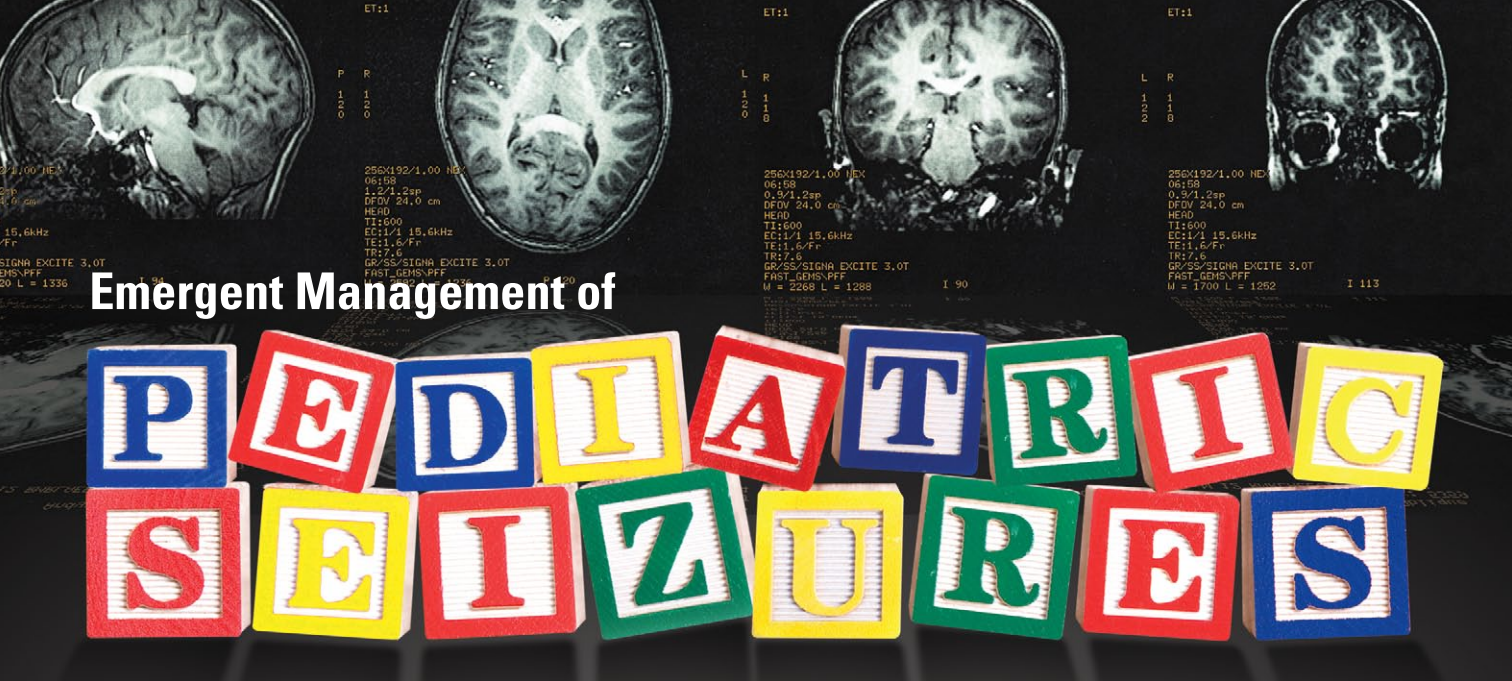


When a child with seizures is brought to the ED, the priorities are to terminate the seizures, to determine their cause, if possible, and to admit or refer patients as necessary. When appropriate, it is also important to reassure parents or caregivers that many seizures are not associated with an ominous etiology. The authors review manifestations of the types of seizures that occur in children, potential complications of seizures, and other conditions that can mimic seizures. Workup and treatment are also discussed.

Joseph King, MD, and Bruce Lo, MD, RDMS

Seizures are the most common neurologic condition of childhood.[1] A seizure occurs suddenly and results from asynchronous neuronal activity in the brain. This abnormal brain activity can lead to extremity convulsions, loss of consciousness, incontinence, and/or sensory disturbance. Each year, an estimated 150,000 children in the United States have a first-time seizure, and of those, 30,000 will eventually be diagnosed with epilepsy.[1] *Epilepsy* is a general term used to describe at least two separate seizures occurring without a known precipitant. A diagnosis of epilepsy confers vulnerability to experiencing another seizure. Nevertheless, 4% to 10% of children have a single seizure without a recurrence.[1]

This article reviews types of seizures and their management in children presenting to the ED.

