

Single Photon Emission Computed Tomography (SPECT) basic level

Overview

A Single Photon Emission Computed Tomography (SPECT) scan is a type of nuclear imaging test that shows how blood flows to tissues and organs.

How does a SPECT scan work?

A SPECT scan integrates two technologies to view your body: computed tomography (CT) and a radioactive material (tracer). The tracer is what allows doctors to see how blood flows to tissues and organs.

Before the SPECT scan, you are injected with a chemical that is radiolabeled, meaning it emits gamma rays that can be detected by the scanner. The test differs from a PET scan in that the chemical stays in your blood stream rather than being absorbed by surrounding tissues, thereby limiting the images to areas where blood flows. SPECT scans are cheaper and more readily available than higher resolution PET scans.

The computer collects the information emitted by the gamma rays and translates them into two-dimensional cross-sections. These cross-sections can be added back together to form a 3D image of your brain.

What does a SPECT scan show?

A SPECT scan is primarily used to view how blood flows through arteries and veins in the brain. Tests have shown that it might be more sensitive to brain injury than either MRI or CT scanning because it can detect reduced blood flow to injured sites.

SPECT scanning is also useful for presurgical evaluation of medically uncontrolled seizures (Figure 1). The test can be performed between seizures (interictal) or during a seizure (ictal) to determine blood flow to areas where the seizures originate.

This type of scanning is also useful in diagnosing stress fractures in the spine (spondylolysis), blood deprived (ischemic) areas of brain following a stroke, and tumors.

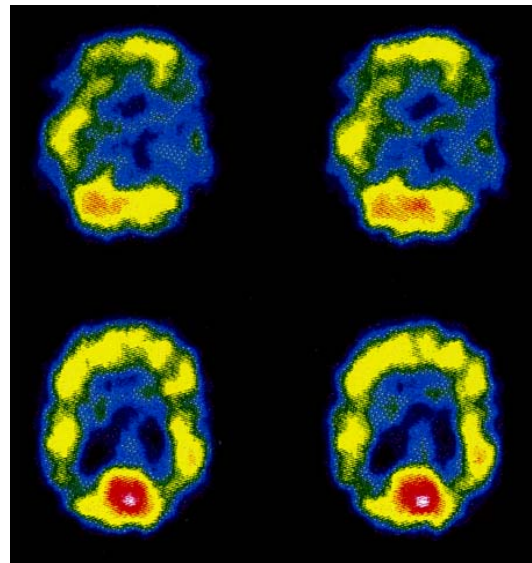


Figure 1: A SPECT scan of a patient with medically uncontrolled complex partial seizures. The temporal lobe on the left side of the brain shows less blood flow than the right, confirming for the surgeon the nonfunctioning area of the brain causing seizures.

How does the tracer work?

The radioisotopes typically used in SPECT to label tracers are iodine-123, technetium-99m, xenon-133, thallium-201, and fluorine-18. These radioactive forms of natural elements will pass safely through your body and be detected by the scanner. Various drugs and other chemicals can be labeled with these isotopes without changing their properties.

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

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. The nuclear medicine doctor will review the images and report the findings.

How should I prepare for the test?

Wear comfortable clothing and be prepared to stay for 1–2 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 10–20 minutes until the tracer reaches your brain. Next you'll lie comfortably on a scanner table while a special camera rotates around your head. Be sure to remain as still as possible so that the machine can get accurate pictures.

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

What are the risks?

The amount of radiation your body is exposed to is less than you receive during a chest X-ray or CT scan. Women who are pregnant or nursing should not undergo a SPECT scan.

How do I get 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

www.nlm.nih.gov/medlineplus/diagnosticimaging.html

Glossary

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

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.

photon: a particle that travels at the speed of light.

positron: an electrically charged particle that has the opposite charge as an electron. It reacts with an electron to produce gamma rays.

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.

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