

PET (Positron Emission Tomography) is the clinical “gold standard” with proven uses in three major areas: Oncology, Neurology and Cardiology. PET/CT can accurately determine whether a tumor is benign or malignant, show the progression of disease and accurately track the effectiveness of cancer treatment. PET/CT can reveal dysfunctional cognitive patterns, making it a valuable tool for assessing patients with various forms of dementia. PET/CT is an imaging modality that has helped advance the treatment of refractory seizures as a pre-surgical diagnostic tool to guide treatment options. A PET/CT scan provides the highest level of accuracy of any non-invasive test for the diagnosis of coronary artery disease and the assessment of myocardial viability.

WHAT IS PET?

Positron Emission Tomography is an advanced molecular imaging procedure that provides a way to diagnose disease through the measurement of metabolic activity. PET is a functional imaging technique: the images are derived from the metabolism of radiopharmaceuticals absorbed by the tissue under study. As such, it complements x-ray, CT and MR, which provide anatomical information. PET/CT often detects pathology before it becomes visible with CT or MR because metabolic changes typically precede anatomic ones.

PET/CT is a nuclear medicine procedure. The patient is injected with a radiopharmaceutical which concentrates at the site of metabolic activity. A sophisticated detector images the distribution of the radiopharmaceutical in the body, thus imaging tissue function. PET can detect the spread of malignant tumors and differentiate cancerous tissue from benign tumors and scar tissue. This can have a dramatic impact on patient treatment, planning and care.

HOW PET WORKS

During a PET/CT scan, patients are first injected with a radiopharmaceutical, usually FDG, a radioactive glucose compound. As the compounds are distributed throughout the body and processed by the cells being targeted for imaging, the PET scanner detects the FDG accumulated in glucose-avid cells and creates images that are displayed on a video monitor. The signals detected by the camera are processed by a computer to create images that display the distribution of metabolic activity as cross-sectional slices. Because cancer cells usually have a higher metabolic rate than surrounding cells, they absorb more of the tracer and will show more prominently on the image.

PET/CT ADVANTAGES FOR PATIENT DIAGNOSIS

PET/CT enables physicians to better determine the presence of a tumor, as well as the extent and spread of disease. With better information about the early presence or spread of cancer, physicians can select the treatment approach that's most effective for the patient.

An important benefit of PET/CT is its high-definition imaging which can detect tissue abnormalities even in the absence of structural changes. The detection of small amounts of malignant tissue, often undetectable by conventional imaging techniques, can have a major impact on the choice of treatment for patients, which may involve drug therapy, surgery, radiation, chemotherapy or a combination of all available options.

PET/CT fusion imaging has the ability to combine the structural information of CT with the metabolic information of PET into a single set of images. This ability to detect the exact location of a “hot spot” by superimposing the PET and CT images provides extremely valuable information for physicians in the treatment of diseases.

PET/CT AND CANCER

PET/CT is particularly effective in identifying whether or not cancers are responding to treatment, if a person is cancer free, or if a cancer has recurred—and where. Cancers for which PET/CT is considered particularly effective include: lung, lymphoma, melanoma, breast, colorectal, esophageal, head and neck, pancreatic, ovarian, cervical and thyroid. Cancer of the prostate, kidney and musculoskeletal system may also be FDG avid.

- Staging of Cancer: PET/CT is extremely sensitive in determining the full extent of disease, especially in the cancers noted above. Confirmation of metastatic disease allows the physician and patient to more accurately decide on how to proceed with the patient's management
- Checking for recurrences: PET/CT is considered to be the most accurate diagnostic procedure to differentiate tumor recurrences from radiation necrosis or post-surgical changes. Such an approach allows for the development of a more rational treatment plan for the patient.



- **Assessing the Effectiveness of Chemotherapy:** The level of tumor metabolism is compared on PET/CT scans taken before and after a chemotherapy cycle. A successful response seen on a PET/CT scan frequently precedes alterations in anatomy and is considered to be an earlier indicator of tumor shrinkage than might be seen with other diagnostic modalities.
- **Early Detection:** Since PET images biochemical activity, it can accurately characterize a tumor as benign or malignant, thereby avoiding surgical biopsy when the PET scan is negative. Conversely, since a PET scan images the entire body, confirmation of non-local metastasis can alter treatment plans in certain cases from surgical intervention to chemotherapy.

PET IN NEUROLOGY

Epilepsy

PET has helped advance the diagnosis of refractory epilepsy leading to cures in certain cases. PET is one of the most accurate methods available to localize the areas of the brain causing epileptic seizures and to determine if surgery is a viable treatment option.

Dementia

The brain is highly dependent on glucose metabolism. PET can reveal abnormal patterns of uptake in the brain and is, therefore, a valuable tool for assessing patients with various forms of dementia. It is particularly useful in diagnosing Alzheimer's disease and in distinguishing Alzheimer's disease from other dementia disorders, such as vascular dementia, Parkinson's disease, Pick's disease and Huntington's disease.

Alzheimer's Disease

Although the only definitive test for Alzheimer's disease (AD) is autopsy, PET can supply important diagnostic information. When comparing a normal brain vs. an AD-affected brain on a PET scan, a distinctive image appears in the AD-affected brain. This pattern may be seen very early in the course of Alzheimer's disease, when all other imaging is normal. The confirmation of AD is a long process of elimination that averages between two and three years of diagnostic and cognitive testing. PET can help to drastically shorten this process by identifying distinctive patterns earlier in the course of the disease. Since currently available medical treatments seem to be more effective if started early, a correct and early diagnosis will have important patient ramifications.



PET IN CARDIOLOGY

Myocardial viability offers the most important role for PET in cardiology. PET metabolism studies are regarded as the "gold standard" in identifying hibernating myocardium, a critical element in determining successful functional recovery after revascularization.

HOW TO PREPARE YOUR PATIENTS FOR A PET/CT SCAN

For most patients, the PET/CT scan takes about two hours to complete

Patients should bring:

- All previous studies, including CT and/or MR films and reports
- Their chemotherapy history, including date of most recent treatment.
- Insurance information.

Preparing for the Test

- Patients should not eat or drink (other than water) four hours prior to the exam.
- Patients are encouraged to drink plenty of water prior to the exam
- Patients should refrain from strenuous exercise for two days prior to the exam (including the day of the exam).
- Diabetic patients may require special preparation and should call the radiology department for instructions.

**For more information regarding the PET/CT scan call (970) 256-6445
or visit YourCommunityHospital.com.**

Mktg/Radiology/2009/PET Scan/PET/CT Physician Fact