

Epilepsy

Epilepsy is a disorder of the brain characterized by repeated seizures. A seizure is usually defined as a sudden alteration of behavior due to a temporary change in the electrical functioning of the brain. Normally, the brain continuously generates tiny electrical impulses in an orderly pattern. These impulses travel along the network of nerve cells, called neurons, in the brain and throughout the whole body via chemical messengers called neurotransmitters. In epilepsy, however, the brain's electrical rhythms have a tendency to become imbalanced, resulting in recurrent seizures. In patients with seizures, the normal electrical pattern is disrupted by sudden and synchronized bursts of electrical energy which may briefly affect their consciousness, movements, or sensations. Epilepsy is usually diagnosed after a person has had at least two seizures that were not caused by some known medical condition like alcohol withdrawal or extremely low blood sugar.

If seizures arise from a specific area of the brain, then the initial symptoms of the seizure often reflect the functions of that area. The right half of the brain controls the left side of the body, and the left half of the brain controls the right side of the body. So for example, if a seizure starts from the right side of the brain, in the area that controls movement in the thumb, then the seizure may begin with jerking of the left thumb or hand.

Types of Seizures

There are so many kinds of seizures that epilepsy specialists are still updating their thinking about how to classify them. Usually, they classify seizures into two types, primary generalized seizures and partial seizures. The difference between these types is in how they begin.

Primary generalized seizures begin with a widespread electrical discharge that involves both sides of the brain at once. Hereditary factors are important in many of these seizures. Epilepsy in which the seizures begin from both sides of the brain at the same time is called primary generalized epilepsy. Primary generalized epilepsy is more likely to involve genetic factors than partial epilepsy, in which the seizures arise from a limited area of the brain.

Partial seizures begin with an electrical discharge in one limited area of the brain. Some are related to head injury, brain infection, stroke, or tumor, but in most cases the cause is unknown. One question that is used to further classify partial seizures is whether consciousness (the ability to respond and remember) is "impaired" or "preserved." The difference may seem obvious, but there are actually many degrees of impairment or preservation of consciousness.

The following factors may increase the risk of seizures in people predisposed to seizures:

- Stress
- Sleep deprivation or fatigue
- Insufficient food intake
- Alcohol use or drug abuse

Failure to take prescribed anticonvulsant medications About half of the people who have one seizure without a clear cause will have another one, usually within six months. You are twice as likely to have another seizure if you have a known brain injury or other type of brain abnormality. If you do have two seizures, there is about an 80 percent chance that you will have more. If your first seizure occurred at the time of an injury or infection in the brain, you are more likely to develop epilepsy than if you did not have a seizure in that situation.

Prevalence and Incidence of Epilepsy

About 2.5 million people in the United States have epilepsy, and as many as 9 percent of the entire population may experience a seizure at some point in their lives. Epileptic seizures may be tied to a brain injury or genetics, but most of the time the cause is unknown. New cases of epilepsy are diagnosed most commonly in the first year of life. The rate of new cases in children gradually declines until about age 10, and then stabilizes. After age 55 or 60, the rate starts to increase, as people develop strokes, brain tumors, or Alzheimer's disease, all of which may cause epilepsy.

About 2.7 million Americans have been treated for epilepsy in the past five years. More men than women have epilepsy. New cases of epilepsy are most common among children, especially during the first year of life. Up to 5 percent of the world's population may have a single seizure at some time in their lives. It is likely that around 50 million people in the world have epilepsy at any one time. Children and adolescents are more likely to have epilepsy of unknown or genetic origin. Brain injury or infection can cause epilepsy at any age. Recent studies show that up to 70 percent of children and adults with newly diagnosed epilepsy can be successfully treated. About 10 percent of children with epilepsy have seizures that do not respond to treatment. The proportion of adults is higher, up to 15 percent.

The reasons why epilepsy begins are different for people of different ages. But what is known is that the cause is undetermined for about half of all individuals with epilepsy, irregardless of age. Children may be born with a defect in the structure of their brain, or they may suffer a head injury or infection that causes their epilepsy. Severe head injury is the most common known cause in young adults. In middle age, strokes, tumors, and injuries are more frequent. In people age 65 and older, stroke is the most common known cause, followed by degenerative conditions such as Alzheimer's disease. Often seizures do not begin immediately after a person has an injury to the brain. Instead, a seizure may occur many months later.

Epilepsy risk factors

- Premature birth or low birth weight
- Trauma during birth (such as lack of oxygen)
- Seizures in the first month of life
- Abnormal brain structures at birth
- Bleeding into the brain
- Abnormal blood vessels in the brain
- Serious brain injury or lack of oxygen to the brain
- Brain tumors
- Infections of the brain such as meningitis or encephalitis
- Stroke resulting from blockage of arteries
- Cerebral palsy
- Mental disabilities
- Seizures occurring within days after head injury
- Family history of epilepsy or fever-related seizures
- Alzheimer's disease (late in the illness)
- Lengthy fever-related (febrile) seizures
- Alcohol or drug abuse

Diagnosis

Diagnosis is made by a doctor based on symptoms, physical signs, and results of tests such as an electroencephalogram (EEG), computed tomography (CT or CAT scan), or magnetic resonance imaging (MRI).

