence in the right breast, with additional localized areas of spread in the left breast, bones, and left axilla (armpit).

After chemotherapy, the patient was referred back for a follow-up PET/CT study (figure 6). This revealed significant decrease in the extent of the cancer in the right breast and skeleton, but increased spread of disease in the left breast and left axilla. These changes can also be seen in the darkened areas on the post-chemotherapy PET scan (figure 4). These findings are consistent with a mixed response to treatment, according to Ronald Van Heertum, MD.

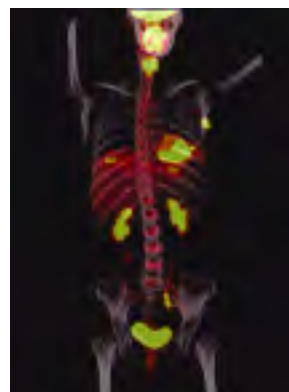
Although the CT scans (figures 2 and 5) were useful to help localize the patient's disease, they did not reveal the extent of disease.



4) PET

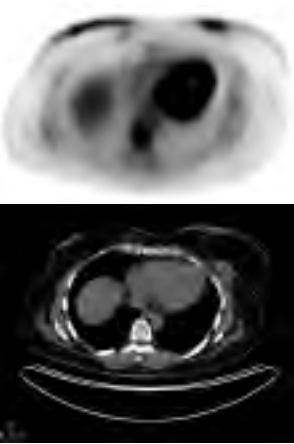


5) CT



6) fused PET/CT

These scans were taken in July 2007, after chemotherapy.




nodes can enlarge for reasons other than cancer, and CT can not distinguish the cause. PET can detect whether there is uptake caused by a tumor, regardless of size, and is more specific than CT.

GAUGING RESPONSE TO TREATMENT

Moreover, PET is highly useful in showing the extent of disease and a patient's response to treatment. Early on, patients with a new tumor may undergo PET after surgery in order to establish a baseline prior to treatment by chemotherapy or hormonal therapy. As treatment progresses, sequential PET scans can determine whether therapy is working, and how well. "PET is now proving to be a great way to follow patients to see if they are responding to treatment," says Dr. Van Heertum. "PET can be very effective in picking up recurrent disease and residual disease when a patient is undergoing treatment by chemotherapy or radiation."

Combined PET/CT scans are particularly useful for monitoring response to therapy, and the addition of anatomical information from CT defines the location of a mass very precisely for the purposes of performing biopsy or radiation therapy. According to Dr. Van Heertum, "Someone may have no evidence of disease on a CT scan but clearly increased metabolic activity on PET. Or, there may be no change on the CT scan, but a dramatic increase or decrease in metabolic activity on PET. This information affects patients' treatment very significantly."

In some cases, the combination of PET/CT can define lesions that would be impossible to clarify by PET or CT alone. For instance, a mass appearing on a CT scan could be a tumor, or it could be fibrosis (scarring) from radiation and surgery. There is no non-surgical way to identify which it is, short of monitoring over time to see whether it grows larger (which would indicate it is cancerous). Instead of waiting, the combined PET/CT scan provides a reliable indication of whether the mass is cancerous or not, without exploratory surgery.

Most insurers and Medicare reimburse for PET scans in the treatment of patients who have recurrent breast cancer. 

For referrals or more information about PET for breast cancer, call 212.923.1555.

APPLICATIONS OF PET AND PET/CT IMAGING

Cancer

PET and PET/CT offer an extremely high level of accuracy in detecting, staging, restaging, or monitoring treatment of nearly all types of cancer, including breast and ovarian cancer, as well as brain, colorectal, esophageal, liver, lung, lymphoma, kidney, pancreatic, thyroid, and many other cancers. In children, PET is particularly useful in the diagnosis of Hodgkin's disease and lymphoma.

Cardiology

PET can delineate blood-flow patterns and assess heart-muscle viability for cardiology patients, helping to establish the optimal treatment plan.

Neurology

PET can reveal abnormal patterns in the brain, helping to localize regions causing epileptic seizures, as well as differentiating among various dementia disorders, including Alzheimer's disease.

The Columbia Kreitchman PET Center works with referring physicians to verify benefits, including enrollment of patients in Medicare's National Oncologic PET Registry (NOPR), which is required for Medicare reimbursement of certain cancers.

For more information, please call 212.923.1555.

DETECTING AND DIAGNOSING OVARIAN CANCER

There is a correlation between breast and ovarian cancer: both are associated with abnormalities in the BRCA1 and BRCA2 genes.

As is the case with breast cancer, tumor markers are monitored after treatment of ovarian cancer for indications that treatment is successful. If these markers rise, the challenge is to discover why — false positives can occur, and if the patient has no symptoms, it can be difficult to determine the location of a new tumor. The use of PET can help to determine the presence of a localized mass, or if there is diffuse systemic disease. Because these types of cancer require very different treatments, the use of PET is extremely important.

PET is also invaluable in determining response to therapy in patients with ovarian cancer. "The only other way to determine whether treatment is effective is to perform surgery," says Dr. Van Heertum. "With PET, we can often see how well therapy is working without surgery."