UNM Neonatal & Pediatric Status Epilepticus Pathway

Indication: neonates - 18 years with:
- seizure > 5 minutes in duration OR
- recurrence of seizure without return to baseline

**Stabilization Phase**
- POC Glucose
- Order if applicable:
  - iStat (VBG and electrolytes)
  - Chem10
  - CBC
  - Calcium (total and ionized)
  - Magnesium
  - Head CT or MRI
- Oxygen
- Utox
- LP (especially if <2 years, immune suppressed, or recent antibiotics)
- Blood cx, UA, Urine cx
- AED Levels – valproic acid, phenytoin, phenobarbital, levetiracetam

**Time from seizure onset**
- 0-5 minutes

**First Line Therapy**
- Did patient already receive appropriate 1st dose of benzodiazepine?
- If yes, proceed to Refractory Pathway
- If no, continue with 2nd line therapy
- If seizure continues give 2nd benzodiazepine 5 minutes from 1st dose

**Route** | **Drug** | **Dose** | **Maximum**
--- | --- | --- | ---
IntraVENOUS | lorazepam | 0.1 mg/kg | 4 mg
IntraNASAL | midazolam | 0.2 mg/kg | 10 mg
IntraMUSCULAR | midazolam | • 5 mg if 13-40 kg
• 10 mg if > 40 kg | 10 mg

**Route** | **Drug** | **Dose** | **Maximum**
--- | --- | --- | ---
IntraVENOUS/IntraOSSEOUS | lorazepam | 0.1 mg/kg | 4 mg
IntraMUSCULAR | midazolam | • 5 mg if 13-40 kg
• 10 mg if > 40 kg | 10 mg

**Second Line Therapy**
- If clinical seizure continues

**Route** | **Drug** | **Dose** | **Maximum** | **Level**
--- | --- | --- | --- | ---
IntraVENOUS | Levetiracetam | 60 mg/kg | 4500 mg | N/A
IntraVENOUS | Fosphenytoin | 20 mg/kg | 1500 mg | 2 hours after Load
IntraVENOUS | Valproic Acid | 40 mg/kg | 3000 mg | 2 hours after Load
IntraVENOUS | Phenobarbital 1st line for 0-1 month old | 20 mg/kg | 1000 mg | 2 hours after Load

**REFERENCES:**
UNM Neonatal & Pediatric Status Epilepticus Pathway
Refractory Status Epilepticus

40 minutes from seizure onset

TRANSFER TO PICU if seizure continues
Start midazolam infusion

MIDAZOLAM INFUSION

- Bolus: 0.2 mg/kg
  Max 10 mg
- Start infusion at 0.1 mg/kg/h

If seizure continues

If seizure recurs

WEAN:
- Decrease rate by 0.05 mg/kg/h q 6 hours

PENTOBARBITAL INFUSION

- Bolus: 5 mg/kg over 30 minutes
- Repeat as needed to burst suppression IBI 10 seconds, up to 30 mg/kg (6 boluses total)

ONCE BURST SUPPRESSION IS ACHIEVED:
- Start infusion at 1.0 mg/kg/h
- Stop midazolam infusion

If seizure continues

WEAN:
- Decrease rate by 0.5 mg/kg/h q 6 hours

- Increase infusion by 0.5 mg/kg/h as needed to maintain BS

Notes:
- Monitor serum levels
- Max rate: 5 mg/kg/h
- If IBI becomes prolonged, hold infusion until IBI < 20 seconds, then resume infusion at dose 0.5 mg/kg/h less than previous dose

Seizure cessation

Continue infusion until 24-48 hours seizure-free

REFERENCES:
4. Phelps S, Pediatric Injectable Drugs, 2013

40 minutes from seizure onset

TRANSFERS TO PICU if seizure continues
Start midazolam infusion

MIDAZOLAM INFUSION

- Bolus: 0.15 mg/kg AND Increase infusion rate by 0.05-0.1 mg/kg/h [Repeat bolus and rate-increase q 15 minutes until seizure cessation]

Notes:
- If a rate of 1 mg/kg/h fails to control seizures for >30 minutes, advance to next agent
- No max rate reported; note that rates above 50 mg/h OR 2 mg/kg/h have been used in adults

