Seizure Emergencies: ARS & New Guidelines for Convulsive Status Epilepticus

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Seizure Emergencies: Emergency Department Epidemiology

- Male: Female = 1.4 : 1
- African American: Caucasians = 1.4 : 1
- Children 1-5 years old most common group
- Infants highest incidence
- Febrile seizures ≈ 1/3 pediatric ED seizures
- Seizures account for
  - 1% of ED visits nationwide
  - 2% of children’s hospitals ED visits
  - Cost of ED care is ~ $1 billion annually (USA)
Spectrum of Seizures

- Recurrent, Unprovoked Seizures
- Isolated Seizures
- Acute Repetitive Seizures (ARS)*
- Prolonged Seizures
- Status Epilepticus (SE)*

*Also known as cluster, crescendo, multiple-recurrent, serial, or sequential seizures
Epidemiology of Acute Repetitive Seizures (ARS)

Approximately 3,000,000 people with epilepsy in the USA. 

30% of people with Treacher Resistant Epilepsy (TRE*)

900,000 people – TRE*

Approximately 10% of people with TRE* have acute repetitive seizures (ARS)

90,000 people - ARS

* TRE = Treatment Resistant Epilepsy

1Epilepsy Foundation of America (www.epilepsyfoundation.org)

Martinez C et al. Epilepsy Research, 2009; 87:137-143
Epidemiology of Acute Repetitive Seizures (ARS): Age Specific Prevalence

Prevalence – ARS per 10,000

Age (Years)

Martinez C et al. Epilepsy Research, 2009; 87: 137-143
Status Epilepticus: General Treatment Principles

The longer the seizure persists, the more refractory to treatment it will be.
Success of Rectal Diazepam vs. Seizure Duration

Seizure Termination Success Rate

Seizure duration < 15 min.
96%

Seizure duration ≥ 15 min.
57%

Diazepam 10mg

Plasma Concentration – Route of Administration

![Graph showing plasma concentration over time for intramuscular, intravenous, and rectal solution routes.](Moolenaar, Int. J. of Pharm., 1980.)
Bioavailability of Rectal Diazepam Gel (Diastat®)

Bioavailability = 90.4 ± 9.0%
Range = 71-110%

N = 18

IM Diazepam

FULL-LENGTH ORIGINAL RESEARCH

A double-blind, randomized, placebo-controlled trial of a diazepam auto-injector administered by caregivers to patients with epilepsy who require intermittent intervention for acute repetitive seizures

*Basel Abou-Khalil, †James Wheless, †Joanne Rogen, §Kevin D. Wolter, ¶Glenn C. Pixton, #Rajesh B. Shulda, §Nancy A. Sherman, ¶¶Kenneth Sommerville, §§Veeraindar Goli, and ¶Carl L. Roland

Epilepsia. **(1) 3-9, 2013
doi: 10.1111/epi.2373

GET TO KNOW YOUR (20mg dose) Vanquix Auto-Injector (Diazepam Injection)

1. Locate patient’s injection site.
2. Check Blue Safety Release.
3. Place against the injection site.
4. Push hard against injection site.

CAUTION: Never touch the orange NEEDLE END!

IMPORTANT: Do not remove BLUE SAFETY RELEASE until ready to use.
Out of Hospital Acute Seizures
Treatment: Intranasal (IN) Midazolam vs. Rectal (PR) Diazepam

0.2 mg/kg
IN-Midazolam
(Mucosal Atomization Device)
N=50

0.3 – 0.5 mg/kg
PR-Diazepam
(Diastat R)
N=42

Out of Hospital Acute Seizure Treatment: IN-Midazolam vs. PR-Diazepam

Primary Outcome Measure: Time to seizure cessation

<table>
<thead>
<tr>
<th></th>
<th>IN-MDZ</th>
<th>PR-DZP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 minutes</td>
<td>4.3 minutes</td>
</tr>
<tr>
<td></td>
<td>(median)</td>
<td>(median)</td>
</tr>
<tr>
<td></td>
<td>(NS)</td>
<td></td>
</tr>
</tbody>
</table>

