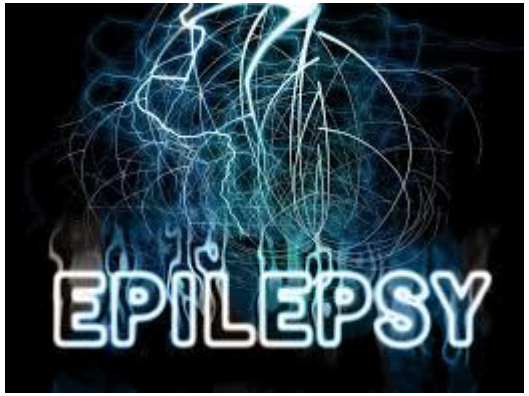

Intensive care for neurologic emergencies. Status Epilepticus

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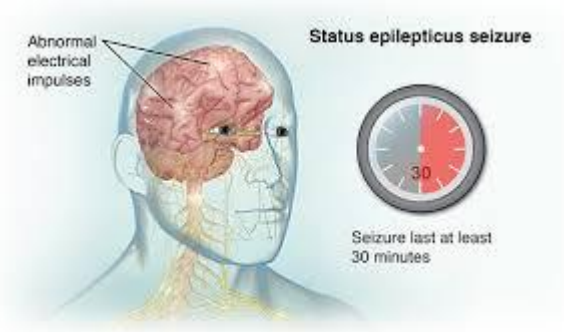
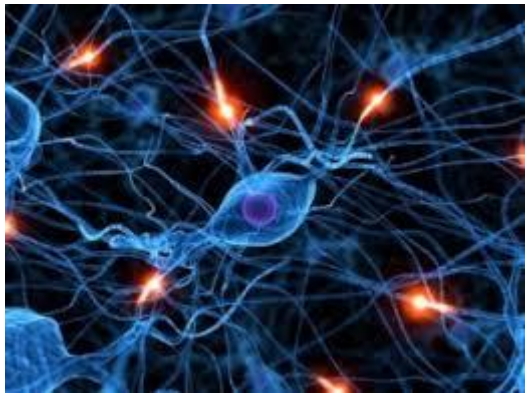


Definition:
Status epilepticus – is seizure activity that continues for 30 minutes, or recurrent seizures without recovery between attacks.

The 30-minute duration has been the subject of debate, since it may delay aggressive therapy.

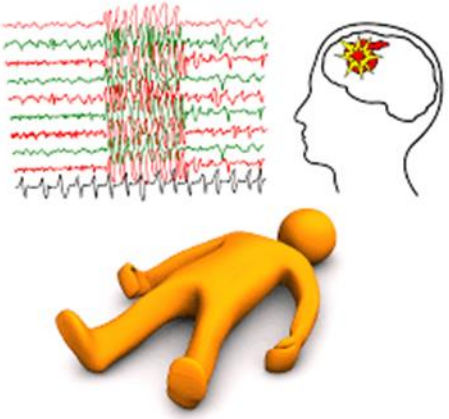
Experimental evidence suggests that irreversible neuronal injury may start after 20 to 30 minutes of generalized convulsive status epilepticus



Every effort has to be made to stop seizure activity prior to irreversible neuronal damage.
A large body of evidence suggests that the generalized tonic-clonic phase of seizures does not last longer than 2 min, except when it evolves into SE.

As a result, it has been suggested that vigorous therapy for SE should be initiated after 5 min of generalized tonic-clonic activity

Lowenstein et al., 1999



A common categorization of status epilepticus divides it into convulsive and non-convulsive SE.

Nonconvulsive SE is generally considered a less serious medical emergency than convulsive SE.

The definitive diagnosis of non-convulsive SE requires confirmation with EEG.

The incidence of SE is likely underestimated.
The overall incidence is about 41 cases per 100,000 per year

DeLorenzo et al., 1996.

The incidence is elevated early in life, decreases after that, then increases in the elderly, with up to 98.9 annual cases per 100,000 persons in that age group

Vignatelli et al., 2003.

