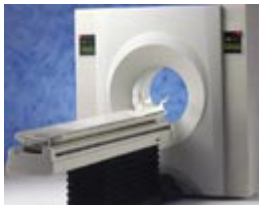
RADIOLOGYINFO™
The radiology information resource for patients

Positron Emission Tomography (PET Imaging)

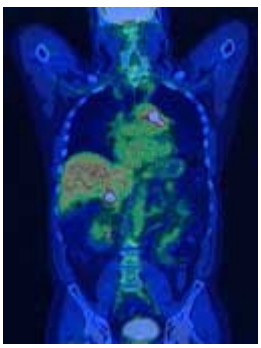


What is Positron Emission Tomography?

Positron emission tomography, also called PET imaging or a PET scan, is a diagnostic examination that involves the acquisition of physiologic images based on the detection of radiation from the emission of positrons. Positrons are tiny particles emitted from a radioactive substance administered to the patient. The subsequent images of the human body developed with this technique are used to evaluate a variety of diseases.

What are some common uses of the procedure?

PET scans are used most often to detect cancer and to examine the effects of cancer therapy by characterizing biochemical changes in the cancer. These scans can be performed on the whole body. PET scans of the heart can be used to determine blood flow to the heart muscle and help evaluate signs of coronary artery disease. PET scans of the heart can also be used to determine if areas of the heart that show decreased function are alive rather than scarred as a



Sample image obtained

using a combination of PET and CT imaging technology.

result of a prior heart attack, called a myocardial infarction. Combined with a myocardial perfusion study, PET scans allow differentiation of nonfunctioning heart muscle from heart muscle that would benefit from a procedure, such as angioplasty or coronary artery bypass surgery, which would reestablish adequate blood flow and improve heart function. PET scans of the brain are used to evaluate patients who have memory disorders of an undetermined cause, suspected or proven brain tumors or seizure disorders that are not responsive to medical therapy and are therefore candidates for surgery.

How should I prepare for the procedure?

PET is usually done on an outpatient basis. Your doctor will give you detailed instructions on how to prepare for your examination. You should wear comfortable, loose-fitting clothes. You should not eat for four hours before the scan. You will be encouraged to drink water. Your doctor will instruct you regarding the use of medications before the test.

Note: Diabetic patients should ask for any specific diet guidelines to control glucose levels during the day of the test.

What does the equipment look like?

You will be taken to an examination room that houses the PET scanner, which has a hole in the middle and looks like a large doughnut. Within this machine are multiple rings of detectors that record the emission of energy from the radioactive substance in your body and permit an image of your body to be obtained. While lying on a cushioned examination table, you will be moved into the hole of the machine. The images are displayed on the monitor of a nearby computer, which is similar in appearance to the personal computer you may have in your home.

How does the procedure work?

Before the examination begins, a radioactive substance is produced in a machine called a cyclotron and attached, or tagged, to a natural body compound, most commonly glucose, but sometimes water or ammonia. Once this substance is administered to the patient, the radioactivity localizes in the appropriate areas of the body and is detected by the PET scanner.

Different colors or degrees of brightness on a PET image represent different levels of tissue or organ function. For example, because healthy tissue uses glucose for energy, it accumulates some of the tagged glucose, which will show up on the PET images. However, cancerous tissue, which uses more glucose than normal tissue, will

accumulate more of the substance and appear brighter than normal tissue on the PET images.

How is the procedure performed?

A nurse or technologist will take you into a special injection room, where the radioactive substance is administered as an intravenous injection (although in some cases, it will be given through an existing intravenous line or inhaled as a gas). It will then take approximately 30 to 90 minutes for the substance to travel through your body and accumulate in the tissue under study. During this time, you will be asked to rest quietly and avoid significant movement or talking, which may alter the localization of the administered substance. After that time, scanning begins. This may take 30 to 45 minutes.

Some patients, specifically those with heart disease, may undergo a stress test in which PET scans are obtained while they are at rest and again after undergoing the administration of a pharmaceutical to alter the blood flow to the heart.

Usually, there are no restrictions on daily routine after the test, although you should drink plenty of fluids to flush the radioactive substance from your body.

What will I experience during the procedure?

The administration of the radioactive substance will feel like a slight pinprick if given by intravenous injection. You will then be made as comfortable as possible before you are positioned in the PET scanner for the test. You will be asked to remain still for the duration of the examination. Patients who are claustrophobic may feel some anxiety while positioned in the scanner. Also, some patients find it uncomfortable to hold one position for more than a few minutes. You will not feel anything related to the radioactivity of the substance in your body.

Who interprets the results and how do I get them?

Patients undergo PET because their referring physician has recommended it. A radiologist who has specialized training in PET will interpret the images and forward a report to your referring physician. It usually takes one to three days to interpret, report and deliver the results. In order to facilitate interpretation, you may be asked to bring any previous radiologic images with you, such as recent CT (CAT) scans or MRI images.

What are the benefits vs. risks?

- Because PET allows study of body function, it can help physicians detect alterations in biochemical processes that suggest disease before changes in anatomy are apparent with other imaging tests, such as CT or MRI.
- Because the radioactivity is very short-lived, your radiation exposure is low. The substance amount is so small that it does not affect the normal processes of the body.
- The radioactive substance may expose radiation to the fetus in patients who are pregnant or the infants of women who are breast-feeding. The risk to the fetus or infant should be considered in relation to the potential information gain from the result of the PET examination. If you are pregnant, you should inform the PET imaging staff before the examination is performed.

What are the limitations of Positron Emission Tomography?

PET can give false results if a patient's chemical balances are not normal. Specifically, test results of diabetic patients or patients who have eaten within a few hours prior to the examination can be adversely affected because of blood sugar or blood insulin levels.

Also, because the radioactive substance decays quickly and is effective for a short period of time, it must be produced in a laboratory near the PET scanner. It is important to be on time for the appointment and to receive the radioactive substance at the scheduled time. PET must be done by a radiologist who has specialized in nuclear medicine and has substantial experience with PET. Most large medical centers now have PET services available to their patients. Medicare and insurance companies cover many of the applications of PET, and coverage continues to increase.

Finally, the value of a PET scan is enhanced when it is part of a larger diagnostic work-up. This often entails comparison of the PET scan with other imaging studies, such as CT or MRI.

Additional Information and Resources:

RadiologyInfo:

Brain Tumors
Colorectal Cancer
Head and Neck Cancer
Lung Cancer

RTAnswers.org:

Radiation Therapy for Brain Tumors

Radiation Therapy for Colorectal Cancer
Radiation Therapy for Hodgkins Lymphoma
Radiation Therapy for Lung Cancer
Radiation Therapy for Non-Hodgkins Lymphoma
Radiation Therapy for Head and Neck Cancer

To locate a medical imaging or radiation oncology provider in your community, you can search the ACR-accredited facilities database.

Note About Links: For the convenience of our users, *RadiologyInfo* provides links to relevant Web sites. *RadiologyInfo*, ACR and RSNA are not responsible for the content contained on the Web pages found at these links.

This procedure is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.

This page was reviewed on April 21, 2005