Secondary Outcome Measure: Total seizure time

<table>
<thead>
<tr>
<th></th>
<th>IN-MDZ</th>
<th>PR-DZP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.5 minutes</td>
<td>12.5 minutes</td>
</tr>
<tr>
<td></td>
<td>(median)</td>
<td>(median)</td>
</tr>
<tr>
<td></td>
<td>(NS)</td>
<td></td>
</tr>
</tbody>
</table>

- No differences for: need for EMT, ED visit; respiratory complications; repeat seizures; ED disposition.
- IN-MDZ easier to give, caretakers liked.

FDA Criteria for Nasal Delivery (IN) of Medication (Spray Characterization):

- Single actuation content delivered through activation life
- Droplet size distribution
- Spray pattern
- Plume geometry
- Priming & re-priming

http://www.fda.gov/cder/guidance/index.htm
Guidance for Industry: Nasal Spray & Inhalation Solution, July 2002
FDA Criteria for Nasal Delivery (IN) of Medication (Spray Characterization):

• Single actuation content delivered through activation life
• Droplet size distribution
• Spray pattern
• Plume geometry
• Priming & re-priming

Future Options: IN Diazepam, Midazolam

http://www.fda.gov/cder/guidance/index.htm
Guidance for Industry: Nasal Spray & Inhalation Solution, July 2002
# Benzodiazepine Pharmacokinetics & FDA Approval

## Lipid Solubility

<table>
<thead>
<tr>
<th></th>
<th>Diazepam</th>
<th>Midazolam</th>
<th>Lorazepam</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution</strong> (T½, min)</td>
<td>1-4</td>
<td>2 – 4</td>
<td>9 - 10</td>
</tr>
<tr>
<td><strong>Elimination</strong> (T½, hr)</td>
<td>24-48</td>
<td>0.5 – 4</td>
<td>8 - 25</td>
</tr>
<tr>
<td><strong>Metabolism</strong></td>
<td>CYP2C19</td>
<td>CYP3A4</td>
<td>UGT</td>
</tr>
<tr>
<td><strong>S.E. Indication</strong></td>
<td>Y</td>
<td>N</td>
<td>Y- Adults</td>
</tr>
</tbody>
</table>

Cloyd J. J Child Neurol, 2007; 22(5): 475 – 525. PDR
New-Onset Seizure Duration in Children

- There is a subgroup of children with prolonged seizures.
  - If the seizure lasts 7 minutes, it will likely continue (and be prolonged).

- The longer a seizure lasts, the less likely it is to stop spontaneously.
  - This occurs at about 10-15 minutes (duration).

- The duration of a second seizure correlates with the initial seizure duration (p<0.0001).

Status Epilepticus: Definitions

- **Epidemiologic:** > 30 minutes \(^1\)
- **Practical:** > 5 minutes \(^2\)
- **Mechanistic:** Failure of inhibitory pathways (GABA) that turn off seizures \(^3\)

\(^1\) Dodson WE et al, JAMA, 1993; 270: 854-859.
\(^2\) Lowenstein DH et al, Epilepsia; 1999; 40: 120-122.
## Precipitants of Status Epilepticus in Children

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever/Infection</td>
<td>35.7%</td>
</tr>
<tr>
<td>Medication Change</td>
<td>19.6%</td>
</tr>
<tr>
<td>Unknown</td>
<td>9.3%</td>
</tr>
<tr>
<td>Metabolic</td>
<td>8.2%</td>
</tr>
<tr>
<td>Congenital</td>
<td>7.0%</td>
</tr>
<tr>
<td>Anoxia</td>
<td>5.3%</td>
</tr>
<tr>
<td>CNS Infection</td>
<td>4.8%</td>
</tr>
<tr>
<td>Trauma</td>
<td>3.5%</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>3.3%</td>
</tr>
<tr>
<td>Ethanol/Drug-related</td>
<td>2.4%</td>
</tr>
<tr>
<td>Tumor</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

