



# Understanding Seizures & Epilepsy

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Comprehensive Epilepsy  
Program



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## Comprehensive Epilepsy Program

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## Understanding Seizures & Epilepsy

### WHAT IS A SEIZURE AND WHAT IS EPILEPSY?

- A **seizure** is an abnormal behavior caused by abnormal electrical activity in the brain. In contrast, **epilepsy** is a group of disorders marked by recurrent seizures over a prolonged period of time.
- **Non-epileptic seizures** (also called pseudoseizures) are not accompanied by unusual electrical activity in the brain and are most often caused by emotional stress or other psychological factors (see pamphlet on psychogenic seizures).
- **Provoked seizures** are single (isolated) seizures that may be caused by trauma, low blood sugar (hypoglycemia), low blood sodium, high fever, or alcohol or drug abuse. Fever-related (or febrile) seizures occur only during early childhood (before age 6). After a careful evaluation to estimate the risk of recurrence, patients who suffer a single seizure may not need treatment.
- **Seizure disorder** is a general term used to describe any condition in which seizures may be a symptom. In fact, seizure disorder is so general that it is not a useful term. Unfortunately, “seizure disorder” is often used to avoid the term epilepsy.

### WHO IS AFFECTED BY EPILEPSY?

- Epilepsy is a common condition, affecting about 1% of the population. This is about 20 times more common than multiple sclerosis.
- In the United States, about 2 million people have epilepsy. In fact, about 9% of Americans will have at least one seizure during their lives.
- Epilepsy can begin at any age.

### TYPES OF SEIZURES

#### Type of seizures

Based on the type of symptoms and electrical brain activity, seizures are divided into two broad categories: generalized and partial (also called local or focal).

**Generalized seizures** are produced by electrical impulses from throughout the entire brain, whereas **partial seizures** are produced (at least initially) by a relatively small part of the brain. The part of the brain generating the seizures is sometimes called the focus. The most common types of seizures are listed in Table 1.



## Understanding Seizures & Epilepsy

**Table 1. Seizure Types and Characteristics**

<b>Generalized Seizures</b> — <i>Produced by the entire brain</i>	<b>Symptoms</b>
<b>1. Generalized tonic clonic (“grand mal”)</b>	Loss of consciousness, fall, convulsions, muscle rigidity
<b>2. Absence</b>	Brief loss of consciousness and staring
<b>3. Myoclonic</b>	Sporadic (isolated), jerking movements
<b>4. Clonic</b>	Repetitive, jerking movements
<b>5. Tonic</b>	Muscle stiffness, rigidity
<b>6. Atonic</b>	Loss of muscle tone

<b>Partial Seizures</b> — <i>Produced by a small area of the brain</i>	<b>Symptoms</b>
<b>1. Simple</b> (awareness is retained) a. <b>Partial Motor</b>  b. <b>Sensory</b>  c. <b>Autonomic</b> d. <b>Psychological</b>	a. Jerking, muscle rigidity, spasms, head-turning b. Unusual sensations affecting either the vision, hearing, smell, taste or touch) c. Stomach sensation d. Memory or emotional disturbances
<b>2. Complex</b> (Impairment of awareness)	Automatisms such as lip smacking, chewing, fidgeting, walking and other repetitive involuntary movements
<b>3. Partial seizure that becomes generalized seizure</b>	Begins as partial (simple or complex) and evolves into grand-mal seizure

### Types of Seizures, continued...

#### Generalized Seizures

- The most common and most dramatic is the generalized convulsion, also called the **generalized tonic clonic** (“grand mal”) seizure. The patient loses consciousness and usually collapses. There is generalized body stiffening (called the “tonic” phase) for 30 to 60 seconds, followed by violent jerking (the “clonic” phase) for 30 to 60 seconds, after which the patient goes into a deep sleep (the “postictal” or after-seizure phase). During these seizures, injuries and accidents may occur, such as tongue biting and urinary incontinence.



