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The first unprovoked seizure

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The initial seizure in a child is a worrisome event that typically calls for urgent medical care. Almost every primary care provider for children is faced with these evaluations, as well as dealing with the child's anxious family.

The majority of initial seizures in children are related to febrile illnesses and assessment tends to focus on the cause of the fever. A lesser number of children have an unprovoked first seizure, and their evaluation is sometimes more problematic.

The dilemma of a child with an unprovoked first seizure involves many questions: Was the seizure truly unprovoked? What was the nature of the event? What diagnostic tests are appropriate? What treatment, if any, is needed? What is the risk of seizure recurrence?

Was the seizure truly unprovoked?

The fundamental principles used to evaluate a first seizure are the same as for any acute medical condition. Careful assessment for potentially dangerous or life-threatening causes of the seizure is essential (see table 1). The history must include information about the child's recent activities and health, with questioning about possible infections, toxins and trauma. The examination must focus particularly on the child's vital signs, current level of consciousness and the presence of any focal neurologic abnormalities.

Once acute causes of seizure are excluded, one must evaluate for remote events that trigger seizures. The episode must be seen in the context of the child's past history, including the birth history, developmental course, risk factors for seizure disorders, and other chronic neurologic or medical conditions. One must make sure that the apparently unprovoked seizures are indeed that.

What was the nature of the event?

Since the different types of seizures have important differences in etiology, treatment and outcome, establishing the nature of the event is of considerable importance. A generalized tonic clonic seizure (GTCS) is essentially unmistakable (see table 2). Identification of other seizure types in children is not so straightforward, however. Seizures fall into two categories: generalized seizures and partial (focal) seizures. The consciousness of a child who is having a generalized

Table 1

Potentially Dangerous Causes of Seizures in Children

[Central nervous system](#) infection: bacterial meningitis, viral encephalitis (e.g. herpes) or tuberculosis

Systemic illness: sepsis, metabolic abnormalities (e.g. hypoglycemia) or renal failure

Increased intracranial pressure: hemorrhage, tumor, edema, or hydrocephalus

Toxins: tricyclic antidepressants, cocaine, alcohol, theophylline

Hypoxia

seizure is instantly altered and movements that occur look symmetrical. The hallmark of the partial seizure is some focality to the clinical event.

Table 2
Seizure Types*

Generalized Seizures

generalized tonic clonic seizures (“grand mal”): Abrupt loss of consciousness and stiffening (tonic=stiffening) that may cause the child to fall down. This is followed by rhythmic jerking of the muscles (clonic movements).

absence (formerly called “petit mal”): A brief change in consciousness. There may be eye blinking or facial twitching. Can occur 100 times a day or more.

myoclonic: Brief, shock-like, symmetrical muscle contractions that may be isolated or repetitive, usually lasting only a few seconds.

atonic (akinetic): Abrupt loss of body posture/tone. Child may exhibit head nodding or sagging at the knees. Lasts only a few seconds.

tonic: Stiffening of the trunk and/or extremities. Can occur during sleep or while awake, typically lasting from a few seconds to one minute.

clonic: Rhythmic, repetitive body jerks.

Partial Seizures

simple partial seizures: Consciousness remains normal. Stiffening or jerking may occur in one part or on one side of the body, or the child may have a sensory event.

complex partial seizures: Consciousness is impaired, ranging from mild alteration to complete loss of consciousness. May begin with a blank stare or decreased responsiveness. The child may have automatic or aimless behaviors.

partial seizure with secondary generalization: A partial seizure that generalizes to a tonic clonic seizure (evolves from a focal onset event to one that involves the whole brain).

* *Descriptions are general and not meant to be exhaustive.*

In children, the most troublesome seizures to identify are often complex partial seizures. These consist of a variety of clinical symptoms during which consciousness may be impaired but not completely lost. In children who have epilepsy (two or more unprovoked seizures), complex partial is the most common type of seizure. These events start in one location of the brain (a focal onset) and may or may not spread to other areas of the brain. The clinical signs of the seizure are dependent on the area of the brain from which they arise. Manifestations may include: abruptly stopping an activity, a change in facial expression, staring, fumbling with the fingers, or lip and mouth movements. Eye deviation to one side, turning of the head, or jerking or twitching on one side of the body more than the other are also “tip-offs” to a focal seizure. The child may be completely unaware of their environment, or may act as if in a daze.

