

Seizures 101

Brush up on the essentials about seizures,
so you can remain calm and provide effective care.

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LET'S FACE IT: Witnessing someone have a violent seizure can be alarming no matter what your profession. Even if you don't work in neurology or critical care, you'll probably care for someone with a seizure disorder who has other health care needs. Knowing the various types of seizures, why they occur, and their treatments can increase your confidence for recognizing seizure activity and offering appropriate care if the need arises. (See *How to Care for Someone Who's Having a Seizure.*)

Covering the basics

First, let's touch on some basic facts about all types of seizures. Seizures are sudden, abnormal, and excessive electrical discharges from the brain that can change motor or autonomic function, consciousness, or sensation. About 2.5 million Americans—two-thirds of them adults—meet the criteria for a seizure disorder diagnosis.

Seizures can develop at any time during a person's life, and they can occur at any time. This unpredictability can profoundly affect a person's life, including intimate and casual relationships and independence. Most states withhold driving privileges from patients diagnosed with seizure disorders until they've been seizure-free for a specified amount of time—usually between 3 months and 1 year, depending on the state.

Fear of death, social embarrassment, and injuries are the most common concerns of

patients with epilepsy, a neurologic condition in which an abnormality in the brain causes recurrent seizure activity. Patients with epilepsy are more likely to be unemployed, unmarried, and childless and to commit suicide than people in the general public.


Not all seizures are epileptic

Not all people who have seizures have epilepsy. Nonepileptic seizures are a response to a stimulus that doesn't originate in the central nervous system (CNS), such as alcohol withdrawal, fever, hypoxia, drug intoxication, and poisoning. Because of the unlimited number of causes for nonepileptic seizures, we'll focus on epileptic seizures.

Epileptic seizures can range in severity from mild and completely controlled to multiple episodes that continue despite treatment. Seizures are unpredictable; depending on the underlying cause, patients may function normally between seizures or have profound neurologic deficits even at baseline.

The two basic types of seizures are *partial* and *generalized*. Partial seizures start in a specific part of the brain and have focal discharges that can be monitored. Partial seizures fall into two types: simple, in which the patient doesn't lose consciousness, and complex, in which the patient loses consciousness.

In contrast, generalized seizures affect the



whole brain from the onset of the seizure to its completion. Absence (or petit mal) and myoclonic seizures are nonconvulsive generalized seizures. The tonic-clonic (or grand mal) seizure is convulsive. If a partial seizure transforms into a generalized seizure, spreading diffusely through the cortex, it's called a secondary generalized seizure.

Be observant for patients who suddenly report unusual symptoms, such as smelling burnt toast, feeling as if spiders are crawling on their arms, or experiencing any other odd odor, taste, or sensation. These experiences, known as auras, may warn the patient of an impending seizure.

The seizure is called the ictus, and is followed by a period called the postictal phase. If the patient is conscious during the postictal phase, he'll most likely be confused, tired, and unaware of the previous events.

Now let's take a closer look at types of seizures.

Simple partial seizures

During a *simple partial seizure*, the person is fully aware but still unable to control what's happening. Symptoms often correspond to the brain lobe involved and the actions it controls.

Electroencephalogram (EEG) monitoring is the most common way to determine where a seizure originates in the brain (more on this later). However, some general guidelines can help clinicians narrow down possible locations.

The *temporal lobe* controls memory, sound, smell, and

emotions. Emotional changes are the biggest symptom associated with temporal lobe seizures. Patients have sudden, intense feelings, such as fear or bliss. They may even report a feeling of déjà vu. The ictus phase usually is short, making it difficult to isolate seizure focus to a specific lobe without continuous EEG monitoring or an EEG recorded during the seizure.

A *frontal lobe* seizure is characterized by movement of an extremity or a change in speech. Patients may report that their head was repeatedly and involuntarily turning to one side or that an arm or hand became stiff. They may experience a jacksonian march: abnormal motor movements that start in a small area, such as the fingers, and progress over seconds or minutes to include a larger area, such as the entire arm. Left hand jerking indicates activity in the right frontal lobe and vice versa. Because the frontal lobe controls part of the speech cortex, the patient may be unable to speak or may repeat words continually.

A *parietal lobe* seizure is characterized by tingling or a feeling of warmth down one side of the body. Arm and leg movement also may occur with these seizures. Patients usually report numbness or tingling that may last for a few minutes but eventually goes away during the postictal phase.