*Greater Richmond Status Epilepticus Study, DeLorenzo et al. 1992*
Precipitants of Status Epilepticus in Children

CHILDREN <16 Years

- Fever/Infection: 35.7%
- Medication Change: 19.6%
- Unknown: 9.3%
- Metabolic: 8.2%
- Congenital: 7.0%
- Anoxia: 5.3%
- CNS Infection: 4.8%
- Trauma: 3.5%
- Cerebrovascular: 3.3%
- Ethanol/Drug-related: 2.4%
- Tumor: 0.7%

Etiology of first febrile S.E.:
- 12% due to bacterial meningitis
- 8% due to viral encephalitis

Other than etiology, what key factor correlates with outcome in the treatment of status epilepticus?
Status Epilepticus Data Base

% Mortality

Peds    Adults    Peds    Adults
< 1 Hr.  2        6.6     4.6
≥ 1 Hr.  37.5

Status Epilepticus vs. Prolonged Seizures: Mortality

Operational Definition (SE)

Interval in which most seizures spontaneously stop

Optimum interval to initiate rescue therapy

Epidemiological, Pathophysiologial, & Outcome Definition (SE)

Time after seizure onset (in minutes)
Phases of Status Epilepticus

- Impending Status Epilepticus
  - 5 minutes
  - Treat before E.D.

- Established Status Epilepticus
  - 30 minutes
  - E.D.

- Refractory Status Epilepticus
  - ICU

Phases of Status Epilepticus

Impending Status Epilepticus

Established Status Epilepticus

Refractory Status Epilepticus

5 minutes

30 minutes

Treat before E.D.

E.D.

ICU

Benzodiazepine → Standard AED → Anesthetic agents

AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Background

- 1993, Epilepsy Foundation of America convened working group (thru PAB) to develop treatment protocol (consensus-based) for convulsive status epilepticus.¹

- Over last 20 years, new therapies, new data.

- Change to evidence-based guidelines.

- 2004, EFA began to re-evaluate literature, completed task with the support of AES.²

¹Recommendations of the EFA’s working group on SE. JAMA, 1993, 270 (7): 854-859.
²Glauser TA et al, 2014.
AES Review: Treatment of Convulsive SE in Adults and Children

Results:

- Search dates 1/1/1940 to 2/29/2012

- 22 randomized controlled trials
  - 3 = Class I evidence
  - 1 = Class II evidence
  - 18 = Class III evidence

- 5 questions addressed

Glauser TA et al, 2014
AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Q1. Which anticonvulsants are efficacious as initial and subsequent therapy?

Q2. What adverse events are associated with anticonvulsant administration?

Q3. Which is the most effective benzodiazepine?

Q4. Is IV fosphenytoin more effective than IV phenytoin?

Q5. When does anticonvulsant efficacy drop significantly (i.e., after how many different anticonvulsants does status epilepticus become refractory)?
Q2. What adverse events are associated with anticonvulsant administration?

Adults
- IV anticonvulsant: respiratory, cardiac symptoms
- Respiratory symptoms fewer in benzodiazepine vs. placebo treated patients (i.e., respiratory problems are consequence of untreated S.E.)
- No difference in cardiorespiratory AEs between phenobarbital and benzodiazepines.

Children
- Fewer AEs than adults
- Respiratory depression is most common
- No difference for MDZ, LRZ, DZP (as relates to respiratory symptoms)
GABA$_A$ Receptor

Prehospital Treatment of Status Epilepticus (PHTSE): IV- DZP vs IV- LRZ vs IV- Placebo

**Design:**

Convulsive Seizure > 5 min.
Age ≥ 18 Yrs

Jan 4, 1994 – Jan 31, 1999
N=205

IV Diazepam (5mg), MR x 1
IV Placebo, MR x 1
IV Lorazepam (2mg), MR x 1

Alldredge BK et al. NEJM, 2001; 345 (9): 631-637
Prehospital Treatment of Status Epilepticus: IV- DZP vs IV- LZP vs IV- Placebo

