

## **Epilepsy & Seizure Center**

Seizures are sudden changes in behavior or consciousness related to abnormally high electrical activity in the brain. Recurrent seizures may indicate epilepsy. Seizure medications help restore brain electrical activity to normal levels. Generalized seizures include tonic-clonic seizures (also known as grand mal seizures). Partial seizures affect only part of the brain.

Epilepsy is a neurological disorder in which patients experience recurrent seizures. At least two seizures must occur before epilepsy is diagnosed. Epilepsy is one of the most common brain disorders in the United States.

An epileptic seizure occurs when the nerve cells in the brain suddenly increase their activity, causing an electrical storm that can overwhelm the brain. This can result in various symptoms ranging from slight changes in taste or smell to loss of consciousness and involuntary muscle contractions that affect the whole body. The symptoms experienced depend on the area of the brain affected.

Anything that disrupts the normal function of the brain can cause seizures and epilepsy. Although roughly half of all seizures have no known cause, there are certain factors that can trigger seizures, such as brain trauma, genetic abnormalities, infections and tumors.

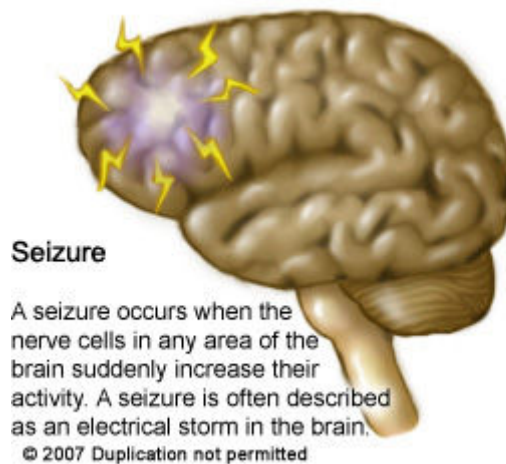
Epilepsy is usually classified according to the type of seizure that the person experiences. Partial seizures involve isolated areas of the brain and generalized seizures can involve both sides of the brain simultaneously. The classification of epilepsy may help determine its treatment. Most patients can control their seizures with medications designed to reduce activity in the part of the brain that is triggering the seizures. When medication is not enough, patients may undergo surgery to remove a portion of their brain or install a device that may reduce the frequency of seizures.

Depending on the severity and frequency of seizures, epilepsy can cause significant disruption to a person's life. People with epilepsy may be unable to keep a job or live independently. They may live in fear of their next seizure. Even people who can control their seizures may experience frustration or the ill effects of others' perception of epilepsy.

### *About epilepsy*

Epilepsy is a neurological disorder that involves a tendency to experience recurring seizures, which are disruptions of the electrical activity in the brain. This may be the result of an underlying medical condition or injury, which makes a person susceptible to the seizures.

Having a seizure does not necessarily mean a person has epilepsy. Epilepsy is not usually diagnosed until a person has had at least two seizures. People who have seizures that are caused by factors that can be controlled or avoided (e.g., certain medications or alcohol or drug use) are not considered to have epilepsy.

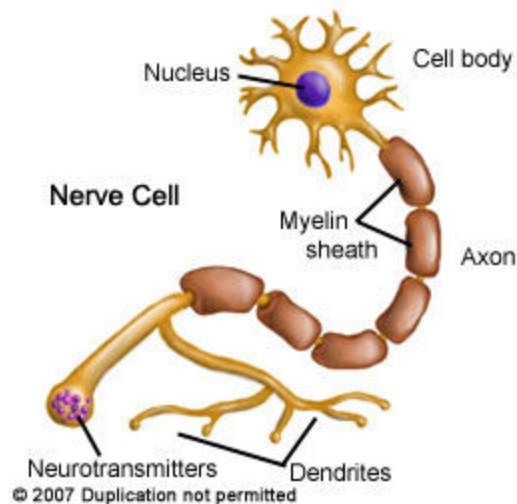


Epilepsy is one of the most common disorders of the brain and can occur in people of all ages. More than 2 million people have had an unprovoked seizure or have been diagnosed with epilepsy, according to the National Institute of Neurological Disorders and Stroke (NINDS). Most new cases of epilepsy are diagnosed in children

under the age of 2 or in adults over the age of 65, according to the Epilepsy Foundation.

Epileptic seizures are the result of a sudden change in electrical activity in the brain. In normally functioning brains, neurons (nerve cells) produce electrochemical signals that instruct other parts of the body to do certain things, such as move or feel emotions or sensations.

