

Evaluation of a First Seizure

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Seizure is a common presentation in the emergency care setting, and new-onset epilepsy is the most common cause of unprovoked seizures. The patient history and physical examination should direct the type and timing of laboratory and imaging studies. No single sign, symptom, or test clearly differentiates a seizure from a nonseizure event (e.g., syncope, pseudoseizure). Electroencephalography is recommended for patients presenting with a first seizure, and neuroimaging is recommended for adults. Neuroimaging also should be performed in children with risk factors such as head trauma, focal neurologic deficits, or a history of malignancy. Magnetic resonance imaging is preferred over computed tomography except when acute intracranial bleeding is suspected. The most common laboratory findings associated with a seizure are abnormal sodium and glucose levels. Patients with a normal neurologic examination, normal test results, and no structural brain disease do not require hospitalization or antiepileptic medications. Treatment with antiepileptic medications reduces the one- to two-year risk of recurrent seizures but does not reduce the long-term risk of recurrence and does not affect remission rates. Regardless of etiology, a seizure diagnosis severely limits a patient's driving privileges, although laws vary by state. (*Am Fam Physician* 2007;75:1342-1347, 1348. Copyright © 2007 American Academy of Family Physicians.)



ILLUSTRATION BY MARK LEFKOWITZ

► **Patient Information:** A handout on seizures, written by the authors of this article, is provided on page 1348.

About 2 to 5 percent of Americans experience an afebrile seizure, and seizures account for approximately 1 to 2 percent of all emergency department visits.¹ The self-reported prevalence of epilepsy is 1.1 to 2.2 percent in the United States.² Most patients (57 percent) who present with a first seizure are younger than 25 years, and 71 percent of this subset is 15 years or younger; 58 percent of patients with a first seizure are men.³

Seizure Types

Seizures are categorized based on presentation and etiology. A generalized seizure involves all areas of the brain (both hemispheres), whereas a partial (focal) seizure involves only one area of the brain. A first seizure is twice as likely to be a generalized seizure as a partial seizure. Most generalized seizures occur when the patient is awake, but one in four occurs during sleep.³ Partial seizures can be further classified as simple (i.e., no loss of consciousness) or complex (i.e., loss of consciousness).

Symptomatic seizures are those that have

a recognizable cause (e.g., head injury, brain tumor), and idiopathic seizures are those for which no abnormality is found. Acute symptomatic seizures are caused by a recent or current event, whereas remote symptomatic seizures are caused by a chronic abnormality such as an old stroke. A provoked seizure is caused by an identifiable transient disturbance such as an electrolyte abnormality (e.g., hypocalcemia). In the year following an acute symptomatic seizure diagnosis, patients have a higher risk of death than those without this diagnosis. Idiopathic seizures are not associated with increased risk of death.⁴

Etiology

There are multiple causes of seizure (*Table 1*⁵), but new-onset epilepsy is the most common cause of a first seizure.³ One in six patients who present with a single seizure will have an identifiable potential cause such as pre- or perinatal brain injury (4.4 percent), cerebrovascular disease (3.9 percent), head injury (3.2 percent), brain tumor (1.7 percent), or alcohol use (0.3 percent).³

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
Neuroimaging is recommended for adults presenting with a first unprovoked seizure and for children with risk factors.	C	1, 7, 17, 20
Immediate neuroimaging is recommended for patients who have an increased risk of acute intracranial pathology.	C	1, 7
Routine laboratory tests in adults should include glucose and sodium measurements and a pregnancy test if applicable; immunocompromised patients should receive a lumbar puncture.	C	1
Electroencephalography is recommended for patients presenting with a first seizure.	C	1, 7, 21
Magnetic resonance imaging is preferred over computed tomography unless acute intracranial bleeding is suspected.	C	7, 16
Patients with a normal neurologic examination and no known structural brain disease or comorbidities do not require hospitalization or antiepileptic medication.	C	1, 7

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, see page 1289 or <http://www.aafp.org/afpsort.xml>.

Table 1. Selected Causes of Seizure

Alcohol use and withdrawal	Medications
Brain injury or abnormality	Analgesics (e.g., local anesthetics, meperidine [Demerol], tramadol [Ultram])
Brain tumor	Antibiotics (e.g., beta-lactam antibiotics, isoniazid [INH; Nydrazid], quinolones, some human immunodeficiency virus medications)
Cerebral dysgenesis	Immunomodulators (e.g., cyclosporine [Sandimmune], interferons, tacrolimus [Prograf])
Cerebrovascular, degenerative, inflammatory/autoimmune diseases	Psychotropics (e.g., antidepressants, antipsychotics, lithium, stimulants)
Genetic disorders	Theophylline
Head trauma	Metabolic disorders
Peri- or prenatal brain injury	Electrolyte abnormalities
Central nervous system infections	Inborn errors of metabolism
Cysticercosis	Liver or kidney failure
Encephalitis	Pyridoxine deficiency
Meningitis	
Contrast agents	
Epilepsy	
Fever (children)	
Illicit drug use and withdrawal	

Information from reference 5.

