Pediatric Seizures

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Overview

• Febrile and afebrile seizures
• Is it a seizure?
• Management algorithm for status epilepticus
• Overview of unusual seizures
Introduction

• 1-3% of all ED visits in Peds ED’s
• 25-40,000 pts - 1\textsuperscript{st} non febrile seizure
• Most common in children < 5yrs
Seizures facts

- Most idiopathic
- Many - genetic etiology
- < 1 year, in Status Epilepticus; 70% later diagnosed with epilepsy
- 5% febrile seizures, present with status epilepticus.
Classification of seizures

Febrile Seizure
- What is source?

- Meningitis
- Encephalitis
- Abscess

Acute -- Non-recurrent

With Fever
- Extracranial Infection
- Intracranial Infection

Without Fever
- Toxic
- Metabolic
- Vascular
- Traumatic
- Hypoxic

Chronic -- Recurrent

Epilepsy
Febrile seizures: the tricky part

- **Acute -- Non-recurrent**
  - With Fever
    - Extracranial Infection
    - Febrile Seizure:
      - What is source?
    - Intracranial Infection
  - Without Fever
    - Meningitis
    - Encephalitis
    - Abscess

- **Chronic -- Recurrent**
  - Epilepsy
    - Toxic
    - Metabolic
    - Vascular
    - Traumatic
    - Hypoxic

**distinguishing IC infection from febrile seizure**
Another way to see it:

- Provoked
- Unprovoked
Provoked

- Head trauma
- Toxins
- Fever -22%
- Electrolyte abnormality
- Hypoglycemia
- Other
Unprovoked

- Cryptogenic - 15%
- Brain malformation
- Disturbance of neuronal migration
- Genetic syndrome
Seizure mimics

- Psychogenic non-epileptic attacks (pseudo seizures)
- Breath-holding spells
- Tics
- Syncope
- Cardiac syncope
- Migraine variants
- Sleep disorders
- GERD
- Hypertonicity in pt. with CP
- Myoclonus while falling asleep or waking up
Life threatening causes of seizures

- Hypoglycemia
- Electrolyte disturbances
- Inborn errors of metabolism
- Head injury
- Atraumatic intracranial bleed
- Ischemic stroke
- Brain tumor
- Infection
- Toxins
- Withdrawal syndromes
- Hypoxemia
- Hypertensive encephalopathy
- Eclampsia
Febrile seizures
• 5yo arrives to the Emergency room after 40 minutes of focal seizure activity. He is still seizing, is febrile to 101.5, unresponsive.
Febrile Seizures

- Most common seizure - 2-5% of all children
- Seizures associated with fever without CNS infection
- Simple or complex
Febrile seizures

Simple febrile seizure
- Neurological normal children
- Age 6mo – 6 yrs.
- Less than 15 minute duration
- No focal features
- Do not recur within 24 hrs.

Complex febrile seizure
- Not meeting SFZ criteria
- Multiple in 24 hr period
- Consider and evaluate for intracranial infection
What are the guidelines for performing a LP for febrile seizures 6mo - 60 mo?

- Not recommended in simple febrile seizure if:
  - Well appearing
  - Fully immunized

Yes if:

- Non immunized
- Meningeal signs
- Pretreated w/ abx

Children’s Healthcare of Atlanta
Seizures and meningitis

Yield of Lumbar Puncture Among Children Who Present With Their First Complex Febrile Seizure

Amir Kimia, Elana Pearl Ben-Joseph, Tiffany Rudloe, Andrew Capraro, Dean Sarco, David Hummel, Patrick Johnston, Marvin B. Harper