Dr. King is an attending physician in the department of emergency medicine at Baptist Health in Jacksonville, Florida. **Dr. Lo** is chief of the department of emergency medicine at Sentara Hospitals in Norfolk, Virginia, and assistant professor and assistant program director in the department of emergency medicine at Eastern Virginia Medical School in Norfolk.

CLASSIFICATION OF SEIZURES

Seizures are classified according to their manifestations, which indicate whether or not the seizure is localized. They are categorized as partial or generalized.

Partial Seizures

Partial seizures involve only a portion of the brain at onset and are further categorized as simple partial or complex partial seizures. *Simple partial seizures* are often motor in nature, with a limb exhibiting some tonic-clonic movements. They are not associated with a loss of consciousness. *Complex partial seizures* are often preceded by an aura and can include rhythmic oral movements, nausea, and vomiting; they also involve loss of consciousness.

Generalized Seizures

Generalized seizures involve both hemispheres of the brain and loss of consciousness with or without convulsions.[2] Patients experience a postictal state following most seizures. This is a period of drowsiness and confusion with a duration roughly equal to that of the seizure itself. The different types of generalized

seizures include absence, myoclonic, atonic, tonic, and tonic-clonic seizures, as well as infantile spasms.

Absence seizures occur suddenly, last about 30 seconds, and are characterized by staring spells and decreased consciousness. These seizures are often reported in school-age children; frequently, affected children are identified by their teachers as not paying attention in class.

Myoclonic seizures involve sudden head-drop with flexion of arms; they can occur with tremendous frequency (hundreds daily).

Atonic seizures involve sudden loss of consciousness and muscle tone. It is difficult to distinguish between narcolepsy and atonic seizures because of their similar presentation.[2]

The most common type of generalized seizure in children is *tonic-clonic*.[2] This type of seizure is characterized by a period of stiffness (*tonic phase*) followed by a convulsive episode (*clonic phase*) that most lay people can identify as a seizure.

Infantile spasms (West syndrome) are characterized by both tonic and myoclonic seizures. They occur in the first 2 years of life, and peak onset is between 4 and 6 months. Children having an infantile spasm frequently flex their upper extremities, resulting in a self-hugging motion. These seizures can occur hundreds of times daily and are very brief in nature. A high percentage of patients also have tuberous sclerosis, so it is worthwhile to examine their skin for ash leaf spots.[3] Unfortunately, 95% of those affected by infantile spasms have severe developmental delay.[1] This disorder carries a mortality rate of up to 31%, with up to 10% of patients dying before age 3 years.[4] Treatment is aimed at controlling the seizures. ACTH (adrenocorticotropic hormone), prednisone, and various antiepileptic medications are often used. Infantile spasms phase out by age 5 years, but there is a tendency for children who have had them to be diagnosed with Lennox-Gastaut syndrome later in life.[5]

Febrile Seizures

The most common specific seizure disorder in children is *febrile seizures*. These seizures most often present between ages 6 months and 5 years, with a peak incidence between 18 and 24 months.[1] *Simple febrile seizures* are the most common type of febrile seizure; they are usually described as tonic-clonic activity that lasts less than 15 minutes and is associated with a febrile illness. Seizures that last longer than 15 minutes, occur in multiple episodes within a 24-hour time frame, or are focal are termed *complex febrile seizures*.[1] Usually, children presenting to the ED due to a febrile seizure have had the episode at home and the seizure does not recur in the ED.

