

Approach to a child with a first afebrile seizure

The clinical history is key when determining the likelihood of recurrence after a child experiences a first afebrile seizure.

ABSTRACT: Afebrile seizures have many causes. Physicians attempting to determine the cause of an afebrile seizure should obtain more information with the help of a detailed clinical history, electroencephalography, and neuroimaging. Antiepileptic medications are rarely indicated after a first afebrile seizure. In all cases of afebrile seizure, physicians should provide support to the family.

Epilepsy is a common neurological disorder in childhood. Although most children who have an epileptic seizure do well, the diagnosis of such a seizure in a child can cause considerable anxiety for the parents. A physician managing a child following a first afebrile seizure should try to answer five questions:

1. Was the episode an epileptic seizure?
2. What is the cause of the seizure?
3. What investigations should I do?
4. Does the child require treatment?
5. What else should I think about?

1. Was the episode an epileptic seizure?

When a child presents following a transient neurological event, making the correct diagnosis is paramount. A misdiagnosis of epilepsy is made in a significant proportion of children who have never had an epileptic seizure.^{1,2} Up to 30% of children referred to a first seizure clinic have not had an epileptic seizure.^{3,4} Some of the more common nonepileptic paroxysmal episodes include:

- Day dreaming.
- Stereotypies and tics.
- Panic/anxiety attacks.
- Psychogenic nonepileptic seizures (formerly called *pseudoseizures*).
- Sleep disorders.

- Migraine (complex).
- Transient ischemic attack/stroke.
- Paroxysmal movement disorder.

Causes of syncope and reflex anoxic seizure include:

- Vasovagal syncope.
- Breath-holding spells.
- Orthostatic hypotension.
- Cardiac abnormalities (prolonged QT, other arrhythmia).
- Gastroesophageal reflux (Sandifer syndrome).
- Hyperventilation syncope.

Taking a good history is key to distinguishing an epileptic seizure from a nonepileptic event. It is important to speak to both the child and the person who witnessed the event. This should be done by telephone if necessary. The key factors to elicit in the history include:

- The setting in which the event occurred. Breath-holding spells are often triggered by pain, anger, or frustration.
- The observations of the witness at

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the start of the event. Pallor is typically observed during a vasovagal or syncopal event.

- How the patient felt just before and at the start of the event. Patients who experience a syncopal event commonly describe lightheadedness, nausea, and a fading out of vision, hearing, or both prior to loss of consciousness.

Syncope can result in generalized clonic jerking, loss of consciousness, and incontinence, and may be misdiagnosed as an epileptic seizure. These clinical features occur as a result of a sudden decrease in oxygen to the brain, either because of a reduction in cerebral blood flow or a reduction of the oxygen content in the blood,^{3,5} and are not epileptic in nature. An electrocardiogram (ECG) should be obtained in children with possible syncope or anoxic seizure to exclude prolonged QT interval and other cardiac causes. A helpful website for families of children with syncope or anoxic events is www.stars.org.uk.

Although electroencephalography (EEG) is useful in characterizing the type of epilepsy and in the selection of an antiepileptic medication, it can be very misleading in determining whether the child has had an epileptic seizure. Normal EEG results are found in up to 50% of children who have had an epileptic seizure.⁶ In addition, 3% to 4% of children who have not had an epileptic seizure have genetic epileptiform abnormalities on their EEG findings, such as generalized spike-wave discharges or rolandic spikes.⁷ Thus, normal EEG results do not exclude a diagnosis of epileptic seizure, and the finding of epileptiform discharges on an EEG is not diagnostic of an epileptic seizure. As mentioned above, the clinical history is the key to the diagnosis of paroxysmal events and should guide the selection of further investigations.

Table 1. Clinical factors associated with idiopathic versus symptomatic epilepsy.

Idiopathic epilepsy	Symptomatic epilepsy
<ul style="list-style-type: none"> • Normal development • Normal neurological examination • Family history of epilepsy • No history of brain injury (e.g., head trauma, meningitis) • Characteristic EEG abnormalities 	<ul style="list-style-type: none"> • Developmental delay • History of brain injury • Abnormal neurological exam results • Dysmorphic features • Other congenital malformations

2. What is the cause of the seizure?

Epileptic seizures are symptoms associated with a variety of clinical factors (see **Table 1**). Determining the underlying cause of the epileptic seizure has implications for both treatment and prognosis.