Results:

<table>
<thead>
<tr>
<th></th>
<th>Lorazepam</th>
<th>Diazepam</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Outcome:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination S.E. by</td>
<td>59.1%</td>
<td>42.6%</td>
<td>21.1% (p=0.001)</td>
</tr>
<tr>
<td>ED arrival</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Outcome:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out of Hospital</td>
<td>10.6%</td>
<td>10.3%</td>
<td>22.5% (p=0.08)</td>
</tr>
<tr>
<td>Complications (↓ BP, ↓ R)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alldredge BK et al. NEJM, 2001; 345 (9): 631-637
# Acute Overdose with Oral Diazepam

<table>
<thead>
<tr>
<th>Author, Yr.</th>
<th>Institution</th>
<th>Diazepam Dose (mg)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hillyer 1965(^2)</td>
<td>Australia (N=1)</td>
<td>250 mg (50 yr., m)</td>
<td>None Ventilated</td>
</tr>
<tr>
<td>Greenblatt 1977(^1) (1962-1975)</td>
<td>Mass. Gen Hospital N=773, 99- Benzodiazepine N=12, Benzodiazepine Alone</td>
<td>Up to 400 mg (31 yr., m)</td>
<td>None Ventilated All Discharged Within 2 Days.</td>
</tr>
<tr>
<td>Jatlow 1979(^3)</td>
<td>Yale; 10/68 to 7/75 N = 93, DZP N = 38 DZP Alone</td>
<td>Up to 600 mg (Levels 1000 to 9000 ng/ml)</td>
<td>None Ventilated All Released From ED</td>
</tr>
<tr>
<td>Busto 1980(^4)</td>
<td>21 Toronto Hospitals N = 1201 Benzodiazepines N=344 Benzo Alone (most DZP)</td>
<td>Not given</td>
<td>335/344 Alert or Only Drowsy</td>
</tr>
<tr>
<td>Divoll 1981(^5)</td>
<td>Mass. Gen Hospital &amp; Hosp. Santa Cabrini (Montreal) 1978 – 1980 N=18, 4 DZP Alone</td>
<td>Up to 750 mg (Levels up to 4792 ng/ml)</td>
<td>None Ventilated Discharged Within 24 Hours</td>
</tr>
</tbody>
</table>

---

Q3. Which is the most effective benzodiazepine?

**Adults**
- IV LRZ = IV DZP
- IM MDZ > IV LRZ

**Children**
- If No IV access: IM-MDZ > PR-DZP
- IV LRZ slightly > IV DZP
Hospital Treatment of Pediatric Status Epilepticus: IV- DZP vs IV- LRZ

**Design:**

Convulsive Seizure > 5 min.

Age 3 months to < 18 Yrs

Mar 1, 2008 – Mar 14, 2012

N= 273

- IV Diazepam 0.2 mg/kg (max 8mg), MR x ½ dose in 5 min
- IV Lorazepam 0.1 mg/kg (max 4 mg), MR x ½ dose in 5 min

Both medicines given by IVP over 1 minute, second dose at 5 min if still convulsing, IV fosphenytoin at 12 min

# Hospital Treatment of Pediatric Status Epilepticus: IV- DZP vs IV- LZP

## Results:

<table>
<thead>
<tr>
<th></th>
<th>Lorazepam (N=133)</th>
<th>Diazepam (N=140)</th>
</tr>
</thead>
</table>

### Primary Outcomes:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Lorazepam</th>
<th>Diazepam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Termination of S.E.</td>
<td>72.9%</td>
<td>72.1%</td>
</tr>
<tr>
<td>(Seizures stop within 10 min, &amp; no seizures for 30 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assisted Ventilation</td>
<td>17.6%</td>
<td>16.0%</td>
</tr>
</tbody>
</table>

