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## PET scan

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### Summary

- Positron emission tomography (PET) is a unique medical imaging procedure that shows the chemical function of an organ or tissue.
  - PET scans can detect cancers, as well as organs that are not working normally (such as areas of the brain affected by Alzheimer's disease or areas of the heart that have been damaged by blocked blood vessels).
  - The PET scan is considered to be a safe procedure that exposes you to around the same amount of radiation that you would receive from the general environment over about three years.
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Positron emission tomography (PET) is a medical imaging procedure that provides unique information about how an organ or system in the body is working. PET scans are mainly used to assess cancers, neurological (brain) diseases and cardiovascular (heart-related) disease.

The PET scanner has a ring of detectors that surround the person. It looks similar to a **CT scanner**. The scan is performed by a healthcare professional called a nuclear medicine scientist, who works with a nuclear medicine specialist (doctor).

### How the PET scan works

A PET scan involves the painless injection of a small amount of a 'positron-emitting' radioactive material (called a radiopharmaceutical). Images of the body are then taken using a PET scanner. The camera detects emissions coming from the injected radiopharmaceutical, and the computer attached to the camera creates two and three-dimensional images of the area being examined.

Areas where the injected radiopharmaceutical gathers (for example, fast-growing cancer cells) appear 'brighter' than normal tissues on the images. Almost all PET scanners today are combined with a CT scanner so that the PET images can be combined or fused with the CT images. This allows the nuclear medicine specialist to combine the structural information from the CT scan with the PET's functional information and improve the accuracy of the test. In these scanners, the person passes through both scanners on the one bed and in the same position.

### When the PET scan is used

Some of the uses of the PET scan include detection and monitoring of conditions such as cancer, neurological disease and cardiovascular disease.

#### Early detection and monitoring of cancer

PET scans can reveal changes in metabolism and how organs and tissues are working. Many **cancers** can be detected using PET before they can be 'seen' using other medical imaging techniques. PET scans can create an image of the entire body. This means that, for some cancers, they can show if (and where) cancer is spreading to other parts of the body. PET might also be used to see if tumours are malignant (cancerous) and to tell the difference between an active tumour and scar tissue.

#### Assessment of neurological disease

PET imaging can provide information about the biochemical function of the brain. For example, **epilepsy** that can't be treated with medications is sometimes treated by surgical removal of the part of the brain that causes the seizures. PET scans can assist this surgery because it can show the exact part of the brain responsible for the person's epilepsy. PET imaging has also been used to assess people with other neurological diseases, including **Alzheimer's disease** and **Parkinson's disease**, because the images can show areas of the brain that are functioning differently to normal.

## **Assessment of cardiovascular (heart-related) disease**

PET scans are used to assess both the blood flow to the heart and how the heart is working. This means that areas of the heart that have been permanently damaged by reduced blood flow (for example, after a heart attack) can be distinguished from those that are still working. The damaged areas may respond to surgical treatments such as angioplasty or coronary bypass surgery.

## **Issues to consider with a PET scan**

Medical considerations prior to the PET scan include:

- Your doctor will look at your medical history and all your diagnostic tests, and talk to you about what to expect from a PET scan.
- When you arrive for your PET scan, the nuclear medicine specialist will also examine the information you bring with you. Either they or the nuclear medicine scientist will take a full medical history and talk to you about the PET scan.
- You may need to fast (not eat or drink) for a set amount of time. Fasting sometimes includes avoiding everything but water before the PET scan.
- If you have diabetes, tell the receptionist or nuclear medicine staff when you make your booking, so that appropriate arrangements can be made.
- Tell your doctor and the nuclear medicine staff if you are pregnant, think you may be pregnant or if you are breastfeeding.

## **PET scan procedure**

Before the scan, you will be given a small injection of radioactive material. The injection is painless and it does not make you feel any different at all. The PET scanner then takes a series of images. For some tests, the procedure begins as soon as you have the injection. In other cases, you may have to wait at least 60 minutes after the injection before the scan is taken.

In most cases, you will need to rest before and after the injection of the radioactive material. For example, if you are having a brain PET scan, you will lie quietly in a darkened room before and after the injection to make sure your brain remains relaxed and is not stimulated by light, noise or reading.

Once the appropriate amount of time has passed, you will be asked to lie on the imaging bed. This bed has special rests for your legs, arms and head to help keep them still and comfortable.

You must lie quietly and still as the scanning table moves through the scanner 'ring'. The scanner detects the gamma rays released by the radioactive material that has localised in the area of your body being investigated, and uses it to create images of your internal body structures.

Imaging generally takes around 30 minutes. The nuclear medicine scientist who performs the test will tell you exactly how long your procedure will take. They will be there to look after you during the procedure. A PET scan is completely painless and you will not feel any different after the injection, during imaging or after the scan.

## **Immediately after the PET scan**

After your PET scan, you can go on with your normal activities straight away. The injection of the radioactive material does not make you feel any different or drowsy. There are no sedative drugs or anaesthesia used during this procedure.

Your scan results will not be available immediately. Before you leave, the nuclear medicine scientist will tell you when your doctor will have the results. You will need to make a follow-up appointment with your doctor to discuss the results of your PET scan.

## **Complications of a PET scan**

A PET scan is considered to be a safe procedure. It exposes you to around the same amount of radiation that you would receive from the general environment over about three years. The injected radioactive chemicals have a very short lifespan and are removed from the body fairly quickly.

Sometimes, you will be advised to avoid close contact with babies or pregnant women in the few hours after your scan. The nuclear medicine scientist will tell you if this is necessary, after your scan.

### **Long-term outlook of a PET scan**

A lot of research has been done to check the safety and long-term side effects of nuclear medicine examinations. Up to now, there are no known issues – the radiation dose you receive from a PET examination is considered to be safe and justified.

### **Alternatives to the PET scan**

Alternatives to the PET scan depend on the condition under investigation, but could include:

- nuclear medicine scan
- **x-ray**
- **magnetic resonance imaging (MRI) scan**
- **computed tomography (CT) scan**
- **ultrasound**
- **blood test**
- **biopsy**.

### **Where to get help**

- Your **GP (doctor)**

**This page has been produced in consultation with and approved by:**

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