



Emergency Neurological Life Support Status Epilepticus Protocol Version 4.0

Authors

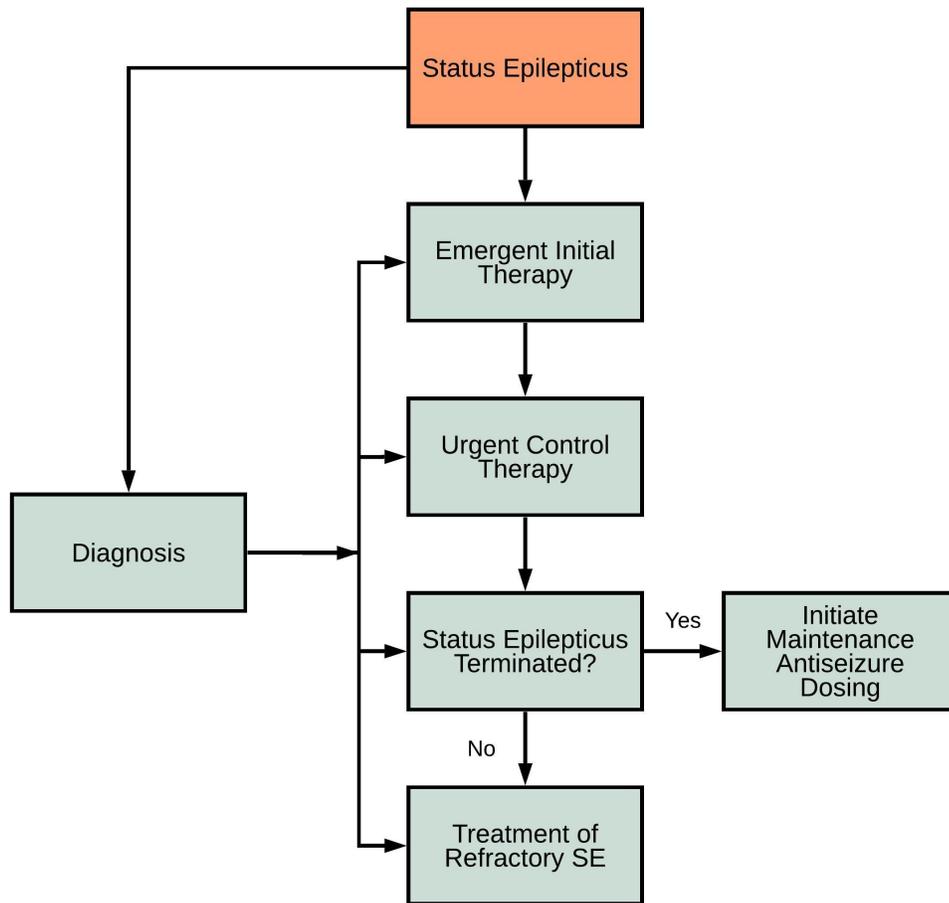
Karen Berger, PharmD, FCCM, BCPS, BCCCP
Joshua N. Goldstein, MD, PhD
A.M. Iqbal O'Meara, MD
Sarah Peacock, DNP, APRN, ACNP-BC

Last updated: October 2019

Protocol developed by:

Karen Berger, PharmD, FCCM, BCPS, BCCCP
Joshua N. Goldstein, MD, PhD

Status Epilepticus Algorithm



Checklist & Communication

Checklist

- Fingerstick glucose
- Obtain IV access
- Monitor pulse oximetry, BP, cardiac rhythm.
- Provide supplemental O₂ and fluids as needed
- Order labs: complete blood count, basic metabolic panel, calcium, magnesium, HCG in females of childbearing age, antiseizure drug levels
- Head CT as needed
- Continuous EEG (if available); notify EEG tech if available (as soon as available unless patient returns to pre-seizure baseline)

Communication

- Clinical presentation
- Duration of status epilepticus
- Relevant past medical history/past surgical history
- Prior medications; medication given so far, and outcomes (i.e., seizures resolved after drug X, no effect from drug Y)
- Relevant labs, including antiseizure drug levels if drawn
- Neurological examination
- Brain imaging/LP results/other results (if available)

Sample sign-off narrative

"I am signing out a 55-year-old woman with a known seizure history taking phenytoin and lacosamide at home"

"She presented with a tonic-clonic seizure lasting 5 min"

"EMS was called and she seized again in the ambulance. She received lorazepam 4 mg IV push with cessation of seizure activity"

"In the ED, the patient had 2 additional witnessed seizures. The first resolved spontaneously and the second required lorazepam 4 mg"

"Her last dose of lacosamide and phenytoin were this morning at 9 a.m. A phenytoin level is pending in the lab. She was reloaded with 20 mg/kg (1500 mg) of fosphenytoin"

"Her neuro exam: GCS score is 9, localizes pain in all 4 extremities, nonverbal, eyes"

"She is being transferred to the neuro-ICU for continuous EEG monitoring"

Status Epilepticus

Unremitting seizures

Status Epilepticus: Ongoing seizure activity is injurious to the brain and can cause other organ system problems like pneumonia and sudden death. Making an accurate diagnosis is essential as is the timely administration of antiseizure drugs to terminate the seizure activity.

