Status Epilepticus: Implications Outside the Neuro-ICU

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Disclosures

• I (unfortunately) have no disclosures related to the content of this presentation

• I am going to focus mainly on adults
Overview

- Status epilepticus
- Treatment principles
- Tips for ‘EEG austere’ environment
  - Approach
  - Subhairline EEG
Status Epilepticus: Definition

• Acute prolonged epileptic crisis lasting **5 minutes** or more
  – Most seizures that stop spontaneously last less than 5 min
  – Neuronal injury occurs quickly

• Continual seizures or seizures without interictal recovery
SE : Epidemiology

- Over 100,000 cases in the US annually

- 2\textsuperscript{nd} most common life-threatening neurological emergency (after stroke)

- Convulsive SE 30-day mortality ~20%

SE: Etiology

- Drug non-compliance
- Withdrawal
- Structural brain injury
  - Acute or Chronic
- Infection
- Metabolic (hypoglycemia, Na⁺, Mg⁺)
- Chronic Epilepsy
- Autoimmune (NMDA-R)
Classification (in Critical Care)

- Generalized tonic-clonic SE
- Non-convulsive SE
  - 4% (population) - 25% (hospital) of all SE
  - ‘Wandering confused’ vs. critically-ill
- Refractory SE
  - Seizure not responding to standard treatment: benzodiazepine + at least one AED
Treatment Goals

- Stop clinical and electroencephalographic seizures
- Obtain definitive control as soon as possible (within 60 minutes)
- Avoid unnecessary exposure to drugs, sedatives and critical care
Approach to Treatment

• **First Line / Emergent Treatment**
  – Benzodiazepines

• **Second Line / Urgent Treatment**
  – Anti-epileptic drugs

• **Third Line / Refractory Treatment**
  – Sedatives infusions and anaesthetic agents
First Line (Emergent)

- Benzodiazepines
  - Lorazepam 0.1 mg/kg IV
  - Diazepam 0.1 mg/kg IV
  - Midazolam 0.05 mg/kg IV OR 10mg IM
Lorazepam First Line

- RCT LZP vs. DZP vs. placebo
- Improved seizure termination rate with lorazepam
  - OR 1.9 [0.8-4.4] vs. Diazepam
  - OR 4.8 [1.9-13.0] vs. placebo

RAMPART

• Prehospital RCT of IV Lorazepam vs. IM Midazolam

• Seizure termination before ED arrival
  MDZ 73.4% vs. LZP 63.4% (p<0.001)

• Rapid administration
  1.2 min vs. 4.8 min

• Despite slower onset
  3.3 min vs. 1.6 minutes

• No difference in intubation or hypotension

Time is of the Essence…

- Must control seizures quickly
- Pharmacoresistance:
  - Reduction / internalization of GABA receptors in neurons after seizures
  - GABAergic drugs become less effective (BZD, barbiturates)
- Other drugs also show time-dependent loss of efficacy
Second Line Therapy (Urgent)

Loading of antiepileptic drug:

- **Phenytoin 20mg/kg IV (@50mg/min)**

- Elsewhere:
  - Valproate IV 30mg/kg
  - Levetiracetam IV 30 mg/kg
  - Fosphenytoin IV 20 mg/kg
Third Line Therapy (Refractory)

• Sedative / Anesthetics Infusions:
  – Propofol  5 mg/kg/hr
    80 mcg/kg/min
  – Midazolam  0.2–0.5 mg/kg/hr
  – Thiopental  5 mg/kg

• Titrated to termination of clinical seizures and EEG (burst-suppression)
Critical Illness

• Intubation for airway protection
• Hemodynamic support
• Impact on nutrition:
  – Propofol
  – Consideration of ketogenic diet
• ICU complications:
  Infections  Atelectasis  Neuropathy
  Ileus       Myopathy
Limited Access to EEG?

• EEG is necessary to:
  – confirm diagnosis
  – rule out non-convulsive seizures in comatose patients
  – confirm therapeutic goal (seizure termination)

• Risk of over-sedation and harm with blind treatment for ?seizures
Limited Access to EEG?

- Practical tips:
  1. Use rapidly acting infusions (e.g. propofol) and achieve burst-suppression on EEG
  2. Disconnect EEG, and don’t touch infusions
  3. Wring hands…. and come back tomorrow
  4. Start weaning infusions
  5. Get another EEG
Game Plan in ICU w/o cEEG

1. Use infusions to get control x 24 - 48 hrs
   – Seizure free OR burst-suppression
2. Wean infusions (+/- EEG monitoring)
3. EEG if not awake
4. Restart infusions if seizures +/- addition of additional AED
Protocols

- Rational use of drugs
- Rational use of EEG
- Avoid unnecessary polypharmacy
Common Mistakes

• Changing drugs before reaching steady state
• Cycling on and off sedative infusions without changing anything
Subhairline EEG Montage

- 2- or 4-channel EEG
- Uses commercially available monitor or module for existing monitors

Subhairline EEG Montage

- Limited diagnostic use compared to standard EEG
  - Sensitivity 39%
  - Specificity 92%
- Potentially useful for monitoring burst suppression and titrating anaesthesia
Subhairline EEG Montage

- Establish diagnosis with EEG
- Apply subhairline montage
- Sedate to burst-suppression pattern
- Titrate sedatives to maintain 50-60% suppression ratio
Summary

• Treat quickly, but not necessarily aggressively

• Have a disciplined, organized approach to refractory status – even more important with limited EEG

• We welcome calls for help