Emergency Neurological Life Support
Status Epilepticus Protocol
Version 5.0

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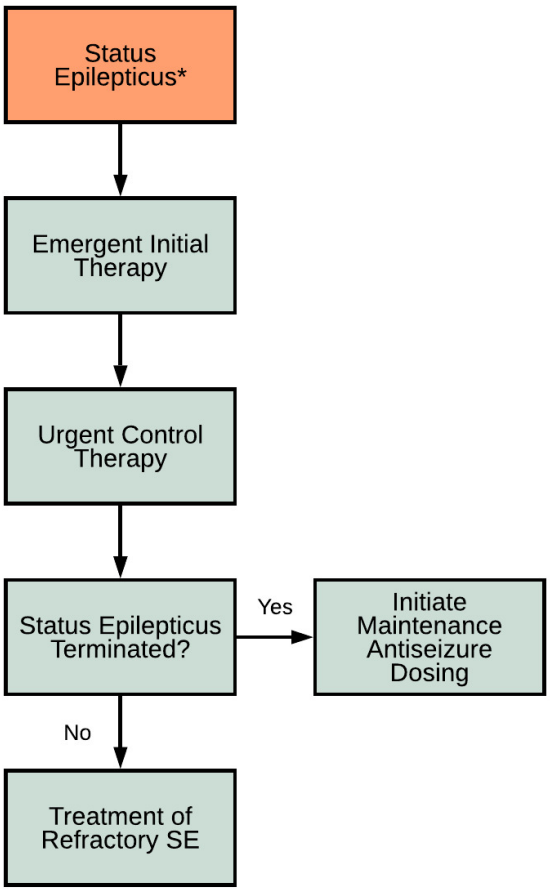
Status Epilepticus Algorithm



**Diagnosis should be made in tandem with treatment of Status Epilepticus*

Checklist

☐ Fingerstick glucose
☐ Obtain IV access
☐ Monitor pulse oximetry, BP, cardiac rhythm
☐ Provide supplemental O_2 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); consider rapid-response EEG with limited montage if continuous EEG is not available

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 open to command. Her head CT was normal."
"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 or functional definition of status epilepticus is five minutes or more of convulsions or two or more convulsions in a 5-minute interval without returning towards 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 towards 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, ensuring that testing does not interfere with or delay control of seizures.

Emergent Initial Therapy

Prehospital management

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

- ABCs, including supportive care if needed (O_2, 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 intranasal 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 IV clonazepam.

For children:

- No IV available: Midazolam intranasal 0.2 mg/kg, maximum dose 10 mg
- When IV access is available, administer lorazepam IV 0.1 mg/kg up to maximum 4 mg per dose. Alternatives include diazepam PR, buccal midazolam, or intramuscular midazolam.

Comments:

- Time is control. The most important factor in predicting successful seizure control is the promptness of 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.

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 (O_2, airway, IV fluids)
- Place on continuous EEG if available
- Monitors: ECG, BP, O_2 saturation, cardiac monitoring, supplemental O_2 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: PO_4, LFTs, troponin, toxicology screen (urine and blood), ABG, HCG for women of childbearing age
- Diagnose hypoglycemia: if hypoglycemic give IV dextrose (do not delay seizure treatment to check glucose)

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 0.15 mg/kg IV (up to 10 mg) or midazolam 10 mg IM

In children with IV access, give:

- Lorazepam 0.1 mg/kg IV, maximum dose 4 mg
- If initial dose is not effective, repeat x1 after 3-5 minutes

In children without IV access:

- Midazolam intranasal 0.2 mg/kg, maximum dose 10 mg
- Alternatives include diazepam PR, midazolam buccal or 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 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 40 mg/kg IV over 10 min

-OR -

- Levetiracetam 60 mg/kg IV (up to 4.5 g)

For children, choose one of the following:

- Fosphenytoin 20 mg/kg IV at up to 150 mg/min

-OR-

- Levetiracetam 60 mg/kg IV

- OR -

- Valproic acid 40 mg/kg IV over 10 min

-OR-

- Phenobarbital 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. In addition, the half-life of benzodiazepines is brief and therefore a longer-lasting antiseizure medication should be administered to prevent recurrent seizures.

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

If possible, determine the cause of the seizure (ie: 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, inflammation, stroke, underlying genetic or metabolic disorders need to be considered as the cause of status epilepticus.

Treatment of Refractory Status Epilepticus

If ongoing seizures despite emergent and urgent therapy

If the seizures have not stopped despite urgent and emergent drug therapy, SE is considered refractory. Intubation and continuous infusion anesthetic 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:

- Midazolam: 0.2 mg/kg IV over 2-5 min; repeat 0.2 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.
  -OR-
- Propofol: 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: 20 mcg/kg/min. Bolus and increase rate until seizure control; maintenance: 30 – 200 mcg/kg/min.
  -OR –
- May consider adding an additional antiseizure drug depending on patient specific factors such as the risk/benefit of intubation

Start continuous EEG if not done already.

For children, give:

- Phenobarbital: 20 mg/kg IV at 1 mg/kg/min
  - OR –
- Midazolam 0.1-0.2 mg/kg; repeat 0.2 mg/kg boluses every 5 minutes until seizures stop. Start midazolam infusion at 0.1-0.2 mg/kg/hour. Rate can be adjusted to achieve seizure control up to 1 mg/kg/hr.
- Additional medications can be considered including pentobarbital. Special consideration for use of propofol for children with or concern for mitochondrial disorders.

Continuous EEG monitoring is essential; if not available in your center, consider transfer to a regional center with this capability.

Comments:

- 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 antiseizure medication when starting treatment of refractory status epilepticus. Consider adding additional second line antiseizure medications based on findings of the continuous EEG.
- The recommended duration of continuous IV antiepileptic medications is unclear. Once seizures are controlled, many providers continue treatment for at least 24 hours prior to consideration of weaning medications. Infusions should be weaned gradually and not abruptly discontinued.