Nursing Management of Status Epilepticus in Paediatrics

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Status Epilepticus

- Status epilepticus is a medical emergency requiring immediate, targeted treatment to help reduce patient morbidity and mortality.
- Convulsive or non-convulsive
- Convulsive status epilepticus is the most common neurologic medical emergency in childhood.
- Prognosis is dependent on management of the underlying condition and on prompt treatment of seizures.
- The highest incidence of convulsive status epilepticus in children is younger than 2 years of age.
Definition of Status epilepticus

- “5 minutes or more” of
  - Continuous clinical and/or electrographic seizure activity
  - Recurrent seizure activity without recovery (returning to baseline) between seizures
  - Shorter seizure duration than previously accepted definition of 30 minutes or longer of continuous seizure activity.
  - Prolonged seizures are more pharmacoresistant
  - Permanent neurological injury, motor abnormalities
  - Worse cognitive and behavioral outcomes
## Classification of seizures

<table>
<thead>
<tr>
<th>Generalized</th>
<th>Partial</th>
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</thead>
<tbody>
<tr>
<td>➢ Loss of consciousness</td>
<td>➢ No loss of consciousness</td>
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<tr>
<td>➢ Whole brain is involved</td>
<td>➢ Focal onset</td>
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### Convulsive
- Tonic-clonic seizure (Grand Mal Epilepsy)
  - Tonic contraction of all body muscles
  - Clonic jerking

### Nonconvulsive
- Absence seizure (Petit Mal Epilepsy)
  - Patient freezes & stares in one direction
  - No muscular movement & jerking
- Atonic seizure
  - Due to excessive inhibitory discharges
  - Relaxation and patient may fall

### Complex Partial seizure
- Change in level of consciousness
- Affects a larger part of the hemisphere

### Partial seizure developing to secondary generalized seizure
- Unconscious
- Tonic-clonic seizure
Etiologies of convulsive status epilepticus

- Febrile convulsion (3 months- 6 years old)
- Acute central nervous system infection: bacterial/ viral meningitis or encephalitis
- Metabolic derangement: hypoglycemia, hyponatremia, hypocalcaemia
- Antiepileptic drug noncompliance or withdrawal
- Neurovascular: Ischemic stroke, Hemorrhagic stroke(AVM, aneurysm)
- Tumor
- Head trauma
- Perinatal hypoxic-ischemic encephalopathy
- Cerebral degenerative disorders
- Idiopathic
Complications of Status Epilepticus

- Hypoxemia
- Acidemia, metabolic acidosis, hyperammonemia, lactic acidosis
- Glucose alterations, hypoglycemia
- Blood pressure disturbances
- Increased intracranial pressure
Complications of Status Epilepticus

◆ Morbidity

   Neurologic sequelae
   ➢ Motor abnormalities
   ➢ Mental retardation
   ➢ Learning and behavioral disorders
   ➢ Persistent epilepsy
   ➢ 6% in over 3 years, 29% in those < 1 year
Outcomes of Status Epilepticus

- Overall mortality associated with convulsive status epilepticus in childhood ~ 0-16%
- Mortality rate in children with pre-existing epilepsy or prolonged febrile seizure is reported to be 0-2%
- Children with acute symptomatic etiologies are reported to be 12.5-16%
- Mortality is higher in younger children, likely due to higher incidence of CNS infections
Assessment & Initial Management of Status Epilepticus

- Time and chart the characteristics of the seizure

- **Airway** – Establish and maintain airway patency
  - Non-invasive airway protection with recovery position, head-tilt, chin lift or jaw-thrust maneuver
  - Administer high flow oxygen 10-15L/min via 100% non-rebreathing mask
  - Consider intubation if respiratory failure

- **Breathing** – Assess work of breathing, efficiency and effectiveness
  - Monitor oxygen saturation (SpO2) with pulse oximeter

- **Circulation** – Assess & monitor HR, P, BP, perfusion and capillary refill time
  - If signs of shock, give 10-20ml/kg normal saline for fluid resuscitation
Assessment & Initial Management of Status Epilepticus

- **Disability** – GCS, pupil size and reaction, posture, any neck stiffness or bulging fontanelle
- **Exposure** – temperature, rash, positioning
- **Establish IV access**
- **Glucose** – check dextrostix, serum glucose, blood gas and other laboratory investigations: CBC, CRP, electrolytes, calcium, magnesium, blood culture, serum anticonvulsant drug levels, urine for toxicology screening
- **History** – present and past history including current febrile illness, recent trauma, history of epilepsy, medication, family history, poison ingestion, last meal
Management Goals

