Neurocritical Care Society

ENLS

EMERGENCY NEUROLOGICAL LIFE SUPPORT

NEUROCRITICAL CARE SOCIETY

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ENLS Version 5.0
Status Epilepticus

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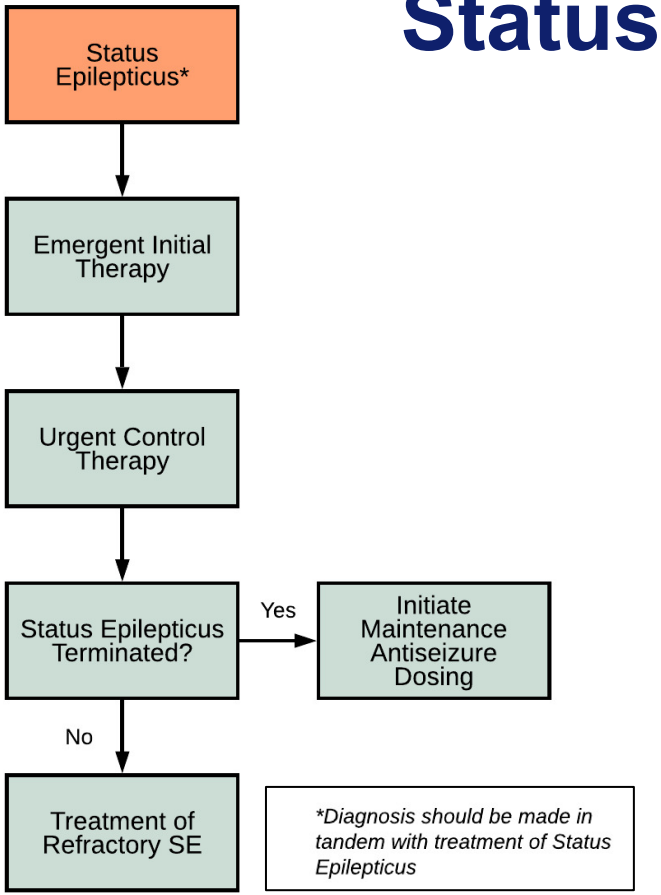
Editors' Note: Global Considerations

The intent of the editors, authors, and reviewers of this ENLS topic was not to address all the variations in international practice for the different diseases. We have discussed major practice variances (e.g., the availability of diagnostic testing, or the type of medications used) and encourage learners to use the ENLS algorithms as a framework on which any relevant local practice guidelines can be incorporated.

Status Epilepticus



Learning Objectives

- Diagnose status epilepticus
- Implement Emergent Initial Therapy
- Implement Urgent Control Therapy
- Identify and treat Refractory Status Epilepticus

Diagnosis of Status Epilepticus

Definition: 5 minutes or more of:

- Continuous seizure activity, OR
- Recurrent seizure activity without return to baseline.

Etiologies of SE

Acute Processes	Chronic Processes
Metabolic disturbances: electrolyte abnormality, renal failure	Epilepsy: breakthrough seizures
Sepsis	Chronic ETOH abuse
CNS infection: meningitis, encephalitis, abscess	CNS tumors
Stroke: ischemic, ICH, SAH	Remote CNS pathology (e.g. stroke, abscess)
TBI	
Drugs (medication NON-ADHERENCE, intoxication, or withdrawal from benzodiazepines, barbiturates, ETOH, and other sedatives)	
Cardiac arrest, hypoxia	
Hypertensive encephalopathy, PRES	
Autoimmune encephalitis, paraneoplastic	