RESULTS: We identified 526 patients. The median age was 17 months (interquartile range: 13–24), and 44% were female. Ninety patients (17%) had a previous history of simple febrile seizures. Of the patients, 340 (64%) had a lumbar puncture (LP). The patients’ median white blood cell count during a CFS was 1 cell per μL (interquartile range: 1–2), and 14 patients had CSF pleocytosis (2.7% [95% confidence interval [CI]: 1.5–4.5]). Three patients had ABM (0.9% [95% CI: 0.2–2.8]). Two had *Streptococcus pneumoniae* in a culture of their cerebrospinal fluid. Among these 2 patients, 1 was nonresponsive during presentation, and the other had a bulging fontanel and apnea. The third child appeared well; however, her blood culture grew *S pneumoniae* and failed the LP test. None of the patients for whom an LP was not attempted subsequently returned to the hospital with a diagnosis of ABM (0% [95% CI: 0, 0.9]).

CONCLUSION: Few patients who experienced a CFS had ABM in the absence of other signs or symptoms.

• Prevnar and HIB vaccines have reduced incidence of meningitis
Risk of having meningitis < 1yr?

Risk of Bacterial Meningitis in Children 6 to 11 Months of Age With a First Simple Febrile Seizure: A Retrospective, Cross-sectional, Observational Study

Romain Guedj, Hélène Chappuy, Luigi Titiomanlio, Thanh-Van Trieu, Sandra Biscardi, Gisèle Nissack-Obiketiki, Béatrice Pellegrino, Oussama Charara, François AngouvanV, Thierry Billette De Villemure, Corinne Levy, Robert Cohen, Jean Baptiste Armengaud, Ricardo Carbejal


OBJECTIVES: National and international guidelines are very heterogeneous about the necessity to perform a lumbar puncture (LP) in children under 12 months of age with a first simple febrile seizure. We estimated the risk of bacterial meningitis in children aged 6 to 11 months with a first simple febrile seizure.

METHODS: This multicenter retrospective study was conducted in seven pediatric emergency departments (EDs) in the region of Paris, France. Visits of patients aged 6 to 11 months for a first simple febrile seizure from January 2007 to December 2011 were analyzed. Bacterial meningitis was sequentially sought for by 1) analyzing bacteriologic data at the time of the visit, 2) looking for data from a second visit to the hospital after the index visit, and 3) phone calling the child’s parents to determine the symptom evolution after the index visit. Infants lost to this follow-up were searched for in a national bacterial meningitis database.

RESULTS: From a total of 1,183,487 visits in the seven pediatric EDs, 116,503 were for children 6 to 11 months of age. From these, 205 visits were for a first simple febrile seizure. An LP was performed in 61 patients (29.8%). The outcome bacterial meningitis was ascertainable for 188 (82%) visits. No bacterial meningitis was found among these patients (95% confidence interval = 0% to 2.2%). None of the 37 infants lost to our follow-up were registered in the national database as having bacterial meningitis.
Children with first-time simple febrile seizures are at low risk of serious bacterial illness

J L Trainor, L C Hampers, S E Krug, R Listerick


OBJECTIVE: To describe the rates of serious bacterial illness (SBI) in children presenting to emergency departments (EDs) with first-time uncomplicated febrile seizures.

METHODS: The ED visits from seven Chicago metropolitan area hospitals (two tertiary pediatric EDs, five community general EDs) for all pediatric patients seen between July 1995 and December 1997 with a discharge diagnosis including the term "seizure" were retrospectively identified. Records of patients who met criteria for simple, first-time febrile seizure were reviewed (age 6-60 months; temperature > or =38.0 degrees C; single, generalized, tonic-clonic seizure <20 minutes; absence of known central nervous system disease). Rates of bacteremia, urinary tract infection, bacterial meningitis, and pneumonia were determined.