- Treatment should begin rapidly, within 5 minutes of seizure onset
- Obtain history of pre-hospital treatment of seizures
- Cumulative doses of benzodiazepine medication (pre-hospital included) increase the risk of respiratory failure
- Continue sequentially until all clinical and electrographic seizures are terminated, ideally within 60 minutes of onset.
- Etiology should be diagnosed and treated as soon as possible
- If meningitis is strongly suspected, initiate treatment with antibiotics as soon as possible, e.g. Cefotaxime & Acyclovir
- Both treatment and diagnostic evaluation should be started simultaneously
Refractory Status Epilepticus

Treatment of Status Epilepticus

Support ABCs, give oxygen, start cardiorespiratory monitoring, obtain IV access

Draw blood for glucose, electrolytes, Ca, Mg, CBC, AED levels, toxicology screen
Consider IV glucose, phenytoin depending on clinical situation

Seizure persists at 5 min

IV access

Lorazepam 0.05 – 0.3 mg/kg IV (max. 4 mg)
or diazepam 0.2 – 0.5 mg/kg IV (max. 10 mg)
or midazolam 0.1 mg/kg IV (max. 5 mg)
(or sodium valproate 10 mg/kg IV at 1 – 5 mg/kg/min
if patient is on sodium valproate and refractory)

No IV access

Diazepam 0.3 – 0.5 mg/kg PR
or midazolam 0.2 mg/kg IV or buccal or IM
or lorazepam 0.05 – 0.15 mg/kg PR or SL

No response after 5 min

Second dose of benzodiazepines

No response after 5 min

Fosphenytoin 20 mg PE/kg IV at 3 mg/kg min
or phenytoin 20 mg/kg IV at 1 mg/kg min
(or fosphenytoin 20 mg/kg IM if still no IV access)

No response after 10 min

Proceed immediately to pentobarbital or midazolam infusion if an ICU bed is immediately available or if the patient has severe systemic disturbances or has seizures for more than 60-90 min

Call for help
Be prepared for intubation
Admit to ICU

Phenobarbital 20 mg/kg IV at 2 mg/kg min

No response after 10 min

Rapid sequence intubation
EEG monitoring

Midazolam 0.2 mg/kg IV loading dose followed by 0.1 – 0.5 mg/kg/hr
or pentobarbital 3 – 10 mg/kg IV loading dose followed by 1 – 3 mg/kg/hr to toxic EEG

Consider sodium valproate 20-30 mg/kg IV at 3 – 5 mg/kg min
Benzodiazepines

- **Diazepam (Valium)**
  - Effective quick acting anticonvulsant, take effect within minutes
  - Short-lasting (about 40 minutes to 1 hour)
  - Side effects: respiration depression and enhanced by addition of other anticonvulsants such as Phenobarbitone
  - Available in IV & rectal route, PR is well absorbed, which can be given outside the hospital
  - 0.2-0.3mg/kg IV (max 10mg)
  - 5-10mg PR repeated after 5 minutes if necessary
Benzodiazepines

**Lorazepam (Ativan)**
- Emergency initial AED therapy (0-5 minutes)
- 0.05-0.1 mg/kg IV stat (max. 4mg) over 2-5 minutes
- Reassess in 5 minutes, may repeat 2\textsuperscript{nd} AED stat if seizure persist
- Rapid onset
- Longer duration of action (12-24 hours VS less than 1 hour)
- Less respiratory depression than diazepam
- Monitor respiration before each repeated IV dose
Benzodiazepines

- **Midazolam (Dormicum)**
  - Short half life, IV or IM
  - Administer when convulsion > 5 mins or if convulsion occur after having intermittent seizures without regaining consciousness for > 5 mins, reassess in 5 minutes
  - 0.1-0.2 mg/kg (max 10mg) IM stat or 0.1 mg/kg IV stat
  - Loading: 0.1-0.3 mg/kg IV stat in Refractory Status Epilepticus
  - Continuous infusion: 0.75-10mcg/kg/min
  - Titrate and withdraw infusion after at least 24-48 hours of electrographic control, withdraw gradually to prevent recurrent status epilepticus
Phenytoin (Dilantin)