Checklist for the first hour

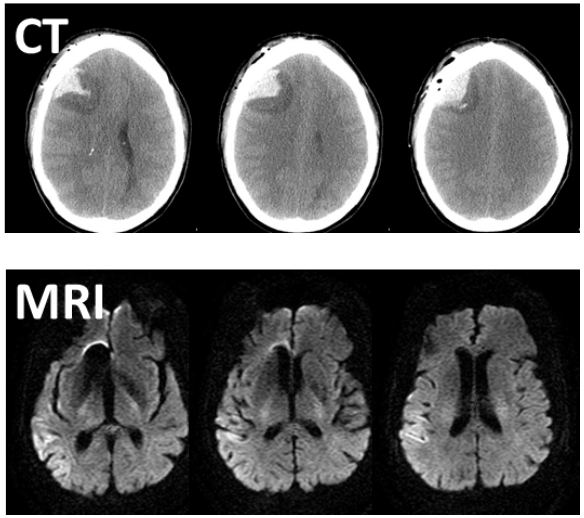
Checklist
☐ Fingerstick Glucose
☐ Obtain IV Access
☐ Pulse Oximetry, BP and cardiac monitoring, Supplemental O2 and Fluid as needed
☐ Labs: CBC, BMP, Ca, Mg, HCG in females of childbearing age
☐ Possible CT head
☐ Continuous EEG (if available); notify EEG tech if available (as soon as available unless patient returns to pre-status epilepticus baseline)
☐ Consider rapid-response EEG with limited montage if continuous EEG is not available

Initial work-up in ER

All patients

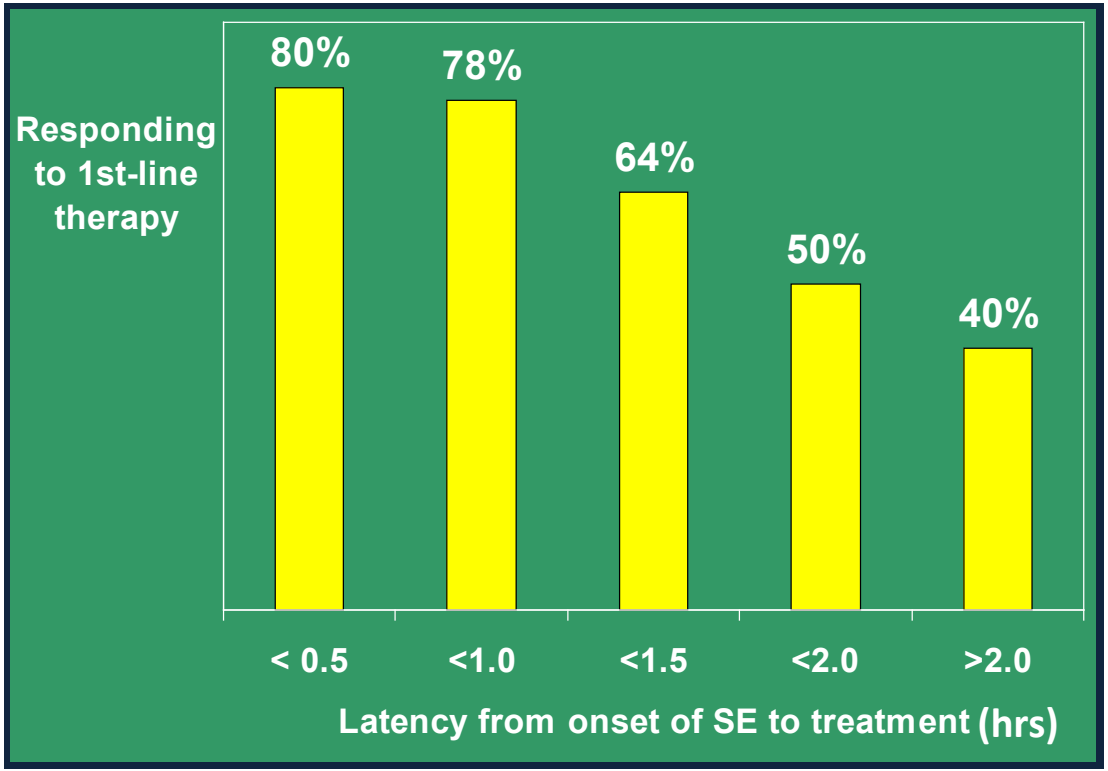
- Airway: adjuncts, O_2
- Monitor EKG, BP, O_2
- IV or IO access: IVF
- Treat hypoglycemia
- Labs: blood glucose, CBC, BMP, Ca, Mg

Consider



LP: if any suspicion for infection

Treat Fast



Lowenstein Neurology 1993; 43:483-488.

Case 1

- A 28-year-old man with no known past medical history is brought by EMS to the emergency department after suffering a seizure at work.
- EMS did not administer any medication in the field or en route to the hospital.
- Seizure activity started approximately 22 minutes ago and continues.

What is the appropriate first line pharmacologic agent to treat this patient's status epilepticus?

