

APPROACH TO A CHILD WITH STATUS EPILEPTICUS

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OBJECTIVES:-

- Definition
- Epidemiology
- To understand the pathophysiologic events..
- Role of optimum investigation.
- To know the algorithm approach.
- To learn principles of management of child presenting with seizure in emergency room.

Definition : Status epilepticus

- 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.

STATUS EPILEPTICUS IN TIME POINT (t1,t2)

TYPE OF SE:	TIME BEYOND WHICH IF SEIZURE PERSIST,PATIENT IS CONSIDERED IN SE (t1)	TIME AFTER WHICH PERSISTANT SEIZURES HAVE LONG TERM CONSEQUENSES(t2)
GENERALISED CONVULSIVE SE	5 MINUTES	30 MINUTES
FOCAL STATUS WITH IMPAIRED CONSIIOUSNESS	10 MINUTES	60 MINUTES

Status epilepticus – operational definition

- Generalized, convulsive status epilepticus refers ≥ 5 min of

1. Continuous seizure or

2. Two or more discrete seizures between which there is incomplete recovery of consciousness.

Why 5 min??

- Defining convulsive SE as a convulsive seizure that last for a period of at least 5 min is not only practical but is supported by the finding that the probability of a seizure stopping spontaneously without intervention is quite low after this.

Etiology :

□ 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 ;

Etiology- (cont.)

□ Unknown cause:

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

NORSE-new onset refractory status epilepticus ??

- Any of the causes of status epilepticus in a patient without prior epilepsy.
- It is often unknown etiology, presumed to be encephalitis or post encephalitis, can last for a week or longer, has poor prognosis.

FIRES OR DESC??

- Is a syndrome of refractory status epilepticus that is associated with acute febrile infections , appears to be postinfectious in nature.
- Highly drug resistant.
- Responsive to ketogenic diet.

EPIDEMIOLOGY

- Convulsive status epilepticus (children) – 10-27/100000 per year.
- Febrile seizure -25-40%.
- Major proportion of morbidity and mortality associated with status epilepticus during episodes of refractory convulsive status epilepticus.

HISTORY AND EXAMINATION

- Past History:
- Developmental Delay
- Neurodeficits
- Abnormal Birth History

- Seizure Precipitating Event:
- AED: Drug And Compliance
- Sleep Deprivation
- Stress
- Missed AED/ Underdosing
- Fever

ASSESS RISK FOR MENINGITIS

▪ History:

- Drowsy ,vomiting
- >3 Days Duration Of Illness
- 6-12 Month Infant
Unvaccinated For Hib ,
Pneumococcus
- Complex Febrile Seizure