Many patients with *occipital lobe* seizures report seeing flashing lights, fireballs, and bright colors shooting across half of the visual field.

A patient experiencing any type of simple partial seizure may be very distressed, especially if he's a child. Use a soothing voice, reassure him, and don't leave his side. The activity of a simple partial seizure can sometimes progress to a generalized seizure, so remain with the person until he's fully recovered.

A postictal phase, during which the person may be weak or briefly paralyzed, can follow any type of seizure.

Complex partial seizures

The person experiencing a *complex partial seizure* can't respond appropriately to commands and won't remember the event, but may appear to be fully awake. These seizures can originate anywhere in the brain, but most occur in the temporal lobe and are characterized by automatisms, or involuntary automatic behaviors such as chewing, lip smacking, picking motions of the hands, bizarre behavior, and hallucinations. Bizarre behaviors may include undressing in public, eating dog food, laughing uncontrollably, and wandering off for hours.

However, in some cases, the symptoms of a partial seizure, such as automatisms, may go unnoticed unless the seizure progresses to a secondary generalized seizure. Even the postictal phase following these



How to care for someone who's having a seizure

First, protect the patient, but don't restrain him to try to prevent the seizure. Provide privacy to protect him from onlookers. Remove harmful objects from his vicinity. Use a nonthreatening manner to try to guide him away from stairs or other potentially harmful situations. Help him to the floor, if possible, and use a pad to protect his head from injury. If he's in a bed, remove the pillows and raise the side rails.

Remember your ABCs and protect the patient's airway throughout the seizure. Loosen his clothing and remove eyeglasses if he wears them. Don't insert anything in his mouth. This won't keep the airway open, and he may swallow or bite the object. Remain with him throughout the seizure and be sure to time its length.

After the seizure, as long as the patient has no evidence of trauma, keep him on his side to prevent aspiration of secretions. Maintain airway patency. Suction him if necessary. When he awakes, reorient him.

If the patient isn't breathing or is pulseless after the seizure, initiate cardiopulmonary resuscitation.

minor partial seizures may be minimal or nonexistent.

Nonconvulsive generalized seizures

Absence (or petit mal) seizures. The teacher sends notes home about a 6-year-old's poor school performance and "too much daydreaming." Your 10-year-old pediatric patient stops speaking midsentence and gives a blank stare. Your 8-year-old neighbor has repeated episodes of lip smacking and eye blinking. These are the main symptoms of absence (or petit mal) seizures, which commonly affect children ages 4 to adolescence, come without warning, and include a sudden, brief lapse of consciousness. The patient doesn't remember the event, doesn't fall, and can even continue some activities, such as riding a bicycle. These seizures can be frequent; a patient may experience several hundred each day. But they usually go unrecognized until the activity warrants further investigation; for example, if the teacher writes to the parents to suggest that a child may have attention deficit disorder.

Children with absence seizures may not be diagnosed as having epilepsy until their seizures progress to grand mal seizures in adulthood.

Myoclonic seizures. Sudden, brief jerking of a muscle group or groups characterizes myoclonic seizures. Affected areas can range from the pinky finger to the torso. Small and rhythmic, the jerking motion, which lasts a few seconds, can occur frequently or just once or twice. The seizures are most common in children and the elderly and can be triggered by fatigue.

Because these seizures are small and brief, they often go unnoticed. After the event, the person may report soreness or cramping in the affected area.

Convulsive generalized seizures

Tonic-clonic (or *grand mal*) seizures don't go unnoticed. Tonic seizure activity is a type of muscle spasm or contraction in which the arms flex and the legs extend. Clonic seizure activity alternates between contraction and relaxation.

Tonic-clonic seizures commonly strike without warning. The aura, if any, consists of just a simple feeling of depression or irritability. In the initial, tonic phase of the seizure, the person suddenly falls to the ground, with a brief flexion of the back, followed by staring. His arms may be up in the air, signaling that the tonic phase is about to begin. He may scream or moan as the air is pushed from the lungs in a tight spasm. The person's breathing is impaired during this time, and he becomes cyanotic. He may lose bladder or bowel control, and his pupils may become dilated. This activity can last for almost 30 seconds.

The muscular contractions during the tonic phase start at about eight spasms per second and slowly intensify to spasms that radiate throughout the body. The spasms can appear very violent, as the person's face is usually contorted and blood may flow from his mouth if he's bitten his tongue. Secretions may pool in the oropharynx. The person sweats profusely and is tachycardic and hypertensive.