The etiology of SE is very dependent on age.

The most common cause in children is febrile status epilepticus (60% of cases)

In adults, SE is much more often due to CVA, TIA, hypoxia and metabolic causes.

Rosenow et al., 2007.

A life-threatening medical condition was the leading cause of subtle GCSE.
It is important to recognize that the majority of patients in status epilepticus do not have a history of epilepsy (15% only).

Treimanet al., 1998.

SE is a neurological emergency that requires prompt intervention.

The goal of therapy is to stop seizure activity in the brain before neuronal injury has started.
In addition, delay in initiating therapy is associated with resistance to treatment.

Prehospital treatment.

Treatment of SE may have to start before arrival in the ER

Even when prehospital treatment was not effective and status epilepticus had persisted upon arrival in the ER, there was evidence that prehospital treatment was associated with a shorter duration of status after arrival to the emergency department

(*Chinet al., 2008)*

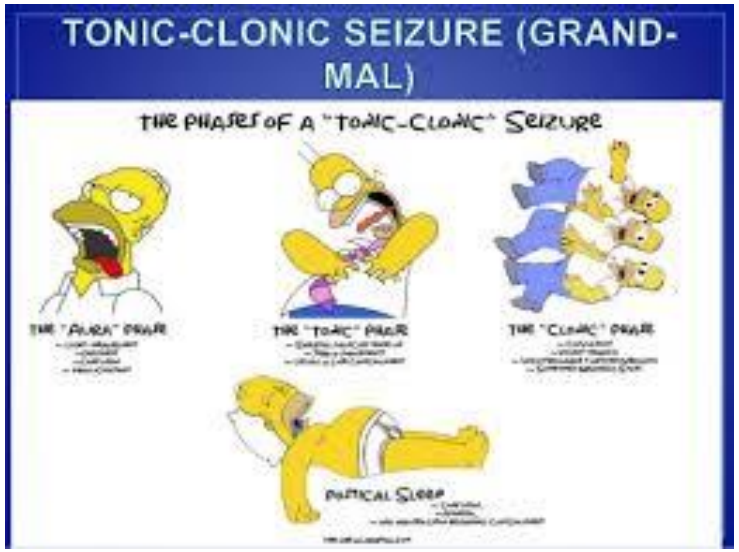
At home treatment by a partner options:

- Buccal midazolam
- Nasal midazolam
- Nasal lorazepam
- Rectal diazepam

ER

If blood glucose is low or cannot be measured rapidly, IV glucose should be administered, in conjunction with IV thiamine if there is a concern for malnutrition.

Blood samples should be drawn for hematological and serum chemistry, as well as AED levels.

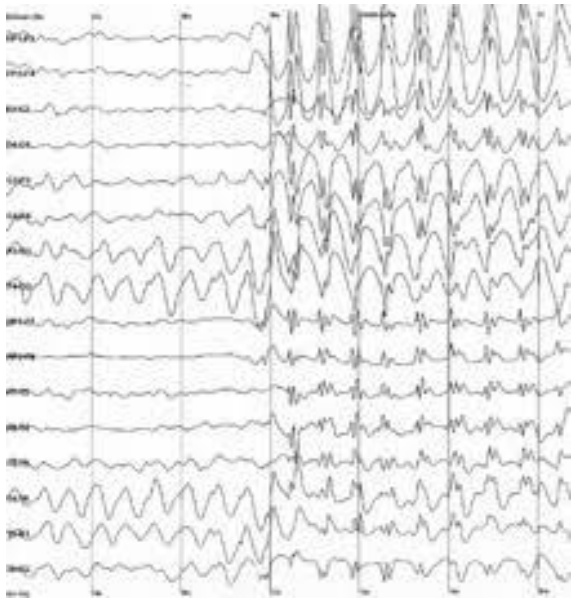


Lorazepam 0.1 mg/kg was the most effective agent, terminating overt SE within 20 minutes in 65% of patients

Treiman et al., 1998

- Airway support
- Breathing support
- Circulation support

Box



Use of 2 mg of IV lorazepam by paramedics was associated with termination of **convulsive** SE before arrival to the ER in 59% of individuals, compared to 21% treated with placebo

Alldredge et al., 2001.