A seizure occurs when something disturbs the pattern of electrochemical signals and causes the neurons to fire at a much faster rate than normal. This storm of electrical activity in the brain can result in changes in mood or behavior, hallucinations, involuntary muscle contractions or loss of consciousness. The symptoms experienced during epileptic seizures depend on the area of the brain affected.



Some people with epilepsy may experience unusual sensations or movements minutes or hours before they have a seizure. This sensation, called an aura, is actually a simple partial seizure. The exact nature of the aura is often unique to each individual, although it may include noticing a strange taste in the mouth, twitching in one limb or an inexplicable feeling of fear or apprehension. Because most people experience the same progression of events during each seizure, auras can serve as a warning that a seizure is going to occur.

Epilepsy is not a sign of brain damage – many people with epilepsy can function well between seizures. However, people with brain damage are more likely to develop epilepsy.

A serious complication of epilepsy is status epilepticus, a condition whereby a person has a longer than average seizure or never regains consciousness between seizures. People with epilepsy have an increased risk of status epilepticus, although it can also occur in people with no prior history of seizures. Seizures lasting more than 5 minutes are considered a medical emergency.

Having one seizure does not always mean that a person will have another seizure or has epilepsy. Many seizures are classed as first seizures. First seizures may be caused by a reaction to anesthesia or certain medications. They may also be the result of withdrawal from alcohol or drugs. However, in many cases, there is no known trigger for a first seizure. Only a small proportion of people who have first seizures develop epilepsy, although the risk of developing epilepsy is increased in people who have experienced a seizure.

People may have seizures that are unrelated to epilepsy. For example, young children with high fevers may develop febrile seizures. Pregnant women may develop a serious condition called eclampsia that involves seizures. Some people appear to have seizures, but there is no evidence of abnormal electrical activity in the brain. These are called *pseudoseizures* and they may be psychological in nature, resulting from stress or other medical conditions. Some people with epilepsy may experience pseudoseizures in addition to actual seizures.

### *Types and differences of epilepsy*

Epilepsy involves recurring seizures and the different types of epilepsy are usually distinguished by the type of seizure and area of the brain affected. Seizures are usually classified as being either partial seizures (also called *local* or *focal* seizures) or generalized seizures.

Partial seizures involve isolated areas of the brain. During a partial seizure, a person may or may not lose consciousness. They may experience abnormal sensations such as inexplicable feelings of joy, anger or sadness, or they may enter a dream-like state of semi-consciousness. These seizures are often marked by auras, which is a vague sensation that may indicate the beginning of a larger seizure.

Generalized seizures involve both sides of the brain simultaneously. These seizures are often more severe and may result in loss of consciousness, involuntary muscle contractions or abnormal body movements.

*The types of epilepsy include:*

- Temporal lobe epilepsy (TLE). Epilepsy marked by partial seizures in one or both of the temporal lobes in the brain. TLE is one of the most common types of epilepsy. It is thought that repeated seizures involving the temporal lobes may result in mild brain damage.
- Absence epilepsy. Epilepsy marked by absence seizures (also called *petit mal seizures*). During an absence seizure, people may experience a temporary lapse in consciousness. They may stare into space or make small unconscious movements, such as jerking their leg or blinking. Absence epilepsy is more common in children, although it often clears up as a child matures.
- Neocortical epilepsy. Epilepsy marked by partial or generalized seizures in the outer layer of the brain, called the cortex. People with neocortical epilepsy may experience visual hallucinations, emotional or behavioral changes, involuntary muscle contractions or loss of consciousness.
- Lennox-Gastaut syndrome. Disorder that includes severe epilepsy in children, experienced as a variety of generalized seizures. It usually appears within the first four years of life. Lennox-Gastaut syndrome is associated with mental retardation

and may involve various forms of brain damage. Unlike other forms of epilepsy in children, Lennox-Gastaut syndrome rarely resolves itself naturally and there is no cure for the disorder.

- West syndrome. Epileptic condition that usually occurs within the first year of life, typically between the ages of 3 to 6 months old. This syndrome involves infantile spasms along with developmental impairment. Seizures may appear as a sudden bending forward and stiffening of the body and occur upon awakening. Seizures may resolve with or without treatment by mid-childhood. Infants with West syndrome may also develop Lennox-Gastaut syndrome as they get older.