It is essential that the type of epilepsy and the type of seizures are both diagnosed properly. There are several major classifications of seizures, and most are associated with specific forms of the disorder.

Treatment of Epilepsy

Epilepsy may be treated with drug therapy, surgery, biofeedback, vagus nerve stimulation (VNS) or a ketogenic diet. The wide range of antiepileptic drugs (AEDs) remains the cornerstone of treatment.

AEDs treat the symptoms of epilepsy (the seizures), rather than curing the underlying condition. The drugs act on the brain to prevent the seizures from starting by reducing the tendency of the brain cells to send excessive and confused electrical signals. Before any drug is prescribed, discuss potential benefits, side effects and risks with your doctor.

Brain surgery may be a viable alternative for some people whose seizures cannot be controlled by medication. A person who has been given adequate dosages of several seizure medications, for an appropriate period of time without good results, is unlikely to achieve complete seizure control with any other medication.

Epilepsy surgery can benefit patients who have seizures associated with structural brain abnormalities, such as benign brain tumors and cortical dysplasia, malformations of blood vessels (such as arteriovenous malformations and cavernous angiomas), the genetic disorder tuberous sclerosis, and strokes. The goal of epilepsy surgery is to identify an abnormal area of brain cortex from which the seizures originate and remove it without causing any major functional impairment.

Surgery is most commonly performed to treat partial epilepsy, since only one area of the brain is involved. After surgery, many patients will be seizure-free, while others will have better controlled seizures. A few patients may not improve and will need to explore further treatment options.

In some cases, a palliative approach is used to stop the spread of seizures, when the actual seizure focus cannot be determined accurately. One such approach involves cutting the nerve fibers connecting the two sides of the brain through a corpus callosotomy. The corpus callosum is a band of nerve fibers located deep in the brain that connects the two sides (hemispheres) of the brain. It helps the hemispheres share information, but it also contributes to the spread of seizure impulses from one side of the brain to the other.

Improved technology has made it possible to identify more accurately where seizures originate in the brain (epileptogenic regions), and advances in surgery have made operative management safer. The benefits of surgery should always be weighed carefully against its risks, because there is no guarantee that it will be successful in controlling seizures.

VNS, approved by the FDA in 1997, is designed to prevent seizures by sending regular, mild pulses of electrical energy to the brain via the vagus nerve. It requires minor surgery to implant a stimulator, which is about the size of a silver dollar. The stimulator is placed under the skin in the

upper chest, like a pacemaker. The treatment appears to be effective for seizures that do not respond well to medications alone. The effectiveness of this treatment is about the same as drug therapy. VNS decreases seizure numbers by at least half in 40 to 50 percent of patients, but rarely eliminates all seizures. Almost all patients need to continue taking medications after the stimulator has been placed, although dosages can usually be decreased.

Living and Coping with Epilepsy

People with epilepsy are at risk for two life-threatening conditions: tonic-clonic status epilepticus and sudden unexplained death in epilepsy (SUDEP). Tonic-clonic status epilepticus is a long-lasting seizure and considered a medical emergency. If not stopped within about 30 minutes, it may cause permanent injury or death.

SUDEP is a rare condition in which young or middle-aged people with epilepsy die without a clear cause. It accounts for less than 2 percent of deaths among people with epilepsy. The risk is about 1 in 3,000 per year for all people with epilepsy. Although, it can be as high as 1 in 300 for those who have frequent, uncontrollable seizures and take high doses of seizure medicines. Researchers are uncertain why SUDEP causes death. Some believe that a seizure causes an irregular heart rhythm. More recent studies have

suggested that the person may suffocate from impaired breathing, fluid in the lungs, and laying face down on bedding.

Although the risk is low, people with epilepsy can also die from inhaling vomit during or just after a seizure.

Most women with epilepsy can become pregnant, but they should discuss their epilepsy and the medications they are taking with their doctors, before getting pregnant. Many patients with epilepsy take high doses of medication that may lead to potentially harmful drug exposure to unborn babies. In some cases, medications may be reduced before pregnancy, particularly if seizures are well-controlled. While seizure medications can produce birth defects, severe birth defects are rare in infants of women who receive regular prenatal care and whose seizures are carefully managed. Women with epilepsy have a 90 percent or better chance of having a normal, healthy baby. Epilepsy is a chronic condition that affects people in different ways. Many people with epilepsy lead normal, active lives. Between 70 and 80 percent of people with epilepsy can successfully control their seizures through medication or surgical techniques.

Some people find that they rarely have to think about epilepsy, except when taking their medications or going to see the doctor. No matter how epilepsy affects you, it is important to remember that being well informed about your condition and keeping a positive attitude are important. Working closely with your health care team and adhering to your prescribed medications are essential to helping you control your seizures so that you can lead a full, balanced life.