▪ Examination

- Neck Stiffness
- Neurodeficit
- Ear Discharge ,sinusitis
- Bulging AF

STATUS EPILEPTICUS



CONVULSIVE SE

NON -
CONVULSIVE SE

EPILEPTIA
PARTIALIS
CONTINUA

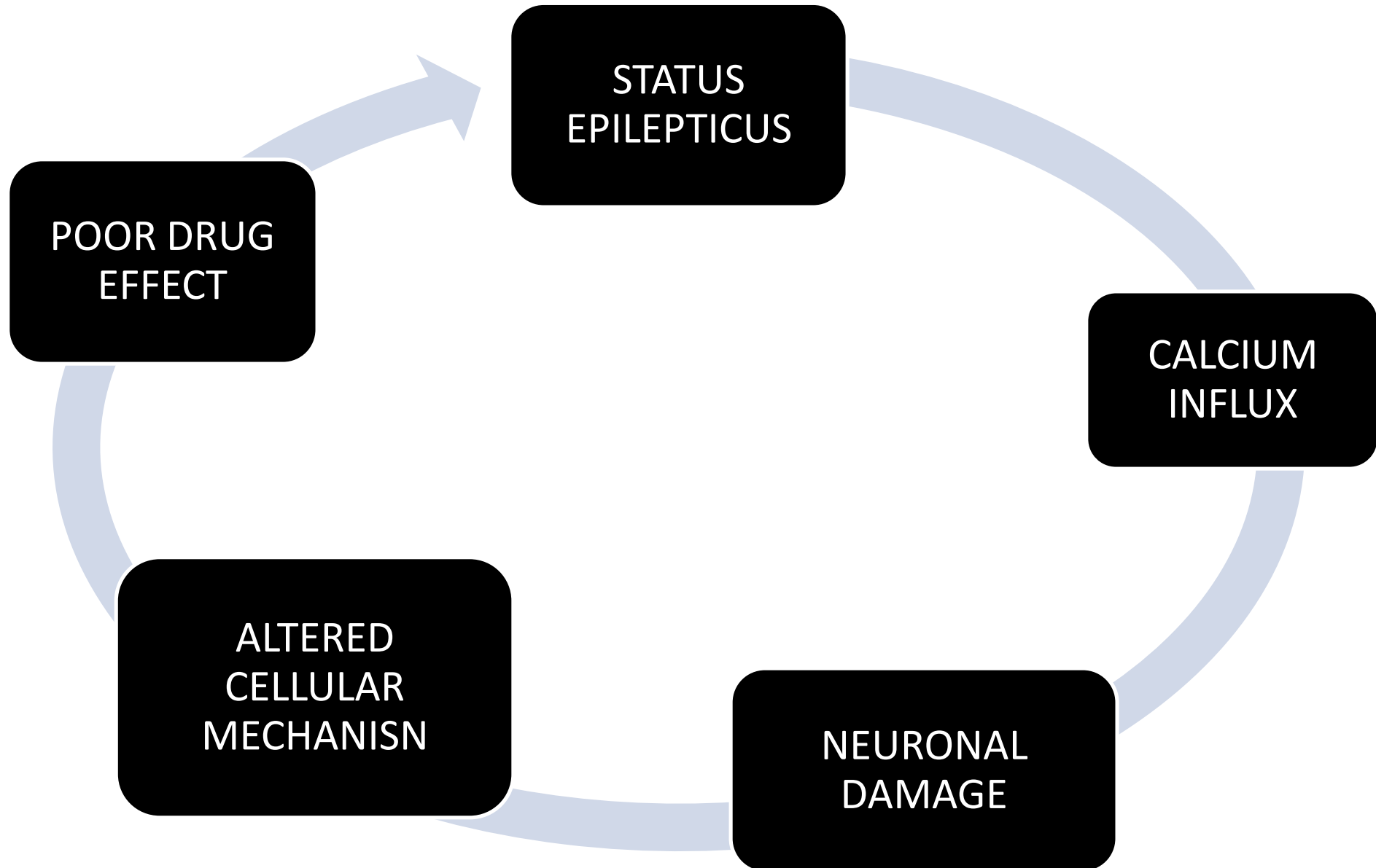
❑ NCSE(Nonconvulsive Status Epilepticus)

- Focal SE with impaired consciousness
- Absence SE

□ NCSE manifest as:

- Confusional state
- Hyperactivity with behavioral problem
- Fluctuating impairment of consciousness
- With a time unsteady sitting or walking
- Fluctuating mental status , hallucination, paranoia ,and or psychotic symptoms.