### Secondary Outcomes:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Lorazepam</th>
<th>Diazepam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrence of GTC Within 60 Min</td>
<td>10.3%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Sedation</td>
<td>66.9%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Prehospital Status Epilepticus Therapy: Intravenous Lorazepam vs. Intramuscular Midazolam (Rapid Anticonvulsant Medication Prior to Arrival Trial: RAMPART)

**Design:**

Convulsive Seizure > 5 min. (Wt. ≥ 13 kg.)
- N = 893 (1/6 Pediatrics)

- 4314 Paramedics
- 33 EMS Agencies
- 79 Hospitals

(Neurologic Emergencies Treatment Trials (NETT) Network)

Silbergleit R et al. NEJM, 2012; 366(7): 591-600
# Prehospital Status Epilepticus Therapy: IV Lorazepam vs. IV Midazolam

## Results:

**Primary Outcome:**
- **IM-MDZ**
  - Seizures Terminated: 74.9%
- **IV-LRZ**
  - Seizures Terminated: 64.3%

**Secondary Outcomes:**
- Intubation within 30 min after ED arrival:
  - IM-MDZ: 14.6%
  - IV-LRZ: 14.3%
- Recurrent seizures within 12 hr after ED arrival:
  - IM-MDZ: 10.2%
  - IV-LRZ: 10.5%
- Hospital admission (N):
  - IM-MDZ: 204
  - IV-LRZ: 243 (p=0.01)
- Time from opening box to cessation convulsion (min):
  - IM-MDZ: 4.5
  - IV-LRZ: 6.4

Silbergleit R et al. NEJM, 2012; 366(7): 591-600
EpiPen
Alsuma Auto-Injector
Intramuscular (IM) Auto-Injector
Diazepam 10 mg: IM vs. PR
Mean Plasma Concentrations - Time Curve

DZ = diazepam; IM = intramuscular; IR = ‘ideal’ rectal; RR = ‘real’ rectal.

Fosphenytoin vs. Phenytoin

- Fosphenytoin vs. Phenytoin

Cerebyx

Dilantin
AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Q4. Is IV Fosphenytoin more effective than IV phenytoin?

- No studies have compared efficacy
- Fosphenytoin is bioequivalent to phenytoin
- Fosphenytoin has better tolerability
## Intravenous Antiepileptic Drugs

<table>
<thead>
<tr>
<th>AED</th>
<th>Approval for S.E.</th>
<th>RCT in S.E.</th>
<th>Open Label Use in S.E.</th>
<th>Rapid Infusion Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenobarbital</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fosphenytoin</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Valproate</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Levetiracetam</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lacosamide</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brivaracetam</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Q5. When does anti-convulsant efficacy drop significantly (i.e., after how many different anti-convulsants does status epilepticus become refractory)?

Only VA status epilepticus trial addressed this question

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AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Q1. Which anticonvulsants are efficacious as initial and subsequent therapy?

Q2. What adverse events are associated with anticonvulsant administration?

Q3. Which is the most effective benzodiazepine?

Q4. Is IV fosphenytoin more effective than IV phenytoin?

Q5. When does anticonvulsant efficacy drop significantly (i.e., after how many different anticonvulsants does status epilepticus become refractory)?
Guidelines for Therapy of Status Epilepticus

1. Have a plan. Do ABCs first.
2. Treat hyperthermia.
3. Treat intravenously.
4. Therapeutic endpoint is cessation of convulsions.
Proposed Treatment Algorithm

Time Line | Interventions
--- | ---
0– 5 Minutes | 1. Stabilize patient (ABC, neurology exam)

2. Time seizure, monitor vital signs

3. If in ED or Hospital setting:
   - Assess oxygenation, give O₂ via nasal cannula or mask & consider intubation if respiratory assistance is needed.
   - Initiate ECG monitoring
   - Collect finger stick blood glucose
AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Proposed Treatment Algorithm