Evaluation

When evaluating a patient who has just experienced a seizure, the physician should first verify that the patient has normal vital signs and adequate oxygenation and that there is no further seizure activity. There is no standardized algorithm for the evaluation of every patient with a first seizure. Instead, a careful history and physical examination should determine imaging and laboratory testing decisions.⁶

The history should initially focus on determining whether a seizure actually occurred and evaluating the circumstances and characteristics of the event. The behaviors of the patient during the event and evidence of partial onset may be important in identifying a specific form of epilepsy. A history of trauma or symptoms of infection (e.g., stiff neck, fever, headache) also helps direct the evaluation. The patient should

Table 2. Risk Factors for Acute Intracranial Pathology in Adults with a First Unprovoked Seizure

Acquired immunodeficiency syndrome
Acute head trauma
Age older than 40 years
Fever
History of anticoagulation
History of malignancy
New focal neurologic deficit
Partial (focal) seizure
Persistent altered mental status
Persistent headache

NOTE: Immediate neuroimaging is important if there is an increased risk of acute intracranial pathology. Information from reference 13.

be asked about medication, illicit drug, and alcohol use. A history of neurologic or developmental disorders or a family history of epilepsy may help narrow the differential diagnosis. The physical examination should include a thorough neurologic and mental status evaluation.

Differential Diagnosis

No sign, symptom, or test clearly differentiates a seizure from a nonseizure event (e.g., syncope, pseudoseizure).⁷ Up to 20 percent of patients diagnosed with epilepsy actually have pseudoseizures. Eye closure throughout the event is rare in true seizures but common in pseudoseizures, and a history of fibromyalgia or chronic pain syndrome is predictive of pseudoseizures.⁸

In older children and adults, a serum prolactin measurement, if obtained within 10 to 20 minutes of the event, is useful in differentiating a generalized tonic-clonic seizure or complex partial seizure from a pseudoseizure. The sensitivity of an elevated prolactin level is 60 percent for generalized tonic-clonic seizures and 46 percent for complex partial seizures.⁹

Syncope may be difficult to differentiate from seizures, particularly if the event was unwitnessed. Up to 90 percent of patients with syncope have myoclonic or other

seizure-like movements while unconscious.¹⁰ Historic features suggestive of seizure include tongue biting, presence of an aura, sensation of epigastric fullness, post-ictal confusion, and focal neurologic signs. Tongue biting, especially lateral, is highly specific but not sensitive for generalized seizures.¹¹ Events precipitated by an emotionally stressful event or preceded by lightheadedness, sweating, prolonged standing, chest pain, palpitations, or slow heart rate are more likely to be syncopal.¹²

Diagnostic Testing

Adults who present to the emergency department after an unprovoked first seizure should receive immediate neuroimaging of the brain if feasible, although testing at a later date may be acceptable in certain patients if follow-up is reliable.¹ Patients at an increased risk of acute intracranial pathology (*Table 2*¹³) need immediate neuroimaging.^{1,7} Current practice guidelines allow a well-appearing child without risk factors to be discharged from the emergency department without emergent neuroimaging.⁷

A lumbar puncture is indicated for patients with a history or examination results suggestive of central nervous system infection and in patients who are immunocompromised. New-onset seizures may be the only symptom of central nervous system infection in patients with human immunodeficiency virus.¹⁴ Lumbar puncture is not routinely recommended in afebrile children but should be considered in children younger than six months and in those who have persistently altered mental status or meningeal signs.⁷

Glucose abnormalities and hyponatremia are the most common laboratory findings associated with seizures.¹ Practice guidelines recommend testing children based on individual clinical circumstances and routinely measuring serum glucose and sodium levels in adults. Pregnancy testing should be performed in premenopausal women, and toxicology testing should be performed when substance abuse is suspected.^{1,7} Infants with new-onset seizures should be tested for electrolyte abnormalities.

Electroencephalography (EEG) is recommended for all patients with new-onset seizures.^{1,7} Emergent EEG testing is indicated if there is concern about status epilepticus. Nonconvulsive or subtle convulsive status epilepticus may be difficult to diagnose clinically and may be mistaken for a prolonged postictal state. One fourth of patients with treated status epilepticus who appear to be seizure-free continue to have seizure activity that is only detectable with EEG. Patients who have had a seizure and are in a drug-induced coma or who have received a long-acting paralytic agent also should receive immediate EEG testing.¹

Most other patients with a first seizure can receive EEG testing at a scheduled follow-up visit. Although EEG within 24 to 48 hours of a seizure is more likely to show an abnormality, some early abnormalities, such as postictal slowing, may not be significant.⁷

Neuroimaging

The recommendations for imaging after a first seizure depend on patient age, seizure type, and associated risk factors.