Seizure cessation

Continue infusion until 24-48 hours seizure-free

If seizure continues

PENTOBARBITAL INFUSION

- Bolus: 5 mg/kg over 30 minutes
- Repeat as needed to burst suppression IBI 10 seconds, up to 30 mg/kg (6 boluses total)

ONCE BURST SUPPRESSION IS ACHIEVED:
- Start infusion at 1.0 mg/kg/h
- Stop midazolam infusion

If seizure continues

WEAN:
- Decrease rate by 0.5 mg/kg/h q 6 hours

- Increase infusion by 0.5 mg/kg/h as needed to maintain BS

Notes:
- Monitor serum levels
- Max rate: 5 mg/kg/h
- If IBI becomes prolonged, hold infusion until IBI < 20 seconds, then resume infusion at dose 0.5 mg/kg/h less than previous dose

Seizure cessation

Continue infusion until 48 hours seizure-free

If seizure continues
# UNM Pediatric Status Epilepticus Pathway

Super refractory status epilepticus treatment options

## KETAMINE INFUSION
(Continue midazolam infusion, see below)

- IV Bolus: 2.5 mg/kg x 2 q 5 minutes
- Start IV infusion at 0.5 mg/kg/h
- Decrease midazolam infusion to 0.05 mg/kg/h q 6 h

- Increase rate by 0.5 mg/kg/h every 15 minutes as needed to achieve resolution of clinical and/or electrographic seizures
- Continue Ketamine infusion until 48 hours seizure-free
- Wean by 0.5 mg/kg/h q 6 h

**Notes**
- Max rate: 3.5 mg/kg/h
- Doses as high as 10 mg/kg/h have been used in adults

**Reference:**

## LACOSAMIDE BOLUS

### Weight ≤40 kg
- IV Bolus: 10 mg/kg
- Maintenance: 10 mg/kg/day div BID (start 12 hours later)

### Weight >40 kg
- IV Bolus: 400 mg
- Maintenance: 200 mg bid

**Notes**
- Max maintenance dose: 14 mg/kg/day
- Max infusion rate: 60 mg/min

**Reference:**
- Phelps S, *Pediatric Injectable Drugs*, 2013
- Hoffer J, Intravenous lacosamide in status epilepticus and seizure clusters, *Epilepsia* (2011)

## PROPOFOL INFUSION

- IV Bolus: 3 mg/kg
- Start infusion at 50 mcg/kg/min
- Stop midazolam infusion

- Increase rate by 8 mcg/kg/min every 15 minutes as needed to achieve burst suppression (goal 1 BI 10 seconds)
- Once burst suppression is achieved → continue infusion for 24 hours → wean to 50% max rate for 6-12 hours → wean to 25% max rate for 6-12 hours → stop

- Monitor ABG, LFTs, CK q 6 x 24 hours, then q12

**Notes**
- Max duration: 48 hours
- Max dose: 300 mcg/kg/min
- **Contraindications:** ketogenic diet, metabolic disorder, egg allergy

**Reference:**
- Phelps S, *Pediatric Injectable Drugs*, 2013

## VALPROIC ACID INFUSION

- IV Bolus: 20-40 mg/kg, then start infusion
  - Obtain level 1 hour after bolus
- Start infusion
  - Rate: 1 mg/kg/h
  - With PHENOBarbital or phenytoin, rate: 2 mg/kg/h
  - With PENTOBarbital, rate: 4 mg/kg/h
- Increase rate by 1 mg/kg/h as needed to achieve serum concentration (80-100 mg/L)
  - Obtain level 2 hours after rate increase

**Notes**
- Max rate: 6 mg/kg/h
- Wean: 1 mg/kg/h q 2 hours
- Contraindicated if suspected or known metabolic disease, caution in children <2 years

- Monitor CBC, CMP daily

**Reference:**
- Phelps S, *Pediatric Injectable Drugs*, 2013

## TOPIRAMATE BOLUS

- Enteral Bolus: 5 mg/kg
- Maintenance: 5 mg/kg/day div BID (start 12 hours later)

