Positron Emission Tomography (PET)

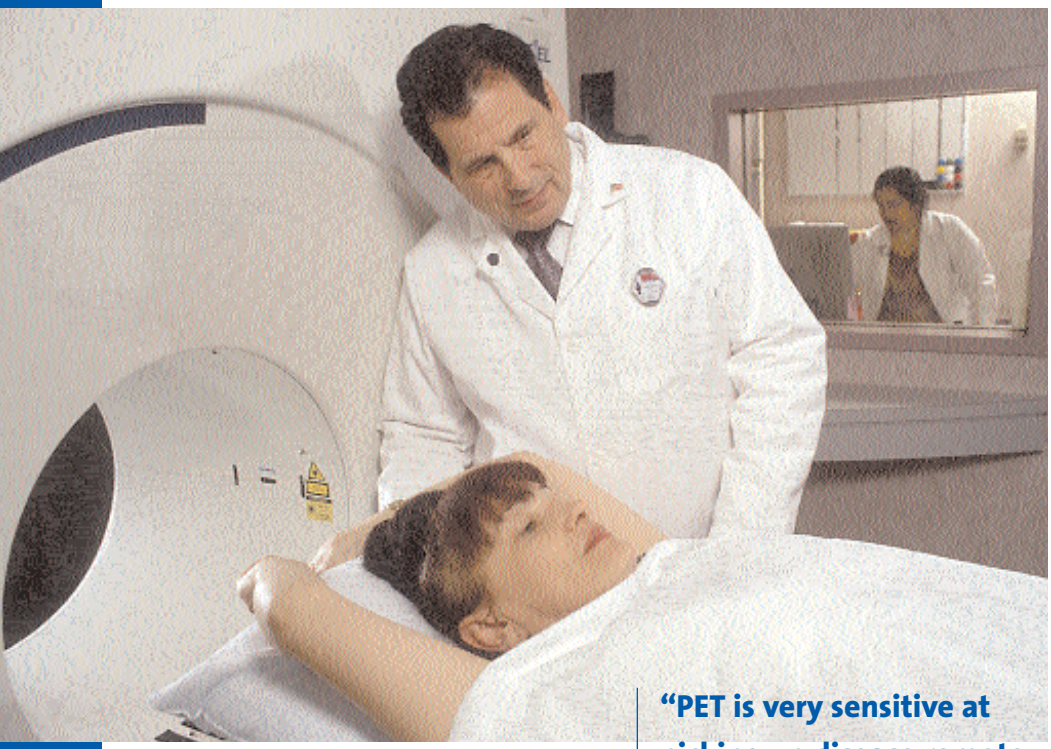
A NEW VIEW ON BREAST CANCER

Breast cancer is among the most feared diseases facing women today. The American Cancer Society predicts that over 212,000 women will be diagnosed with invasive breast cancer in 2003 and over 40,000 women will die from the disease. Early detection is critical to the successful treatment of breast cancer. In fact, breast cancer mortality rates have been falling in the last few years, due to more women being screened and improved screening and treatment methods.

Recently, PET (positron emission tomography) scanning has been added to the arsenal of imaging tools used to detect and stage breast cancer. PET scans detect metabolic changes in body tissues. Like many tumors, breast tumors have an affinity for glucose, a sugar. Glucose feeds the tumors, enabling them to multiply and expand. By revealing areas of increased glucose consumption, PET scans can spot active lesions, or tumors.

Other imaging techniques, such as mammography, CT (computerized tomography), and MRI (magnetic resonance imaging) show structural changes in the body. For example, a mammogram may show the existence of a lump in the breast. However, the metabolic changes associated with that lump may appear on the PET scan before the lump itself becomes evident on a mammogram.

"Currently PET typically has two major applications for breast cancer patients," says **Ronald L. Van Heertum, MD,** *Director*, Morton A. Kreitchman PET Center, and Professor of Radiology at Columbia University College of Physicians & Surgeons. "PET can help reveal whether there is any recurrence of cancer. In addition, PET can help physicians to monitor a patient's response to therapy—showing whether the cancer has grown smaller following chemotherapy."