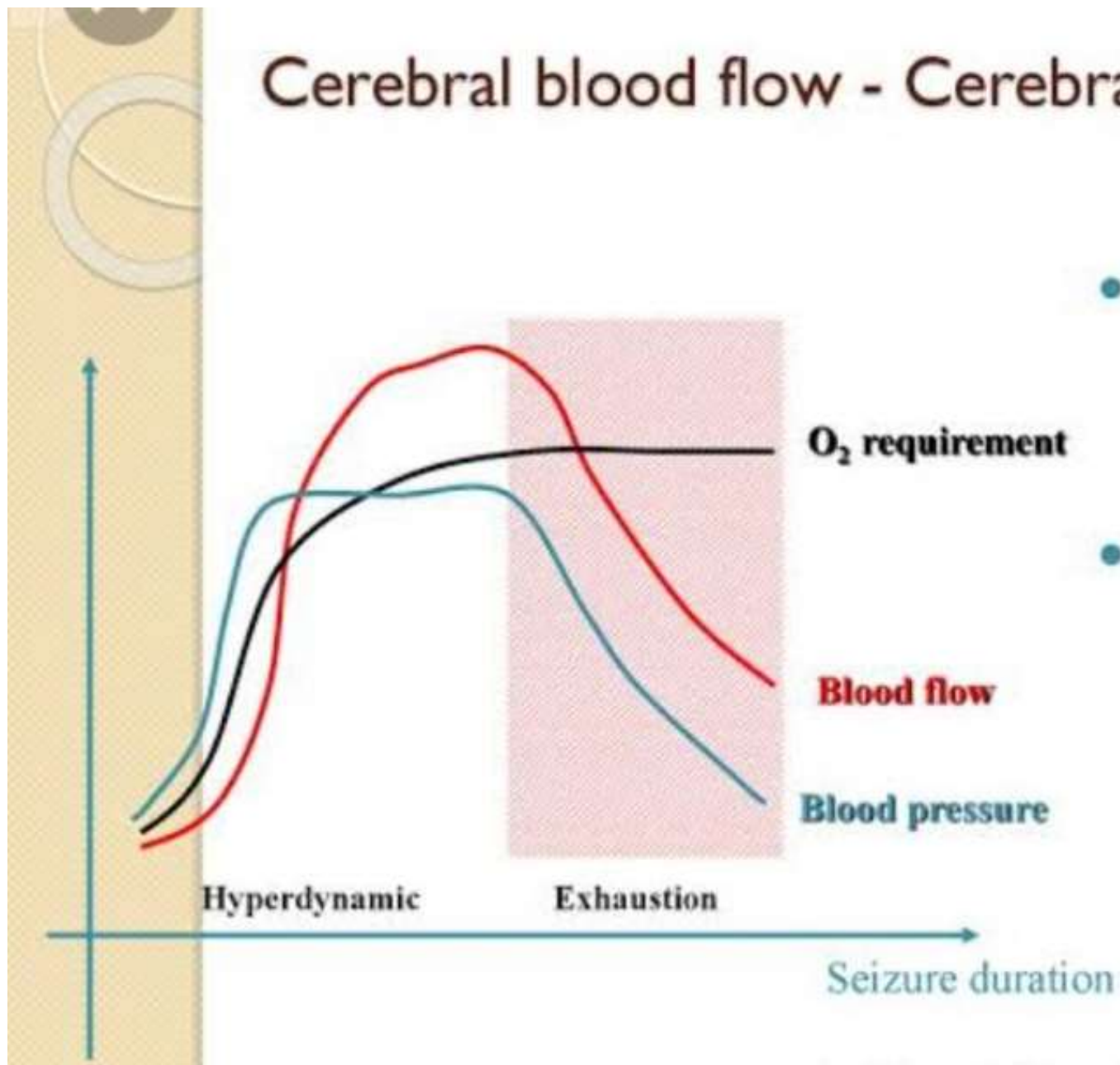
- STATUS EPILEPTICUS IS A VICIOUS CYCLE



HEMODYNAMIC CHANGES OF SE

1. **Hyperdynamic phase-** CBF meets metabolic requirement
2. **Exhaustion phase-**
 - Cerebral blood flow drop as hypotension sets in.
 - Autoregulation exhausted.
 - Neuronal damage ensues.

Cerebral blood flow - Cerebral O₂ requirement



- Hyperdynamic phase
 - CBF meets CMRO₂
- Exhaustion phase
 - CBF drops as hypotension sets in
 - Autoregulation exhausted
 - Neuronal damage ensues

GLYCEMIC CONTROL

- Hyperdynamic phase-hyperglycemia
- Exhaustion phase-hypoglycemia develops and neuronal damage ensues.

