Convulsions and Status Epilepticus

Purpose
This guideline is aimed to guide the management of convulsions and status epilepticus in children and neonates.

Intended Audience
All doctors and nursing staff providing care to children with convulsions and status epilepticus who present to Emergency department, AAU and the medical ward.
1. Introduction

This guideline contains the following:

A. Definition and causes of convulsions or seizure.
B. Afebrile seizures
C. Seizures in children known to have epilepsy
D. Convulsive status epilepticus
E. Neonatal seizures (less than one month old)
F. Primary and secondary assessment, looking for key features
G. Assessment of child who is referred post seizure
H. Other paroxysmal non epileptic events in children

Note: Febrile seizure is not covered here. Please refer febrile convulsions guidelines.

2. Guideline Content

A: Definition and causes of seizure

Seizure or convulsion is defined as “a transient occurrence of signs and / or symptoms due to abnormal excessive or synchronous neuronal activity in the brain. The term transient is used as demarcated in time, with a clear start and finish.” (1)

Causes of convulsions in children are fever (especially in less than 6 years old), Infections (meningitis, encephalitis), head injury (accidental, non-accidental), hypoxia, epilepsy, metabolic (hypoglycaemia, electrolyte imbalances, toxins, inborn errors of metabolism) and non-epileptic or paroxysmal events (2).

B: Afebrile seizures

The term is self-explanatory - a seizure without fever as a trigger to event.

It is important to ascertain if seizure was a first episode or a recurrent.

Management: Perform finger prick blood glucose. In first afebrile fit, perform ECG looking for cardiac causes of seizures like Long QT syndrome. Discuss with registrar or consultant or Neurology team if the seizure was entirely focal or started with a focal seizure onset with secondary generalisation where neuroimaging might be required. It is better to allow uncertainty about nature of episode than to make a firm but wrong diagnosis which will mislead parents and other clinicians. Give a possible diagnosis (like first afebrile seizure) or even a descriptive diagnosis (e.g., a five-minute unresponsive episode with shaking of limbs and wandering eyes or funny episode).

First afebrile seizure: Most children will not need any other investigations after first seizure except for finger prick blood glucose and ECG. Do not start anti-epileptics routinely. Arrange follow up in a general paediatric outpatient clinic.
Recurrent afebrile seizure: Discuss with medical consultant for need for EEG and neuroimaging and arrange general paediatrics outpatients follow up.

C: Seizures in children known to have epilepsy

It is best practice to refer alerts on edm (electronic health record) for special instructions and specific tailored made treatment protocol from neurology consultants. Some children may not require admission particularly if the seizure was usual for them, back to normal and parents are happy. Consider discussion with epilepsy liaison nurses via switch or Neurology Registrar about their attendance to hospital.

D: Convulsive status epilepticus or status epilepticus

It is defined as generalised convulsions lasting 30 minutes or longer or when successive convulsions occur so frequently over a 30-minute period that the child does not recover consciousness between them (2). The rationale behind this definition was that irreversible neuronal injury may occur after 30 min of ongoing seizure activity. Convulsions that persist beyond 5 minutes may not stop spontaneously, so it is usual practice to institute anti convulsive treatment after it has lasted 5 minutes or more (2). For practical purposes, approach to a child who presents with tonic-clonic convulsion lasting more than 5 minutes should be same as the child who is in “established” status – to stop seizure and to prevent development of status epilepticus (6).Irreversible neuronal injury may occur after 30 minutes of seizure activity (1). Status epilepticus can be fatal because of cause, underlying disease process and complications of convulsions that includes obstruction of airway, hypoxia, and aspiration of vomit, overmedication, cardiac arrhythmias, hypertension, pulmonary oedema, hyperthermia, DIC and myoglobinuria (1).

<table>
<thead>
<tr>
<th>Causes of Status Epilepticus (1)</th>
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<tbody>
<tr>
<td>Known (symptomatic)</td>
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<tr>
<td>1. Acute (e.g., meningitis, encephalitis, stroke, intoxication, VP shunt related)</td>
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<td>2. Remote (e.g., post traumatic, post encephalitic, post stroke etc.)</td>
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<td>3. Progressive (e.g., space occupying lesion, neuro metabolic, epilepsy syndromes etc.)</td>
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<td>4. Status epilepticus in defined electro-clinical syndromes</td>
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<tr>
<td>Unknown causes (cryptogenic)</td>
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Investigations in children presenting with status epilepticus

Perform tests based on the differential diagnosis and causes.

