TEST

Positron emission tomography

A PET scan uses a radioactive tracer to show how active tissues are.

WHAT IT MEASURES
Radiotracer uptake showing how active tissues are

SAMPLE
None

FASTING NEEDED?
Sometimes: usually 4-6 hours before an FDG scan

HOW LONG IT TAKES
Usually about 2-3 hours

RESULTS IN
Usually 1-3 days; varies by laboratory and imaging service

USED FOR
Diagnosis, staging, treatment planning, and monitoring

MAIN LIMITATION
Inflammation can resemble cancer on FDG PET images

Overview

Positron emission tomography, usually called PET, is an imaging test. It shows how active different tissues are rather than only showing their size or shape.

Before the scan, you receive a small amount of a radioactive substance called a radiotracer . The PET scanner detects signals from this tracer and turns them into images.

The most common tracer is fluorodeoxyglucose, or FDG. It behaves in a similar way to glucose, a type of sugar. Tissues that use more glucose may absorb more FDG and appear brighter on the scan.

High uptake is not automatically cancer. Normal organs, inflammation, infection, healing tissue and active muscles can also take up FDG.

PET is often combined with computed tomography, known as PET/CT. CT provides detailed pictures of body structures, while PET shows tissue activity. Some centres use PET with magnetic resonance imaging, called PET/MRI.

Other tracers target particular cells or body processes. For example, specialised tracers may be used for prostate cancer, neuroendocrine tumours, heart conditions or brain disorders.

Why the test is ordered

A PET scan may help investigate an abnormality found through symptoms, examination or another imaging test. It can show whether an area has unusually high or low activity.

In cancer care, PET may be used to:

PET may also assess blood flow and metabolism in the heart or patterns of brain activity. The reason for the test determines which tracer is used and which part of your body is scanned.

PET is not generally used as a stand-alone screening test for healthy people. It can find changes that are harmless, miss some small or slow-growing abnormalities, and expose you to a small amount of radiation.

- Help locate active disease and assess how far it has spread
- Help plan surgery, radiotherapy or another treatment
- Check how a condition is responding to treatment
- Investigate whether changes after treatment represent active disease or scar tissue

Who should have the test

A PET scan may be appropriate when the result is likely to answer a specific question or change your care. It is often used alongside examination, laboratory tests, CT, MRI, ultrasound or biopsy results.

Tell the imaging team before the appointment if you are pregnant, could be pregnant or are breastfeeding. The team can assess the radiation exposure, timing and whether another test would be more suitable.

You should also tell them if you have diabetes, kidney problems, severe claustrophobia or difficulty lying still. Mention previous reactions to CT contrast dye. These issues do not always prevent PET, but they may change the preparation or scanning plan.

Children can have PET when medically needed. The radiotracer amount is adjusted for factors such as body size and the type of examination.

How to prepare

Follow the instructions from your imaging centre because preparation differs by tracer. For a typical FDG PET scan, you are usually asked not to eat for about four to six hours. Plain water is

generally allowed and encouraged.

Do not consume coffee, tea, flavoured water, sweets or chewing gum during the fasting period unless your centre says otherwise. Even sugar-free products or caffeine can affect body activity and image quality.

Avoid strenuous exercise for the period specified by the centre, often the day before the scan. Exercise can increase tracer uptake in muscles.

If you have diabetes, you may need individual instructions about food, insulin and other glucose-lowering medicines. Do not change or skip prescribed medicine unless the imaging team has told you how to manage it.

Tell the team about all medicines and recent treatments. This includes steroids like prednisone or hydrocortisone , chemotherapy, medicines that stimulate blood-cell production, and recent surgery, radiotherapy or vaccination.

Wear warm, comfortable clothing without metal if possible. You may be asked to remove jewellery, hearing aids, a belt or other metal objects.

What happens during the test

A member of the imaging team will confirm your medical history and may check your blood glucose. A small intravenous line is placed into a vein, usually in your arm or hand, and the radiotracer is injected.

You then rest quietly while the tracer moves through your body. For FDG, this uptake period is commonly around 45 to 60 minutes. Talking, walking, reading or using your phone may be restricted because activity can change uptake in muscles and the brain.

You will lie on a padded table that moves through the scanner. The scanner is shaped like a large ring rather than a long enclosed tunnel. You need to remain still while the pictures are taken, usually for about 20 to 40 minutes.

A PET/CT examination may include a low-dose CT scan. Some examinations also use injected or oral CT contrast, which provides more detailed anatomical images.

The full appointment commonly lasts two to three hours, including preparation and tracer uptake.

Understanding your results

A specialist in nuclear medicine or radiology interprets the images. The report describes where

the tracer collected, how intense the uptake was and whether it matches a structure seen on CT or MRI.

The report may include a standardised uptake value , or SUV. This is an estimate of how much tracer an area absorbed. There is no universal SUV cutoff that reliably separates harmless from harmful changes.