RENÉ PEREZ

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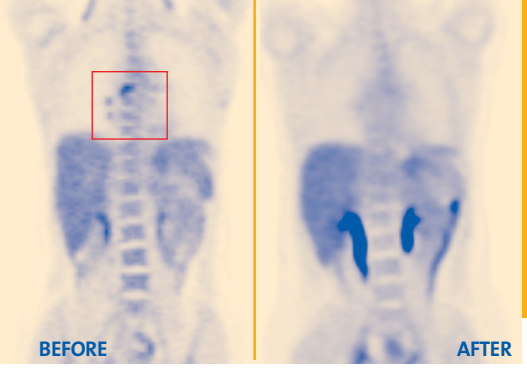
How PET Works

Before having a PET scan, patients receive an injection of a harmless tracer that attaches to glucose in the body. This tracer enables the PET scanner to track patterns of glucose consumption and is easily absorbed and eliminated by the body. Breast cancer patients typically have a "full body scan," which covers the entire trunk of the body. With the full body approach, physicians can determine whether the cancer has spread beyond the breast. The scans typically take less than one hour. Patients lie on a table that slowly slides through the scanner. Only a small portion of the patient is covered by the scanner at any time. The radiation exposure is similar to that from an X-ray or CT scan.



◀ **Breast lesions appear as dark spots in the original scan (far left). Eighteen months later, following treatment, no evidence of breast cancer remains (left). Note: The darkened sections in the lower body correspond with natural digestive processes.**

PET and Breast Cancer

The greater level of sensitivity offered by PET enables physicians to better tailor the treatment plan to the individual patient. PET can be used to:

Monitor Response to Therapy

Patients with advanced, or invasive, breast cancer often receive chemotherapy to treat their disease. Full body PET scans, conducted upon completion of a course of chemotherapy, can reveal the impact of that therapy on the disease. Such knowledge can affect whether a patient receives another course of the existing regimen or whether a new treatment approach is recommended.

Detect Recurrent Disease

For patients who have been previously diagnosed with invasive breast cancer, PET scans can offer the most accurate assessment of their status. Early detection of any recurrence can be critical to effectively fighting the disease.

In addition, PET can be used to:

- Stage breast cancer—determining whether the disease remains localized or has metastasized (spread) to tissues and organs outside the breast.
- Determine the optimal location for performing a breast biopsy.
- Detect disease in women with very dense breasts or breast implants—distinguishing between benign and malignant lesions.

"We can use PET to work up the extent of disease and determine the optimal treatment path for patients with established breast cancer," says **Freya R. Schnabel, MD,** *Chief* of the Breast Surgery Section at Columbia. "PET is very sensitive at picking up disease remote from the breast and can even help us rule out disease. For example, PET can distinguish between metastases and benign nodules in the lungs—a very helpful piece of information."

Both Dr. Schabel and Dr. Van Heertum see advances on the horizon for PET for breast cancer. "We are beginning to use PET to assess the effects of chemotherapy or radiation therapy midcourse, instead of waiting until the patient has completed a full course of treatment," reports Dr. Van Heertum.

"We are also using PET as a prognosticator; studies have shown that patients with no evidence of disease upon completion of therapy have a better chance for a full recovery. Finally, we are developing new PET radiopharmaceuticals that can more specifically highlight breast cancer tumors in the body by targeting more specialized markers than glucose."

For more information, please contact the Columbia Kreitchman PET Center at 212.923.1555 or info@columbiapet.org.

Oncology PET

In addition to benefiting breast cancer patients, PET offers an extremely high level of accuracy in detecting, staging, restaging, or monitoring the following types of cancer:

- Brain
- Cervical
- Colorectal
- Esophageal
- Head and Neck
- Lung
- Lymphoma
- Melanoma
- Musculoskeletal
- Ovarian
- Pancreatic
- Soft Tissue Sarcoma
- Testicular
- Thyroid
- Unknown Primary

For pediatric oncology patients, PET particularly aids in the diagnosis of Hodgkin's disease and lymphoma. PET is currently under investigation for kidney cancer.

Additional PET Applications

PET applications reach beyond the field of oncology. PET can delineate blood-flow patterns and assess heart-muscle viability for **cardiology** patients, helping to establish the optimal treatment plan.

In **neurology**, PET can reveal abnormal patterns in the brain, helping to localize regions causing epileptic seizures and to differentiate among various dementia disorders.