RESULTS: Four hundred fifty-five children were identified who had first-time simple febrile seizures. The study participants had a mean age of 21 months and a mean temperature of 39.6 degrees C, and 64% were male. Seventy-three percent were seen in a community hospital setting. Blood cultures were obtained for 315 children (69%). Four children (1.3% [95% CI = 0.1% to 2.5%]) were bacteremic, all with Streptococcus pneumoniae; the rate of bacteremia did not differ in the subset at highest risk for bacteremia (6-36 months, temperature >39 degrees C). No demographic or laboratory data distinguished the bacteremic children from those with negative blood cultures. One hundred seventy-one children (58%) had urine cultures obtained; 5.9% [95% CI = 2.4% to 9.4%] of the cultures grew >100,000 colony-forming units/mL of a single pathogenic organism. One hundred thirty-five children (30%) had cerebrospinal fluid cultures performed. None of these cultures grew a bacterial pathogen [95% CI = 0% to 2.2%]. Two hundred eight children (45.7%) had chest x-rays performed; 12.5% [95% CI = 10.2% to 14.8%] (n = 26) of the x-rays were read as consistent with pneumonia by the radiologist at the treating institution. None of the blood cultures performed on children with abnormal radiographs were positive (cultures drawn on 23 of 26 patients, 88%). Stool cultures were performed on 14 children (3.1%); two cultures (14.3% [95% CI = 0% to 32.6%]) grew a bacterial pathogen, both Shigella.

CONCLUSIONS: Rates of SBI in this multi-institution population of children with first-time simple febrile seizures were low and are consistent with those published in the literature for febrile children without seizures.

Very low
1.3% bacteremia
Strep pneumo
6%UTI
No meningitis
N=450
LESS IS MORE.

[MORE OR LESS]
Do I need to do labs?

Identify source of fever

Labs limited value...

• CBC, CRP, Urine and urine culture
• Electrolytes- ongoing seizure activity, AMS
• Toxicology- TCA’s
Summary of recommendations for the management of infantile seizures: Task Force Report for the ILAE Commission of Pediatrics

Jo M Wilmshurst, William D Gaillard, Kollencheri Puthenveettil Vinayan, Tammy N Tsuchida, Perrine Plouin, Patrick Van Bogaert, Jaime Carrizosa, Maurizio Elia, Dana Craiu, Nebojsa J Jovic, Doug Nordli, Deborah Hirtz, Virginia Wong, Tracy Glauser, Eli M Mizrahi, J Helen Cross

Epilepsia 2015, 56 (8): 1185-97

Evidence-based guidelines, or recommendations, for the management of infants with seizures are lacking. A Task Force of the Commission of Pediatrics developed a consensus document addressing diagnostic markers, management interventions, and outcome measures for infants with seizures. Levels of evidence to support recommendations and statements were assessed using the American Academy of Neurology Guidelines and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. The report contains recommendations for different levels of care, noting which would be regarded as standard care, compared to optimal care, or "state of the art" interventions. The incidence of epilepsy in the infantile period is the highest of all age groups (strong evidence), with epileptic spasms the largest single subgroup and, in the first 2 years of life, febrile seizures are the most commonly occurring seizures. Acute intervention at the time of a febrile seizure does not alter the risk for subsequent epilepsy (class 1 evidence). The use of antipyretic agents does not alter the recurrence rate (class 1 evidence), and there is no evidence to support initiation of regular antiepileptic drugs for simple febrile seizures (class 1 evidence). Infants with abnormal movements whose routine electroencephalography (EEG) study is not diagnostic, would benefit from video-EEG analysis, or home video to capture events (expert opinion, level U recommendation). Neuroimaging is recommended at all levels of care for infants presenting with epilepsy, with magnetic resonance imaging (MRI) recommended as the standard investigation at tertiary level (level A recommendation). Genetic screening should not be undertaken at primary or

Antipyretics do not prevent recurrence
No evidence supports initiation of antiepileptics
There may be a trend in higher positive test yield in children <2 yrs  -EEG, MRI
What is my spiel?

• Children younger than 12 months at the time of their first simple febrile seizure have an approximately 50% probability of having recurrent febrile seizures.
• Children older than 12 months at the time of their first event have an approximately 30% probability of a second febrile seizure.
What is my spiel? (cont.)