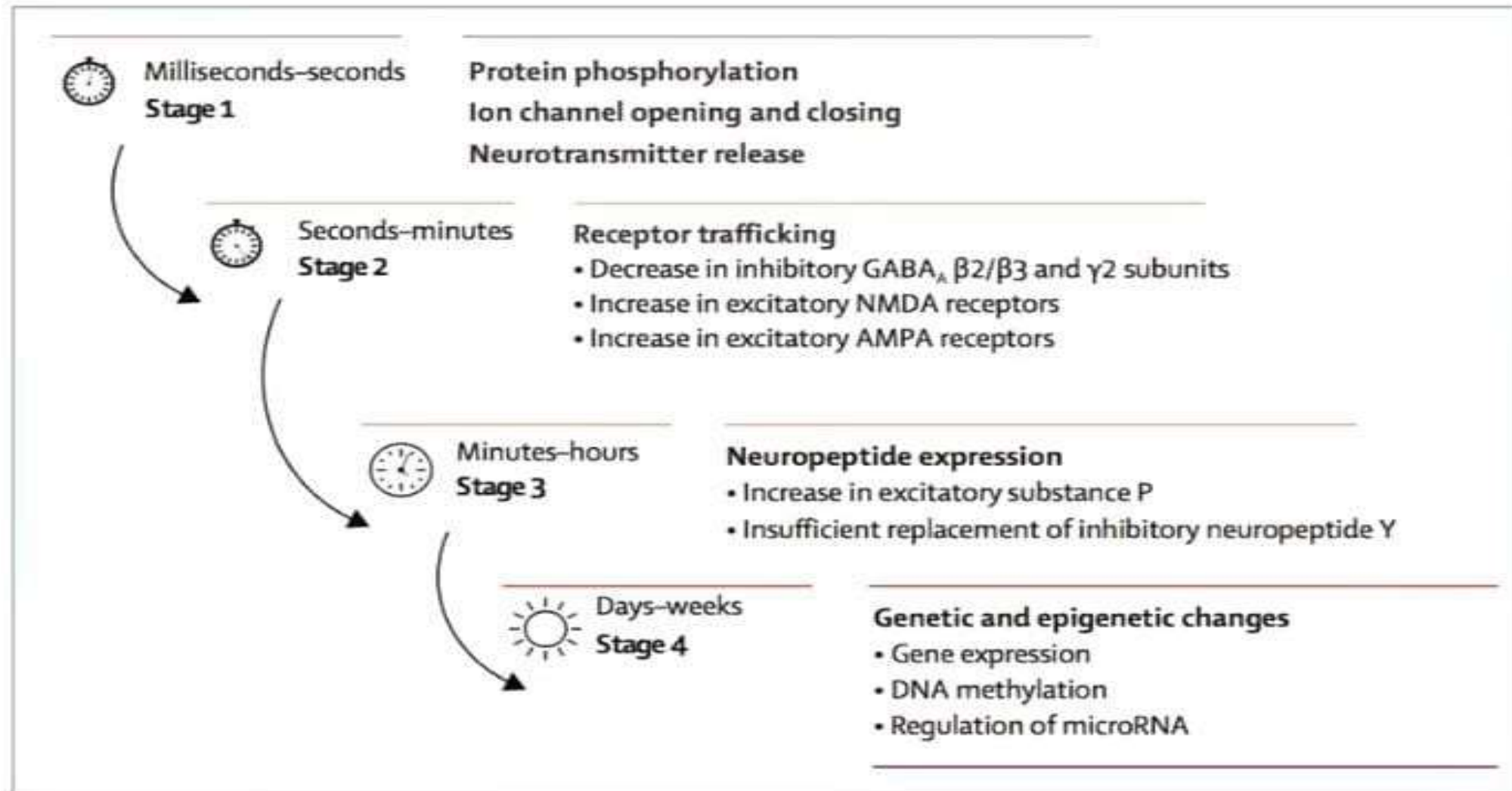
PATHOPHYSIOLOGY OF STATUS EPILEPTICUS

- Cell death may result from –
- Excessive release of glutamate / excessive stimulation of glutamate receptors ,a process is known as excitotoxicity.
- The most vulnerable areas of brain include the hippocampus, amygdala ,cerebellum ,middle cortical area , and thalamus.