It is critical to get as accurate a description of the seizure as possible from an eyewitness. The features of the seizure onset are particularly important: was there focal or symmetrical onset? This is the crucial distinguishing factor for assessing seizure type. Be aware that the seizure that ends as a GTCS event may actually have had a focal onset. Focal onset seizures can spread electrically, causing a secondarily generalized tonic clonic convulsion.

Other factors that should be determined (if possible) include:

- progression of the seizure activity
- the child’s level of consciousness throughout the event
- duration of the seizure
- the child’s postictal (post seizure) state
- how much time it took the child to return to their baseline functioning

This information may give additional clues about seizure type and causation. And if the child does go on to have another seizure in the future, a careful record of the initial event may be of significant help to those making decisions about treatment and risk of recurrence.

What diagnostic evaluation is necessary?

Lab tests. When an otherwise healthy child presents to the clinic or emergency room with a first seizure, standard lab tests — CBC, electrolytes, blood glucose, calcium and magnesium — are rarely helpful. The practice of obtaining these studies is so entrenched however, that it is a rare child that escapes without them.

EEG. If a brief (less than 10 minutes) GTCS event has occurred, an EEG is not absolutely necessary. One may wait for a second seizure before obtaining the study. If the onset of the seizure was not witnessed, an EEG is prudent; the apparent GTCS may have been a focal seizure that secondarily generalized. New onset of other seizure types require an EEG for appropriate evaluation. (A few exceptions to this rule do exist. These include children who meet the criteria for well-defined epilepsy syndromes of benign nature, such as childhood epilepsy with centrotemporal spikes.)

The EEG record needs to be obtained while the child is sleep deprived. Sleep deprivation itself is a significant activating factor and, coupled with drowsiness, it will yield more reliable information than a routine wakeful EEG. In most children, sleep deprivation will also help avoid the need for sedation.

Neuroimaging studies. In the child who has a focal onset seizure or has focal abnormalities on the EEG, it is reasonable to obtain an MRI scan. In the absence of acute trauma, a CT scan is unnecessary if the child appears normal after a first seizure. CT scanning is not sensitive enough to reliably detect a number of causes for seizures such as gray matter heterotopia and asymmetry in hippocampal size. Therefore, MRI is the study of choice.

Imaging studies may not be needed in the group of children with a history of static encephalopathy of known cause (e.g., as in cerebral palsy after intraventricular hemorrhage as a neonate). In these children, the cause of focal seizures can be reasonably assumed.

An otherwise healthy child who has returned to their baseline neurologic status after a seizure rarely needs an urgent imaging study.

What treatment is needed and what is the recurrence risk?

After the first unprovoked seizure, the most important treatment strategy is to reassure the child and family. Brief seizures, although very frightening to witness (particularly for the first time) are not in and of themselves life threatening. They do not cause brain damage.

The recurrence risk for an unprovoked GTCS is only 30 to 40 percent in a child who has a normal medical and developmental history and a normal exam. The likelihood of recurrence in children with multiple risk factors is 50 to 80 percent, depending on the clinical situation (see table 3). Focal seizures and focal neurologic deficits are significant risks for recurrence — another reason why defining the characteristics of the initial event is so important to decision making.

Even patients in the higher risk category do not all go on to have additional seizures, however. With many patients, it is wisest to wait until the second seizure to consider antiepileptic medication. Candidates for medication after a first seizure include children who have had a prolonged first seizure (>15 minutes), those with multiple risk factors for additional seizures, and those with a significantly abnormal EEG.

In some cases, it is prudent to refer the child to a pediatric neurologist. These include:

- when a child has a second seizure
- to firmly establish the child's diagnosis or seizure type
- when a child with a focal/partial seizure is 3 years of age or less
- when the seizure appears to be one of the less common types (atypical absence, myoclonic, akinetic, tonic or simple partial)

Table 3

Risk factors for seizure recurrence

1. Focal seizure
2. Abnormal neurologic exam with focal signs
3. Prior history of neurologic injury
4. Focally abnormal EEG
5. Family history of epilepsy

In most cases, by the time the child presents in the clinic or emergency room they will have returned to normal or near normal. If the child has returned to their baseline functioning, and no provoking factor for the seizure can be identified, further urgent evaluation is usually not necessary. In such instances, educating the family about first aid for seizures and providing them with information and reassurance about the initial event are the essential management strategies.