As the tonic phase evolves into the clonic phase of

the seizure, periods of muscle relaxation occur between tonic muscle contractions. The periods of relaxation gradually lengthen until the end of the seizure.

During the postictal phase, the person lies very still, with flaccid muscles. Excessive salivation may cause stridorous breathing, and the person's airway may be obstructed partly by secretions or totally by his tongue. Gradually, over minutes to hours, he'll regain consciousness. He may speak during this time, but he won't remember the event or what he says. Because of exhaustion, he may sleep for hours after the seizure.

He may awaken in a hospital bed, confused about how he got there and complaining of a headache. His muscles will ache from the spasms, and he may be seriously injured from the event. Because he has no recollection of the seizure, you'll need to reorient him.

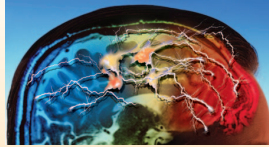
Diagnosing electrical activity

The first step in determining if a patient has epilepsy is to take a history, which can help rule out other conditions that mimic seizure, such as syncope. Besides a complete physical and neurologic exam, the patient will have lab studies, which can rule out common metabolic causes of seizures. Additional studies, such as imaging studies or a lumbar puncture, may be needed to rule out structural abnormalities that cause seizures, such as brain tumors.

The EEG is the most definitive test to diagnose epilepsy and identify a seizure's location (and focus, if there is one and the seizure occurs during the EEG).

Treating epilepsy with medication

Drug	Indication	Adverse reactions
Carbamazepine	Primary therapy for generalized and complex partial seizures	Diplopia, ataxia, gastrointestinal (GI) upset, skin rash, blood dyscrasia, hepatic dysfunction
Felbamate	Monotherapy or adjunct therapy in adults with severe seizures or in children with Lennox-Gastaut syndrome and uncontrolled seizures. Benefits of using the drug must outweigh its serious risks.	Anorexia, vomiting, insomnia, somnolence, aplastic anemia, hepatotoxicity
Gabapentin	Adjunct therapy for partial seizures, including secondary generalized seizures	Somnolence, fatigue, ataxia, dizziness, GI upset, dyspnea
Lamotrigine	Adjunct therapy for partial seizures, including secondary generalized seizures	Rash (including Stevens-Johnson syndrome), dizziness, ataxia, blurred vision, nausea
Phenytoin	Status epilepticus; parenteral treatment and prevention of seizures	Pruritus, nystagmus, dizziness, somnolence, ataxia, nausea, tinnitus, hypotension, groin discomfort with infusion
Topiramate	Adjunct therapy for partial seizures	Dizziness, somnolence, ataxia, confusion, fatigue, paresthesia, speech difficulties, diplopia, impaired concentration, nausea
Valproic acid	Primary therapy for myoclonic, tonic-clonic, and adult-onset absence seizures	GI upset, weight gain, hair loss, tremor, hepatic dysfunction, thrombocytopenia



Ideally, a patient should have an EEG within 24 hours of a suspected seizure. The recording session may take only 20 to 30 minutes, but some clinicians prefer that the patient undergo documentation for 24 hours. The patient should be calm throughout the recording because the machine will pick up extra movement, making interpretation difficult.

The EEG machine may not be completely accurate, and seizures may be overlooked. False negatives are possible, as the patient may not have a seizure during the recording.

Taking stock of therapy options

Long-term drug treatment is recommended for patients who've had recurrent seizures with an unknown cause or a cause that can't be reversed. A neurologist selects drugs and dosages based on the patient's age and weight and the type, frequency, and cause of the seizures. (See *Treating Epilepsy with Medication*.) To prevent toxicity and reduce the risk of adverse reactions, the initial dosages are low and are steadily increased until seizures are adequately controlled. In many cases, monotherapy controls seizures.

If seizures persist, the drug's dosage and timing are changed. If this doesn't work, a second drug is prescribed. About one-third of patients with epilepsy don't respond to monotherapy and need a combination regimen.

Not adhering to therapy is the most common cause of recurrent seizures in patients taking antiseizure drugs, so teach patients the importance of taking their medications. Teenagers, in particular, don't want to be perceived as different because they have to take daily medication and are at higher risk for not adhering to therapy. Also warn patients about over-the-counter drugs that interact with their epilepsy drugs.