**Notes**
- **CAUTION** if patient has acidosis
- Seizure-free after 24 hours: Continue 5 mg/kg/day div BID
- Seizures continue after 24 hours: Increase dose by 5 mg/kg/day q day
- Max dose reported in children: 25 mg/kg/day
- Max dose reported in adults: 1600 mg/day

- Monitor BMP daily

**Reference:**
UNM Pediatric Status Epilepticus Pathway
Super refractory status epilepticus treatment options

**IMMUNOTHERAPY**

**METHYLPREDNISONE**
- 30 mg/kg/day IV x 3 days

**IMMUNOGLOBULINS**
- 1 gm/kg x 2 days

**PLASMA EXCHANGE**
- 5 exchanges
- Frequency: every other day

Notes
- Ensure all auto-antibody/infectious titers are drawn prior to administration

If an autoimmune or paraneoplastic etiology is confirmed and patient is not responding to above treatments, consider rituximab or cyclophosphamide.

Reference:

**KETOGENIC DIET**

<table>
<thead>
<tr>
<th>Step 1: Draw Screening Labs</th>
<th>Step 2: Develop a Feeding Plan</th>
<th>Step 3: Diet Initiation</th>
<th>Step 4: Diet Monitoring</th>
<th>Step 5: Discharge Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>-CBC</td>
<td>Estimate caloric needs:</td>
<td>Remove all dextrose from fluids</td>
<td>BMP, Mg, Phos daily</td>
<td>If weaning diet, can decrease by 0.5:1 ratio every week until negative urine ketones then resume a regular diet</td>
</tr>
<tr>
<td>-CMP</td>
<td>For intubated patients: Use the BMR (see below)</td>
<td>Change all medications to low-carbohydrate forms</td>
<td>UA q8hrs until 4+ ketones then q12hrs</td>
<td></td>
</tr>
<tr>
<td>-Mg and Phos</td>
<td>For extubated patients: Use the BMR x 1.2-1.4</td>
<td>Slowly advance continuous feeds to goal and condense feeds further as tolerated</td>
<td>Blood glucose q4hrs until 4+ ketones then q8hrs</td>
<td></td>
</tr>
<tr>
<td>-Plasma acylcarnitine profile</td>
<td>Estimate fluid needs: 0-10 kg: 100 mL/kg/day</td>
<td>CO2 level</td>
<td>If on carbonic anhydrase inhibitor</td>
<td></td>
</tr>
<tr>
<td>-Urine organic acids</td>
<td>10-20 kg: 1000mL + 50mL/kg/day</td>
<td>1 mEq/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Plasma amino acids</td>
<td>20-40 kg: 1500mL + 20mL/kg/day</td>
<td>16</td>
<td>1 mEq/kg</td>
<td></td>
</tr>
<tr>
<td>-Free and total carnitine</td>
<td>&gt;40kg: use adult fluid needs</td>
<td>13-15</td>
<td>2 mEq/kg</td>
<td></td>
</tr>
<tr>
<td>-25-hydroxy vitamin D3</td>
<td>Determine starting ratio:</td>
<td>&lt;12</td>
<td>3 mEq/kg</td>
<td></td>
</tr>
<tr>
<td>-Zn and Se</td>
<td>&lt;18 months: Initiate at 3:1 ratio and adjust as needed</td>
<td>Determine formula recipe: Ketocal 4:1 liquid is 1.5 kcal/mL</td>
<td>Ketocal 4:1 or 3:1 powder is 7 kcal/g</td>
<td>Blood sugar Intervention</td>
</tr>
<tr>
<td></td>
<td>&gt;18 months: Initiate at 4:1 ratio and adjust as needed</td>
<td>(Displacement: 1mL/g)</td>
<td>1. Give 15-30 mL of juice PD (or 3-5 oz unflavored Pedialyte via tube)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Determine formula recipe:</td>
<td>Ketocal 4:1 liquid is 1.5 kcal/mL</td>
<td>2. Wait 15 min &amp; recheck blood sugar levels. If &lt;40 mg/dL give an additional 15 mL juice (or 3 oz Pedialyte) &amp; recheck blood sugar until &gt;40 mg/dL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ketocal 4:1 or 3:1 powder is 7 kcal/g</td>
<td>(Displacement: 1mL/g)</td>
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