



## **Seizures in Childhood**

The child who has just had a seizure but now appears well is a common clinical problem in the emergency department. Most of these children do well, but the potential for a life-threatening illness to be present is substantial. The lecturer will examine the literature to determine the most cost-effective approach to seizures in children based on age and clinical presentation.

- Discuss the differential diagnosis of febrile, nonfebrile, and neonatal seizures.
- Describe a cost-effective approach to the management of seizures in children.

MO-34  
Monday, October 11, 1999  
1:30 PM - 2:25 PM  
Room # N251  
Las Vegas Convention Center

## **FACULTY**

Brent R King, MD

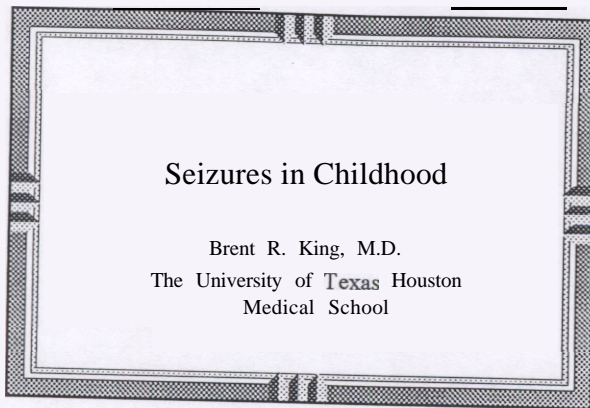
Associate Professor, Emergency  
Medicine and Pediatrics; Chairman,  
Department of Emergency Medicine,  
The University of Texas, Houston  
Medical School, Houston, Texas

Track: Pediatric Disorders  
Course: Seizures in Childhood  
MO-34  
1 Hour  
Faculty: Brent R. King, MD

Course Description:

The child who has just had a seizure but now appears well is a common clinical **problem in the** emergency department. Most of these children do well, but the potential for a life-threatening **illness** to be present is substantial. The lecturer will examine the literature to **determine** the **most** cost-effective approach to seizures in children based on age and clinical presentation.

- Discuss the differential diagnosis of febrile, nonfebrile, and neonatal seizures.
- Describe a cost-effective approach to the management of seizures in children.



---

---

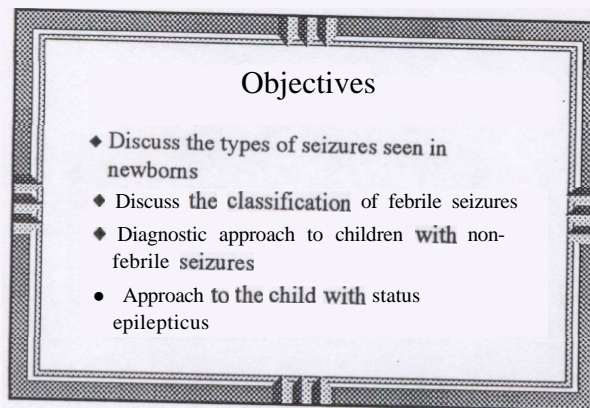
---

---

---

---

---



---

---

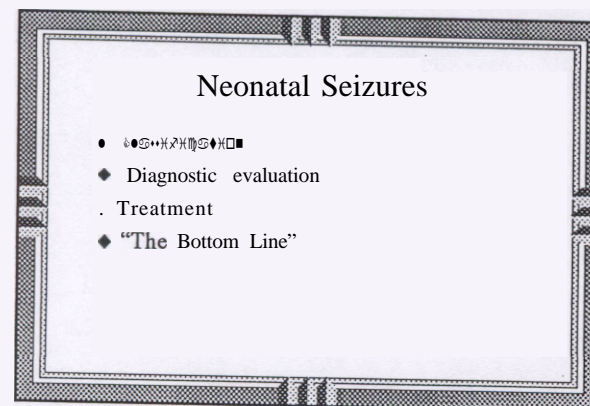
---

---

---

---

---



---

---

---

---

---

---

---

### Neonatal Seizures - Classification

- . Subtle
- . **Clonic**
  - . Focal
  - . Multifocal
- ◆ Tonic
  - . Focal
  - . **Generalized**

---

---

---

---

---

---

---

### Neonatal Seizures - Classification (con't)

- ◆ Myoclonic
  - Focal
  - Multifocal
  - Generalized

---

---

---

---

---

---

---

### Neonatal Seizures - Subtle

- ◆ Not clearly Clonic, Tonic, **Myoclonic**
- . Subtle **movements**
  - . e.g. **eye** blinking, **tongue thrusts**
- ◆ Repetitive motions of hands or feet
  - "Boxing"
  - Pedaling
- **May or may** not have EEG **abnormality**

