To diagnose epilepsy, your doctor will review your symptoms and medical history and may order several tests to help determine the cause of your seizures. This is a brief guide to the tests that help diagnose epilepsy. Not everyone will need every test. If you are unsure why your doctor has suggested certain tests and not others, then it is best to ask.

The EEG
An electroencephalogram (EEG) is a recording of the brain's electrical rhythms, so it looks at how the brain functions. It is a simple, painless and harmless procedure. Small discs called electrodes are placed on the surface of the scalp by parting the hair and holding them in place with temporary glue, or sometimes a special cap. The electrical activity of the brain is recorded, and may reveal changes or rhythms that are helpful in diagnosing epilepsy.

An EEG can take up to one hour. The person relaxes with eyes closed for most of the test, and may be asked to open and close their eyes at times, breathe deeply for a few minutes and later be exposed to a flashing light. These methods may provoke brain wave changes on the EEG.

An EEG done while asleep can give additional information. This is called a sleep deprived EEG.

While many people with seizures or epilepsy have abnormal EEGs, some do not. Because an EEG is just a snapshot of that particular time, it is possible for someone with epilepsy to have an EEG that returns within normal limits. Also occasionally people have abnormal EEGs but have never experienced a seizure.

There are a number of other tests that may help doctors diagnose epilepsy.

**EEG ambulatory monitoring**
Sometimes, particularly if the neurologist wants to record an event or seizure, it is necessary to obtain a recording over several hours or days. This can be done when the person is in the home environment. A compact portable EEG recorder may be worn which records brain activity while the person carries out normal daytime activities, and during sleep. The person will also be asked to keep a diary of symptoms.

**EEG/video monitoring**
At times it is necessary to perform simultaneous EEG and video recording. This combined information can be valuable in understanding a person's seizures and helps to obtain an accurate diagnosis. Continuous monitoring may be needed for hours or days, depending on the frequency of symptoms and seizures. It is therefore necessary to admit the person to hospital for several days, sometimes reducing or withholding medication to make seizures more likely.
MRI scanning

MRI or Magnetic Resonance Imaging, which looks at the brain structure, produces extremely clear and detailed images of the brain - without the use of x-rays, but instead strong magnetic fields. Images can be generated in either two or three dimensions.

For an MRI, the person is put on a table and placed inside the scanner, which is like a tunnel. As this can be stressful for people who dislike confined spaces, a mirror at the person's head provides a view of the room, while a call button and an intercom allows communication with the technician.

During the scan, the machine makes different loud thumping noises, like the beating of a drum, or drill. Most units provide earplugs or muffs. Again, complete stillness is required during this test and young children and people with an intellectual disability may require sedation or a light, general anaesthetic. The entire procedure takes 30-60 minutes. MRI may be able to detect lesions or abnormalities in the brain that could be causing seizures.

Functional MRI (fMRI)

A functional MRI measures the changes in blood flow that happens when specific parts of the brain are working. Doctors may use an fMRI before surgery to identify the exact locations of critical functions, such as speech and movement, so that surgeons can avoid injuring those places while operating.

SPECT scanning

Single Photon Emission Computerised Tomography (SPECT) also uses a computer to generate pictures that look at the blood flow within the brain. A radioactive substance is injected into a vein and is carried to the brain in the bloodstream. A scan is then performed which produces a picture of the brain showing where blood flow is increased or decreased. Blood flow in the area triggering seizures can be decreased in between seizures and temporarily increased during seizures.

Scans usually take 20-30 minutes and are usually performed in hospital as part of EEG/video monitoring for surgical assessment.

PET scanning

Positron Emission Tomography (PET) appears similar to SPECT but the radioactive substance goes to areas of the brain that are actively working, so it looks at the glucose metabolism within the brain. So it is a functional scan, showing how the brain is working. In the area triggering seizures, brain cells are often functioning at lower levels in between seizures.

Fasting is generally necessary prior to scanning and the scan takes approximately 30-60 minutes. EEG monitoring may also need to be performed during the PET. This scan is also usually only performed as part of a surgical assessment.

The actual process is similar to what the person experiences with CT, MRI or SPECT.
Neuropsychological tests.
Although these tests don’t diagnose epilepsy, they assess many functions including thinking, memory and speech skills. The test results help doctors determine which areas of the brain are dominant for certain functions and which areas are affected by the epilepsy.

CT scanning
Computerised Tomography (CT) uses x-rays to take pictures of the brain. It is not commonly performed in the routine diagnosis of epilepsy. CT scans can show abnormalities in the brain that might be causing seizures, such as tumours, bleeding and cysts. The person lies on a table, and the head of the table is placed into the CT unit. Pictures are taken to generate the brain images. Sometimes a dye is injected into a vein to enhance the quality of the images. Rarely, the person experiences an allergic reaction to the dye. This may cause a skin rash, mild symptoms of flushing, nausea and some difficulty with breathing. The entire procedure takes about 30-45 minutes.

Note on diagnostic criteria
Epilepsy is a disease of the brain defined by any of the following conditions:

1. At least two unprovoked seizures occurring more than 24 hours apart
2. One unprovoked seizure with a probability of further seizures
3. At least two seizures considered reflex epilepsy, such as photosensitive epilepsy

Epilepsy is considered to be “no longer present” for people who had an age-dependent epilepsy syndrome but are now past the applicable age or those who have remained seizures free for at least 10 years off antiepileptic medication, provided there are no known risk factors related to a high probability of future seizures.