Case 1

A. Levetiracetam 1000 mg IV over 15 minutes
B. Lorazepam 2 mg IVP
C. Lorazepam 0.1 mg/kg IVP
D. Propofol 1 mg/kg IV push followed by infusion of 0.5 mg/kg/hr
E. Phenytoin 20 mg/kg IV push

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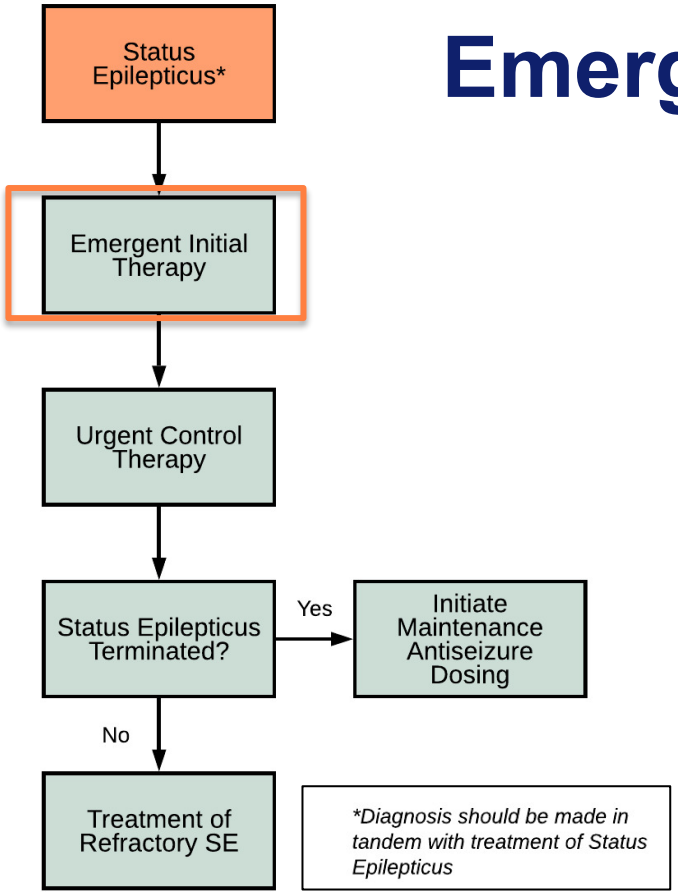
The Veterans administration (VA) cooperative trial identified 0.1 mg/kg of IV lorazepam as the preferred first line pharmacologic agent.

IM midazolam may also be considered as a first line pharmacologic agent.

Emergent Initial Therapy



Silbergleit et al, NEJM 2012

- **Seizure activity needs to be treated as fast as possible**
- **Benzodiazepines are first line therapy**
  - **IV access will determine the benzo of choice**
- **Establish IV access as soon as possible**

Emergent Initial Therapy

Recommended dosing

NO IV ACCESS

Adults

- Midazolam 10mg IM if > 40kg
- Midazolam 5mg IM if < 40kg
  - If unavailable, Diazepam 20mg PR

Children

- Midazolam Buccal 0.2-0.5 mg/kg (max 10mg)
- Midazolam Intranasal 0.2mg/kg (max 10mg)
- Midazolam IM 0.2mg/kg
  - >40kg: max dose 10mg
  - 13-40kg: max dose 5mg

Emergent Initial Therapy

Recommended dosing

WITH IV ACCESS

All Patients	• Lorazepam 0.1mg/kg (up to 4mg per dose)

Case 2

50-year-old man presents by EMS for seizures lasting 14 minutes which stopped for 2 minutes following lorazepam 4 mg x 1 dose.

The seizures then recurred without return to baseline.

Does this patient meet criteria for the diagnosis of status epilepticus?