## Understanding Seizures & Epilepsy

### Types of Seizures, continued...

- **Absence seizures** cause a short loss of consciousness (just a few seconds) with few or no other symptoms. The patient, most often a child, typically interrupts an activity and stares blankly. These seizures begin and end abruptly and may occur several times a day. Patients are usually not aware that they are having a seizure, except that they may be aware of “losing time.”
- **Myoclonic seizures** consist of sporadic jerks, usually on both sides of the body. Patients sometimes describe the jerks as brief electrical shocks. When violent, these seizures may result in dropping or involuntarily throwing objects.
- **Clonic seizures** are repetitive, rhythmic jerks that involve both sides of the body at the same time.
- **Tonic seizures** are characterized by stiffening of the muscles.
- **Atonic seizures** consist of a sudden and general loss of muscle tone, particularly in the arms and legs, which often result in a fall.

### Partial Seizures

Partial seizures are divided into simple, complex, and those that evolve into (secondary) generalized seizures. The difference between simple and complex partial seizures is that during **simple partial seizures**, patients retain awareness; during **complex partial seizures**, they lose awareness.

- **Simple partial seizures** are further subdivided into four categories according to the nature of their symptoms: motor, sensory, autonomic or psychological.
  - Motor symptoms include movements such as jerking and stiffening.
  - Sensory symptoms caused by seizures involve unusual sensations affecting any of the five senses (vision, hearing, smell, taste or touch).
  - When simple partial seizures cause sensory symptoms only (and no motor symptoms), they are called “auras.”
  - The only common autonomic symptom is a peculiar sensation in the stomach that is experienced by many patients with temporal lobe epilepsy.



## Understanding Seizures & Epilepsy

### Types of Seizures, continued...

- Finally, simple partial seizures with psychological symptoms are characterized by various experiences involving memory (the sensation of *deja-vu*), emotions (such as fear or pleasure), or other complex psychological phenomena.
- **Complex partial seizures**, by definition, include impairment of awareness. Patients seem to be “out of touch,” “out of it” or “staring into space” or “in a trance” during these seizures. There are often odd movements called **automatisms**, which are involuntary but coordinated movements that tend to be purposeless and repetitive. Common automatisms include lip smacking, chewing, fidgeting and walking.
- The third kind of partial seizure is one that begins as a focal seizure and evolves into a generalized convulsive (“tonic clonic”) seizure.

### TYPES OF EPILEPSY

#### Types of epilepsy

Most types of seizures occur in different types of epilepsy, and most patients with epilepsy experience more than one seizure type. This is because seizures are only symptoms. Therefore, it is essential that your neurologist diagnose your type of EPILEPSY, not just the type(s) of SEIZURE you are having.

Epilepsy can be divided into two broad categories: idiopathic and symptomatic. **Idiopathic epilepsy** is caused by **genetic** factors, as opposed to brain damage. **Symptomatic epilepsy** is caused by physical defects in the brain. Based on the type of seizure affecting the patient, idiopathic and symptomatic epilepsies can be further categorized (See Table 2).



## Understanding Seizures & Epilepsy

**Table 2: Major Types of Epilepsy.**

Types of Epilepsy	Generalized Epilepsy	Partial Epilepsy
Idiopathic (genetic causes)	Childhood absence epilepsy Juvenile myoclonic epilepsy Epilepsy with grand-mal seizures only Others	Benign focal epilepsy of childhood
Symptomatic (cause known) or cryptogenic (cause unknown)	West syndrome Lennox-Gastaut syndrome Others	Temporal lobe epilepsy Frontal lobe epilepsy Others

### Types of Epilepsy, continued...

#### Type 1: Idiopathic Generalized Epilepsy

- This is a genetic and inherited group of disorders, so there is often, but not always, a family history of epilepsy.
- Idiopathic generalized epilepsy tends to appear during childhood or adolescence, although it may not be diagnosed until adulthood.
- In this type of epilepsy, there are no nervous system abnormalities other than the seizures; the brain is structurally normal.
- People with idiopathic generalized epilepsy have normal intelligence, and the results of the neurological examination and brain scan are normal.
- The results of the electroencephalogram (EEG - a test which measures electrical impulses in the brain) are also normal, except for the discharges associated with epilepsy.
- The types of seizures affecting patients with idiopathic generalized epilepsy may include myoclonic, absence, and generalized tonic-clonic seizures, with one type predominating. Idiopathic generalized epilepsy is usually treated with medications and is a condition that is commonly outgrown, as in childhood absence epilepsy.