Ohtahara syndrome (also known as *early infantile epileptic encephalopathy*). An extremely rare epileptic condition that affects newborns with underdeveloped cerebral hemispheres. Seizures usually appear within the first 10 days of life. Ohtahara syndrome primarily involves a stiffening of the limbs with asymmetrical movements. Boys appear to be affected more often than girls. As the condition progresses, seizures become more frequent and are accompanied by physical and mental retardation. About half of all patients with this condition die in infancy. Surviving infants may go on to develop West syndrome and Lennox-Gastaut syndrome as they grow older.

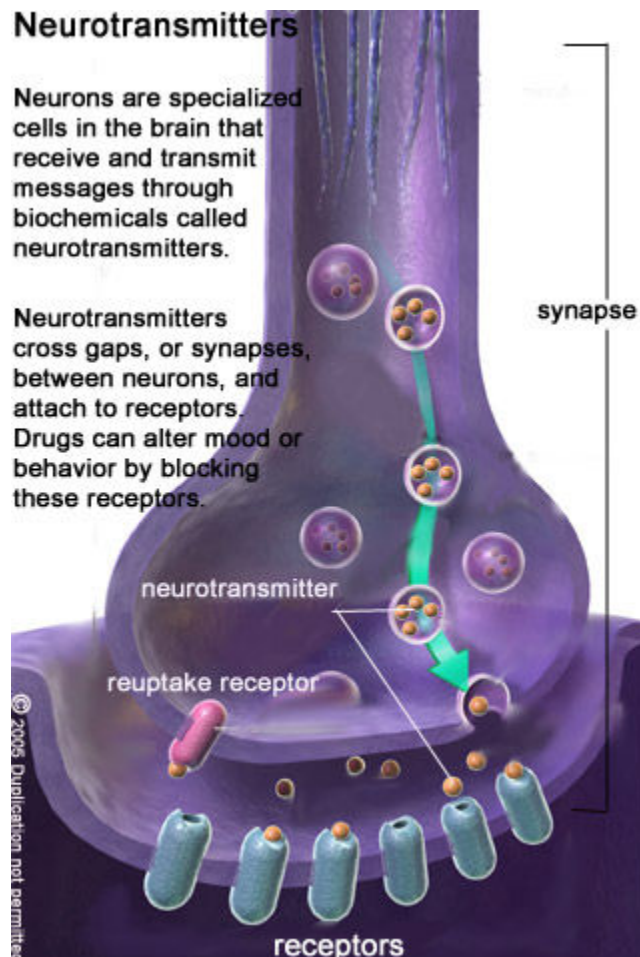
#### *Risk factors and causes of epilepsy*

Brain damage or injury, as well as a family history of epilepsy or other neurological abnormalities, may increase a person's risk of developing epilepsy.

Anything that disrupts the function of the brain can cause epilepsy. Roughly half of all seizures have no known cause (sometimes called *idiopathic epilepsy*), according to the National Institute of Neurological Disorders and Stroke (NINDS). However, certain conditions may cause or trigger recurrent seizures.

#### *Factors that may trigger epileptic seizures include:*

- Brain injury. People who have experienced some sort of brain trauma, such as a severe head injury, are at a high risk of developing epilepsy. Trauma to the brain may disturb the functioning of the neurons, which may lead them to misfire and cause seizures. Many people who sustain a head injury experience a seizure within weeks of the injury. However, these are sometimes isolated events and do not always mean that the person will develop epilepsy.



- Genetic abnormalities. Some forms of epilepsy have been found to run in families and are thought to be caused by genetic abnormalities. There are many genes that have been linked to epilepsy. However, only a small proportion of epilepsy types are believed to develop as a direct result of genetic abnormalities. Instead, studies have shown that people

with certain genetic abnormalities are more susceptible to seizures caused by other factors, such as brain trauma.

- Infections. Certain infections such as meningitis, encephalitis and brain abscesses can result in recurrent seizures. In some cases, successful treatment of the underlying infection can resolve the epilepsy. However, some infections may cause irreparable damage to neurons in the brain.
- Tumors. Tissue growth in the brain can cause pressure to build within the skull and may disrupt neuron function. Epileptic seizures that are caused by brain tumors usually begin as partial seizures but may develop into generalized seizures as the tumor grows. Surgery can sometimes be used to remove the tumor, although this may merely reduce rather than eliminate seizures.