Case 2

A. No, 30 minutes of continuous seizure activity is required before a patient is considered to be in status epilepticus
B. No, the seizure stopped for a short period of time indicating recurrent seizures but not status epilepticus
C. No, the diagnosis of status epilepticus cannot be reached without confirmatory EEG testing
D. Yes, the patient's seizure activity lasted longer than 5 minutes without return to neurologic baseline
E. Yes, the patient has a history of seizure activity and is therefore in status epilepticus

Case 2

A. No, 30 minutes of continuous seizure activity is required before a patient is considered to be in status epilepticus

B. No, the seizure stopped for a short period of time indicating recurrent seizures but not status epilepticus

C. No, the diagnosis of status epilepticus cannot be reached without confirmatory EEG testing

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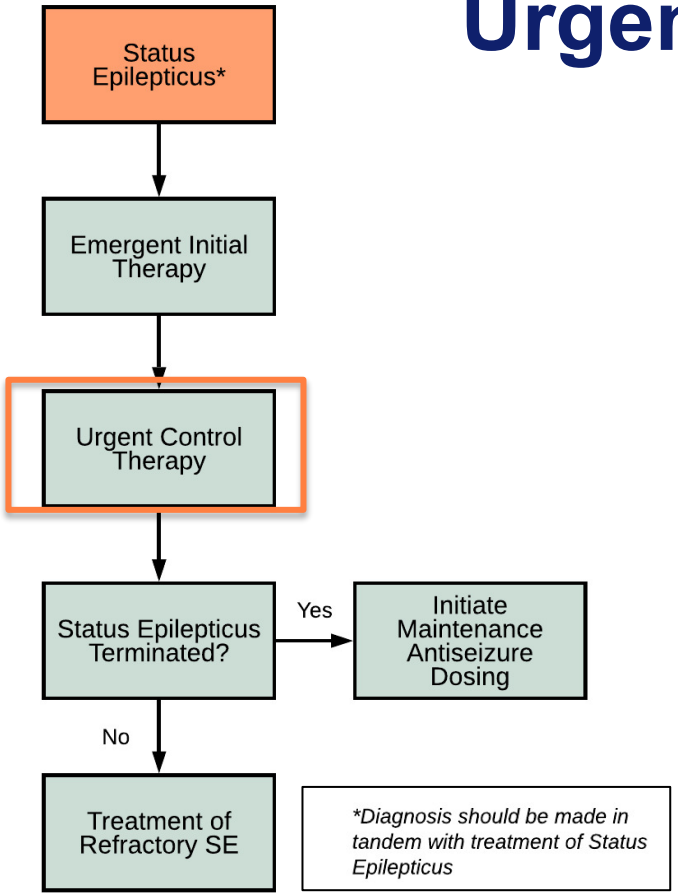
Urgent Control Therapy

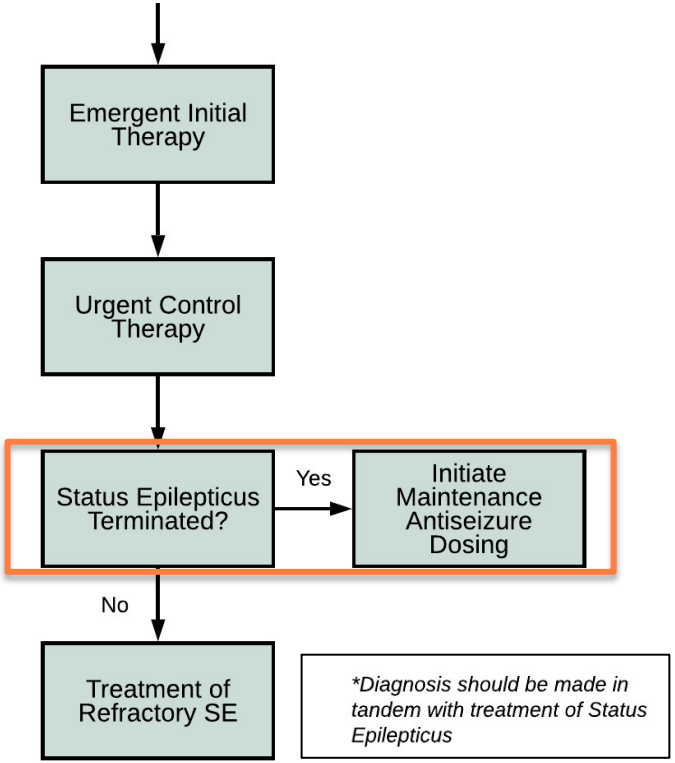


- If SE persists after 10-20 mins despite two adequate doses of benzos, second-line antiseizure medications are added
- If SE is aborted, antiseizure medications are added to prevent further seizures