It is important to discuss the risks for epilepsy and for recurrent febrile seizures with the child's parents or caregivers, as these will be matters of great concern. The risk for epilepsy in a child who has had a febrile seizure is greater than that in the general population but still small, at 1 in 100 cases, if high-risk factors are not present.[6] Such factors include focality, prolonged seizure, recurrence of seizure within 24 hours, or history of neurologic diseases or developmental delay. Risk factors for recurrent febrile seizures include age younger than 15 months at the time of first seizure, family history of febrile seizures, history of frequent fevers, and initiation of seizure either with a relatively low fever or soon after onset of fever.[6]

If a child has a seizure in the ED, the usual therapy for seizures can be administered (See "Treatment," page 10). The traditional approach of fever control with acetaminophen and ibuprofen does not prevent febrile seizures. It is thought that the rapid rise of temperature, not the maximal degree of temperature, causes a febrile seizure. However, antipyretic therapy does provide symptom relief and is still recommended for children with fever. Acetaminophen and/or ibuprofen are the agents of choice. Aspirin use is generally avoided in children due to the risk of Reye syndrome that is associated with aspirin administration in febrile children.

>>FAST TRACK<<

It is important to discuss the risks for epilepsy and for recurrent febrile seizures with the child's parents or caregivers, as these will be matters of great concern.

As with any febrile child, management of a child with a simple febrile seizure requires evaluation for the source of the fever. The most common infectious diagnosis for children with a febrile seizure is otitis media.[7] Other causes, in order of decreasing frequency, include upper respiratory tract infection, viral syndrome, and pneumonia.[7] Ancillary testing, such as a complete blood count (CBC), a basic metabolic panel, chest radiography, and urinalysis should be ordered as warranted according to findings from the clinical examination.

Table. Pediatric Seizure Types

Absence
Atonic*
Tonic-clonic*
Infantile spasms (West syndrome)
Febrile
Benign rolandic epilepsy
Juvenile myoclonic epilepsy
Lennox-Gastaut syndrome

*Also common in adults.

There is some controversy regarding the extent of workup in febrile seizures, especially when the child is younger than 18 months. The controversy stems from the American Academy of Pediatrics' guidelines recommending that lumbar puncture be strongly considered in children younger than 12 months and considered in children 12 to 18 months for first simple febrile seizure (FSFS) to evaluate for bacterial meningitis.[8] Although seizure is a possible complication of bacterial meningitis, there is no evidence that a previously healthy child older than 6 months will present with a simple febrile seizure as the only sign of bacterial meningitis.

A recent study examined the incidence of bacterial meningitis in FSFS.[9] This retrospective study enrolled 704 patients ages 6 to 18 months presenting with FSFS. Of the 704 patients in the study, lumbar puncture was attempted in 271 and successful in 260 patients. In 10 of the 260 cerebrospinal fluid specimens, a pleocytosis was present, defined as greater than 7 white blood cells/mm^3. There were no organisms on any of the Gram stains, and all 260 cultures were negative for pathologic growth. No child returned to the hospital with a diagnosis of bacterial meningitis. The authors concluded that in a patient with FSFS, lumbar puncture should not be routinely recommended without clinical signs of meningitis.[9] The American Academy of Pediatrics will likely change their recommendation in the near future, based in part on this study.

Complex febrile seizures are a separate entity and require a more thorough workup and admission. As with simple febrile seizures, it is unlikely that complex febrile seizures will be the sole presenting problems in a child with bacterial meningitis, and for this reason lumbar puncture may not be necessary in an otherwise healthy-appearing child with a first-time complex febrile seizure.[10] Although the yield from head CT may be low, this modality should be considered in children who do not return to baseline status, as it can help the inpatient team to quickly narrow the differential diagnosis.

Other Pediatric Seizure Disorders

In addition to infantile spasms and febrile seizures, several other seizure disorders are unique to pediatrics (Table).

Benign rolandic epilepsy is known for its "jacksonian march," which refers to the "march" of seizures that begins in one group of muscles and progresses to adjacent groups, reflecting the progression of abnormal electrical activity from one area of the cerebral cortex to adjacent areas. The face is commonly affected in a clonic fashion, and there are tonic-clonic movements of the arm and/or leg, with the progression of movements from one muscle group to another resembling that of a march. These episodes most often occur during sleep and can awaken the child. This disorder is diagnosed in children ages 3 to 13 years. The child usually outgrows these episodes by adolescence or early adulthood, and therapy is not required.[1]

Juvenile myoclonic epilepsy is a familial disorder that commonly begins after age 10. It features myoclonic or tonic-clonic seizures involving the neck, shoulders, and/or arms. The seizures often cause the patient to drop objects, which may be attributed to clumsiness. This seizure disorder rarely affects the legs, and consciousness is preserved during seizures. Patients usually will have good neurologic outcomes with this type of epilepsy. Decreased sleep, alcohol use, and stress have been known to provoke seizures in persons with juvenile myoclonic epilepsy.