#### Type 2: Idiopathic Partial Epilepsies

- **Idiopathic partial epilepsy** begins in childhood (between ages 5 and 8) and runs in families.



## Understanding Seizures & Epilepsy

### Types of Epilepsy, continued...

- Also known as benign focal epilepsy of childhood or benign Rolandic epilepsy, this is one of the mildest types of epilepsy.
- It is almost always outgrown by puberty and is never diagnosed in adults.
- Seizures tend to occur during sleep and are most often simple partial motor seizures that involve the face and secondarily generalized (grand mal) seizures.

### Type 3: Symptomatic Generalized Epilepsy

- This is caused by widespread brain damage, and injury during birth is the most common cause.
- When the cause of symptomatic general epilepsy cannot be identified, the disorder may be referred to as cryptogenic epilepsy.
- Specific, inherited brain diseases, such as adrenoleukodystrophy (ADL, which was featured in the movie “Lorenzo’s Oil”), or brain infections (such as meningitis and encephalitis) can also cause symptomatic generalized epilepsy.
- In addition to seizures, these patients often have other neurological problems, such as developmental delay, mental retardation or cerebral palsy.
- These epilepsies include different subtypes—the most typical is the Lennox-Gastaut syndrome. Multiple types of seizures (generalized tonic-clonic, tonic, myoclonic, tonic, atonic and absence seizures) are common and can be difficult to control.

### Type 4: Symptomatic Partial Epilepsy

- This is the most common type of epilepsy to begin in adulthood.
- It is caused by a localized abnormality of the brain, which can result from strokes, tumors, trauma, scarring or “sclerosis” of brain tissue (common in the temporal lobe), cysts or infections.
- Sometimes these brain abnormalities can be seen on magnetic resonance imaging (MRI) scans, but often they cannot be identified, despite repeated attempts, because they are microscopic.
- When the cause of symptomatic partial epilepsy cannot be identified, the disorder may be referred to as cryptogenic epilepsy.



## Understanding Seizures & Epilepsy

### HOW IS EPILEPSY DIAGNOSED?

The evaluation of patients with epilepsy is aimed at determining the type of seizures and their cause, since different types respond best to specific treatments. The diagnosis is based on:

- The patient's **medical history**, including any family history of seizures, associated medical conditions and current medications.

Some important questions you will be asked include:

- At what age did the seizures begin?
  - What circumstances surrounded your first seizure?
  - What factors seem to bring on the seizures?
  - What do you feel before, during and after the seizures?
  - How long do the seizures last?
  - Have you been treated for epilepsy before? What medications were prescribed and in what dosages? Was the treatment effective?
  - Others who have often seen you before, during and after seizures, such as family and close friends, should be present to provide details of your seizures if they involve loss of consciousness.
- A complete **physical and neurological examination** —your muscle strength, reflexes, eye sight, hearing and ability to detect various sensations are tested so your doctors can better understand the cause of your seizures
  - An **electroencephalogram (EEG)**, which measures electrical impulses in the brain.
    - This is the only test that directly detects electrical activity in the brain, and seizures are defined by abnormal electrical activity in the brain. During an EEG, electrodes (small metal disks) are attached to specific locations on your head. The electrodes are attached to a monitor to record the brain's electrical activity. The EEG is useful not only to confirm a diagnosis of epilepsy, but also to determine the type of epilepsy.
    - A routine EEG only records about 20 minutes of brain waves (however, the routine EEG procedure takes about 90 minutes). Because 20 minutes is such a short amount of



## Understanding Seizures & Epilepsy

### How is Epilepsy Diagnosed? continued...

- time, the results of routine EEG studies are often normal, even in people known to have epilepsy. Therefore, prolonged EEG monitoring may be necessary. Prolonged
- **EEG-video monitoring** is an even better diagnostic method. During this type of monitoring, an EEG monitors the brain's activity and cameras videotape body movements and behavior during a seizure. Prolonged monitoring often requires the patient to spend time in a special facility for several days. Prolonged EEG-video monitoring is the only definitive way to diagnose epilepsy.
  - **Imaging studies of the brain**, such as those provided by magnetic resonance imaging (MRI). This can identify the cause of the seizures, but the vast majority of patients with epilepsy have normal MRIs.