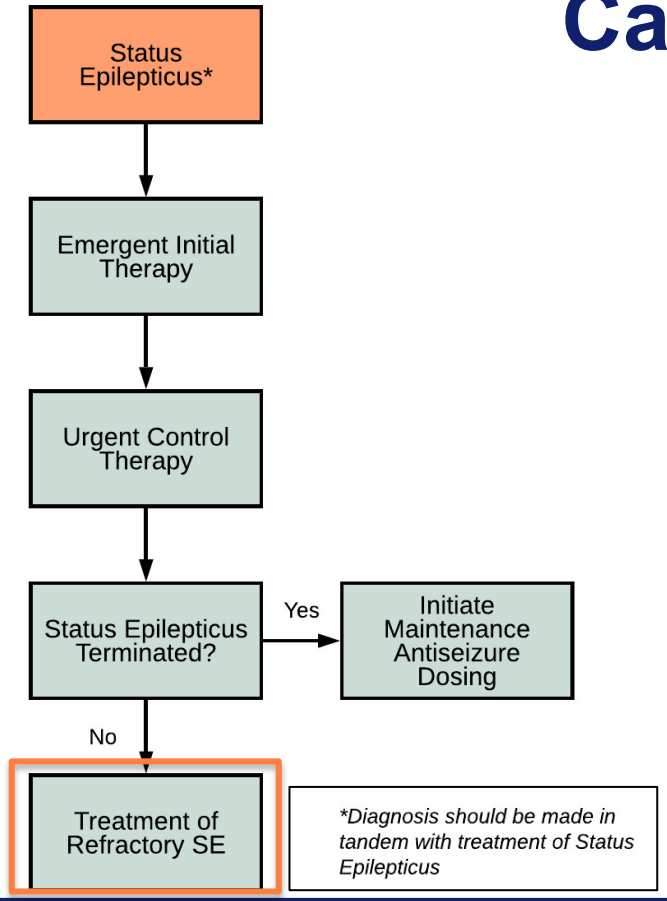
Urgent Control Therapy

Adults and Children	Fosphenytoin IV 20mg PE/kg Valproate IV 40mg/kg Levetiracetam IV 60mg/kg (max dose 4500mg)
Neonates	Phenobarbital IV 20mg/kg Fosphenytoin IV 20mg/kg Levetiracetam IV 40-60mg/kg (max dose 4500mg)

Have Seizures Stopped?



Case 2, continued



- The patient continues to have convulsions intermittently
- Not following commands in between seizures
- The patient is now in refractory SE

Treatment of Refractory SE

Adults

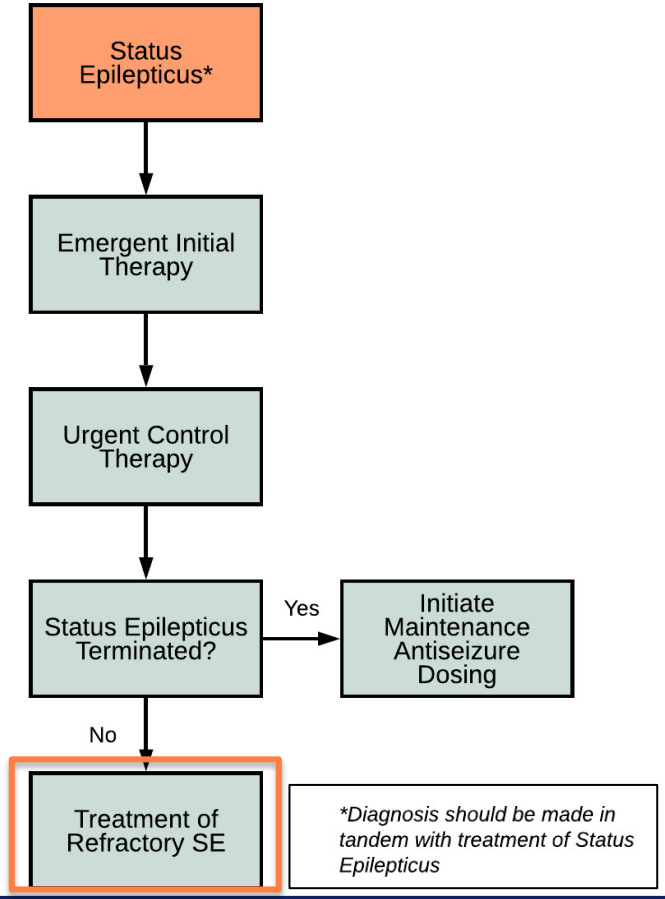
Midazolam	• Bolus: 0.2 mg/kg IV • Infusion: 0.1-2.0 mg/kg/h
Propofol	• Bolus 1-2 mg/kg IV • Infusion: 20-200 mcg/kg/min
Ketamine	• Bolus: 1-2 mg/kg IV • Infusion: 0.5-10 mg/kg/h