1. Blood: Blood gas (with glucose, lactate), FBC, UE, LFT, bone profile, clotting (if required), blood culture (if concerns regarding sepsis).
2. Urine culture and urine toxicology (if concerns about ingestion of toxins)
3. ECG – in all first seizure
4. Neuroimaging (CT Brain) – depends on cause
5. Lumbar puncture: Remember, the contraindications of LP: Recent seizure (within 30 min), prolonged seizure (> 30min) or tonic seizure, reduced or altered conscious level, clinical signs of or CT findings of raised intracranial pressure.
**Management of Status Epilepticus in children (age: more than one month old)**

Call for senior help; perform primary assessment and resuscitation to ensure seizure is not secondary to hypoxia and poor blood supply to brain. Next step is to stop the convulsion. Primary assessment should take less than 60 seconds.

**Airway**
- Is it open or closed or partially obstructed?
- Children with cerebral depression and neuromuscular disease will have respiratory inadequacy because of reduced respiratory drive. Remember: Exhaustion is a pre-terminal sign.
- Connect pulse oximetry and ECG electrodes and monitor.
- Chin lift or jaw thrust
- Suction airway
- Airway adjuncts

**Breathing**
- Rate, work and efficacy, recessions, inspiratory or expiratory noises, gasping
- Children may present with reduced respiratory rate.
- Give 15 L oxygen with mask and reservoir bag.
- May need bag valve mask ventilation or intubation.

**Circulation**
- Heart rate, pulse volume, capillary refill, blood pressure, skin colour
- Prolonged hypoxia leads to bradycardia – pre terminal sign.
- Attach saturation probe, ECG leads, insert IV cannula, blood gas

**Disability**
- Neurological evaluation:
  - Both shock and hypoxia decreases conscious level. Any problem with ABC must be addressed before assuming that a decreased conscious level is due to primary CNS problem.
  - Assess AVPU (conscious level), Pupil size and reaction, signs of raised ICP
  - Look for neck stiffness or AF in infant.
  - Treat Hypoglycaemia
  - Treat status epilepticus (as described below).

**Exposure:**
- Check temperature, rash, bruises, Think Sepsis and consider toxins.
- Do we need IV Cefotaxime and or IV Aciclovir.

*Figure 1: Primary Assessment specific for convulsions and resuscitation*
Seizures more than 5 minutes: Airway & high flow oxygen, vascular access

Vascular access?

No

Yes

Step 1

Administer: Midazolam (buccal)
Dose: 0.5 mg/kg or as below
3 months – 1 year: 2.5 mg
1 year – 4 years: 5 mg
5 year – 9 years: 7.5 mg
10 year or older: 10 mg
If less than 3 months Rectal Diazepam: 2.5 mg

Administer: Lorazepam 0.1 mg / kg IV OR IO over 1 minute and 5ml saline flush (max 4 mg)
Not more than 2 doses of Benzodiazepine (including prehospital drug)

Monitor

No

Still seizures?

Yes

Step 2: 10 minutes after start of step 1

If IV access: Give IV Lorazepam

If No IV access: Give Buccal Midazolam or rectal diazepam

Not more than 2 doses of Benzodiazepine (including prehospital drug)
Ask parents / edms: if already on Phenytoin: prepare Phenobarbitone, if not on Phenytoin, prepare Phenytoin.

Monitor

No

Still seizures?

Yes

Step 3: 10 minutes after start of step 2

Seek senior help (ED consultant / Medical Registrar / crash call – Anaesthetics and PICU)
If on Phenytoin: Do not give IV Phenytoin, Give IV Phenobarbitone (20 mg/kg) over 20 minutes
OR
If NOT on Phenytoin: Give IV Phenytoin 20 mg/kg over 20 minutes (cardiac monitor, BP)
OR
As an alternative, consider IV Levetiracetam 40 mg/kg over 5 minutes (max dose 2.5 gram)

Monitor

No

Still seizures?