### HOW IS EPILEPSY TREATED?

The majority of epileptic seizures are controlled through drug therapy. The type of treatment prescribed will depend on several factors including the frequency and severity of the seizures as well as the person's age, overall health and medical history. An accurate diagnosis of the type of epilepsy (not just the type of seizure, since most seizure types occur in different types of epilepsy) is also critical in choosing the best treatment.

#### Drug Therapy

- Many drugs are available to treat epilepsy, several of which have only recently been released.
- Older, classic medications used to treat epilepsy include:
  - phenytoin (Dilantin)
  - phenobarbital
  - carbamazepine (Tegretol, Carbatrol)
  - primidone (Mysoline)
  - ethosuximide (Zarontin)
  - valproic acid (Depakote)
  - diazepam (Valium) and its derivatives



## Understanding Seizures & Epilepsy

### How is Epilepsy Treated? continued...

- Newer drugs to treat epilepsy include:
  - felbamate (Felbatol)
  - gabapentin (Neurontin)
  - lamotrigine (Lamictal)
  - oxcarbazepine (Trileptal)
  - topiramate (Topamax)
  - tiagabine (Gabitril)
  - levetiracetam (Keppra)
  - zonisamide (Zonegran)
- In general, for a given type of epilepsy there are only minor differences among appropriate drugs. The choice is most often based on other factors specific to each patient, such as side effects.
- In general, newer drugs are better tolerated and easier to use than older ones.
- Although the different types of epilepsy vary greatly, in general, medications can control seizures in about 70% of epilepsy patients. Idiopathic generalized epilepsies and benign focal epilepsy of childhood are the easiest to treat, whereas symptomatic generalized epilepsies are the most difficult. The majority of partial epilepsies fall somewhere in between.
- In the United States, most newer drugs are currently approved to be used in combination with a “classic” drug. However, it is well known that they do work on their own, and are often used this way.
- Seizure medications should not be stopped abruptly.

#### Side effects

- As is true of all drugs, the drugs used to treat epilepsy have side effects. The occurrence of side effects depends on the dose, type of medication and length of treatment.
- The side effects worsen with higher doses but tend to be less severe with time as the body adjusts to the medication. Anti-epileptic drugs are usually started at lower doses and increased gradually to make this adjustment easier.



## Understanding Seizures & Epilepsy

### How is Epilepsy Treated? continued...

- Some medications have potential side effects when taken for a long period of time, including effects on the ovaries and bones.
- Some seizure medications also interact with other medications. For example, several older drugs can make the birth control pill less effective, and this may need to be addressed.

#### How the medication is prescribed

- How and when the drug is taken may be an important factor in determining which drug patients prefer. If a patient's schedule makes it difficult to take medications several times a day, drugs given once daily may be preferred.
- The flexibility of the drugs with which the drug can be prescribed is also important. For example, women with seizures related to menstruation benefit from extra medication during their periods. Patients with nighttime seizures benefit from extra doses at bedtime.

#### Will treatment work

- Overall, medications control seizures in about 70% of patients.
- If one drug does not work or causes side effects, others drugs or combinations should be tried.
- However, what we have learned over the last 10 years is that *if 3 drugs have been tried and have not controlled the seizures, it is unlikely that other drugs ever will, so at that point EEG-video monitoring should be performed to examine other treatment options.*

#### How long does treatment last

- In some types of epilepsy, patients can be taken off treatment after a few years, while other types of epilepsy require life-long treatment.
- With few exceptions, patients who are seizure-free for a certain period should be reevaluated to determine whether the drug can be discontinued.
- If a medication is going to be discontinued, it should be weaned gradually.



## Understanding Seizures & Epilepsy

### How is Epilepsy Treated? continued...

#### Other Treatment Options

- **Epilepsy surgery** is safe and effective, and is the treatment of choice when drugs do not work. (see pamphlet on epilepsy surgery).
- **The ketogenic diet** is effective for treating certain types of epilepsy. Specifically, it is effective in children with severe symptomatic generalized epilepsies with more than one type of seizure and brain damage. However, the diet requires careful planning and may be difficult to follow, so is usually not feasible in older children or adults. The diet is started in the hospital, and when successful, it is usually maintained for 2 to 3 years. It requires a very motivated family, and a qualified dietician.
- **Vagus nerve stimulation (VNS)**. This treatment requires minor surgery to implant a stimulator, which is about the size of a pacemaker. It is placed under the skin in the left upper chest, like a pacemaker. This treatment appears to be effective for seizures that do not respond well to medications alone. The degree of effectiveness of VNS is about the same as any of the new medications, but unlike drugs VNS causes few side effects. VNS almost never eliminates all seizures and almost all patients need to continue taking medications.