- If seizures persist & reassess in 5 mins after administer 2\textsuperscript{nd} dose of benzodiazepine with no response
- 2\textsuperscript{nd} AED, 15-20mg/kg IV loading in single dose, reassess in 10 mins, if seizures persist 20 minutes, may administer additional dose of 5-10mg/kg 10 mins after loading dose
- Administer IV should be diluted in 0.9% Sodium Chloride solution slowly, not to exceed 1-3mcg/kg/min
- Maximum concentration of 10mg/ml IV
- Maintenance: 4-8 mg/kg/day IV Q12H
- Monitor plasma Phenytoin level
- Risk of hypotension and cardiac arrhythmia, little respiration depressant effect
- Monitor HR, ECG, BP & RR
- Peak action within 1 hour but long half-life is dose-dependent
- Risk of extravasation reaction, purple glove syndrome
Phenobarbital

- Short acting barbiturate
- Act as 2\textsuperscript{nd} AED of febrile and neonatal Status Epilepticus or 3\textsuperscript{rd} AED of Status Epilepticus and treatment of Refractory Status Epilepticus
- If seizures persist & reassess in 5 minutes after administer 2\textsuperscript{nd} dose of benzodiazepine with no response or 10 minutes after administer 2\textsuperscript{nd} AED with no response
- 20mg/kg IV loading at 2 mg/kg/min, max 50mg/min, over 10-20 minutes
- Reassess in 10 minutes
- Additional dose 5-10mg/kg IV
- Significant side effects: respiratory depression, hypotension, myocardial depression, reduced cardiac output, pulmonary oedema, ileus
- Monitor BP & respiration
- Intubation may be required
Refractory status epilepticus

- If seizures persist > 30 minutes, unresponsive to standard treatment regimes, such as initial benzodiazepine followed by an additional anti-epileptic drug (AED), regardless of elapsed time

- While awaiting response to 2nd AED, consider potentially treatable conditions

  - Sub-therapeutic AED levels, hypoglycaemia, hyponatremia, hypocalcemia, hypoxia, intoxication, CNS hemorrhage, CNS infection, hyperthermia

- Reassess airway, breathing & hemodynamics continuously, provide support as needed

- Sedation, hypotension & respiratory depression are common adverse effects of AEDS

- Consult neurologist & PICU
Refractory status epilepticus

- Once clinical seizures have stopped, consider continuous EEG monitoring to assess for non-convulsive seizures
- **Do not wait for EEG to continue treatment of clinical seizures**
- Continue diagnostic evaluation and treatment of underlying etiology
- Lumber puncture should never be performed in patient with reduced level of consciousness
- Obtain urgent neuroimaging, CT, MRI, neuro-vascular imaging to rule out any CNS haemorrhage or trauma
- **CT scan before lumber puncture** to exclude intracranial abnormality, e.g. suspected subarachnoid haemorrhage (SAH) and prevent the risk of herniation
PICU Management

- If seizures persist after 3rd AED or has seizures for more than 30 minutes
- Start phenobarbital or midazolam infusion if PICU bed is immediately available
- Not just stop of seizures, is to reduce metabolic stress
- Maintain adequate cerebral perfusion pressure & deliver adequate oxygen and nutrients to brain cells
- Prevent hyperthermia
- Monitor GCS
- Prepare rapid sequence intubation when airway compromised, decreased GCS or if child in convulsive status epilepticus 20 minutes after administer of IV Phenytoin or Phenobarbitone
PICU Management

- Secure the airway
- Obtain central IV access
- Consider arterial line for continuous hemodynamic monitoring
- Many anti-epileptic infusions may decrease cardiac output, decrease systemic vascular resistance, cause clinically significant hypotension
- Prepare to support hemodynamics by inotropes infusion if needed
- Start continuous EEG monitoring if not yet done
Sodium Valproate (Epilim)

- Act as 3rd AED & use in refractory status epilepticus
- IV 20-30mg/kg/day, increased up to 40mg/kg/day if inadequate control, 2-3 times/day
- Given by direct slow IV injection over 3-5 minutes or by infusion using a separate IV line in 0.9% normal saline or dextrose 5%
- Monitor plasma valproic acid level, chemistry & haematological parameters
- Use with caution for patients < 2 years old
- Contraindications in liver disease or severe hepatic dysfunction
- IV Epilim should be replaced by oral Epilim therapy as soon as possible
- If patient < 2 months old, consider 50-100mg pyridoxine IV, infused over 1-3 hours
Levetiracetam (Keppra)