Lorazepam was much less effective in **subtle** convulsive SE, terminating it within 20 minutes in only 18% of patients.

Lorazepam was superior to phenytoin alone, which controlled overt convulsive status within 20 minutes in 59% compared to 43% with phenytoin.

Treiman et al., 1998

Lorazepam was not significantly superior to phenobarbital (15 mg/kg) or diazepam (0.15 mg/kg) plus phenytoin (18 mg/ kg).
However, lorazepam was recommended over these treatments, because it is easier to use.

If the first treatment failed to control SE, the chances of control with the second treatment was minimal and mortality was twice as high.

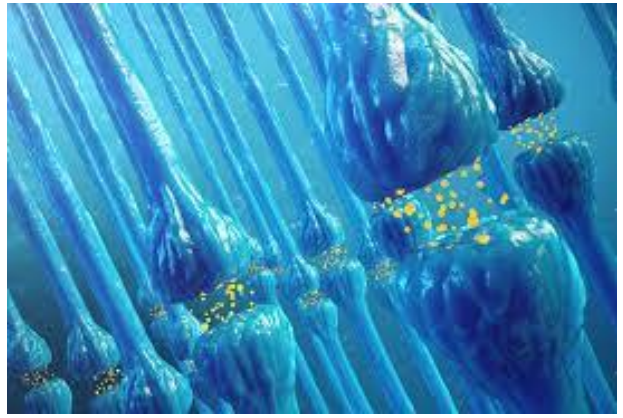
Lorazepam is usually the first agent used for terminating SE. Lorazepam’s duration of action is approximately 12 to 24 hours.

Intravenous diazepam is not recommended in place of lorazepam because of its rapid redistribution in adipose tissue, making the duration of its effect approximately 15 min.

If lorazepam is successful in stopping SE, the decision to add another agent depends on the underlying etiology.
If the etiology is reversible (SE due to metabolic or toxic factors), lorazepam may be the only treatment necessary.

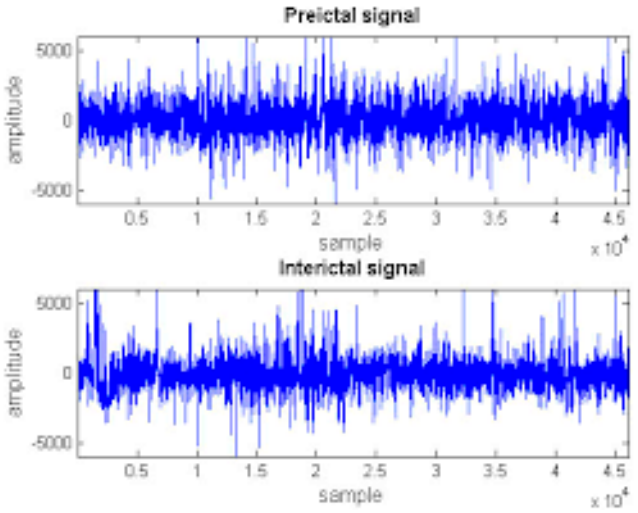
Another longer-acting AED is needed if the underlying etiology is not rapidly reversible.

If GCSE is not controlled after lorazepam 0.1 mg/kg, infusion of 20 mg/kg of fosphenytoin is necessary.
An additional 10 mg/kg can be infused if there is partial response to the initial dose of fosphenytoin.



If GCSE is still unresponsive to treatment, endotracheal intubation is necessary at this point.

The purpose of general anesthesia is to control electrical SE in the brain.
EEG monitoring is necessary at this point, because electrical status epilepticus may continue after motor activity stops.
If the EEG continues to show ictal activity, the anesthesia has to be deepened to a burst-suppression pattern and even to complete suppression in some cases.