- Those who do have a second febrile seizure, 50% have a chance of having at least 1 additional recurrence.
- No IQ damage
- No common deaths
- Antipyretics and anticonvulsants – do not prevent recurrent febrile seizures
Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures

Steering Committee on Quality Improvement and Management, Subcommittee on Febrile Seizures
What do you (I) do?

- Child has more than one seizure in a 24hr period, looks good, non focal neuro exam....
- *Admit or discharge home?*
- Child meets criteria for complex febrile seizure...
- *Do full workup including LP and treat?*
Seizing children < 6mo have significant underlying pathology


Infant seizures not so infantile: first-time seizures in children under six months of age presenting to the ED.

Bui TT¹, Delgado CA, Simon HK.

Abstract
Data regarding first-time seizures in children <or=6 months of age is limited. This retrospective study, therefore, reviews the presentation, management, and outcome of children <or=6 months of age presenting to a pediatric tertiary care facility with a first-time seizure. Charts for 31 patients were identified and reviewed. Nineteen patients (61%) received sepsis work-ups. Two of the 31 (7%) had infectious etiologies. One of these infants, a 3-month-old who presented with only a history of fever and eyes rolling back but otherwise appeared well on initial presentation, had pneumococcal meningitis. Neuroimaging studies were performed in 22 (71%) patients with 12 of 22 (54%) having abnormal findings. Electroencephalogram (EEGs) were performed on 22 patients (71%) with 11 (50%) showing seizure activity. Electrolytes were checked on 19 patients (61%) with 5 being clinically significant. Etiologies included idiopathic (32%), congenital anomalies (26%), inborn errors of metabolism (16%), electrolyte abnormalities (16%), infection (7%), and trauma (3%). In conclusion, unlike children >6 months of age in whom febrile seizures and idiopathic seizure disorders are most common, a large percentage of children <or=6 months of age presenting with first-time seizures have significant underlying pathology. This pathology often includes immediately life-threatening conditions in these children who may look deceptively well on initial evaluation.
When to do emergent neuroimaging- CT

- Prolonged postictal focal deficit- Todd’s paresis
- Failure to return to baseline within several hours
Neuroimaging

- 8% in status have imaging abnormality;
- few changed ED management
- CT
- MRI - more sensitive and specific
MRI

- Is recommended as standard of care

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When to do non-emergent neuroimaging -MRI

- Unexplained cognitive or motor delay
- Focal neurologic deficits
- Partial (focal) seizures or without secondary generalization
- EEG that does not represent a benign epilepsy of childhood
- Children < 1yo
EEG
Children’s Healthcare of Atlanta

EEG

• If EEG is not diagnostic video EEG may be helpful
EEG

• After first unprovoked seizures
• Helps predicting seizure recurrence- 54% vs. 25%
• Differentiates seizures from non epileptic events
Emergent diagnostic testing for pediatric nonfebrile seizures

Ashley M Strobel, Vikramjit S Gill, Michael D Witting, Getachew Teshome

*American Journal of Emergency Medicine 2015, 33 (9): 1261-4*

**BACKGROUND:** Guidelines from the American Academy of Neurology recommend laboratory studies or computed tomography (CT) for children who experience a nonfebrile seizure if anything in their history suggests a clinically significant abnormality.

**OBJECTIVE:** To ascertain if any patient or seizure characteristics are associated with a greater likelihood that laboratory studies or CT scan will yield clinically significant results.

**METHODS:** This retrospective case series reviewed 93 children with nonfebrile seizure, who were evaluated in an urban pediatric emergency department (ED) between July 2007 and June 2011.

**RESULTS:** Laboratory studies were performed in 87% of the study group; 7% of those tests gave clinically significant results. Computed tomographic scans were obtained in 35% of our patients; 9% showed clinically significant findings. Presence of an active seizure in the ED or a first nonfebrile seizure had an 8% and 11% difference, respectively, for clinically significant laboratory abnormality. Children younger than 2 years showed a 7% difference of clinically significant laboratory abnormality.