Approximately 50% or more of children with epilepsy do not have a brain lesion, and genetic factors predispose them to recurrent seizures.⁸ The term *idiopathic* has been used to describe this genetic predisposition to epileptic seizures, while the term *symptomatic* is used when an underlying brain abnormality is involved (see **Table 2**).⁹ Three common idiopathic epilepsies are absence epilepsy, benign rolandic epilepsy, and juvenile myoclonic epilepsy. Children who have idiopathic epileptic seizures have normal neurological development and normal findings upon neurological

examination. There is no history of a serious neurological insult such as meningitis or head injury, and there is often, but not always, a family history of epilepsy. Children who have idiopathic epileptic seizures nearly always have characteristic epileptiform discharges on an EEG. Thus, EEG can be used to confirm the clinical suspicion of an idiopathic epileptic seizure.

Approximately 50% of children with epilepsy will have an underlying brain abnormality that is the cause of the seizures.⁸ The epilepsy is called *symptomatic* when the underlying cause can be shown and is called *probably symptomatic* (or *cryptogenic*) when an underlying brain lesion is suspected but cannot be demonstrated. Abnormalities of brain development are the commonest cause of symptomatic epilepsy. When seizures occur as a result of previous trauma, infection, hypoxia, or stroke, there

Table 2. Causes of afebrile epileptic seizures in children.

Idiopathic (50% of cases)	Symptomatic or probably symptomatic (50% of cases)
<ul style="list-style-type: none"> • Childhood and juvenile absence epilepsy • Benign rolandic epilepsy • Juvenile myoclonic epilepsy 	<ul style="list-style-type: none"> • Malformations of brain development • Neurocutaneous syndromes (e.g., tuberous sclerosis, Sturge-Weber syndrome) • Vascular malformation • Congenital or acquired CNS infection • Hypoxic ischemic brain injury • Stroke • Traumatic brain injury • Tumor • Inborn error of metabolism

is usually a significant past medical history. Vascular brain abnormalities, brain tumors, and inborn errors of metabolism are rare causes that require specific treatment. The possibility of a symptomatic epileptic seizure is suggested by a history of delayed

Electroencephalography

Electroencephalography is the most useful investigation following an afebrile epileptic seizure. Although EEG results can be misleading in the diagnosis of an unusual event, they are particularly helpful in children who have

sy, and benign childhood epilepsy with centrotemporal spikes (benign rolandic epilepsy), do not require brain imaging. Brain imaging should, however, be performed in children who have had two or more afebrile epileptic seizures and who do not have the clinical or EEG features of an idiopathic epilepsy.¹¹ Although MRI is superior to CT in demonstrating subtle brain developmental abnormalities,¹¹ the choice of imaging modality will be influenced by the availability of MRI and the need to administer a general anesthetic to young children during the MRI.

Although neuroimaging abnormalities occur in up to one-third of children with a first afebrile seizure, only 2% demonstrate clinically significant abnormalities that influence management.¹¹ Seizures are an uncommon presenting symptom of a brain tumor in children. Thus, brain imaging (CT or MRI) in the emergency department following the first afebrile seizure is usually not warranted. Emergency neuroimaging should therefore be considered only in a child who:

- Presents with afebrile status epilepticus.
- Has focal neurological signs that persist for several hours.
- Has had recent head trauma, persistent headache, or history of cancer or anticoagulation.^{11,13}
- Is not returning to baseline within several hours of the seizure.

4. Does the child require treatment?

Antiepileptic drug treatment is not usually started after the first unprovoked focal or generalized tonic-clonic seizure because most children only have one or two seizures. Fifty percent of children who have an epileptic seizure will never have another seizure and 20% of children who have two epileptic seizures will never have

neurological development, abnormal results from a neurological examination, a history of previous neurological insult, or the presence of dysmorphic features or other congenital abnormalities.

3. What investigations should I do?

A child presenting immediately after a first epileptic seizure should have a blood glucose test. Further laboratory investigations should be guided by the clinical features at that time—for example, a history of vomiting, fever, or illness. Toxicology testing should be considered if accidental ingestion of a toxic substance is possible. If the clinical history suggests a possible syncopal or reflex anoxic seizure, an ECG with QT corrected interval calculation should be performed. These investigations are relatively easy to obtain and may help to exclude a number of nonneurological causes of seizures.

had a definite epileptic seizure. An electroencephalogram can be used to assess the risk of seizure recurrence, determine whether the child has an idiopathic or a symptomatic epilepsy, and guide the selection of an appropriate antiepileptic drug.¹⁰⁻¹² For example, a child with a first generalized tonic-clonic seizure who has generalized polyspike and wave on EEG has a high risk of seizure recurrence, is highly likely to have an idiopathic epilepsy, and is more likely to respond to certain antiepileptic medications (e.g., valproic acid, lamotrigine, topiramate or levetiracetam). It is important to perform a sleep-deprived EEG, since the likelihood of detecting epileptiform discharges increases during sleep.