Time Line

3 – 5 Minutes

Interventions

1. Attempt IV access & collect electrolytes, hematology, toxicology screen & AED levels.

2. If glucose < 60 mg/dl:
   - Adults: 100 mg thiamine then 50 ml D50W IV
   - Children ≥ 2 yrs: 2 ml/kg D25W IV
   - Children ≤ 2 yrs: 4 ml/kg D12.5W IV
AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Proposed Treatment Algorithm

**Time Line**

5 – 30 Minutes

**Interventions**

IV Access Available

YES

Preferred Pathway
1. LRZ  2. Fos-PHT

Alternative Pathway 1
1. DZP+Fos-PHT  2. LRZ

Alternative Pathway 2
1. PB  2. Fos-PHT

NO

Establish IV access. If seizure continues, give Fos-PHT

Preferred Pathway
IM MDZ

Alternative Pathway 1
PR DZP

Alternative Pathway 2
IN/Buccal MDZ
AES Review: Treatment of Convulsive Status Epilepticus in Adults and Children

Proposed Treatment Algorithm

**Time Line**

30 – 60 Minutes

**Interventions**

YES

Seizure Continues

If patient at baseline, then symptomatic medical care

NO

Patient poorly responsive or has altered mental status: beside EEG to clarify

UNSURE

Administer anesthetic doses of pentobarbital, propofol or midazolam
# Refractory Status Epilepticus: Midazolam vs. Propofol vs. Pentobarbital (Meta-Analysis)

<table>
<thead>
<tr>
<th></th>
<th>Midazolam (N=54)</th>
<th>Propofol (N=33)</th>
<th>Pentobarbital (N=106)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Treatment Failure</strong></td>
<td>20% (11)</td>
<td>27% (9)</td>
<td>8% (8)</td>
</tr>
<tr>
<td><strong>Seizure Recurrence</strong></td>
<td>51% (23)</td>
<td>15% (2)</td>
<td>12% (11)</td>
</tr>
<tr>
<td><strong>Ultimate Treatment Failure</strong></td>
<td>21% (10)</td>
<td>20% (4)</td>
<td>3% (3)</td>
</tr>
<tr>
<td><strong>Hypotension – vasopressors needed</strong></td>
<td>30% (14)</td>
<td>42% (10)</td>
<td>77% (79)</td>
</tr>
</tbody>
</table>

Claassen J et al, Epilepsia, 2002; 43: 146-153
Receptor Trafficking in Transition from a Single Seizure to Status Epilepticus

Chen J.W.Y., Wasterlain C.G.; Lancet Neurol, 2006;5 (3): 246 - 256

GABA_A Receptors

NMDA Receptors
Morbidity & Mortality of Pediatric Status Epilepticus

Mortality Associated With Status Epilepticus

SE in the Richmond, Virginia metro area: 41 SE events per year per 100,000 population.\(^1\)

<table>
<thead>
<tr>
<th></th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>3%</td>
</tr>
<tr>
<td>Adults</td>
<td>26%</td>
</tr>
<tr>
<td>Total</td>
<td>22%</td>
</tr>
</tbody>
</table>

Extrapolated to 126,000 to 195,000 SE events, 22,000 to 42,000 deaths per year in the US.\(^1\)

Mortality rate and seizure duration\(^2\):

- 10-29 minutes: 3%
- ≥30 minutes: 19%

Mortality After Initial Pediatric Status Epilepticus

Logroscino G et al, Epilepsia, 1997; 38: 1344-1349.
Status Epilepticus: Think Time

• **Time** to treatment needs to be shorter.
• Response to treatment is **time** dependent.
• Morbidity and mortality are related to etiology and **duration (time)** of status epilepticus.
• Subsequent epilepsy may depend on the **duration (length of time)** of the status epilepticus.
• **Prolonged** seizures predict future **prolonged** seizures.
Status Epilepticus

This is a medical emergency.
Have a treatment plan.
You can do it.

Stay calm.

All children with epilepsy should have an individualized emergency plan in place.
Questions?