---

---

---

---

---

---

---



### Neonatal Seizures - Clonic

- ◆ Two types - Focal and Multifocal
- ◆ Different from clonic seizures in older kids
  - Slower (1 -3 jerks/second)
  - Infant may be unconscious even with focal events
  - Several body parts are involved in multifocal. Non-Jacksonian migration

---

---

---

---

---

---

---

### Neonatal Seizures - Clonic (con't)

- ◆ Whether the *seizure* is focal or multifocal the *abnormality* is usually focal.
- ◆ BUT focal *events* in newborns can be caused by generalized processes (e.g. metabolic *abnormalities*)

---

---

---

---

---

---

---

### Neonatal Seizures - Tonic (Focal)

- ◆ Posturing of a limb
- Asymmetric posturing of the head, neck, or trunk
- Often have associated EEG abnormalities

---

---

---

---

---

---

---

Neonatal Seizures - Tonic  
(Generalized)

- ◆ May resemble decorticate or decerebrate posturing
- ◆ EEG abnormalities not consistently seen
  - . May be posturing

---

---

---

---

---

---

---

---

Neonatal Seizures - Myoclonic

- ◆ Different from clonic activity
  - More rapid jerks
  - Predilection for flexor muscles
- ◆ Three types
  - Focal
  - Multifocal
  - Generalized

---

---

---

---

---

---

---

---

Neonatal Seizures - Myoclonic  
(Focal)

- **Flexor** muscles of one extremity (usually upper)
- 3 of 4 1 patients **studied** had an associated EEG abnormality

---

---

---

---

---

---

---

---

### Neonatal Seizures Myoclonic (Multifocal)

- ◆ Asynchronous twitching of **several** parts of the body
- **none** of **5 infants** studied had EEG abnormalities

---

---

---

---

---

---

---

### Neonatal Seizures - Myoclonic (Generalized)

- ◆ Bilateral flexion jerks of upper (and sometimes lower) extremities
- ◆ Often associated with abnormal EEG

---

---

---

---

---

---

---

### Benign Myoclonus

- ◆ Associated with sleep
- ◆ Seen in **normal** newborns
- **Resolves** by six **months** of age
- ◆ No EEG abnormalities

---

---

---

---

---

---

---



### Neonatal Seizures - Classification Summary

- ◆ Distinct types of seizures
- ◆ Not like those **seen** in older children
- Not consistently associated with EEG abnormalities

---

---

---

---

---

---

---

### Neonatal Seizures - Questions

- ◆ *Are the movements not associated with EEG abnormalities really seizures?*
- ◆ The answer is unknown
- ◆ Animal studies suggest that some seizures may occur deep within the brain and not be recorded by surface electrodes

---

---

---

---

---

---

---

### Neonatal Seizures - Questions

- ◆ *How can true seizures be identified?*
- ◆ Stimulus sensitivity
  - True seizures should **not** be initiated by tactile stimulation
- ◆ Suppressibility
  - True seizures should not be suppressed or eliminated by gentle passive restraint

---

---

---

---

---

---

---

### *How can seizures be identified (con't)*

- ◆ Association with autonomic changes
  - True seizures should be associated with autonomic changes ( e.g. tachycardia, increased BP)

---

---

---

---

---

---

---

### *Neonatal Seizures - Questions*

- ◆ *What about treatment?*
- ◆ Best candidates:
  - Pts who meet above criteria and meet criteria for status epilepticus
- ◆ Treat causes
- ◆ Look for elevated ICP

---

---

---

---

---

---

---

### *Treatment (con't)*

- ◆ Drug therapy
  - benzodiazepines
  - phenobarbital
- ◆ Consider consultation prior to treatment of patients **not** in status

---

---

---

---

---

---

---

### The Bottom Line(s)

- ◆ Babies make a lot of “funny” movements
  - Many of these are not electrical seizures
- ◆ Babies “break the rules”
- ◆ Use clinical criteria to identify true seizures
- ◆ Look for underlying causes

---

---

---

---

---

---

---

---

### Febrile Seizures

- ◆ Definitions
  - Diagnostic evaluation
- ◆ The “Bottom Line”

---

---

---

---

---

---

---

---

### Febrile Seizure

- ◆ Definition
  - Convulsive activity accompanied by fever
  - Child 6 months to 5 years of age
  - No CNS infection
  - No underlying seizure disorder

---

---

---

---

---

---

---

---



### Febrile Seizure - Types

- ◆ Simple
  - Brief (<15 mins long)
  - Generalized
  - Do not recur within 24 hours
- ◆ Complex (or complicated)
  - All others