Lennox-Gastaut syndrome (LGS) is a form of epilepsy characterized by multiple daily seizures. Seizures in patients with LGS usually begin between ages 2 and 6 years. There are multiple seizure types that occur with LGS, with the three most common being tonic, atypical absence, and nonconvulsive status epilepticus, also known as *drop attacks*.[5] Approximately half of LGS patients develop *nonconvulsive status epilepticus*, which involves sudden falls from a

standing position. Because of this, patients often wear a helmet for protection. Mental retardation is common with this syndrome, and parents and caregivers are often highly distressed by an LGS diagnosis.

COMPLICATIONS

The risks posed by seizure activity can be grouped into immediate and long-term effects. The immediate injuries from seizures include injuries to the oral cavity, such as tongue lacerations and broken teeth. Shoulder dislocation (posterior dislocation is possible), head trauma, and soft tissue contusions from falling are other common injuries. Todd paralysis is a transient paresis that usually affects one side of the body and sometimes occurs after a tonic-clonic seizure.

The two most serious long-term consequences of seizures are permanent neurologic deficits and acute renal failure. During a seizure, widespread catecholamine release leads to increases in body temperature, heart rate, blood pressure, and blood glucose, as well as possible cardiac arrhythmias. The increased metabolic demand occurring during a prolonged seizure (>15 minutes) leads to increased lactate production from anaerobic metabolism. The body's increased metabolism during seizure activity makes neurologic damage more likely as the duration of seizure increases. Also, because of the increased metabolism throughout the body, muscle breakdown occurs, which can lead to rhabdomyolysis and acute renal failure from myoglobinuria. The effects of poorly controlled seizure disorder over time can be cumulative and lead to permanent neurologic dysfunction.

Any seizure lasting more than 30 minutes represents *status epilepticus*. This definition of status epilepticus encompasses continuous convulsive activity and seizures that occur in succession without a return to baseline status[11] (for example, two seizures occurring 10 minutes apart without a return to baseline status 30 minutes after the start of the first seizure). Status epilepticus is mainly used as a descriptive term and not one that should guide treatment. Regardless of seizure duration, attempts to terminate the seizure activity should begin on presentation.

SEIZURE MIMICS

It is paramount to remember that some disorders have features resembling those of seizures but are not, in fact, seizure disorders. The differential diagnosis for seizure is broad. For example, parents often mistake breath-holding spells for seizures. Breath-holding spells are common in children ages 6 months to 5 years; they often occur when a child is extremely upset.[7] Classically, these episodes have a clear course: the child holds his or her breath, turns blue, loses consciousness, and may have some jerking of the extremities after passing out. Upon awakening, the child returns to baseline status. Breath-holding spells affect 5% of children and are a problem that is likely to be encountered in the ED.[7]

Syncope is another clinical entity that can be confused with seizures. This is common in adolescents and is often preceded by an aura consisting of nausea and lightheadedness. Syncope results from a temporary decrease in blood flow to the brain, which causes the body to lose tone. Loss of consciousness is transient, and return to baseline status is rapid. There can be jerking movements with syncope that can be confused with a seizure. As in breath-holding spells, the child affected by syncope returns to baseline status upon awakening; there is no postictal state.

Narcolepsy, tics, gastroesophageal reflux, and benign myoclonus may also be mistaken for seizures. The characteristics of narcolepsy are sudden, inappropriate onset of deep sleep resulting in a loss of muscle tone that can lead the affected individual to collapse to the floor from a standing position.[7] Tics are repetitive movements, such as lip smacking, that can be initiated by stress. Gastroesophageal reflux in infants often presents shortly after or during feeding. It manifests as back arching, grimacing, twisting movements of the trunk, and crying. Benign myoclonus occurs during the initiation of sleep and is associated with the sensation of falling or tripping.[7]

>>FAST TRACK<<

The two most serious long-term consequences of seizures are permanent neurologic deficits and acute renal failure.