CHILDREN

There is insufficient evidence to recommend for or against routine neuroimaging in children who present only with a single unprovoked seizure, although unnecessary radiation exposure should be avoided. The estimated lifetime risk of death from radiation-induced malignancy caused by a single computed tomography (CT) scan of the head at one year of age is 0.07 percent.¹⁵

Neuroimaging should be performed in children with a postictal focal neurologic deficit that does not resolve or in children who do not return to baseline neurologic function within several hours. Neuroimaging also should be performed in children with head trauma or a history of malignancy. Nonurgent magnetic resonance imaging (MRI) should be seriously considered in children younger than one year and in children with any of the following characteristics: significant cognitive or motor impairment of unknown etiology, unexplained abnormalities on neurologic examination, partial onset

of seizure with or without secondary generalization, or no evidence of benign partial epilepsy of childhood or primary generalized epilepsy on EEG.⁷ Seizures only provoked by the presence of fever (febrile seizures) do not require neuroimaging.¹⁶

ADULTS

Neuroimaging scans reveal abnormalities in 3 to 38 percent of patients with a first seizure, depending on patient demographics. A joint consensus statement from the American College of Emergency Physicians (ACEP), the American Academy of Neurology (AAN), and others states that immediate neuroimaging is indicated when a serious structural brain lesion is suspected and also should be considered for patients with partial-onset seizures and for those who are older than 40 years. Neuroimaging at a later date is acceptable for patients who have completely recovered from their seizures and when there is no clear etiology, although immediate imaging should be performed if follow-up cannot be guaranteed.¹⁷

MRI is the preferred imaging method because it has greater sensitivity for detecting abnormalities than CT.^{7,16} However, patients with acute seizures initially should undergo CT because it more accurately detects acute bleeding and is reasonably sensitive in detecting other abnormalities.^{7,16}

Intracranial disease is commonly detected on neuroimaging scans even if a nonbrain etiology for the seizure is apparent. A study of unselected patients presenting to an urban emergency department after a first seizure related to alcohol withdrawal showed brain abnormalities that required intervention or change in therapy in 10 out of 259 patients (3.9 percent). History of trauma and neurologic examination findings did not predict these abnormalities.¹³

Treatment

When predicting future risk, all seizures occurring within 24 hours are considered a single seizure. Approximately one half of patients who have a first unprovoked seizure and three out of four who have multiple seizures will have another seizure within the next eight years.¹⁸ Risk factors for seizure

recurrence in children presenting with a first unprovoked seizure include abnormal EEG test results; a history of febrile seizures; remote, symptomatic etiology; seizure that occurs during sleep; and Todd's paralysis.¹⁸

Most states require a three- to 18-month seizure-free period before a patient may resume driving a private vehicle.

The decision to initiate treatment after a single unprovoked seizure is controversial. A randomized controlled trial showed that antiepileptic medications initiated at the occurrence of a first seizure reduced the incidence of additional seizures over the next one to two years but did not reduce the long-term recurrence risk or affect remission rates.¹⁹

An AAN practice guideline states that treatment with antiepileptic medications is not indicated in children for the purpose of preventing epilepsy, but treatment may be considered if the benefits of reducing the risk of a second seizure outweigh the risks of pharmacologic and psychosocial adverse effects.²⁰ There is no guideline for adults.

ACEP policy states that patients evaluated in the emergency department for a seizure who have a normal neurologic examination, no known comorbidities, and no known structural brain abnormalities may be referred for outpatient follow-up without initiating an antiepileptic medication.¹ Consultation with a subspecialist is indicated if uncertainty remains after evaluation.²¹ If an antiepileptic medication is initiated, acceptable choices include carbamazepine (Tegretol), phenytoin (Dilantin), valproic acid/divalproex (Depakene), phenobarbital, gabapentin (Neurontin), lamotrigine (Lamictal), oxcarbazepine (Trileptal), and topiramate (Topamax).²²

Driving Limitations

Most states require a three- to 18-month seizure-free period before a patient may resume driving a private vehicle, although most states have an appeals process for driving restrictions.²³ Some states require physicians to report patients who are diagnosed with epilepsy.²³ State driving laws for patients with epilepsy are available at <http://www.epilepsyfoundation.org>; click the driving link under Quick Links.

Usually, patients with a history or current diagnosis of epilepsy may not hold a commercial driver's license. If a seizure is caused by a medical condition (e.g., drug reaction, high fever, acute infectious disease, dehydration, acute metabolic disturbance), the patient may be allowed to hold a commercial driver's license after full recovery from the condition.²⁴ Drivers with a history of epilepsy or seizures who have not needed antiseizure medication and have been seizure-free for 10 years may reapply to operate a commercial vehicle in interstate commerce.²⁴ Drivers with a history of a single unprovoked seizure may be qualified to drive a commercial vehicle if they have not needed antiseizure medication and have been seizure-free for at least five years.²⁴

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