### FIRST AID FOR A PERSON HAVING A SEIZURE

Most seizures are self-limited and will stop within a few minutes. If someone is having an epileptic seizure, here's what you can do:

- Loosen clothing around the person's neck.
- Do not try to hold the person down or restrain him or her; this can result in injury
- Do not insert any objects in the person's mouth; this can also cause injury
- Reassure bystanders who may be panicking and ask them to give the person room
- Remove sharp objects (glasses, furniture, and other objects) from around the person to help prevent injury
- After the seizure, it is helpful to lay the person on his or her side to maintain an open airway and prevent the person from inhaling any secretions.



### SAFETY AND EPILEPSY

- In most cases, especially if the person is known to have epilepsy, it is not necessary to call an ambulance.

Today, treatment enables most patients to live active and productive lives. However, there are situations in which you have the responsibility to recognize and accept certain limitations. Below are some important guidelines to follow to make sure you stay safe in the event of a seizure.

- Carry medical identification. If an emergency occurs, your medical information can help the people around you maintain your safety and provide the appropriate treatment.
- Make sure your family, friends and co-workers know what to do if you have a seizure.
- Avoid the potential dangers of high places or moving machinery at work if you have active seizures. Though there is less risk if your seizures are under control, your attention should focus on the specific risks of your own job.
- It is important for you to remain active, but perform sports and other activities with caution. Avoid potentially dangerous activities, such as bathing with no one nearby, swimming alone or mountain climbing alone. Try to have another person with you. Your risk of injury in all sports is not from the sport itself but from the effect of having a seizure while playing the sport.
- If you are prescribed anticonvulsant medication, do not suddenly stop taking it or change the dosage without consulting your doctor. The type of anticonvulsant medication you are prescribed depends on the type of epilepsy you have, and the dose is prescribed especially for you according to your weight, age, gender and other factors.
- Be alert to the risks of possible drug interactions between your seizure medications and other medications you may take, including over-the-counter drugs.
- Always call your doctor or pharmacist if you are not sure what interactions could occur before taking any medication.
- Avoid excessive alcohol, as it can interfere with the effectiveness of your medications.



## Understanding Seizures & Epilepsy

### EPILEPSY AND DRIVING

- On one hand, it is obvious that people with uncontrolled seizures should not drive. On the other hand, if seizures are controlled, one should be allowed to drive.
- How long should one be seizure free before being allowed to drive? The driving laws differ in each state, but all states require a seizure-free period before they allow a patient with epilepsy to drive.
- In Florida, it is *6 months* with the approval of your physician. It is usually your responsibility to tell the state Bureau of Motor Vehicles of any condition that you have, such as epilepsy, which may affect your driving ability.
- In a few states (not Florida), physicians are required to report patients with epilepsy to the Department of Motor Vehicles.
- In Florida, the duty of the physician is only to inform patients of the legal requirements.

### EPILEPSY AND PREGNANCY

- Given the proper care, over 90% of women with epilepsy have safe pregnancies without complications and deliver healthy babies.
- In addition, all anti-epileptic drugs can be taken during pregnancy. The increased risk of birth defects is increased to about 6-8%, as opposed to 3-4% in the non-epileptic population.
- Important factors to avoid complications include:
  - Good prenatal care and monitoring throughout the pregnancy, with both the neurologist and the obstetrician
  - Taking a single drug, the most effective drug for the specific type of epilepsy; and prescribe the lowest possible dose of the drug.
  - Planning the pregnancy and taking folic acid *before* becoming pregnant.

### MORE INFORMATION

- Epilepsy Foundation of America:
  - <http://www.efa.org>
  - (800) EFA-1000
- The USF/TGH Comprehensive Epilepsy Program: <http://epilepsy.usf.edu>