**CONCLUSION:** This study did not identify statistically significant predictors of laboratory or CT abnormalities for children with nonfebrile seizure presenting to the ED. Age less than 2 years, having an active seizure in the ED, and experiencing a first-time seizure showed a trend toward an increased yield of laboratory testing. In accordance with the American Academy of Neurology guidelines, we conclude that the history of a child’s present illness preceding the nonfebrile seizure, not characteristics of the seizure, should be used to determine the need for further testing.

AJEM: Similar to PEDs febrile guidelines a higher testing yield <2yo
Case

• 2yo presents to your office for routine checkup while in the waiting room, he is noted to have tonic clonic movements of his arms, eyes rolled back, foaming from his mouth, unresponsive, dusky with perioral cyanosis. He is brought back to one of the exam rooms and he continues to seize. No fever, no previous seizures, no history of trauma, no bruises. Seizure no has been present for 15 minutes. You have called 911.
What will you do?

- ABC’s
- Temperature
- Glucose, Sodium
- Attempt IV
  - No success
- Drugs?
Status epilepticus

- Continuous seizure activity or series of seizures without return to baseline or
- Lasting > 5 minutes
Seizures lasting more than 5-10 mins are unlikely to stop expontaneously

Ann Neurol. 2001 May;49(5):659-64.

How long do new-onset seizures in children last?
Shinnar S¹, Berg AT, Moshe SL, Shinnar R.

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Abstract
Although there are data on the duration of seizures in patients with refractory epilepsy, little is known about the duration of seizures in nonrefractory epilepsy populations. In a prospective study, seizure duration was determined in 407 children with a first unprovoked seizure using a structured interview and review of medical and ambulance records. Analysis focused on the distribution of seizure duration and on the conditional probability that a seizure would stop once it had already lasted for a specified time. Seizures lasted > or = 5 minutes in 50% of cases, > or = 10 minutes in 29%, > or = 20 minutes in 16%, and > or = 30 minutes in 12%. Seizure duration data were best fit as the sum of two exponential distributions, one with a mean of 3.6 minutes accounting for 76% of cases and the other with a mean of 31 minutes accounting for 24% of cases. The longer a seizure lasted, the less likely it was to stop within the next few minutes. In the 182 children with 2 or more seizures, the durations of the first and second seizures were highly correlated (r = 0.395, p < 0.0001). We conclude that the distribution of seizure duration in children with a first unprovoked seizure differs markedly from that observed in patients with refractory epilepsy. A subgroup of patients are predisposed to prolonged seizures. The data suggest that, once a seizure lasts for more than 5-10 minutes, it is unlikely to stop spontaneously within the next few minutes, and intervention is therefore indicated. These findings also support the continued use of the current definition of status epilepticus as a seizure lasting for 30 minutes or longer for epidemiologic studies.
Known seizure disorder breakthrough

Seizure what to do?

• No guidelines
• Check drug levels
• Neuroimaging not recommended (no head trauma or new neuro findings)
Treatment – Status epilepticus

• ABC’s
• Glucose, electrolytes
• Support airway as needed
• Decision making for advanced airway:
  – Clinical status
  – Oxygen saturation
  – Oxygen requirement
  – Pts ability to protect his airway
Treatment - anticonvulsants

• Benzodiazepines
• Hydantoins
• Barbiturates
• Levetiracetam
• Valproic acid
• Lacosamide
• General anesthetics-propofol
Biggest mistake in kids….

Give a little bit.
Give a little bit of your love to me.
No IV access!!!
NO problem

Think:

- PR- DZP
- IN- MDZ
- IM- MDZ, Lorazepam, Fospheny

CHOA Guidelines Removed for Legal Compliance
Prehospital intranasal midazolam for the treatment of pediatric seizures

Maija Holsti, Benjamin L Sill, Sean D Firth, Francis M Filloux, Steven M Joyce, Ronald A Furnival

Pediatric Emergency Care 2007, 23 (3): 148-53

BACKGROUND: The local emergency medical services (EMS) council implemented a new pediatric treatment protocol using a Mucosal Atomization Device (MAD) to deliver intranasal (IN) midazolam for seizure activity.