Neuroimaging

Patients with a clinical history and EEG findings consistent with an idiopathic epilepsy, such as childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilep-

another seizure.¹² In addition, seizures lasting less than 30 minutes do not result in brain damage and failure to prevent the first several seizures does not alter the overall prognosis.¹⁴⁻¹⁷

Although only 50% of children who have an epileptic seizure will have a recurrence, certain factors are known to increase the risk of a second seizure:

- Focal (partial) seizure.
- Abnormal neurological examination.
- Developmental delay.
- Seizure begins while asleep.
- Family history of epilepsy.
- Epileptiform discharges shown on EEG.

The physician can individualize the seizure recurrence risk based on a careful history and EEG results. The decision to initiate antiepileptic therapy should be made by the parents, the physician, and child if he or she is old enough. Factors that might influence the decision include:

- The risk of seizure recurrence.
- The degree of patient or parental anxiety about a further seizure.
- Whether the family lives in an area remote from medical help.

Early treatment might also be considered in the child who has status epilepticus as the initial seizure. Although the recurrence risk for a second seizure (50%) is not increased following status epilepticus, if a second seizure occurs, it is more likely to be prolonged. For that reason, it may help to provide the family of such a child with rescue anticonvulsant medication to abort a seizure. The parents can be shown how to use rectal diazepam (0.5 mg/kg; maximum dose 10 mg) or buccal midazolam (0.3 mg/kg; maximum dose 10 mg) for seizures lasting 5 minutes or longer.

5. What else should I think about?

A child who has a first afebrile seizure should be evaluated by a physician with experience in the management

of children with epilepsy. Children with infantile spasms, multiple seizure types, and those who have not achieved seizure control after two antiepileptic medications should be referred to a pediatric neurologist. Referral to a pediatric neurologist should also be considered if a focal lesion is demonstrated on neuroimaging, there is uncertainty as to seizure type or epilepsy syndrome, and when the seizure is associated with developmental delay or regression.

It is important to consider the needs of the family as well. Seizures are frightening and many parents who witness a first seizure fear initially that their child is dying. A diagnosis of epileptic seizure in a child can consume a parent with worry about issues such as the possible cause, the possibility of brain damage, and the prognosis for intellectual outcome. The possibility of side effects of antiepileptic drugs is also a major concern for many parents. These concerns may explain why approximately one-third of mothers of children with newly diagnosed epilepsy exhibit symptoms of posttraumatic stress disorder or major depressive disorder.¹⁸ Education of the child and parents about seizures, epilepsy, and medication plays an important part in reducing the emotional stress on the family. Providing the child and family with written material on epilepsy and antiepileptic medications can be very helpful. It is important to review appropriate seizure precautions with the family, including proper positioning of a child during a seizure and issues regarding water safety and driving. The British Columbia Epilepsy Society website has detailed information sheets in several languages (www.bc.epilepsy.com). Another reliable resource for families is www.epilepsy.com. Children or parents who continue to have a difficult time coping may

Key points for management of afebrile seizures

- Afebrile seizures have many causes.
- A clinical history, blood glucose testing, electroencephalography, and neuroimaging can help identify the cause of an afebrile seizure.
- Antiepileptic drug treatment may be considered if findings indicate the risk of recurrence is high.
- Physicians should ensure that adequate support is provided to the family.

benefit from referral for psychological counseling.

Summary

Afebrile seizures are a common childhood problem presenting to primary care physicians. A detailed clinical history of the episode is the most important step in making a diagnosis. The clinical history and EEG findings will help physicians determine the underlying cause of the seizure and calculate the probability of seizure recurrence. Brain imaging should be carried out in patients who do not have the characteristic features of an idiopathic seizure. Antiepileptic drug treatment is not usually started after a first unprovoked seizure unless the clinical or EEG features suggest a high risk of recurrence.

Competing interests

None declared.