

Assessing First Seizures in Children and Adolescents

By **Laura Speltz, M.D., pediatric neurologist**

Each year, 120,000 children seek medical attention because of a first or newly diagnosed seizure. Within that group, approximately 45,000 develop recurring seizures or epilepsy. Many first seizures result from an event such as trauma, hypoglycemia or a high fever. Such provoked seizures might recur whenever the precipitating situation is present, but they generally do not require long-term treatment.

In contrast, unprovoked seizures do not result from an immediate precipitating event. An unprovoked seizure suggests the possibility of an underlying neurological disorder that might predispose a child to recurrent seizures that need treatment.

Children who experience a first seizure are often stabilized in an emergency department or an urgent care setting. This ensures that a serious, treatable medical problem is not the cause of the seizure. Other children are not seen immediately, but are identified as first seizure patients within a few days of the event. Frequently, an appointment with a primary care physician or a trip to the emergency room will not clarify the underlying cause of an unprovoked seizure. Families typically have many questions remaining.

Evaluating a First Seizure

An essential component in an initial evaluation is educating the patient's parents or caregivers. After a first seizure, parents need to know that while brief seizures may be frightening, they are not life-threatening.

Clarifying the type of seizure is vital to confirming the underlying etiology and prognosis as well as making appropriate treatment decisions. When evaluating a child after a first seizure, providers should conduct a physical exam that assesses the child's current vital signs, level of consciousness and neurologic function. Look for any neurologic abnormalities such as asymmetries of strength. Also, obtain a detailed medical history that includes information about recent infections, trauma and possible toxin exposures.

An accurate description of the seizures is critical in order to assess the type and cause. Usually, patients will not remember the events surrounding the seizure,

KEY INSIGHTS

- Unprovoked seizures do not result from an immediate precipitating event. An unprovoked seizure suggests the possibility of an underlying neurological disorder that might predispose a child to recurrent seizures that need treatment.
- An accurate description of the seizures is critical in assessing their type and cause.
- An EEG is useful in classifying the seizure type and, in some cases, diagnosing an epilepsy syndrome. An EEG is recommended for all children who experience an unprovoked seizure.
- Medication usually is not prescribed until after a second seizure occurs.

so providers often rely on parents or other bystanders to communicate such information. When available, a smartphone video can be very helpful. Critical details include:

- Any focal neurological signs identified in the seizure (particularly at onset), such as eye deviation or repetitive, nonpurposeful movements of one extremity or one side of the body.
- Patient's level of consciousness throughout the event
- Duration of the seizure
- Patient's postictal (post-seizure) state
- Length of time it took the patient to return to baseline (normal) functioning

A detailed record of a seizure semiology helps determine recurrence risk and treatment decisions.

Diagnostic Tests

When an otherwise healthy child is evaluated for a first seizure in a clinic or emergency department, standard lab tests—including complete blood counts, electrolytes, and serum glucose—are commonly drawn if an infection or dehydration is suspected. Physicians might also consider ordering toxic screens of blood and/or urine if they suspect illicit-drug use caused the seizure.

Electroencephalogram (EEG)

An EEG is most useful in classifying the seizure type and, in some cases, diagnosing an epilepsy syndrome. An EEG is recommended for all children who experience an unprovoked seizure. An EEG might help determine whether the episode was a focal (partial) seizure or generalized in nature. It is important to note that many children who have abnormal EEGs do not have epilepsy. Similarly, many children with epilepsy can have a normal interictal EEG. It is best to obtain an EEG record while a child is sleep-deprived as sleep deprivation itself is a significant activating factor. A sleep-deprived EEG will yield more reliable information than a routine wakeful EEG.

Neuroimaging studies

When children have focal-onset seizures, focal abnormalities on their EEG or an abnormal neurologic examination, neuroimaging must be considered. Often an acute computed tomography (CT) scan is unnecessary if a child's mental status and neurologic exam has returned to baseline. However, certain clinical exceptions may apply. For example, if a medical provider has concerns about the focal exam findings (e.g., asymmetric reflexes or weakness) or if the seizure followed an acute trauma, a CT scan is appropriate. CT scans

are not sensitive enough to reliably detect subtle anatomical abnormalities, such as gray matter heterotopia or asymmetry in hippocampal size. A magnetic resonance imaging scan, therefore, is the study of choice when neuroimaging is needed.

Children who have a known static encephalopathy may not need repeat imaging studies. Such children include children who have developed cerebral palsy from a remote intraventricular hemorrhage or prior ischemic insult. In this patient population, physicians can reasonably assume the cause of focal seizures. In addition, otherwise healthy children who return to their baseline neurologic status after a seizure rarely need an urgent imaging study.

Risk of Recurrence

Unprovoked, generalized tonic clonic seizures recur in only 30 to 40 percent of children who are otherwise healthy (i.e., unremarkable medical and developmental history, normal exam and EEG after the first seizure). The likelihood of recurrence in children with multiple risk factors, such as focal seizures with a focal neurological deficit, and/or an abnormal EEG, is 50 to 80 percent, depending on the clinical situation.