### *Other disorders*

Epilepsy can also develop as a result of other disorders that may affect brain function, such as Alzheimer's disease and cerebral palsy. People who have had a heart attack or stroke, where the brain is deprived of oxygen for a period of time, are also more at increased risk of developing epilepsy.

### *Signs and symptoms of epilepsy*

The signs and symptoms of epilepsy vary depending on the part of the brain affected and the type of seizure (whether partial or generalized). Some seizures may barely be noticeable to the patient or witnesses.

*Signs and symptoms of partial and generalized seizures may include:*

<i>Partial Seizures</i>	<i>Generalized Seizures</i>
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Involuntary movements affecting half the body (e.g., one leg or side of the face)	Blank stare with only eye blinking
Purposeless movements (e.g., lip-smacking, picking at clothes, swallowing)	Sudden loss of awareness
Strange physical sensations (e.g., crawling, tickling, numbness)	Involuntary muscle contractions that affect the whole body
Hallucinations	Loss of consciousness
Abdominal pain	Sudden muscle tension and rigidity
Nausea	Incontinence
Sweating	Biting tongue or cheek
Impaired consciousness	
Dilated pupils	

People who witness an epileptic seizure should not attempt to move or disturb the person while the seizure is taking place. Instead, they should move any objects that may cause harm to the person. Nothing should be placed in the person's mouth (including fingers). Contrary to popular belief, it is physically impossible for a person to swallow their own tongue during a seizure. If this is the first time a person has had a seizure or if the seizure lasts five minutes or more, emergency services should be called.

### *Diagnosis methods for epilepsy*

Electro Diagonastic Testing for Diagnosis of epilepsy usually begins with a medical history and physical examination. Because there are many different types of seizures, some of which are not related to

abnormal brain activity, it is important that a physician identify the type of seizure a patient has had. The physician may ask questions that relate to:

- What sensations the patient feels before, during or after a seizure
- How long the seizure normally lasts
- Which side of the body is most affected during a seizure
- To what extent the patient experiences a change in or loss of consciousness
- Whether the patient feels any pain before, during or after the seizure

If patients do not remember the nature of their seizures, a physician may ask questions of the patient's caregiver, parents or others who have witnessed the seizures. The physician may also ask about any other conditions or symptoms the patient has, any medications the patient may be taking, and whether the patient uses alcohol or drugs.

In addition to the medical history and physical examination, a physician may conduct tests to assess which areas of the brain may be involved in the seizures. These tests may include:

- Electroencephalogram (EEG). An EEG is one of the most common tests that a physician may conduct following a seizure. During an EEG, electrical activity in the brain is monitored through electrodes placed on the scalp. People with epilepsy may show abnormally slow frequencies or spikes and other disruptions, even when they are not having a seizure. A physician may request that the EEG be performed while the patient is sleeping to get an accurate picture of normal brain activity.

- Computed axial tomography (CAT) scan. A CAT scan is a noninvasive or minimally invasive test that uses a rotating x-ray device to create detailed cross-sectional images of different body parts, including the brain. It can be used to identify tumors or other abnormalities in the brain that may be causing a patient's recurring seizures.
- MRI (magnetic resonance imaging). An MRI is a noninvasive procedure that uses powerful magnets and radio waves to produce clear, cross-sectional and three-dimensional images of the body's tissues. Like the CT scan, it can be used to view the brain and identify abnormalities. A special kind of MRI, called a *functional MRI* (fMRI), can be used to allow physicians to see how the brain functions. During an fMRI, the patient may be asked to perform a task while the machine scans the brain and records its activity. This can then be used to gauge which parts of the brain are functioning abnormally.

### *Blood tests*

Blood samples may be taken to screen for conditions such as diabetes, infection or anemia, which may be the causing a patient's recurrent seizures. Blood tests may also be used to identify metabolic or genetic disorders that may be related to the seizures.

### *Treatment options for epilepsy*

There is no cure for epilepsy. However, 80 percent of people with epilepsy are able to effectively control their seizures through various treatment methods, according to the National Institute of Neurological Disorders and Stroke (NINDS). Treatment should begin as soon as possible after diagnosis. Studies have shown that patients are more likely to be able to control their seizures effectively if treatment is started early.

The most common treatment method for epilepsy is the use of anticonvulsant (*anticonvulsants*). These medications attempt to control

the area of the brain that triggers the seizures. For this reason, it is important that a patient's seizures be accurately classified before treatment is started. Patients are usually prescribed a low initial dose of one type of anticonvulsant. Their progress will then be monitored by a physician to assess if the anticonvulsant is effective or if the dosage level needs to be adjusted. Patients should understand what side effects are possible so they can report them to their physician. In some cases, a patient may require two types of anticonvulsants to control the seizures.