WORKUP

A child with a new-onset seizure requires a prudent investigation into the etiology of the seizure as well as reliable follow-up. Infectious, neurologic, metabolic, traumatic, vascular, and toxicologic etiologies should be considered, although the majority of childhood seizures are found to be idiopathic. Infectious causes include meningitis, encephalitis, brain abscess, and neurocysticercosis.

Neonates

The clinical workup of seizures is rarely extensive unless the patient is a neonate, defined as a full-term infant in the first 28 days after birth. Preterm infants are considered neonates until they reach what would be 44 weeks' gestational age (for example, an infant born at 28 weeks' gestational age is considered a neonate for the first 4 months of life).

A neonate presenting with a seizure requires several diagnostic tests, including electrolyte and glucose measurements; CBC; urinalysis and analysis of urine organic acid; and measures of serum amino acid, calcium, and magnesium levels. In addition, lumbar puncture and CT of the head must be performed.[12] Hyponatremia is a potential cause of seizure in neonates who have been given diluted formula or free water. Blood glucose levels should be checked promptly, as hypoglycemia is also a common precipitant of neonatal seizures.

Taking a thorough prenatal history is paramount, as TORCH infections (toxoplasmosis, rubella, cytomegalovirus, herpes simplex) and drug withdrawal can present as neonatal seizures.[12] If there are cats in the household, toxoplasmosis should be included in the differential diagnosis. Other maternal infections to consider include HIV, syphilis, and varicella.

>>FAST TRACK<<

All neonates presenting with a seizure require urgent evaluation, treatment, and admission, since morbidity and mortality are higher in this population.

Neonatal seizures often signal a serious underlying abnormality. The most common cause is hypoxic insult to the brain.[12] Usually, affected neonates have undergone a traumatic birthing experience resulting in intracranial hemorrhage and hypoxic encephalopathy. The neonate's underdeveloped immune system also increases the likelihood of infectious causes. All neonates presenting with a seizure require urgent evaluation, treatment, and admission, since morbidity and mortality are higher in this population.[12] However, for the small percentage of neonates with a parental history of neonatal seizures and a negative workup, there is lower comparative morbidity and mortality.[12]

All Pediatric Patients

A patient presenting with generalized seizure and no history of febrile illness requires a more extensive workup than a patient with first-time simple febrile seizure. Glucose and electrolyte levels should be checked, as hypoglycemia and electrolyte abnormalities are common precipitators of seizure. CT of the head is not routinely performed unless the seizure was focal or lasted more than 15 minutes or the patient is immunocompromised or has persistent altered mental status.[13] An ECG is important to evaluate for prolonged QT as the syncope from long QT syndrome can be mistaken for seizure disorder. In nonfebrile children with seizure, discharge to home can be considered if they demonstrate a return to baseline status and close outpatient follow-up with good social support is likely.

Patients presenting with a new-onset seizure that is complicated by prolonged altered mental status and patients with a partial complex seizure should be admitted, although their initial workup does not necessarily vary from that described above. The patient with altered mental status requires observation for deterioration. The patient who presents with complex partial seizures requires head imaging, starting with noncontrast CT of the head, because of the high occurrence of intracranial abnormalities with this specific seizure type.[7] MRI is more sensitive than CT for the evaluation of pediatric seizures, but its use must take into account factors such as availability, time, and possible need for procedural sedation.[7] For patients with symptoms concerning enough to warrant neuroimaging, early neurologic consultation may be prudent to decide if MRI should be ordered instead of CT.

Electroencephalography (EEG) can be arranged on an inpatient basis once the decision to admit the patient is made. Video-monitoring EEG, which is often performed over a 24-hour period, is more helpful than EEG without video in diagnosing convulsive disorders.

A more limited workup can often be pursued for the child with known seizure disorder who is taking antiepileptic medication. Medication noncompliance is a common cause of breakthrough seizures, and if the blood levels of the antiepileptic drug are subtherapeutic, it is usually acceptable to forgo neuroimaging.