Treatments

Usually medication is not prescribed until after a second unprovoked seizure occurs. A second seizure typically indicates epilepsy or another neurologic abnormality. Candidates for medication after a first seizure include children who have had a prolonged first seizure (more than 15 minutes), who have multiple risk factors for additional seizures, or who have a significantly abnormal EEG. Each treatment decision must be individualized and based on a child's unique clinical presentation.

Antiepileptic drugs (AEDs) fully control seizures in about 60 percent of children. Another 10 to 15 percent of children will gain good control of their seizures after a trial with a second medication. Children usually continue medications until they are seizure-free for two years. At that time, a child neurologist will often consider tapering their antiepileptic medication.

Many children outgrow seizures. However, there are a number of serious epilepsy syndromes that continue into adulthood. Long-term follow-up studies suggest that the remission rates for generalized tonic clonic epilepsy are approximately 50 percent in patients followed into adulthood. Partial seizures have a remission rate closer to 25 percent.

Medications

Multiple new medications to treat epilepsy have become available in the past two decades. Various factors influence antiepileptic drug selection, including seizure type, side effect profile and ease of administration. Child neurologists will discuss side effects and potential drug interactions with the family prior to prescribing any medication for their child.

These rescue medications are commonly prescribed:

Rectal diazepam gel (Diastat Acudial) is a safe, effective means of stopping seizure activity outside a hospital setting. A dose of the premeasured rectal gel should be given after three minutes of generalized tonic clonic or focal seizure activity. If a child experiences any significant respiratory compromise, or if the seizure persists after Diastat use, caregivers must seek emergency medical attention.

Intranasal Versed is now available for school-age children who experience frequent prolonged seizures. This form of rescue medication is typically preferred for older children, who may have frequent seizures that occur in public places such as school, because administering the medication does not require privacy.

Common daily prophylactic medications prescribed for children with epilepsy include:

Levetiracetam (Keppra) is a useful broad-spectrum medication for patients experiencing partial and/or generalized seizures. Levetiracetam comes in various formulations, including liquid suspension and tablets. Levetiracetam does not interact with most common medications. Common side effects include sedation/somnolence and mood or personality changes.

Topiramate (Topamax) is effective for multiple seizure types. It is useful in treating partial seizures and primary generalized tonic clonic seizures. This medication comes in various formulations, including tablets, liquid suspension and sprinkle capsules, which are sometimes easier to administer to children. Side effects of topiramate include sedation and cognitive slowing, but they are usually mild at lower doses. Starting the medication slowly and raising it in small amounts significantly minimizes side effects to the central nervous system.

Phenobarbital may be used in a neonatal intensive care unit, but typically children transition to other medications as they get older.

Types of Seizures

There are many different types of seizures. The particular type depends on several factors, including which part of the brain is affected. Although most children experience one seizure type, some have multiple types. Seizures are divided into two main categories: generalized seizures (tonic clonic, absence, atonic, myoclonic and tonic) and focal or partial seizures.

Generalized Seizures

Tonic clonic seizures (formerly called grand mal seizures) are the most common and well-known type of generalized seizure. They begin with loss of consciousness and stiffening of the limbs (the tonic phase), followed by jerking of the limbs and twitching of the face (the clonic phase).

During the tonic phase, breathing might decrease or cease altogether, producing cyanosis of the lips, nail beds and face. Breathing typically returns during the clonic phase, but it might be irregular. The clonic phase usually lasts less than one minute. Some people experience only the tonic phase of the seizure; others exhibit only the clonic movements. Still others might have a tonic-clonic-tonic pattern.

Absence seizures (formerly called petit mal seizures) are lapses of awareness—typically staring—that begin and end abruptly, are often associated with eye fluttering, and last only a few seconds. There is no warning and no postictal confusion. Absence seizures are frequently so brief that they might escape detection, even if a child experiences 50 to 100 daily episodes. It is important to note that not all staring spells are absence seizures. Absence seizures are more common in children than in adults.

Atonic (akinetic) seizures produce an abrupt loss of muscle tone that causes children to nod their heads or sag at the knees. Full body drops to the floor might occur. Such seizures are typically brief and only last a second or two. Because they are abrupt and children who experience them might fall with force, atonic seizures can cause injury. They often are difficult to treat.

Myoclonic seizures are rapid (only lasting a few seconds). Such seizures cause brief, symmetrical muscle contractions that might be isolated or repetitive.

Tonic seizures cause generalized stiffening of the body and are often brief.

Partial Seizures

Simple partial seizures can cause stiffening or jerking in one part or on one side of the body. Such seizures also affect emotions and sensations. Children who experience simple partial seizures do not lose consciousness during the seizure.

Complex partial seizures affect consciousness and affect a larger area of the brain than do simple partial seizures. Complex partial seizures might affect a child's ability to interact normally with others, control movements or speak. Amnesia for seizure events is typical. This type of seizure might begin with a blank stare or decreased responsiveness. Simple partial and complex partial seizures can evolve into generalized tonic clonic seizures.

***Note:** Our seizure definitions are based on proposed classifications being considered by the International League Against Epilepsy (ILAE), an organization that advances epilepsy research, education and care. The ILAE is still developing its seizure classification system; the classification of seizures may eventually differ from the information presented here.*

Author PROFILES



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After graduating from the University of Minnesota Medical School, she com-

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