For some people with epilepsy, medications fail to control their seizures. In these cases, a physician may recommend additional treatment methods that may be used with medications. These treatment methods include:

- **Surgery.** Surgery may be considered if a physician thinks that the patient is unlikely to respond to medication. It usually involves removing a small area of the brain. Tests such as electroencephalograms (EEGs) and magnetic resonance imaging (magnetic resonance imaging) may be used to identify the area of the brain triggering the seizures. A surgical team will assess whether the portion of the brain to be removed is close to areas that control motor function, sensations or language. Complications from brain surgery are rare. Studies have shown that most people with epilepsy who have surgery either stop having seizures or the frequency of their seizures is drastically reduced.
- **Vagus nerve stimulation.** The vagus nerve is a cranial nerve that originates in the brain stem and controls numerous organs in the body. People with epilepsy that cannot be controlled through medication may have an electronic device surgically implanted under the skin of the chest and attached to the vagus nerve in the lower neck. This device stimulates the vagus nerve through a series of small shocks. These shocks can reduce

seizures in people with epilepsy by 20 to 40 percent, according to the NINDS.

- **Diet.** There is evidence that a diet that is low in carbohydrates and high in fat can help control seizures in some patients, especially children. This type of diet is called a *ketogenic diet* because it forces the body to enter a state called *ketosis* where it burns fat instead of carbohydrates to function. Although there is evidence to support the ketogenic diet as a treatment method, the diet is difficult to maintain and may result in nutritional deficiencies, which can be especially damaging for children.

Some people stop having seizures after a period of time. This is more likely in people (especially children) who have epilepsy with no known cause. People who stop experiencing seizures for a period of two to five years are considered seizure-free and they may be able to stop taking their medications. However, this should be done under the guidance and supervision of a physician.

### *Prevention methods for epilepsy*

Because many cases of epilepsy have no known cause, it is difficult to prevent epilepsy. However, people can reduce their risk of brain injury, which is one of the causes of seizure, by wearing protective headgear while riding a bike or motorcycle or while playing contact sports. In some cases, people who experience an isolated seizure may be prescribed seizure medications for a short period of time until the underlying cause of the seizure is identified. This may reduce the risk of developing epilepsy after a first seizure.

Pregnant women can prevent epilepsy in their children by obtaining appropriate prenatal care to reduce the risk of the fetus developing neurological problems.

There is often little that individuals who have been diagnosed with epilepsy can do to prevent their seizures. However, people can

reduce the risk of having a seizure by avoiding alcohol and drugs, maintaining a healthy diet and getting plenty of sleep. They should also ensure that they take medications prescribed for their epilepsy at the appropriate times and for as long as their physician recommends. One of the most common causes of seizures in people who have been seizure-free for months or years is failure to take their medication as instructed.

### *Lifestyle considerations with epilepsy*

Depending on the severity and frequency of seizures, epilepsy can cause considerable disruption in a person's life. Even people who control their seizures with medication or other treatment methods may experience problems with other people's perception of epilepsy. People who cannot effectively control their seizures may have more far-reaching restrictions placed on their lives. They may not be able to keep a job or live without supervision. In some cases, living with the threat of a seizure can be severely debilitating.

Many people with epilepsy experience behavioral or emotional problems. Adults may feel frustrated at their inability to control their seizures and the effect that this lack of control may have on other aspects of their lives. Epilepsy can be particularly difficult for children. Although children often respond well to treatment and may be seizure-free by adolescence, the psychological effects of epilepsy can continue to affect them into adulthood. Children whose seizures are not well controlled may experience a disrupted education, which has wider implications for employment and social functioning later in life. They may also be bullied, teased and generally misunderstood by other members of the school, adding to the psychological problems that many people with epilepsy face. In these cases, counseling may help a patient deal with the emotional and practical frustrations of living with epilepsy.

Most states do not allow people with epilepsy to drive unless they can prove they have been seizure-free for a certain period of time.

Sometimes this restriction applies even if the seizures do not involve losing consciousness, although some states may make exceptions for people who have very mild seizures.

Patients with epilepsy may be advised to carry medical information in their wallets or on specially designed medical alert bracelets or necklaces. This alerts bystanders or emergency medical personnel of their condition.