Potential adverse reactions to antiseizure drugs include nausea, vomiting, and diarrhea. To deal with minimal adverse reactions, the clinician may adjust the drug dosage. If adverse reactions are serious, he'll switch the patient to a new drug. Tapering doses of the old drug while a new one replaces it prevents serious withdrawal reactions, such as rebound seizures.

A patient who's been free from seizures for 2 to 5 years, has a normal neurologic exam, and has a normal EEG may be able to be weaned from antiseizure therapy. Ideally, trial weaning should occur during a low-risk period of life, such as before a teenager begins to drive, to minimize consequences if seizures recur.

Some patients with intractable complex partial seizures require surgery. Although the indications are

In many cases, one drug can control a patient's seizures. If this doesn't work, a second drug is prescribed.

still debated, most neurologists will refer these patients for surgery if multiple drug therapy doesn't control their seizures. With recent advances in presurgical evaluation and microsurgical techniques, surgery is both more common and more successful than in past decades. Using EEG monitoring and magnetic resonance imaging or positron emission tomography scans, the clinician can detect the specific area of the brain that's causing the seizure activity. The

goal of surgery is to remove this localized area of damaged tissue while preserving as much healthy tissue as possible.

The most common surgical procedure used to treat complex partial seizures is a temporal lobectomy. Small portions of the hippocampus (part of the temporal lobe) on the affected side also are removed. Some 70% to 80% of patients who have this surgery become seizure-free, and 20% have a reduction in seizure frequency. Complications are rare, with memory loss and language difficulties reported in patients with left temporal lobe surgery. In severe cases of intractable generalized seizures, a corpus callosotomy may be performed.

Patients with medically refractory epilepsy who aren't candidates for brain surgery have another treatment option: electrical stimulation of the vagus nerve, the longest nerve in the body. In this procedure, a neurosurgeon implants a device similar to a pacemaker. Leads are wrapped around the left vagus nerve in the lower part of neck, and the device can be programmed to deliver intermittent electrical pulses, stimulating the vagus nerve and aborting a seizure.

However, vagal stimulation can cause adverse reactions such as dyspnea, hoarseness, coughing, and tingling in the neck. Surgery is needed to replace the batteries in the vagal nerve stimulator about every 5 years.

Status epilepticus

Despite medical and surgical therapy, some patients with epilepsy still have seizures and can develop life-threatening status epilepticus. This rare condition is defined as continuous seizure activity lasting for longer than 30 minutes, or repetitive discrete seizures with impaired consciousness between seizures. The sustained seizure activity can cause cardiopulmonary dysfunction, metabolic derangements, and hyperthermia that can lead to permanent brain damage.

In one-third of cases, status epilepticus is triggered by physiologic causes, such as drug withdrawal or toxicity, metabolic disturbances, CNS tumors, refractory epilepsy, or head injury. In these cases, focus on

treating the underlying event; anticonvulsant therapy alone won't work for metabolic conditions. Mortality can be as high as 33%, depending on the severity of the precipitating event.

Another third of cases are caused by lack of adherence to medication therapy. Determine why the patient stopped taking the medication and resume therapy with the current drug or a new one. Outcomes are generally good for these patients. The remaining cases are of unknown etiology and often have poor outcomes.

The main drug therapy for status epilepticus is intravenous lorazepam combined with phenytoin or fosphenytoin. If seizures continue after these drugs have been given, adjunctive therapy with phenobarbital or anesthesia with midazolam or propofol may be needed. The patient will need continuous EEG monitoring and treatment for several days or weeks until the seizures are controlled.

Living with epilepsy

If your patient has a seizure disorder, make his hospital environment as safe as possible. Be alert for signs of an impending seizure, such as the patient's report of a possible aura. Teach the patient to avoid seizure triggers such as caffeine.

Teach the patient about his medications, tell him to avoid over-the-counter drugs unless his primary care

provider approves them, and recommend that he wear a medical-alert bracelet. His family also should learn how to respond during a seizure. Remind him to take showers rather than baths (because of the risk of drowning) and to avoid swimming alone.

Provide him with information about support groups and reassure him that proper medication and medical management can control his seizure disorder. **N**

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SELECTED WEB SITES

American Epilepsy Society <http://www.aesnet.org>
Epilepsy.com <http://www.epilepsy.com>
Family Caregiver Alliance http://www.caregiver.org/caregiver/jsp/content_node.jsp?nodeid=372
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