Positron Emission Tomography (PET)

Overview

A positron emission tomography (PET) scan is an imaging test that shows the metabolic activity (energy usage) of your body. A PET scan can give your doctor information about how your brain is working. It may be used to detect cancer, seizures, or Alzheimer's.

How does a PET scan work?

PET is a nuclear imaging test that integrates computed tomography (CT) and a radioactive tracer. The tracer is what allows doctors to see how your body tissues absorb and use different chemicals in real time.

Before the PET scan, a tracer is injected into your bloodstream. After the tracer is absorbed in the body, you are positioned in the scanner. The tracer is radiolabeled, meaning it emits gamma rays that are detected by the PET scanner. The computer collects the information emitted by the tracer and displays it on the CT images.

The radioisotopes used in PET to label tracers are 11C, 13N, 150, and 18F (carbon, nitrogen, oxygen, and 18F used as a substitute for hydrogen). These radioactive forms of natural elements will pass through your body and be detected by the scanner. Various drugs and other chemicals can be labeled with these isotopes.

The type of tracer used depends on what your doctor wants to measure. For example, if your doctor is looking at a tumor, he or she might use radiolabeled glucose (FDG) and watch how it is metabolized by the tumor.

What does a PET scan show?

PET can measure blood flow, blood volume, oxygen usage, tissue pH (acidity), glucose (sugar) metabolism, and drug activity. PET is very useful in detecting the activity of cancer. Because malignant cells grow at a fast rate, they metabolize more sugar than normal cells. This can give your doctor a glimpse into how aggressive a tumor is or how its growth is slowed by therapy.

Another common use for PET is for presurgical evaluation of medically uncontrolled seizures (Fig. 1). By detecting metabolic changes in the brain, the surgeon can pinpoint the nonfunctioning area of the brain causing seizures.

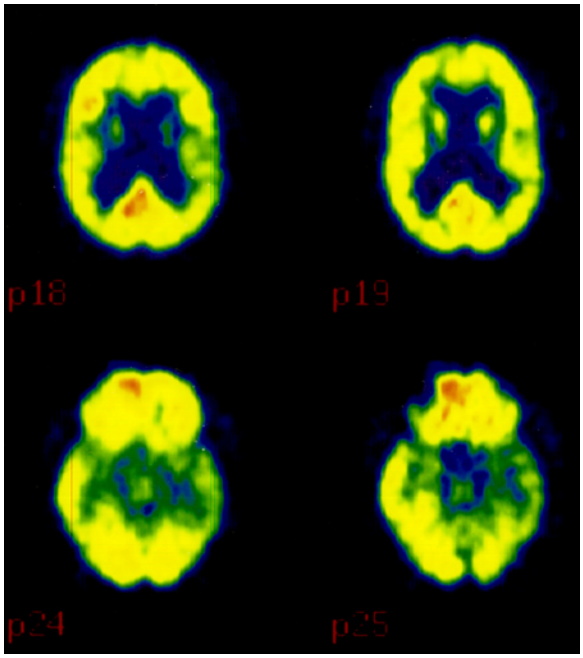

Figure 1. A PET scan of a patient with uncontrolled complex partial seizures. The temporal lobe on the left side of the brain metabolizes less sugar than the right, confirming for the surgeon the nonfunctioning area of the brain causing seizures.

Since PET measures the chemical activity of tissues some diseases such as diabetes or other metabolic disorders may give false results.

Who performs the test?

A specially trained nuclear medicine technologist will perform the test in the Nuclear Medicine department of the hospital, or at an outpatient imaging center.

How should I prepare for the test?

- Do not eat anything for 4 to 6 hours before the exam
- If you take certain medications or have certain diseases, such as diabetes, you will receive specific instructions.
- Wear comfortable clothing
- Be prepared to stay for 2 to 3 hours

What happens during the test?

First, you will receive an injection of a small amount of radioactive tracer. You'll be asked to rest for about 30–45 minutes until the tracer reaches your brain (2 hours to be absorbed by bone). Next, you'll lie comfortably on a table that moves slowly through the scanner. Be sure to remain as still as possible so that the machine can take accurate pictures. Depending on the information your doctor needs, you may be asked to perform certain tasks like read or speak to activate areas of your brain.

Once the scan is complete, you can leave. Be sure to drink plenty of fluids to flush the tracer from your body.

What are the risks?

The tracer is radioactive, which means your body is exposed to radiation. This exposure is limited, however, because the radioactive chemicals have short half-lives. They breakdown quickly and are removed from the body through the kidneys.

The long-term risk of radiation exposure is usually worth the benefits of diagnosing serious medical conditions. Your exposure risk could vary, however, depending on how many CT or other scans you have had. If you have concerns about your cumulative radiation exposure, talk to your doctor.

Women who are pregnant or nursing should not undergo a PET scan.

Some people may have an allergic reaction to the tracer or the contrast agent.

How do I get the test results?

The nuclear medicine doctor will promptly review your images and communicate directly with your referring doctor, who in turn will discuss the results with you.

Sources & links

If you have further questions about this diagnostic test, contact the doctor that ordered the test or visit www.radiologyinfo.org.

Glossary

gamma rays: electromagnetic radiation emitted during radioactive decay and having an extremely short wavelength.

glucose: a simple sugar that is a source of energy for the body and the only source of energy for the brain.

positron emission tomography (PET): a nuclear medicine test in which tissue function can be imaged. Damaged tissues have reduced metabolic activity; therefore, gamma radiation from these areas is reduced or absent.

radiolabel: the technique of attaching, or "tagging", a radioactive molecule to another molecule (such as a protein) so that it can be identified in the body. The radiolabeled substance emits positrons that can be picked up by a special scanner.

tomography: the technique of using rotating X-rays to capture an image at a particular depth in the body, bringing those structures into sharp focus while blurring structures at other depths.

tracer: a substance, usually radioactively labeled, which is injected into your body and can be followed to gain information about metabolic processes.

updated > 3.2019
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