This protocol gives a practical, step-by-step guide to how status epilepticus can be terminated.

Diagnosis

The clinical definition of status epilepticus is five minutes or more of convulsions or two or more convulsions in a 5-minute interval without return to preconvulsive neurological baseline. However, a patient may be seen to seize, then, when brought into the hospital may not regain consciousness quickly. This too may be status epilepticus and usually requires EEG monitoring to diagnose.

Since emergency medical services (EMS) response times are often 5 minutes or longer, patients found seizing upon EMS arrival may be considered in status epilepticus as well. EEG is necessary to identify non-convulsive SE in patients who do not return to a normal level of consciousness.

The diagnostic workup of status epilepticus should proceed in parallel with emergent initial therapy, urgent control therapy, and treatment of refractory status epilepticus.

Emergent Initial Therapy

Prehospital management

Seizures are most frequently diagnosed outside of the hospital, and EMTs and paramedics are often the first responders. Do the following:

- ABCs, including supportive care if needed (O₂, airway, blood pressure)
- Diagnose hypoglycemia
 - If hypoglycemic give IV dextrose (if an IV is available) or IM glucagon if not

For adults:

- Unless IV access is immediately available, provide midazolam 10 mg IM. Alternatives include diazepam 20 mg PR, buccal midazolam, or nasal midazolam.
- If IV access is immediately available, give IV lorazepam 0.1 mg/kg (up to 4 mg per dose) over 2 min. Alternatives include IV diazepam and clonazepam.

For children:

- >40 kg, IM midazolam 10 mg or IM diazepam 20 mg
- 13-40 kg, IM midazolam 5 mg
- <13 kg, IM midazolam 0.2 mg/kg
- When IV access is available, administer lorazepam IV 0.1 mg/kg up to maximum 4 mg per dose. Alternatives include diazepam 0.15 mg/kg IV up to 10 mg per dose.

Comments:

- Time is control. The most important factor in predicting ease of seizure control is the time elapsed prior to initiating antiseizure drugs. Intramuscular delivery of midazolam can be more rapid and effective than intravenous lorazepam in the prehospital setting.
- Respiratory decompensation is more commonly encountered in untreated status epilepticus than in status epilepticus treated with benzodiazepines.
- Lorazepam needs to be refrigerated or restocked every 60 days. For this reason, it is often impractical for EMS use and diazepam or midazolam are used as alternatives.

Emergency Department Arrival

Once the patient has arrived at the hospital, determine what treatments, if any, have been given to the patient and quickly assess their ability to follow commands. If they are still seizing or have not awakened yet, do the following:

- ABCs, including supportive care if needed (O₂, airway, IV fluids)
- Place on continuous EEG if available
- Monitors: ECG, BP, O₂ saturation, cardiac monitoring, supplemental O₂ as needed
- Obtain IV access
- Perform a rapid focused neurologic exam
- Draw labs: CBC, BMP, CA, Mg, antiseizure drug levels. Additional orders to consider for specific circumstances: Labs: PO₄, LFTs, troponin, toxicology screen (urine and blood), ABG, HCG for women of childbearing age
- Diagnose hypoglycemia: if hypoglycemic give IV dextrose.

In adults with IV access, give:

- Lorazepam 0.1 mg/kg up to 4 mg IV
 - If initial dose is not effective, repeat x1 after 3-5 minutes
 - Alternatives include diazepam 5 mg IV or midazolam 10 mg IM

In children with IV access, give:

- Lorazepam 0.1 mg/kg IV, maximum dose 4 mg
- For children 13-40 kg, an alternative is midazolam 5 mg given IM
- For children 40 kg or larger, an alternative is midazolam 10 mg IM

Comments:

- First line benzodiazepines are frequently under-dosed.
- Initiate a complete workup of the underlying etiology for status epilepticus. Seizures will be difficult to control with antiseizure drugs if they are caused by an underlying uncorrected metabolic problem.
- Consider ECG, chest X-ray
- Consider toxins that can cause seizures: INH (treat with lorazepam followed by pyridoxine 70 mg/kg; max dose 5 gm); tricyclic antidepressants (look for QRS widening on the EKG, treat with sodium bicarbonate); theophylline; cocaine / sympathomimetic; alcohol withdrawal (rarely causes SE, treat with accelerating doses of a benzodiazepine); organophosphates (treat with atropine, midazolam, and pralidoxime)
- Almost any agent in overdose may cause a seizure indirectly if they cause hypoxia, hypotension, or electrolyte (including hypoglycemia) abnormalities

Urgent Control Therapy

If SE continues after 10–20 min of adequate doses of benzodiazepines, and no correctable underlying etiology is found during this time, the next step will typically be to start urgent control therapy with a second-line antiseizure drug.