TREATMENT

Hypoglycemia is a potentially reversible cause of seizure that requires prompt treatment with IV

dextrose. For neonates, 10% dextrose should be administered at a dose of 2 to 4 mL/kg IV.[12] After hypoglycemia has been ruled out, first-line therapy in the treatment of neonatal seizures is phenobarbital—as opposed to benzodiazepines, which are used in other pediatric seizures. If phenobarbital does not terminate the seizure, then phenytoin, lorazepam, and pyridoxine are used in a stepwise fashion until seizure activity ceases. Pyridoxine is used because pyridoxine-dependent seizures can occur in a neonate who is unresponsive to traditional therapies.[12]

Anoxic brain injury is the most serious complication of seizures, and prompt treatment is required to avoid this injury. The initial treatment for seizures in children and adults is benzodiazepines, as noted previously. The Figure shows an algorithmic approach to the termination of seizures in children older than 1 month.

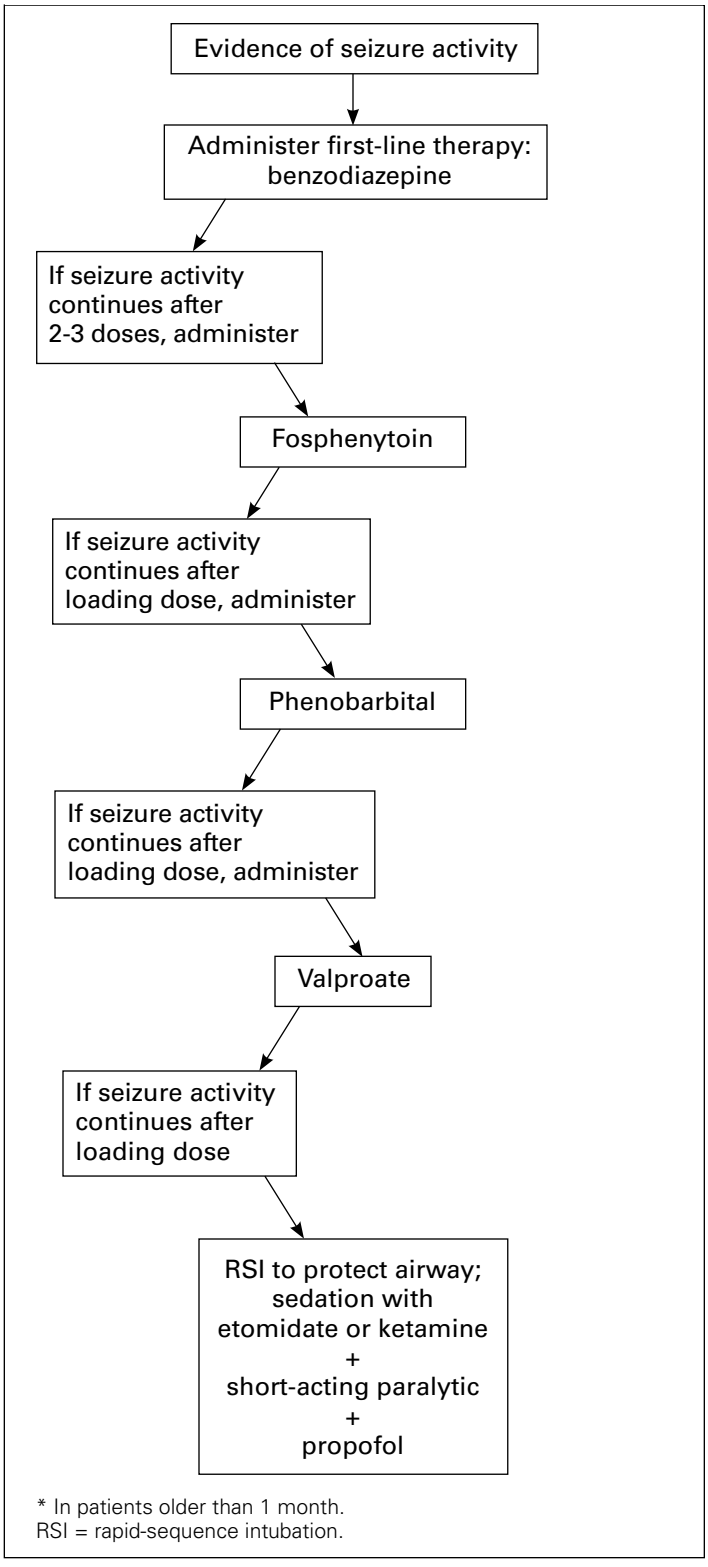
Benzodiazepines

It is more common to use alternative routes of administration in children, such as rectal, buccal, and intranasal, due to the difficulty in obtaining peripheral venous access in some cases. The ideal route is intravenous, however, and the ideal medication is lorazepam dosed at 0.03 to 0.1 mg/kg. Compared to diazepam, lorazepam is equally effective and carries a lower risk of respiratory depression in children.[14]

