



**The 2004 ACEP Seizure Clinical Policy:
What About Pediatric Seizure and
Status Epilepticus Patients?**

John M. Howell, MD, FACEP

**Clinical Professor of Emergency Medicine
George Washington University
Washington, DC**

**Director, Academic Affairs
Best Practices, Inc.
Department of Emergency Medicine
Inova Fairfax Hospital
Falls Church, VA**

In May of 2004, the ACEP Clinical Policy Committee published in the *Annals of Emergency Medicine* that addresses six clinical questions in the area of adult seizures and status epilepticus (SE). This policy specifically did not address the needs of pediatric patients who present with seizures or are in SE. This, of course, leaves the Emergency Medicine practitioner to wonder how the information in this adult seizure clinical policy might apply to the management of these disorders in pediatric patients. The lecture and written materials included here will discuss the main clinical points addressed in the clinical policy and how the information in this policy might be used to guide ED pediatric seizure and SE therapy in order to optimize patient outcome.

Key Clinical Questions and Learning Points

What are the epidemiology, etiology, and prognosis of status epilepticus (SE) in children?

In children, SE is most common in the very young (i.e., less than 2 years of age). Among these children, 80% have either febrile or acute symptomatic etiologies. In one population-based cohort study of children with epilepsy, 27% had SE. Risk factors for SE include remote symptomatic causes (e.g., chronic encephalopathy, brain malformation), age of onset 6 years or younger, and partial seizures.

Among children with symptomatic SE, causes include bacterial meningitis, encephalitis, dehydration, electrolyte abnormalities (e.g., hyponatremia), toxic ingestions, and subdural hematoma. Causes of SE among children with remote causes of the seizure disorder include chronic encephalopathy, anoxia, brain malformation, cerebral palsy, and Sturge-Weber syndrome. Treatable causes of SE under six months of age include pneumococcal meningitis (pre-Prevnar), inborn errors of metabolism, electrolyte abnormalities, and brain trauma.

Overall mortality from SE in children is 4-6%, but in the first six months mortality is 24%. Mortality in children with *refractory* SE (resistant to initial drug therapy) is 16-43.5%.

What drugs should be used in status epilepticus refractory to benzodiazepines?

Based on the literature, there is no clear mandate for specific anti-epileptic drugs in refractory status epilepticus. The following drugs may be used: phenytoin, midazolam, phenobarbital, pentobarbital, thiopental, and propofol.

The ACEP clinical policy on seizures in adults recommends phenytoin, followed by one of the following (i.e., if benzodiazepine and phenytoin fails): high dose phenytoin (mean dose 24 mg/kg), valproic acid, midazolam, pentobarbital, or propofol (level C recommendation). In the VA cooperative study (1998), phenobarbital, phenytoin, lorazepam, and phenytoin plus phenytoin had similar efficacies in terminating adult SE: lorazepam 65%, phenobarbital 58%, diazepam plus phenytoin 56%, and phenytoin alone 48%.

Meaningful studies evaluating refractory SE in children are limited. A practice guideline developed in the U.K. recommends either phenytoin (18 mg/kg) or

phenobarbital (20 mg/kg). One treatment protocol reported a 99% response rate to diazepam, a repeat dose of the initial anti-epileptic drug, or thiopental. Another treatment protocol reported a 94% response rate to diazepam followed by phenytoin and paraldehyde.

What is the recurrence rate of seizures among children with a first non-febrile seizure?

The recurrence risk is 30-50% (by 2 years) for children with first seizures that are idiopathic. The recurrence risk is generally above 50% for children with “remote” causes of the seizure.

Should laboratory tests and lumbar puncture be performed routinely for children with a first non-febrile seizure?

It is an option for emergency physicians to perform serum tests (e.g., electrolytes, complete blood count, toxicology screen) on children with a first non-febrile seizure. This recommendation is based on a series of class I and class II publications. Two classes I, prospective cohort studies of children with new seizures found that the rate of significant electrolyte disorders diagnosed in these children was 0-1%; however the 95% confidence intervals were in the 10-20% range. Larger class II studies identified hypoglycemia, hypocalcemia, and cocaine intoxication at about the same rate (i.e., 0-1%).

Lumbar puncture (LP) is of limited value in children with first-time non-febrile seizures. In one study of LP performed in 57 children with non-febrile seizures, no subjects (95% CI: 0-6.3%) had meningitis although the CSF of 12% reflected post-seizure CSF pleocytosis.

The ACEP Clinical Policy suggests as a level B recommendation that one determine a serum glucose, pregnancy test, and sodium in adults with new onset seizures. The policy also states that neuroimaging and LP be performed in immunocompromised adults (level B).

Should computed tomography (CT) be performed routinely for children with a first non-febrile seizure?

Perform emergency CT in patients with a first non-febrile seizure if there are clinical suggestions of an anatomic abnormality (e.g., focal seizure, prolonged ictal period, post-ictal focal neurologic deficits, and prolonged post-ictal period). Abnormalities on neuroimaging occur in up to one third of children with a first seizure, although most of these abnormalities do not influence treatment or management decisions. Of available reported imaging results from Class I and Class II studies of children, an average of about 2% revealed clinically significant findings that contributed to further clinical management. The majority of these studies were performed because the seizure was focal or there were other clinical findings suggestive of an anatomic CNS abnormality (e.g., prolonged seizure, prolonged post-ictal period, and post-ictal focal deficits). These studies of neuroimaging in children with first seizures note the improved accuracy of MRI (compared to CT) and additional diagnoses made with MRI (e.g., atrophy, infarction, and evidence of trauma, cerebral dysgenesis, and cortical dysplasia).

The ACEP Clinical Policy lists as a level B recommendation the following: perform CT when available and deferred outpatient neuroimaging may be arranged if reliable follow up is available.

Should lumbar puncture be performed in children with febrile seizures?

The American Academy of Pediatrics (AAP) recommended (1996) that an LP be *strongly considered* in patients younger than 12 months of age and *considered* in children 12-18 months of age. The literature suggests the incidence of meningitis in children with febrile seizures is less than 5% (pre-Prevnar). The risk of meningitis is increased in children with atypical febrile seizures (i.e., prolonged, focal, etc.), suspicious physical examinations (e.g., petechiae, bulging fontanelle, hypotension, grunting), and abnormal neurological examinations. Clinical assessment is less accurate in children already on antibiotics. That is, meningitis presenting as a typical febrile seizure in children older than a few months and not already on antibiotics is unusual.

Suggested Readings

ACEP Clinical Policies Committee: Clinical policy: critical issues in the evaluation and management of adults patients presenting to the emergency department with seizures. *Ann Emerg Med* 2004;43:605-625.

American Academy of Neurology: Practice parameter: evaluating a first nonfebrile seizure in children. *Neurology* 2000;55:616-623.

Practice parameter: the neurodiagnostic evaluation of the child with a first simple febrile seizure. *Pediatrics* 1996;97:773-775.

Shinner S, et al: Mortality following a first unprovoked seizure in children. *Neurology* 2005;64:880-882.

Sankar R, et al: Neonatal seizures: after all these years we still love what doesn't work. *Neurology* 2005;64:776-777.