METHODS: We sought to compare outcomes in seizing pediatric patients treated with IN midazolam using a MAD (IN-MAD midazolam) to those treated with rectal (PR) diazepam, 18 months before and after the implementation of the protocol.

RESULTS: Of 857 seizure patients brought by EMS to our emergency department (ED), 124 patients (14%) had seizure activity in the presence of EMS and were eligible for inclusion in this study. Of the 124 patients eligible for this study, 67 patients (54%) received no medications in the prehospital setting, 39 patients (32%) were treated with IN-MAD midazolam, and 18 patients (15%) were treated with PR diazepam. Median seizure time noted by EMS was 19 minutes longer for PR diazepam (30 minutes) when compared with IN-MAD midazolam (11 minutes, P = 0.003). Patients treated with PR diazepam in the prehospital setting were significantly more likely to have a seizure in the ED (odds ratio [OR], 8.4; confidence interval [CI], 1.6-43.7), ED intubation (OR, 12.2; CI, 2.0-75.4), seizure medications in the ED to treat ongoing seizure activity (OR, 12.1; CI, 2.2-67.8), admission to the hospital (OR, 29.3; CI, 3.0-288.6), and admission to the pediatric intensive care unit (OR, 53.5; CI, 2.7-1046.8).

CONCLUSIONS: The IN-MAD midazolam controlled seizures better than PR diazepam in the prehospital setting and resulted in fewer respiratory complications and fewer admissions.

IN MDZ better than PR DZP fewer resp complic, fewer admissions
### Benzodiazepine dosing for seizures

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose</th>
</tr>
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<tbody>
<tr>
<td>Midazolam</td>
<td>Intranasal – use atomizer or drip into nares</td>
<td>0.2 mg/kg, max 10 mg</td>
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<tr>
<td></td>
<td>Intramuscular</td>
<td>0.1-0.2 mg/kg, max 10 mg</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>Intravenous</td>
<td>0.1 mg/kg, max 4 mg</td>
</tr>
<tr>
<td></td>
<td>Intranasal (may have low/delayed absorption) – use atomizer or drip into nares</td>
<td>0.1 mg/kg</td>
</tr>
<tr>
<td>Diazepam</td>
<td>Intravenous</td>
<td>0.1-0.3 mg/kg, max 10 mg</td>
</tr>
<tr>
<td></td>
<td>Rectal (max 20 mg)</td>
<td>Age 2-6 y: 0.5 mg/kg</td>
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<tr>
<td></td>
<td></td>
<td>Age 6-12 y: 0.3 mg/kg</td>
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<td></td>
<td></td>
<td>Age &gt; 12 y: 0.2 mg/kg</td>
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CHOA Guidelines Removed for Legal Compliance
American Epilepsy Society Guideline

Evidence-Based Guideline: Treatment of Convulsive Status Epilepticus in Children and Adults: Report of the Guideline Committee of the American Epilepsy Society

Tracy GlauserMD, Shlomo ShinnarMD, PhD, David GlossMD, Brian AldredgePharmD, Ravindra AryaMD, DM, Jacquelyn BainbridgePharmD, Mary BareMS, Thomas BleckMD, Edwin DodsonMD, Lisa GarrityPharmD, Andy JagodaMD, Daniel LowensteinMD, John Pello,M DD, James RivielloMD, Edward SloanMD, MPH, David M. TreimanMD

Interventions for emergency department, in-patient setting, or prehospital setting with trained paramedics

