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Evaluation and Management of Status Epilepticus in Children

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Evaluation and Management of Status Epilepticus in Children

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Introduction

Status epilepticus (SE) is the most common childhood neurological emergency. Practically, SE is defined as any child presenting convulsing to a healthcare facility or having repeated seizures without regaining of consciousness in between. The International League Against Epilepsy (ILAE) defines SE in terms of time points (t1 and t2) **(Table 1)**.

TABLE 1: Status epilepticus (SE) in terms of time points (t1 and t2).

Type of SE	***Time beyond which if seizures persist, patient is considered in SE (t1)***	***Time after which persistent seizures have long-term consequences (t2)***
Generalized convulsive SE	5 minutes	30 minutes
Focal status with impaired consciousness	10 minutes	>60 minutes

Etiology

Etiology may be known or unknown:

☑ *Known (symptomatic):*

- *Acute* (stroke, toxicity, derangements in serum electrolytes and blood glucose, trauma, hypoxia, febrile seizures, neuroinfections, and inborn errors of metabolism)
- *Remote* (brain scars due to above causes, genetic, brain malformations, etc.)
- *Progressive* (neurodegenerative disorders and tumors)
- *Known cases of epilepsy:* Poor drug compliance or by nature drug-resistant epilepsies such as Lennox–Gastaut syndrome and Dravet syndrome

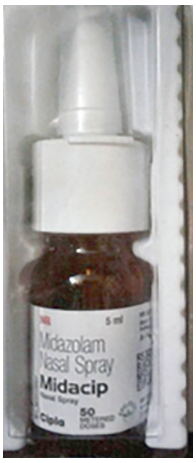
☑ *Unknown cause*: Entities like new-onset refractory status epilepticus (NORSE), a subset of which is febrile infection-related epilepsy syndrome (FIRES)

Management

Status epilepticus is a life-threatening emergency. To improve outcomes, each unit should have a fixed protocol and team members should be familiar with their roles. Diagnosis and management should proceed together. A quick focused history and examination help to search for etiology, which helps in streamlining diagnostic work-up.

Prehospital Management (Home or Clinic)

1. The child should be put in *recovery position* (to prevent aspiration).
2. *Rescue medication*: Any of the following can be kept handy in the clinic:
   - *Midazolam* (buccal/nasal)—*2 puffs/5 kg weight* (0.1–0.2 mg/kg/dose) or
   - *Lorazepam* (intramuscular or intranasal)—0.1–0.2 mg/kg/dose or
   - *Diazepam* (intramuscular or rectal)—0.5 mg/kg/dose
   - *Blood sugar* can be checked and glucose started, if low
3. Airway, breathing, and circulation should be maintained.
4. Shift the child to a hospital, preferably with oxygen in an ambulance.



In-hospital Management

At arrival (0–5 minutes)	*General measures*: Maintain airway, O_2, breathing (ventilation), and circulation (IV access). Quick history and examination, ask if on any AED.	*Investigations* Take blood samples for CBC, sugar, calcium, magnesium, sodium, potassium, and ABG/VBG. *Treat* if abnormal. Blood culture, if fever.	*Management—IV preferable* Lorazepam 0.1 mg/kg (maximum 4 mg) or Diazepam 0.2–0.3 mg/kg (maximum 10 mg) or Midazolam 0.15–0.2 mg/kg (maximum 5 mg) If IV access cannot be established then IM, intranasal, buccal, or rectal routes can be used
5–20 minutes	*General measures*: Shift to PICU if unstable. Watch for signs of raised intracranial pressure (ICP)—treat with mannitol/3% NaCl	*Management—if seizures persist* IV phenytoin 20 mg/kg in NS @1 mg/kg/min or IV fosphenytoin 20 mg/kg of phenytoin equivalent (PE) @3 mg/kg/min with HR monitoring Can repeat IV phenytoin 10 mg/kg or IV fosphenytoin 10 mg PE/kg	
30–60 minutes	*General measures*: Watch for raised ICP, rhabdomyolysis, cardiac arrhythmia, sepsis, and hypersensitivity to AED. Monitor for organ function.	*Management (please see below)—if seizures persist* IV valproate 20–40 mg/kg or IV phenobarbitone 20 mg/kg in NS @ 2 mg/kg/min or IV levetiracetam 20–60 mg/kg @ 5 mg/kg/min Start maintenance dose after 8–12 hours	
1–24 hours: Refractory status epilepticus	*General measures—refractory status epilepticus*: Shift to PICU, start bedside EEG, if available, to titrate dose of infusion *Investigations*: SF for neuroinfections, MRI brain ± contrast, and CT brain, if unstable. Autoimmune panel, metabolic and genetic studies based on clinical suspicion.	*Management—general anesthetics to achieve burst suppression* *Midazolam*—0.2 mg/kg IV bolus followed by infusion @1 µg/kg/min, increasing 1 µg/kg/min, every 5–10 minutes, till seizures stop, up to a maximum of 30 µg/kg/min, tapering initiated after 24 hours of seizure control @ 1 µg/kg/min, every 3 hours Or *High-dose phenobarbitone*: 5–10 mg/kg boluses every 30 minutes up to 120 mg/kg over 24 hours, target seizure control and burst suppression, maintenance up to 40 mg/kg/day Or *Propofol* loading dose of 1–2 mg/kg, followed by continuous infusion of 1–2 mg/kg/h, maximum of 5 mg/kg/h Or *Thiopentone* loading dose 5 mg/kg bolus followed by 3–5 mg/kg/h infusion rate to achieve burst suppression followed by tapering after 24 hours seizure free period. *Topiramate* through orogastric/nasogastric tube (2–5 mg/kg enteral loading, increase by 5–10 mg/kg/day up to maximum of 25 mg/kg/day) while tapering anesthetic agents. *Ketamine* can also be tried.	
After 24 hours: Super refractory status epilepticus	*General measures*: Shift to a higher center with neurocritical care unit, to be managed by pediatric neurologist with intensivists.	*Therapeutic options* (on case-to-case basis): *Ketogenic diet*—should be started early by expert dietician *Immunotherapy*—IV methylprednisolone/IVIG/others Vagal nerve stimulation, therapeutic hypothermia, etc. Epilepsy surgery can be tried in selected cases. Counseling of parents regarding higher chances of mortality/morbidity.	

(ABG: arterial blood gas; AED: antiepileptic drug; CBC: complete blood count; EEG; electroencephalogram; IV: intravenous; IVIG: intravenous immunoglobulin; NS: normal saline; PICU: pediatric intensive care unit; VBG: venous blood gas)

Special Points

- ☑ All caregivers of children with seizures should be taught first aid including recovery position and use of rescue medications.
- ☑ These three drugs are not preferred in a particular sequence. Avoid phenobarbitone if facility for mechanical ventilation is not available; avoid valproate if suspected inborn error of metabolism or liver dysfunction (levetiracetam is the preferred drug in such cases).
- ☑ In known cases of epilepsy with breakthrough seizures (on phenytoin ≤6 mg/kg/day, phenobarbitone ≤5 mg/kg/day, valproate ≤30 mg/kg/day or levetiracetam ≤30 mg/kg/day), give half the maintenance dose. For larger doses avoid loading and give the maintenance dose.

Outcome

Mortality in acute phase is seen in 10–20 %. Around 15–56% show long-term cognitive and motor disability.

Conclusion

A structured and systematic approach should be followed for treatment of SE, with the role of individual team members well-specified beforehand, as …. ***Time is Brain!***

Further Reading

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