- Act as 3rd AED & use in children >1 month old with refractory status epilepticus
- Not yet approved for initial treatment of status epilepticus
- 20-60mg/kg/day IV Q12H
- IV use only and must be diluted in 0.9% Sodium chloride or Dextrose 5% injection over 15 minutes
- Amount of diluent should not exceed a maximum Keppra concentration of 15mg per ml of diluted solution
- Switch to oral route, dosage and frequency same with IV administration
- Antiepileptic drugs, including Keppra, should be withdrawn gradually to minimize the potential of withdrawal seizures or increased seizure frequency
Thiopental (Thiopentone)

- Prolonged status epilepticus
- Raised intracranial pressure
- Only used in intubated & mechanically ventilated patients
- Initial IV loading dose of 2-4mg/kg followed by continuous IV infusion of thiopentone & diluted with 0.9% Sodium Chloride or 5% Dextrose at 1-8mg/kg/hr via central line only for 3-5 days
- Other epileptic medications must be continued
- Side effects: Hypotension, reduced cardiac output, arrhythmia, myocardial depression, laryngospasm, reduced urine output. Higher doses can cause hypokalaemia
After Care when seizure control

- Maintain at least 24-48 hours of seizure control or burst suppression before weaning continuous AED infusions
- Identify anti-epileptic medications for maintenance therapy before weaning continuous infusions
- Consider supplemental anti-epileptic therapies
- Medications: Sodium Valproate (Epilim), Levetiracetam (Keppra), Phenobarbitone, Carbemazepine (Tegretol), Lamotrigine (Lamictal), Topiramate (Topamax), Clobozam, Clonazepam
- Other options: ketogenic diet, epilepsy surgery
- Neurological & dietitian follow up and health education
Ketogenic diet

- Adjunctive treatment in patients with drug-resistant or difficult control refractory epilepsy
- High fat, adequate-protein, *low carbohydrate* diet
- Liver converts fat into fatty acids & ketone which pass into brain & replace glucose as energy source
- Ketosis (elevated serum level of ketone), leads to reduction in the frequency of epileptic seizures
- Ketogenic diet contains 4:1 ratio by weight of fat to combined protein & carbohydrate
- Exclude high-carbohydrate foods: starchy fruits & vegetables, bread, pasta, grains & sugar
- Increase consumption of high fat food: nuts, cream & butter, coconut oil (rich in MCTs)
- Most common side effect: constipation
- Contraindication: fat metabolic disorders, carnitine deficiency, parent or caregiver non-compliance
Ketogenic diet
Ketogenic diet
Corpus Callosotomy

- Surgical procedure to control generalized seizures without identifiable focus, primarily atonic seizures (drop attacks), fail multiple anti-convulsants
- By cutting corpus callosum to block interhemispheric spread of secondarily generalized seizures
- The corpus callosum is a band of nerve tissue that connects & transmits messages between the two hemispheres of the brain
- Does not involve removing any portion of the brain
- Effective for atonic seizures, reduce falls & consequent injuries
- May not decrease occurrences of partial seizures
Discharge Plan

- Provide psychosocial counseling and discuss general information of first seizure or newly diagnosed epilepsy with parents & caregivers

- Explain “What is epilepsy?”

- Possible causes, even majority no specific etiology was identified

- Recurrent risk factors, e.g. abnormal EEG, neonatal meningitis, previous febrile seizures, after AED withdrawal, family history

- Prognosis

- Management of acute seizure – first aid

- Sudden Unexpected Deaths in Epilepsy Patients (SUDEP)
First aid of epilepsy

Learn about Seizure First Aid
Lifestyle and social issues

- Education & leisure activities as usual
- +/- Provide epileptic information to school
- Epilepsy is not reason to prohibit from sports, provide adequate safety measures
- Swimming under close supervision only
- Avoid climbing high or dangerous activities
- Advice on minimize possible hazards at home
- Avoid bath tub, turn on shower tap with cold water first
Anticonvulsants

- Principle of AED treatment – to decrease attacks, not for “cure”
- Potential problems of poor seizure control – injury, accidents, increase risk of SUDEP
- Monitoring drug compliance & effectiveness
- General side effects: sedation/ hypersensitivity
- Drug specific side effect
- Expected course of treatment, medication plan
- AED withdrawal should only be considered in children who have been seizure-free for 2 or more years because concern about side-effects of AED
Support organizations

- **香港啟迪會有限公司**

- **香港復康會**
  [http://www.rehabsociety.org.hk/121.0.html](http://www.rehabsociety.org.hk/121.0.html)

- **香港協癇會**

- **Epilepsy Action (UK)**

- **Epilepsy Foundation (US)**
References


Abend N.S., Loddenkemper T. (2014). Management of pediatric status epilepticus. *Curr Treat Options Neurol*, 16(7), 301