- Acute changes-venous congestion ,small petechial hemorrhages ,and edema.
- Ischemic cellular changes are the earliest histologic finding ,followed by neuronophagia, microglial proliferation ,cell loss ,and increased number of reactive astrocytes.

- Neuronal concentration of calcium ,arachidonic acid and prostaglandins increase and may promote cell death.
- **Autonomic dysfunction**- hypotension and shock as well as lactic acidosis.

Seizure to Status - Mechanism



SEIZURE TO STATUS MECHANISM

Stage 1- protein phosphorylation and neurotransmitter release.



stage 2- receptor trafficking



stage 3- neuropeptide expression.



stage 4- genetic and epigenetic changes

gene expression and DNA methylation.

- Status epilepticus is a life-threatening emergency. To improve outcomes, each unit should have a fixed protocol.
- Diagnosis and management should proceed together.
- A quick history and examination help to search for etiology

MANAGEMENT GOALS

1. Stabilization – maintain vital functions.
2. Abolish seizure.
3. Eliminate /treat precipitating cause.

4. Rational investigations:-

- Routine investigations
- CSF
- Neuroimaging
- EEG

5. Manage complications

6. Prevent recurrence

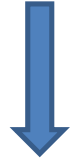
STEP 1 - ACTIVELY SEIZING CHILD: INITIAL STABILIZATION(0 -5 MINUTES)

- Position child to avoid injuries.
- Ensure airway patency.
- Oxygen by nasal canula /mask.
- Prepare to assist with bag and mask ventilation.
- Assess and maintain vitals .
- Cardio-respiratory and saturation monitoring.
- Start timing seizure.
- Iv- line placement.

INDICATIONS FOR ENDOTRACHEAL INTUBATION.

- Severe hypoxia (bradycardia , hypotension, poor perfusion)
- Failure or prolonged requirement of bag and mask ventilation.
- Children with features of raised intracranial pressure.
- Refractory status epilepticus.

TEAM APPROACH TO SEIZING CHILD



- **DESIGNATE TEAM MEMBER TO PROCEED TO ACHIEVE EACH OBJECTIVES.**



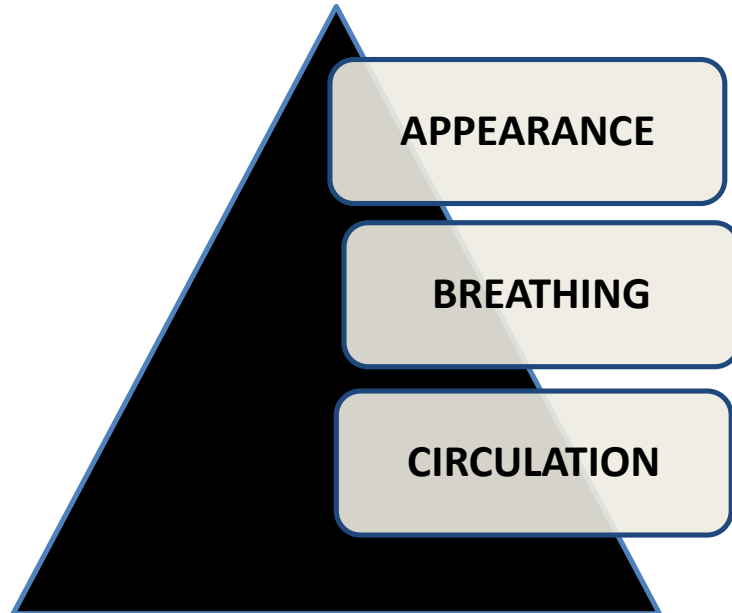
**INTRAVENOUS
ACCESS**



**PROCEED WITH
SEIZURE
MANAGEMENT
ALGORITHM**



**PEDIATRIC
ASSESSMENT
TRIANGLE**



FOCUSSED HISTORY



**PHYSICAL
EXAMINATION**

STEP- 1(0-5MIN)