Lorazepam has also been shown to require less repeat dosing than diazepam and is associated with a lower incidence of ICU admission.[14] When considering a benzodiazepine for the treatment of seizure, it is important to remember the differences within the class in duration of action. While midazolam and diazepam have rapid onset of action, their effects last only 30 minutes. When given intravenously, lorazepam's effect lasts 12 to 24 hours.

If IV access is not promptly available, buccal midazolam at a dose of 0.5 mg/kg should be the choice for seizure termination. Buccal midazolam has been shown to be more effective than rectal diazepam in ending acute tonic-clonic seizures.[14] Rectal diazepam can be administered in doses of 0.5 mg/kg for children ages 2 to 5 years, 0.3 mg/kg for those 6 to 11 years, and 0.2 mg/kg for those 12 years and older. Intranasal midazolam at a dose of 0.2 mg/kg and intranasal lorazepam at 0.1 mg/kg have also been shown to be effective in terminating seizures.[14] Aerosolizing the drug allows for better availability via the

Figure. Algorithmic Approach to Medication Use in Pediatric Seizure Termination*



* In patients older than 1 month.
RSI = rapid-sequence intubation.

vascular nasal passages. If the IM route is chosen, midazolam dosed at 0.2 mg/kg is appropriate.

Phenytoin and Fosphenytoin

Benzodiazepines are effective as a first-line therapy in aborting seizures approximately 80% of the time.[14] The most commonly employed second-line therapy is phenytoin, which is dosed at 20 mg/kg IV. Propylene glycol, a diluent in phenytoin, is associated with serious side effects of hypotension and cardiac dysrhythmias. Because of these side effects, phenytoin should be given at a rate no greater than 50 mg/min. Fosphenytoin, the prodrug of phenytoin, is considered safer because it is not made with propylene glycol. Fosphenytoin can be given at a maximal IV rate of 150 mg/min and is dosed as phenytoin equivalents (PE). Fosphenytoin is dosed at 20 mg PE/kg. Fosphenytoin can also be given intramuscularly following the same dosing used with the IV route. These advantages make fosphenytoin preferable to phenytoin for use as a second-line agent.

>>FAST TRACK<<

While levetiracetam is not approved for treatment of status epilepticus, published case reports have described its use to treat many types of refractory seizures. Because it has very few side effects, it may warrant consideration if all else has failed.

Barbiturates

Barbiturates can be employed if phenytoin fails, but these require close monitoring because they are associated with significant respiratory depression. Phenobarbital is the most commonly used barbiturate and is dosed at 20 mg/kg IV, with a rate of 1 mg/kg/min not to exceed 30 mg/min. IV valproate dosed at 10 to 30 mg/kg can also be employed if the seizure persists.

Sedatives and Paralytics

If the seizure does not terminate with the aforementioned therapies, higher doses of respiratory depression–inducing antiepileptics must be administered, possibly requiring airway protection via rapid-sequence intubation with a sedative such as etomidate or ketamine and a short-acting paralytic agent such as succinylcholine. A propofol drip can then be started for sedation; this agent also has antiseizure properties. It is important to remember that in patients who are intubated and paralyzed, it will be impossible to determine from the clinical exam if seizure activity has stopped. If the patient remains paralyzed, EEG should be performed and neurologic consultation obtained as soon as possible to determine if additional measures should be pursued because of persistent seizure activity.

Levetiracetam

Levetiracetam is an antiepileptic drug that is approved by the FDA for use in children 4 years and older for partial-onset seizures. While it is not approved for treatment of status epilepticus, published case reports have described the use of levetiracetam to treat many types of seizures that are refractory to other therapies.[15] However, there are no studies using it as an adjunct to seizure control in the ED. Because levetiracetam has very few side effects, it may warrant consideration as an alternative therapy if all else has failed.