Yes

Step 4: 20 minutes after start of Step 3 (start of infusion)

Rapid Sequence Intubation – PICU team

Figure 2: Status Epilepticus Protocol – for infants more than one month old and children
**E: Neonatal seizures (seizures in neonates less than one month old)**

Neonatal seizures are treated differently from those in infants and older children. Seek senior help early and early discussion with consultant neurology on-call.

<table>
<thead>
<tr>
<th>Causes in convulsions in neonatal period (reference 3, 4)</th>
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<tbody>
<tr>
<td>1. Hypoxic Ischemic Encephalopathy (HIE) – important cause in neonates</td>
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<td>2. Cerebro-vascular causes (intraventricular haemorrhage, perinatal arterial ischemic stroke, venous or cortical sinus thrombosis)</td>
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<td>3. Structural (cerebral dysgenesis, neuro-cutaneous syndrome)</td>
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<td>4. Neonatal epilepsy syndromes</td>
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<tr>
<td>5. Infections (meningitis, encephalitis, congenital infections)</td>
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<tr>
<td>6. Metabolic (hypoglycaemia, electrolyte imbalances, inborn errors of metabolism, pyridoxine deficiency)</td>
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**Investigations of Neonatal seizures**

In addition to investigations detailed in page 3, in neonatal period, perform metabolic tests that includes urine organic acids and bloods for blood gas, ammonia, lactate, acyl carnitine, amino acids and organic acids.

**Management of neonatal seizures**

1. Perform primary survey (as detailed above) and resuscitation
2. IV Phenobarbitone 20 mg / kg over 20 minutes.
3. Early discussion with consultant neurologist because of need for further medications like repeat doses of Phenobarbitone, IV Phenytoin, IV Levetiracetam, IV Midazolam, Pyridoxine and enteral biotin if seizure continues.

**F: Secondary Assessment and emergency treatment**

While primary assessment and resuscitation is being performed, take focused history of child’s behaviour and activity over previous 24 hours, history of fever, trauma, poison, or overdose ingestion, change in medication & compliance and significant past medical history (history of epilepsy, diabetes, adrenal insufficiency).

Emergency treatment: Follow status epilepticus protocol (as above), look, and treat if signs of raised intracranial pressure (decreasing conscious level, asymmetrical pupils, abnormal posturing, abnormal ocular motor reflexes), look for signs of infection (meningitis, encephalitis) and treat with IV Cefotaxime and or IV Aciclovir.

Remember to write drug chart for antipyretics, buccal midazolam on prn side of drug chart, need for IV fluids and chase blood results. If moved to another ward, refer child to specific ward registrar.

**G: Assessment of a child who is referred post seizure**

History taking: It is important to get a detailed history in assessment: the “five Ss”.

1. Scene: What was the setting in which the event happened?
2. Start: How did it begin?
3. Sequence: What actually happened and in what order?
4. Stop: How did it stop?
5. Sequelae: Were there any after-effects (post-ictal)?

Document the duration of event, obtain history from witness, and obtain the type of seizure (generalised, focal, and focal with secondary generalisation) and pre-hospital treatment given. Gather history for any trigger for seizure depending on the causes listed previously.

Examination: Perform detailed system wise examination including head circumference and plot, looking for neurocutaneous markers (birth marks) and consider other paroxysmal events seen in childhood as detailed below.

Investigations: Ensure investigations are performed as detailed previously in page 3, 4, and 6.

Management: Perform appropriate management as detailed in previous pages.

H: Other paroxysmal events seen in childhood (5)

There are number of non-epileptic conditions associated with anoxia / hypoxia and syncope which are most likely to be confused with epilepsy that are

Anoxic syncope: Breath holding spells (reflex anoxic seizures), vasovagal syncope, cardiogenic syncope (long QT interval), obstructive syncope (Sandifer’s syndrome, suffocation).

Involuntary movements: Rigors, jitteriness, shuddering, paroxysmal dyskinesia’s, alternating hemiplegia of infancy.

Migraine equivalents: Benign paroxysmal vertigo, cyclical vomiting, paroxysmal torticollis.

Behaviour and sleep disorders: Daydreaming, hyperventilation, pseudo seizures, gratification, night terrors, sleeps myoclonus, narcolepsy / cataplexy.

3. References


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