A benzodiazepines is the initial therapy of choice(level A)

- iv access established (level A)
- First AED :iv Lorazepam -0.1mg/kg,(max 4mg/dose),may repeat dose once or
- iv Midazolam- 0.15-0.2mg/kg,(max 5 mg) ,or
- iv Diazepam-0.2-0.3 mg/kg , (max 10 mg/dose), may repeat dose once

STEP-1(0-5MIN)

- **If iv access not available (level B)**

Rectal diazepam 0.2-0.5mg/kg, max 20mg/dose, single dose. Or

Intranasal midazolam/ buccal midazolam.

- **If benzodiazepine not available:**

Intravenous phenobarbitone 15mg/kg/dose ,single dose.

STEP-1(0-5MIN)

- Take blood samples for CBC, sugar ,calcium, magnesium, sodium,potassium,and ABG/VBG
- Treat if abnormal. Blood culture if fever.

STEP-2 (5-20 MIN) SECOND THERAPY PHASE

- No evidence based preferred second therapy of choice (level U)
- **General measures:**
 - Shift to picu if unstable.
 - Watch for raised ICP-treat with mannitol/3%Nacl
- **Choose one of the following.**
- IV phenytoin 20mg/kg in NS@1mg/kg/min
- iv fosphenytoin 20pe/kg , phenytoin @3mg/kg/min with HR monitoring(level U)
- Can repeat IV phenytoin10mg/kg or IV fosphenytoin 10mgPE/kg

STEP-3 (30-60MIN) THIRD THERAPY PHASE

- **General measures** - watch for raised ICP , rhabdomyolysis , cardiac arrhythmia, sepsis and hypersensitivity to AED. Monitor for organ function.
 - **Management** : if seizure persists :
 1. Iv valproate 20-40 mg/kg
 2. Iv phenobarbitone 20mg/kg in NS@2mg/kg/min
 3. Iv levetiracetam 20-60mg/kg @5mg/kg/min
- ➔ Start maintenance dose after 8-12hr

REFRACTORY STATUS EPILEPTICUS

- Refractory SE-failure of first line + second line anticonvulsant drugs ,such as an initial benzodiazepine followed by another AED
- The second therapy appears less effective(marginal benefit with each additional AED-5% with second AED)
- Additional benefit of 23% move fast to HDST.

Step 4 - (1-24hours)

- **General measures** – Refractory status epilepticus : shift to PICU, start bedside EEG.
- **Investigations** : screen for neuroinfection , MRI brain +/- contrast and CT-brain if unstable. Autoimmune pannel, metabolic and genetic studies based on clinical suspicion.
- **Management** :
 - A. General anaesthesia to achieve burst supression.

B. Midazolam : 0.2mg/kg iv bolus followed by infusion @ 1mcg/kg/min, increasing 1mcg/kg/min every 5 to 10 min till seizure stops , upto max 30mcg/kg/min , tapering initiated after 24hr of seizure control @ 1mcg/kg/min every 3hr.

OR

High dose Phenobarbitone – 5 – 10 mg/kg boluses every 30 min upto 120mg/kg over 24hr, target seizure control and burst suppression , maintenance upto 40mg/kg/day.

OR

Propofol : Loading dose of 1-2mg/kg, followed by continuous infusion of 1-2mg/kg/hr , max 5mg/kg/hr.

OR

Thiopentone : Loading dose 5mg/kg bolus followed by 3-5mg/kg/hr infusion to achieve burst suppression followed by tapering after 24 hr seizure free period.

Topiramate through OG/NG tube (2-5mg/kg enteral loading , increase by 5-10mg/kg/day upto max of 25mg/kg/day) while tapering anaesthetic agents. **Ketamine** can also be tried.

SUPER REFRACTORY STATUS EPILEPTICUS

- Persistent seizure activity or seizure recurrence despite 24 hour of general anesthesia with medications such as midazolam , pentobarbital ,and/or propofol.