For adults, choose one of the following:

- Fosphenytoin: load 20 mg/kg IV at up to 150 mg/min
- OR -
- Phenytoin 20 mg/kg IV at up to 50 mg/min
- OR -
- Valproic acid: load: 40 mg/kg IV over 10 min
- OR -
- Levetiracetam: load 1-4.5 g IV

For children, give:

- Fosphenytoin: load 20 mg/kg IV at up to 150 mg/min
- Levetiracetam IV 20-60 mg/kg, not to exceed 1-3 g
- Valproic acid: load 40 mg/kg IV

Status Epilepticus Terminated?

Have the seizures stopped or the patient began following commands?

Status epilepticus is terminated when the patient returns to his/her pre-status responsiveness or there is EEG evidence of seizure cessation. Even if the convulsions have stopped the patient may still be seizing. If the patient does not rapidly awaken following the administration of the first line antiseizure drugs, one should consider the patient still may be seizing.

Initiate Maintenance Antiseizure

Seizures have stopped, and the patient is following commands

The half-life of benzodiazepines is brief and therefore a longer-lasting antiseizure medication should be administered to prevent recurrent seizures.

For adult patients, give:

- Fosphenytoin: load 20 mg/kg IV at up to 150 mg/min
- OR -
- Phenytoin: load 20 mg/kg IV at up to 50 mg/min
- OR -
- Valproic acid: load: 40 mg/kg IV over 10 min
- OR -
- Levetiracetam: load 1-4.5 g IV

For children, give:

- Fosphenytoin: load 20 mg/kg IV at up to 150 mg/min
- Levetiracetam IV 20-60 mg/kg, not to exceed 1-3 g
- Valproic acid: load 40 mg/kg IV

If possible, connect to EEG unless the patient wakes up or returns to pre-convulsive baseline.

Determine the cause of the seizure (prior history of seizures and medication non-compliance, new onset seizure, etc.). Serum levels of antiseizure drugs are useful to determine what threshold the patient with epilepsy has for developing seizures. Urine toxicology screen may be helpful for recreational drug-associated seizures.

In children, CNS infections or underlying genetic or metabolic disorders are more frequently the cause of status epilepticus.

Treatment of Refractory Status Epilepticus

If status epilepticus has still not halted

If the seizures have not stopped despite urgent and emergent drug therapy, SE is considered refractory. Intubation and drug-induced coma are recommended in these circumstances.

For adult patients: If the patient is still having seizures despite benzodiazepines and urgent control therapy, intubate the patient and initiate treatment with one of the following:

- Continuous infusions of midazolam: load: 0.2 mg/kg IV over 2-5 min; repeat 0.2-0.4 mg/kg boluses every 5 minutes until seizures stop, up to a maximum loading dose of 2 mg/kg. Initial rate: 0.1 mg/kg/hour. Bolus and increase rate until seizure control; maintenance: 0.05-2 mg/kg/hour.
 - Continuous infusions of propofol: Load: 1-2 mg/kg IV over 3-5 min; repeat boluses every 3-5 minutes until seizures stop, up to maximum total loading dose of 10 mg/kg. Initial rate: 33 mcg/kg/min. Bolus and increase rate until seizure control; maintenance: 30 – 200 mcg/kg/min.
- OR -
- Add additional antiseizure drug.

Start continuous EEG if not done already.

For children, give:

- Phenobarbital: Load: 20 mg/kg IV at 1 mg/kg min, no faster than 30-60 mg/min
- OR -
- Midazolam 0.2 mg/kg, maximum dose 10 mg. If seizures persist after 5 more minutes, repeat midazolam 0.2 mg/kg (max 10 mg) and start midazolam infusion at 0.1 mg/kg/hour.
 - If seizures persist, start pentobarbital 5-15 mg/kg at a rate of up to 50 mg/min, with repeated 5–10 mg/kg boluses until seizures stop, and then maintenance of 0.5–5 mg/kg/hr.
 - Pentobarbital: Load 5 mg/kg, start infusion 1 mg/kg/hr titrated to EEG burst suppression, usual range 1-3 mg/kg/hr.
 - Continuous EEG monitoring is essential; if not available in your center, consider transfer to a regional center with this capability.

Comments:

- Hypotension is frequently encountered as a side effects of pentobarbital and vasopressors should be readily available. Other side effects include gastric

- stasis, myocardial suppression, thrombocytopenia, metabolic acidosis (several IV antiseizure medications contain polyethylene glycol).
- Titrate antiseizure drugs to therapeutic levels. When checking post-load drug levels, wait at least 2 hours post infusion for fosphenytoin, phenytoin, and valproate.
 - Continue second line antiepileptic medication when starting treatment of refractory status epilepticus.
 - The recommended duration of continuous IV antiepileptic medications is unclear. Once seizures are controlled, many physicians continue treatment for at least 24 hours prior to consideration of weaning medications. Infusions should be weaned gradually and not abruptly discontinued.