CONCLUSION

When a child presents to the ED with active seizures, the primary goal is to terminate the seizure. Benzodiazepines, especially lorazepam, are typically effective at attaining this goal. If benzodiazepines do not work, several other agents can be employed. If all antiepileptics fail, the patient may need to be intubated for airway control and further sedation.

Most patients who present with seizures need only a focused workup, unless the child is a neonate, has had a complex partial seizure, or exhibits persistent altered mental status. Children with a responsible parent or caregiver can be referred to a neurologist for outpatient follow-up studies such as EEG. If the patient is to be discharged home, the most important step is making sure the parents are appropriately counseled. If the child has had a febrile seizure, parents or caregivers should be reassured that this is a common disorder and rarely results in epilepsy.

All parents and caregivers sent home with a child who has had a seizure should be instructed to bring the child back to the ED if the seizure recurs and lasts more than a couple of minutes or is associated with persistent altered mental status or new findings such as a petechial rash. As with any clinical entity, a solid knowledge of the causes and treatments for pediatric seizures will allow timely evaluation, treatment, and disposition. □

REFERENCES

1. Blumstein MD, Friedman MJ. Childhood seizures. *Emerg Med Clin North Am*. 2007;25(4):1061-1086, vii.
2. Holmes GL. Classification of seizures and the epilepsies. In: Schachter SC, Schomer DL, eds. *The Comprehensive Evaluation and Treatment of Epilepsy: A Practical Guide*. San Diego, CA: Academic Press; 1997:1-32.
3. Ohtahara S, Ohtsuka Y, Yamatogi Y, et al. Prenatal etiologies of West syndrome. *Epilepsia*. 1993;34(4):716-722.
4. Riikonen R. Long-term outcome of patients with West syndrome. *Brain Dev*. 2001;23(7):683-687.
5. Markand O. Lennox-Gastaut syndrome (childhood epileptic encephalopathy). *J Clin Neurophysiol*. 2003;20(6):426-441.
6. *Febrile Seizures*. Bethesda, MD: Office of Scientific and Health Reports, National Institute of Neurological Disorders and Stroke, National Institutes of Health; 1995. NIH publication 95-3930.
7. Freedman SB, Powell EC. Pediatric seizures and their management in the emergency department. *Clin Pediatr Emerg Med*. 2003;4(3):195-206.
8. American Academy of Pediatrics. Practice parameter: the neurodiagnostic evaluation of the child with a first simple febrile seizure. Provisional Committee on Quality Improvement, Subcommittee on Febrile Seizures. *Pediatrics*. 1996;97(5):769-772.
9. Kimia AA, Capraro AJ, Hummel D, et al. Utility of lumbar puncture for first simple febrile seizure among children 6 to 18 months of age. *Pediatrics*. 2009;123(1):6-12.
10. Kimia A, Ben-Joseph, EP, Rudloe T, et al. Yield of lumbar puncture among children who present with their first complex febrile seizure. *Pediatrics*. 2010;126(1):62-69.
11. Abend N, Dlugos DJ. Treatment of refractory status epilepticus: literature review and a proposed protocol. *Pediatr Neurol*. 2008;38(6):377-390.
12. Silverstein FS, Jensen FE. Neonatal seizures. *Ann Neurol*. 2007;62(2):112-120.
13. Hirtz D, Ashwal S, Berg A, et al. Practice parameter: evaluating a first nonfebrile seizure in children: report of the quality standards subcommittee of the American Academy of Neurology, The Child Neurology Society, and The American Epilepsy Society. *Neurology*. 2000;55(5):616-623.
14. Appleton R, Macleod S, Martland T. Drug management for acute tonic-clonic convulsions including status epilepticus in children. *Cochrane Database Syst Rev*. 2008;(3):CD001905.
15. Patel NC, Landan IR, Levin J, et al. The use of levetiracetam in refractory status epilepticus. *Seizure*. 2006;15(3):137-141.

Correction

In the August 2010 article "Blunt Abdominal Trauma" (Knepel SA, Kman NE, O'Rourke K, Hays H. *Emergency Medicine*. 2010;42[8]:6-13), Figure 2 should have been labeled "Positive FAST exam window showing free fluid between the spleen and kidney in the left upper quadrant."