Step 5 – after 24 hr (super refractory SE)

- **General measure** : shift to higher center with neurocritical care unit.
- **Therapeutic options** (on case to case basis)
 1. Ketogenic diet
 2. Immunotherapy – IV methylprednisolone/ IV IG/Others
 3. Vagal nerve stimulation , therapeutic hypothermia
 4. Epilepsy surgery in selected cases

IF THE CHILD IS ALREADY ON ANTI EPILEPTIC DRUG AND CAME IN STATUS EPILEPTICUS ?

For phenytoin $\leq 6\text{mg/kg/day}$,
phenobarbitone $\leq 5\text{mg/kg/day}$, valproate $\leq 30\text{mg/kg/day}$
, levetiracetam $\leq 30\text{mg/kg/day}$ or if the child has missed
few doses of aed or child has vomiting /diarrhea



**GIVE HALF THE LOADING DOSE OF
RESPECTIVE AED**

- If the child is receiving AED at dose higher than mentioned in previous slide .



**AVOID LOADING WITH THAT AED ,
AND MOVED TO NEXT STEP**

STATUS EPILEPTICUS PROTOCOL

- COMORBIDITY RX
- HYPOXIA
- HYPERTHERMIA
- HYPOGLYEMIA
- CEREBRL EDEMA

**FIRST AED: IV Lorazepam/Midazolam/Diazepam
If No iv , Diazepam per rectal/ im Midazolam**

Second Aed : iv Phosphenytoin/ Phenytoin

**Third Aed :iv Valproate /
Levetira/Phenobarbitone**

**Burst Suppression
Midazolam/Thiopentone/Propofol/Pentobarbital**

LAB
INVESTIGATION
ECG

EEG
MONITORING:
BURST
SUPPRESSION
NCSE

Laboratory investigation

- Complete blood count.
- Serum electrolyte.
- Blood urea nitrogen , creatinine.
- Glucose , calcium.
- Should be considered based on individual clinical circumstances (vomiting , diarrhea, dehydration , failure to return to baseline alertness)
- Blood sugar – in all prolonged seizure and neonate.

INDICATION OF LUMBAR PUNCTURE

- < 6month:Lumber puncture Warranted For Any Child With Fever and Seizures.
- 6-12 Month : If Child Has Seizures And Is Non Vaccinated For Hib , Pneumococcus.
- >12 Month :any Child With Fever And Meningeal Sign(Concern About Meningitis Or Encephalitis)
- Immunocompromised Patients.

ROLE OF NEUROIMAGING

- **CT scan is the imaging of choice in emergency room.**

➔ It Should Be Done If:

1. Acute Onset Neurodeficits/ Focal Seizure
2. Prolonged Seizure
3. Features of raised ICP.

3. HDST(High dose suppressive therapy)
 4. Refractory status epilepticus
 5. H/O head trauma / VP shunt
- **Should be done only after the child is stabilized**

ROLE OF EEG IN EMERGENCY ROOM

- Persistent altered sensorium after clinical seizures have stopped for detection of NCSE.
- Suspected herpes encephalitis.
- For assessment and monitoring of the efficacy of therapy for seizure and status epilepticus.

ANTI-EPILEPTIC DRUG LEVEL

- It should be considered when a child with epilepsy on AED prophylaxis develops prolonged seizure.

PROGNOSIS

- Prolonged status epilepticus is associated with high mortality and morbidity.
- Mortality of 28% - 2 hour.
- Mortality of 50% - > 24 hour .
- Long term sequelae- epilepsy , focal neurologic deficits , cognitive decline.

TAKE HOME MESSAGE

1. ABC first and AED next.
2. Intubate SOS at any time
3. Mortality is due to poor airway management
4. Midazolam = lorazepam = diazepam

5. Phosphenytoin = levetiracetam = valproate.

6. Refractory status – midazolam infusion widely used.

7. EEG monitoring – NCSE , burst suppression.

8. immunotherapy



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2005

WALK TO CURB
DIABETES

2005

THE WALK TO CURB DIABETES

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JUNE 2005

Runners
We're on Track
For a Cure