---

---

---

---

---

---

---

### Febrile Seizure - Significance of Classification

- ◆ Long term prognosis
  - Simple febrile seizures are not predictive of later epilepsy
- ◆ Short term prognosis
  - Simple febrile seizures are rarely associated with a serious underlying cause
  - Simple febrile seizures have no associated morbidity or mortality

---

---

---

---

---

---

---

### Simple Febrile Seizures - Diagnostic Evaluation

- CBC, **lytes**, calcium, BUN, **creatinine**, etc.
  - Not warranted
- Neuroimaging
  - Not warranted
- **Dextrostick** should be routine

---

---

---

---

---

---

---



### Simple Febrile Seizure - To LP or Not to LP?

- ◆ Meningitis very unlikely overall.
- ◆ Older children
  - LP only if toxic appearing, meningeal signs, etc
- ◆ Children under 9 mos to 1 year
  - More difficult to evaluate clinically
  - LP should be considered

---

---

---

---

---

---

---

### Complex Febrile Seizure - Diagnostic Evaluation

- ◆ Chemistries, CBC, etc.
  - Still unlikely to be abnormal and should be obtained only if indicated by history or exam
- ◆ Neuro imaging
  - Only for persistent focal findings, evidence of head trauma, etc.
- ◆ Dextrostick is *still* routine

---

---

---

---

---

---

---

### Complex Febrile Seizure - LP?

- ◆ Bacterial meningitis is **more common**
- ◆ Older children usually have suspicious findings
- ◆ Younger **patients** **are often** candidates

---

---

---

---

---

---

---

### The Bottom Line(s)

- ◆ Simple febrile seizures have a good prognosis
  - Diagnostic work-up is **very rarely needed**
- ◆ Complex febrile seizures are **more likely to** represent a serious underlying problem

---

---

---

---

---

---

---

### Hyponatremic Seizures

- ◆ **Diagnosis**
- ◆ **Confirmation and Management**

---

---

---

---

---

---

---

### Hyponatremic Seizures - “The Sodium Will be Done in an Hour”

- ◆ Making a diagnosis
  - Infants and young children
  - Low rectal temperature
  - History of excessive free water intake
  - Severe seizures

---

---

---

---

---

---

---

### Confirmation and Management

- ◆ Rapid **serum** sodium ("Supergas")
- If "Supergas" is **not available** Consider 20cc/Kg NS
- Once Dx is known - 10cc/Kg 3% Saline
  - Caution should be used
  - Rapid correction is associated with osmotic demyelination syndrome

---

---

---

---

---

---

---

---

### Hyponatremic Seizures - The Bottom Line(s)

- ◆ Consider in:
  - Infants under 6 months of age
  - Hypothermia
  - Status epilepticus
  - History of free water intake

---

---

---

---

---

---

---

---

### Older Child with a First Non-Febrile Seizure

- How much work-up should be done in **the ED?**
- **Lytes**, Calcium, Magnesium, etc.
  - **Very unlikely to be abnormal in children** who are non-tonic and **not in status**
- ◆ **Dextrostick** Cheap and simple Do it
- ◆ Consider Causes (e.g. **Toxins**)

---

---

---

---

---

---

---

---



### Older Child with Non-Febrile Seizure

- ◆ Imaging
  - History suggesting a lesion
  - Focal Findings
  - Non-Generalized Seizure
  - Persistent alteration of mental status

---

---

---

---

---

---

---

### First Non-Febrile Seizure

- ◆ Imaging
  - Pts who recover normally can have imaging study as an outpatient
- ◆ EEG
  - Also best done electively

---

---

---

---

---

---

---

### First Non-Febrile Seizure - Treatment?

- Definition of epilepsy is at least two non-febrile seizures without a cause
- ◆ Most neurologists do not treat first seizures
- ◆ Discharge instructions are important
  - . swimming
  - . Bathing
  - Other activities

---

---

---

---

---

---

---

### First Non-Febrile Seizure - The Bottom Line(s)

- ◆ Diagnostic work-up is **usually not needed** in children who have brief seizures and who recover completely in the ED with no **persistent** abnormalities
- ◆ Presumptive treatment only *after* consultation
- Discharge instructions are very important

---

---

---

---

---

---

---

### “His eyes rolled back and he tried to go to sleep!”- Pallid Breath Holding Spells

- ◆ Can look **like** seizures
- Patients are **usually young children**
  - Most cases start before 18 months
  - Step by 3 or 4 years of age
- ◆ Minor **noxious** stimulus