Treatment of Refractory SE

Children

Midazolam	• **Bolus: 0.1-0.2 mg/kg IV** • **Infusion 0.1-1.0 mg/kg/h**
Phenobarbital	• **Bolus: 20 mg/kg IV** • **Infusion: n/a**
Ketamine	• **Bolus: 1-2 mg/kg IV** • **Infusion: 0.5-10 mg/kg/h**

Case 2



- He is intubated using propofol and rocuronium
- No more convulsions are seen
- EEG is started

EEG monitoring

- EEG is necessary to evaluate for non-convulsive SE in patients not returning to baseline
  - Ideally, EEG would be initiated *within one hour* of suspected non-convulsive SE or if the patient does not return to baseline
  - Rapid response EEG with reduced montage may aid in quickly identifying patients with non-convulsive SE in critical care settings where continuous EEG monitoring is not available

- cEEG is necessary to assess treatment goals of sedatives in the management of refractory SE
  - Titration goal controversial – seizure control, burst suppression, or completely suppressed background

Pediatric Considerations

- Similar etiologies as adults, but also include
  - Febrile seizures (30-50% pediatric SE)
  - Genetic and metabolic disorders
  - Hyponatremic seizures
  - Hypoparathyroidism and hypocalcemia (first weeks of life)
  - Abuse head trauma
- Neonatal seizures are often non-convulsive

Pediatric Considerations

- First-line emergent treatment similar to adults
- Refractory treatment
  - Favor midazolam and pentobarbital over propofol
    - » Higher risk of propofol infusion syndrome

Nursing Considerations

- Knowledge of action, timing and side effects of antiseizure medications
- Safety measures
  - Lateral recumbent position
  - Head of bed elevated
  - Padding
  - Suction supplies
  - No restraints or putting anything into the mouth
  - Supplemental O2 if hypoxic
  - Vigilant monitoring of vital signs
- Obtain IV access

Pregnancy Considerations

- Treatment similar, with Benzo as first line
  - Exception is Eclampsia – give magnesium
- Caution with the teratogencity of antiseizure medications
  - High Risk = Valproate, phenobarbital, and phenytoin
  - Lower Risk = lamotrigine, levetiracetam
- Monitor drug levels

Communication

- ☐ Clinical presentation
- ☐ Duration of status epilepticus
- ☐ Relevant PMH/PSH
- ☐ Relevant labs, including anticonvulsant levels if drawn
- ☐ Prior medications, medication given so far
- ☐ Neurological examination
- ☐ Brain imaging/LP results (if available)

Example of a sign-off narrative:

- 54 yo M found on sidewalk, shaking with all 4 extremities, no commands, Lac R forehead.
- Unclear duration of SE but seizing on off for 25 min
- Hx of epilepsy after remote TBI, with subtherapeutic levels of phenytoin
- Received lorazepam 4 mg IV x 2 and loaded with 20 mg/kg fosphenytoin
- Vital signs stable, afebrile
- Exam: not shaking but comatose, treated with propofol and rocuronium for intubation
- Head CT no evidence for bleed, stroke, or mass

Clinical Pearls - Management

- Early, aggressive management of patients with SE is imperative. Delay of therapy reduces the likelihood of seizure termination.
- Benzodiazepines are frequently underdosed for initial therapy, and should be dosed aggressively in SE adequately
- Continuous EEG is necessary
- Diagnostic work-up in parallel to treatment

Clinical Pearls – Medication

- Benzo's are first line treatment
- Fosphenytoin is the prodrug of phenytoin; it can be administered more rapidly than phenytoin
- Fosphenytoin, levetiracetam, and valproic acid have comparable rates of seizure cessation in patients with SE who have failed a benzodiazepine (<50%).
- Monitor antiseizure medication levels and interactions with other mediccations and diet

Questions?

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