

Diagnosing Epilepsy

To diagnose epilepsy, your doctor will look at your symptoms and medical history and may order several tests to help determine why you have had 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 is working.

It is a simple, painless and harmless procedure.

Small discs called electrodes are placed on the surface of the scalp and held in place with temporary paste, 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.

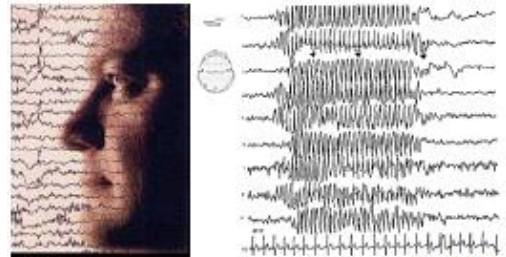


Fig 1: EEG

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

An EEG done while asleep can give helpful additional information. A person is often given instructions and advised to have a lot less sleep the night prior to the test. This is called a sleep deprived EEG.

While many people with seizures or epilepsy have abnormal EEGs, many do not. An EEG is just a snapshot of time during the test, so it's possible for someone with epilepsy to have an EEG, but the results are normal. Also, occasionally people have an abnormal EEG, but who have never experienced a seizure.

There are several other tests that may help doctors diagnose epilepsy.

EEG ambulatory monitoring

If the neurologist wants to record an event or seizure, it is sometimes 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.



This records brainwaves while the person carries out normal daytime activities, as well as during sleep. The person will also be asked to keep a diary of any symptoms they might experience during this time. This test can be set up in the clinical setting, then the person goes home for a few days for the recording process and returns to the hospital or clinic to have



EEG/video monitoring

Ideally it is best to perform EEG and video recording at the same time. 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. In some cases, this can be done at home. However, this type of monitoring often needs to be done in the hospital setting. This is so the person can be closely monitored because their medication is reduced or withheld, in order to induce seizures. This process can several days.

MRI scanning

Magnetic Resonance Imaging looks at the brain structure and produces 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 lies on a table and is placed inside the scanner, which is like a tunnel. As this can be stressful for people who don't like confined spaces, a mirror at the person's head provides a view of the room, 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 a fMRI prior to surgery to identify the exact locations of critical functions; such as speech and movement, so the surgeon can avoid injuring those places during an operation.

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 increases or decreases.

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



PET scanning

Positron Emission Tomography (PET) records the glucose metabolism within the brain. A radioactive substance is injected which travels to areas of the brain that are actively working. This 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 this scan which takes approximately 30-60 minutes. EEG monitoring is usually performed during the PET. This scan is also usually only performed as part of a surgical assessment for epilepsy. The process is similar to what the person experiences with CT, MRI or SPECT.

Neuropsychological tests

This is a comprehensive assessment of a person's cognitive, psychological, emotional and behavioural functioning. Although this test does not diagnose epilepsy, the results help doctors determine which functions, such as thinking, memory and speech, are affected by the epilepsy.

CT scanning

Computerised Tomography (CT) uses x-rays to take images of the brain. It is not commonly performed in the diagnosis of epilepsy. CT scans can show abnormalities in the brain, that might be causing seizures, such as tumours, bleeding and cysts. 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 epilepsy 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 high probability of further seizures
3. At least two seizures considered reflex epilepsy, such as photosensitive epilepsy

Epilepsy is considered to be "resolved" for:

1. People who had an age-dependent epilepsy syndrome but are now past the age that further seizures are expected, or
2. People who have remained seizure free for at least ten years with no antiepileptic medication for the last 5 years, and there is not a high probability of future seizures.

ILAE 2014

References:

ILAE Official Report: A practical clinical definition of epilepsy. (2014) *Epilepsia*, 55(4):475-482

Mayo Clinic. Epilepsy Diagnosis <https://www.mayoclinic.org/diseases-conditions/epilepsy/diagnosis-treatment/drc-20350098> Accessed Apr 2020

Thanks to Royal Prince Alfred Hospital Sydney, Neurophysiology Department for their assistance.