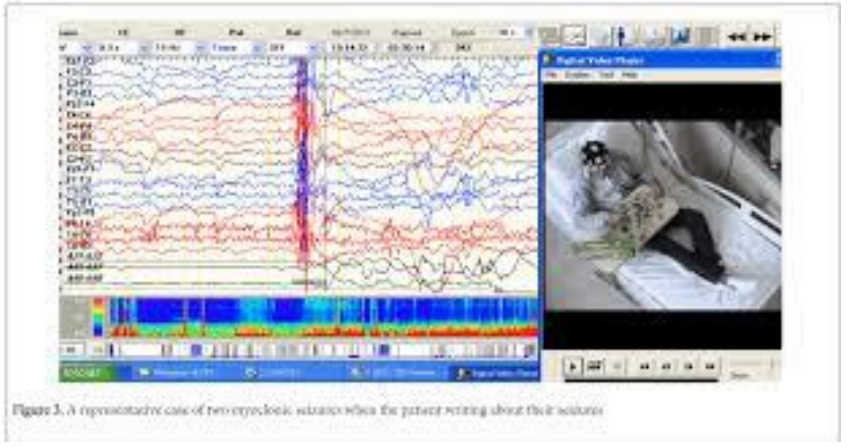


<u>Induction drugs:</u>
Thiopental
Phenobarbital
Midazolam
Propofol

Patients who require GA to control SE, require long-term maintenance with AEDs.
Serum levels of AEDs must be in a high therapeutic zone prior to discontinuation of GA.

Valproate, levetiracetam, and lacosamide have IV formulations and evidence to support efficacy in refractory SE.

During the treatment of refractory SE with AEDs, the cause of SE has to be identified and treated appropriately



0-15 min	IV: normal saline at TKO If blood glucose low: 1 amp D_{50} (50 mL IVP) and start second IV with D_5NS Thiamine 100 mg IVP if given D_{50} or if cachectic/malnourished/alcoholic If actively seizing: Lorazepam IV, 10 mg at <2 mg/min Fosphenytoin, max. delivery rate = 150 mg/min, total dose 20 mg/kg • Do not use if status is due to a metabolic cause unlikely to respond to phenytoin • Reduce delivery rate if AV block or hypotension • Current treatment with phenytoin is not a contraindication
15-60 min	For patients with decreasing seizures after fosphenytoin load: additional 10 mg/kg of fosphenytoin For patients continuing to seize who require intubation: Thiopental ± succinylcholine (avoid succinylcholine if possible) Consider additional dose of fosphenytoin 10 mg/kg For continuing seizures post intubation: Midazolam: 0.3 mg/kg by slow IV injection, may repeat at 5-min intervals ×3 doses. Midazolam infusion starts at 2 µg/kg/min; increase by 1 µg/kg/min every 15 min until seizure activity stops *or:* Propofol: 1-2 mg/kg, then 2-10 mg/kg/h *or:* Pentobarbital: 5 mg/kg loading dose (to achieve burst-suppression pattern on EEG with interburst intervals of approx. 7 sec); repeat load as necessary to max. of 15 mg/kg, then 1-3 mg/kg/h maintenance dose ×6-12 h; reevaluate patient *or:* Phenobarbital: 20 mg/kg at <100 mg/min

AV, Atrioventricular; *D,* dextrose; *EEG,* electroencephalogram; *IV,* intravenous; *IVP,* IV push; *NS,* normal saline; *TKO,* to keep open.

Outcome of SE

Outcome of SE depends on the underlying cause, patient age, duration and severity of status epilepticus, and rapidity of therapy initiation.
In the Richmond status epilepticus study, mortality was 3% for children and 26% for adults

DeLorenzo et al., 1996

SE of than 1 h duration had a 2.7% mortality rate after 1 month, compared to 32% for SE persisting longer than 1 hour

Towne et al., 1994.

Thank you for your time!