Ranges and interpretation vary by imaging centre and laboratory, as well as by age, sex, pregnancy status, medicines and clinical context. The tracer, scanner, uptake time and reason for the examination also matter.

An area of increased FDG uptake may represent cancer, but it can also reflect infection, inflammation, recent treatment or normal organ activity. Low uptake does not always exclude disease.

Results are interpreted alongside your previous scans, symptoms, examination and other test results. The report may recommend comparison imaging, a more detailed CT or MRI, or a tissue sample called a biopsy.

What affects the results

PET images can be misleading even when the scanner and radiotracer are working correctly.

High blood glucose can compete with FDG and reduce uptake in some tissues. Recent insulin can move FDG into muscles and fatty tissue, making images harder to interpret.

Recent exercise, shivering, talking or repeatedly chewing can increase muscle uptake. Feeling cold can activate brown fat , a type of fat that produces heat and may become bright on FDG images.

Infection, inflammation, surgery, radiotherapy and healing injuries can all produce increased uptake. Recent vaccination may cause temporary uptake in nearby lymph nodes. Medicines that stimulate bone marrow can increase activity throughout the bones.

Kidney function can affect how quickly some tracers leave the body and may change background activity. It also matters if CT contrast is planned.

Movement can blur the scan or cause PET and CT images to line up poorly. Body size, tracer dose, the time between injection and imaging, and scanner calibration can alter SUV measurements.

Age, sex, pregnancy and medicines may change normal patterns of uptake. A recent transfusion usually does not directly affect an FDG PET scan, but the condition that required it may be relevant.

Accuracy and limitations

How often PET finds disease correctly depends on the condition, tracer, body area and size of the abnormality. There is no single accuracy figure that applies to every PET scan.

PET may miss very small abnormalities because the scanner cannot resolve them clearly. Some slow-growing tumours use little FDG and may not stand out. High blood glucose, movement or scanning too soon after treatment can also hide relevant changes.

PET may indicate disease when none is present. Infection, inflammation, recent procedures and normal uptake in organs can resemble cancer. This is why a bright area on PET does not provide a diagnosis by itself.

A diagnostic CT or MRI may be better for showing fine anatomical detail. A specialised PET tracer may be more useful than FDG for certain diseases. When the exact cell type matters, a biopsy is usually needed because imaging cannot examine cells directly.

Risks and complications

The intravenous injection may cause brief discomfort, a small bruise or light-headedness. Occasionally, some tracer leaks into the surrounding tissue, causing local soreness or swelling.

PET involves ionising radiation. The amount depends on the tracer and whether CT is included. The radiotracer loses its radioactivity over time and leaves mainly through urine.

Allergic reactions to PET tracers are uncommon. CT contrast has separate risks, including nausea, warmth, allergic reactions and possible kidney problems in people at risk.

Seek emergency help for trouble breathing, fainting, or swelling of the face, lips or throat after contrast or tracer injection. For mild but persistent pain, redness or swelling at the injection site, contact the imaging centre for routine advice.

What happens next

You can usually eat and return to normal activities after the scan unless you received a sedative or were given different instructions. Drinking water and emptying your bladder regularly help remove the tracer.

The imaging centre may advise temporarily limiting close contact with pregnant people or young children. The timing depends on the tracer and local radiation-safety procedures.

A report is sent to the healthcare professional who requested the test. Routine follow-up may

involve discussing whether the scan answered the original question or whether another scan, laboratory test or biopsy is needed.

An unclear or unexpected result does not necessarily mean something serious. PET findings often need to be matched with other information before their meaning is clear.

Common questions

Can I drink coffee before a PET scan?

Usually not during the fasting period, even if it is black or sugar-free. Plain water is generally allowed, but follow your centre's instructions.

Does the time of day matter?

The clock time is usually less important than correct fasting, medicine timing and a consistent tracer uptake period. People with diabetes may receive a particular appointment time to help manage glucose and insulin.

Can I exercise beforehand?

Avoid strenuous exercise for the period specified by the imaging centre, often about 24 hours. Exercise can make muscles absorb more FDG and interfere with interpretation.

Can I drive home afterward?

Most people can drive after PET. Do not drive if you received a sedative or if the imaging team advises against it.

How long am I radioactive?

The tracer's radioactivity falls quickly, but the timing differs by tracer. Follow instructions about fluids, toileting and close contact with children or pregnant people.

Will I feel claustrophobic?

The PET scanner is open at both ends and shorter than many MRI scanners. Tell the centre in advance if enclosed spaces are difficult for you so they can discuss support.

Sources

- RadiologyInfo.org. "PET/CT." American College of Radiology and Radiological Society of North America
- NHS. "PET scan"

- Boellaard R, Delgado-Bolton R, Oyen WJG, et al. "FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0." European Journal of Nuclear Medicine and Molecular Imaging . 2015;42:328-354
- International Atomic Energy Agency. "Radiation protection of patients during PET/CT scanning"