Time Line

0-5 min Stabilization phase

1. Stabilize patient (airway, breathing, circulation, disability - neurologic exam)
2. Time seizure from its onset, monitor vital signs
3. Assess oxygenation, give oxygen via nasal cannula/mask, consider intubation if respiratory assistance needed
4. Initiate ECG monitoring
5. Collect finger stick blood glucose. If glucose < 60 mg/dl then
   - Adults: 100 mg thiamine IV then 50 ml D50W IV
   - Children ≥ 2 years: 2 ml/kg D25W IV
   - Children < 2 years: 4 ml/kg D12.5W
6. Attempt IV access and collect electrolytes, hematology, toxicology screen, (if appropriate) anticonvulsant drug levels

Does Seizure continue?

Yes

A benzodiazepine is the initial therapy of choice (Level A):
Choose one of the following 3 equivalent first line options with dosing and frequency:
- Intramuscular midazolam (10 mg for > 40 kg, 5 mg for 13-40 kg, single dose, Level A) OR
- Intravenous lorazepam (0.1 mg/kg/dose, max: 4 mg/dose, may repeat dose once, Level A) OR
- Intravenous diazepam (0.15-0.2 mg/kg/dose, max: 10 mg/dose, may repeat dose once, Level A)

If none of the 3 options above are available, choose one of the following:
- Intravenous phenobarbital (15 mg/kg/dose, single dose, Level A) OR
- Rectal diazepam (0.2-0.5 mg/kg, max: 20 mg/dose, single dose, Level B) OR
- Intranasal midazolam (Level B), buccal midazolam (Level B)

Does seizure continue?

No

5-20 min Initial therapy phase

20-40 min Second therapy phase

40-60 min Third therapy phase

If patient at baseline, then symptomatic medical care

If patient at baseline, then symptomatic medical care

If patient at baseline, then symptomatic medical care.

If patient at baseline, then symptomatic medical care.

There is no evidence based preferred second therapy of choice (Level U):
Choose one of the following second line options and give as a single dose
- Intravenous fosphenytoin (20 mg PE/kg, max: 1500 mg PE/dose, single dose, Level U) OR
- Intravenous valproic acid (40 mg/kg, max: 3000 mg/dose, single dose, Level B) OR
- Intravenous levetiracetam (60 mg/kg, max: 4500 mg/dose, single dose, Level U)

If none of the options above are available, choose one of the following (if not given already)
- Intravenous phenobarbital (15 mg/kg, max dose, Level B)
Propofol infusion (class II/III)

• 2012 guidelines - contraindicated in young children
• Consider vasopressors to maintain BP
• Propofol infusion syndrome:
  – Severe metabolic acidosis
  – Rhabdomyolysis
  – Heart failure
  – Renal failure
  – Hepatomegaly
  – Death
Other

• Naloxone 0.1mg/kg/dose IV, IM SQ
• Pyridoxine 50-100mg IV/IM – dependency, deficiency or INH tox
• Antibiotics – if meningitis considered
To treat or not to treat?

• Treatment of the first single unprovoked epileptic seizure does not affect prognosis

• Some children may never have another seizure- 40-50% recurrence

• Recurrence risk factors:
  – Abnormal EEG
  – Seizure while asleep
  – Todd’s paresis
  – Hx of prior febrile seizures
Future directions in treatment for status

• Class III trials support efficacy and safety of valproic acid as first-line therapy, second line and refractory therapy.

• The use of levetiracetam and lacosamide is limited but due to their favorable pharmacokinetics compared to phenobarbital and fosphenytoin future studies may find them helpful as optimal second line therapy for benzodiazepine-resistant status epilepticus
Pyridoxine dependent epilepsy

- Refractory to anticonvulsants
- Give pyridoxine 100mg IV
Conclusions

• We need to figure out the causes the require immediate management
• Think IV alternatives
• Mega workups- not always needed
• Seizure lasting >5 min start Benzos at recommended doses and repeat as needed.
• Fosphenytoin or phenytoin – second line
• Phenobarbital better second line for neonates and tox related seizures