---

---

---

---

---

---

---

### Pallid Breath Holding Spells - Clinical Picture

- ◆ Child becomes quiet
  - Pallor and/or diaphoresis may be noted
- Pulse is **slow** and may appear “weak”
- ◆ May be a brief episode (<30secs) of tonic-clonic activity
- ◆ An apparent “post-ictal” phase

---

---

---

---

---

---

---

### Pallid Breath Holding Spells - Etiology

- ◆ Not primary seizures
- ◆ Possibly an exaggerated vagal discharge
  - Bradycardia
  - Brief periods of aystole
- Movements are related to cerebral anoxia

---

---

---

---

---

---

---

---

### Pallid Breath Holding Spells - Natural History

- Rarely if ever serious
- Half of affected children have stopped by age 4
- ◆ Almost all have stopped by school age
- ◆ Differential diagnosis includes Prolonged QT Syndrome
  - Consider in the older child with PBHS

---

---

---

---

---

---

---

---

### Pallid Breath Holding Spells - The Bottom Line(s)

- Probable **cause** of many "seizures" **related** to minor head trauma
- ◆ Benign condition
- Think of prolonged QT
  - Esp in older children
  - Very especially in the child who is older at age of onset

---

---

---

---

---

---

---

---



## Status Epilepticus

- ◆ Definition
- ◆ Treatment Options

---

---

---

---

---

---

---

## Status Epilepticus - Definition

- ◆ A. **Seizure** lasting longer **than 30 mins**
- ◆ B. Intermittent seizures for **>30 mins** without a lucid interval
- ◆ C. (Practical) Almost **any child who arrives at the ED seizing**

---

---

---

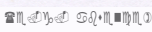
---

---

---

---

## Status Epilepticus -Types

- ◆ Generalized Convulsive Status Epilepticus
  - Most common type
- ◆ ☐ Convulsive Status 

---

---

---

---

---

---

---



### Status Epilepticus - Initial Treatment

- Identify and address treatable causes
  - Glucose
  - Trauma
  - Etc.
- ABC's

---

---

---

---

---

---

---

### Treatment of Status - First Line

- Benzodiazepines
  - Lorazepam 0.1 mg/kg I.V.
  - Diazepam 0.2 mg/kg I.V

---

---

---

---

---

---

---

### Treatment of Status -First Line

- No I.V. ?
  - Diazepam 0.5 mg/kg P.R.
  - Lorazepam or Midazolam 0.2 mg/kg P.R.
  - Midazolam 0.2 mg/kg Nasally
  - Midazolam 0.1 mg/kg I.M.

---

---

---

---

---

---

---

### Treatment of Status - When Benzos Fail

- ◆ Give more
  - Up to three doses
  - Be prepared to support ventilation
- ◆ If benzos still don't work ...

---

---

---

---

---

---

---

### Treatment of Status - Second Line Agents

- ◆ Fosphenytoin 20 mgPE/kg LV. or I.M.
- Or Phenytoin 20 mg/kg I.V.

---

---

---

---

---

---

---

### Status - Second Line Agents (con't)

- ◆ *Why Fosphenytoin (Cerebyx - Parke-Davis)? Isn't it really expensive?*
- ◆ Yes, but ...
- ◆ Less risk of tissue damage
  - Fewer scarring extravasations
  - Fewer lawsuits
- ◆ I.M. injections possible
- ◆ Can be administered faster

---

---

---

---

---

---

---

### Status Epilepticus - Third Line Agents

- ◆ Reconsider treatable causes
- ◆ Give more fosphenytoin or phenytoin
  - May give a total of 30 mgPE/kg or 30 mg/kg, respectively
- ◆ Consider phenobarbital 20 mg/kg I.V.
  - Risk of apnea and or loss of upper airway reflexes is high
  - Consider elective intubation

---

---

---

---

---

---

---

---

### Status Epilepticus - Third Line Agents (*con't*)

- ◆ Consider a *single* dose of lidocaine 1 to 1.5 mg/kg I.V.
  - Higher doses of lidocaine are epileptogenic
  - Some reports from Europe of success in refractory seizures

---

---

---

---

---

---

---

---

### Status Epilepticus - Refractory Seizures

- ◆ pentobarbital coma
- midazolam continuous infusion
- ◆ propofol

---

---

---

---

---

---

---

---



Status Epilepticus - Other Agents

◆ IV Valproate

• Recently released

• Case report of success in refractory status (25 mg/kg)

---

---

---

---

---

---

---

Status Epilepticus - The Bottom Line(s)

. Start with benzos

◆ Then go to fosphenytoin or phenytoin

● Consider treatable causes

. Protect the airway

. Newer agents (e.g. IV valproate) may have a role

---

---

---

---

---

---

---