

# Etiologies of seizures

By: Jassim  
abdelghani

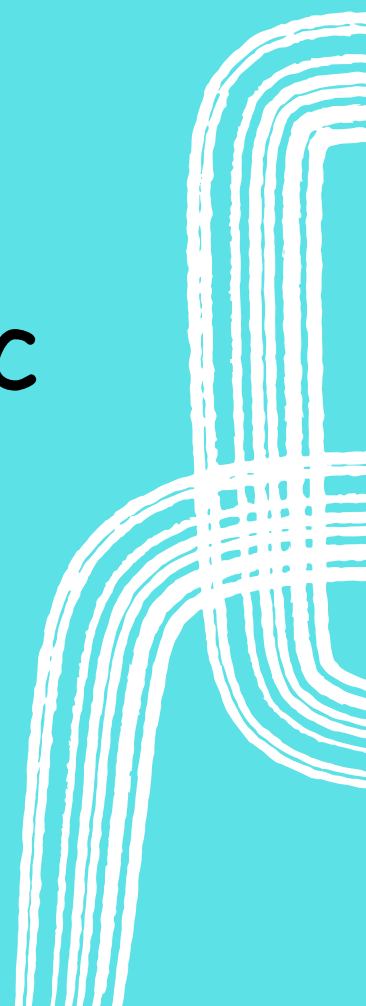


- seizure is an abnormal hypersynchronous electrical discharge of neurons in the brain, producing a clinical dysfunction.
- Epilepsy is defined as a condition in which there is a tendency to have recurrent unprovoked seizure
- the diagnosis of epilepsy is often applied after a patient has had two unprovoked seizures.



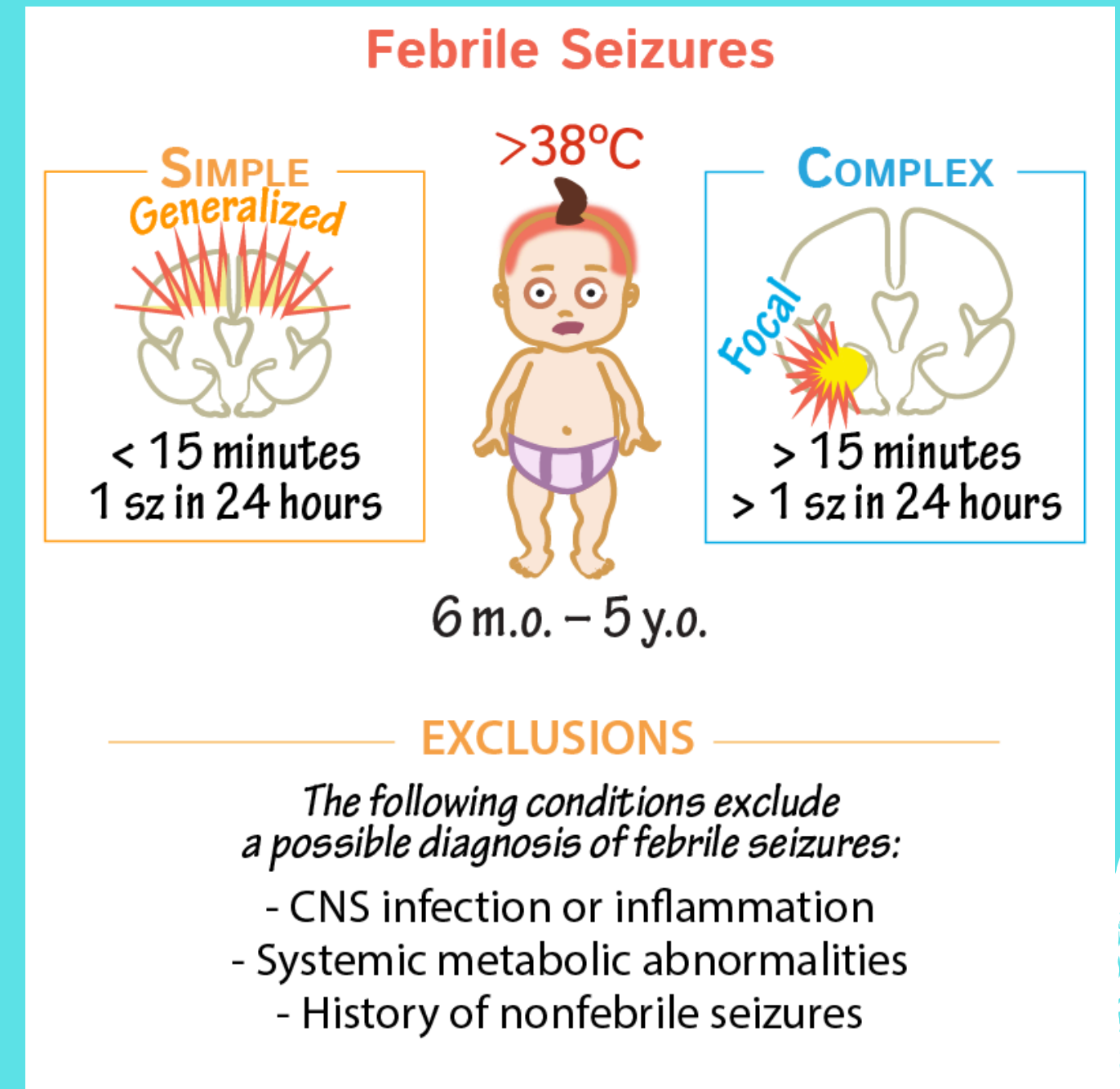


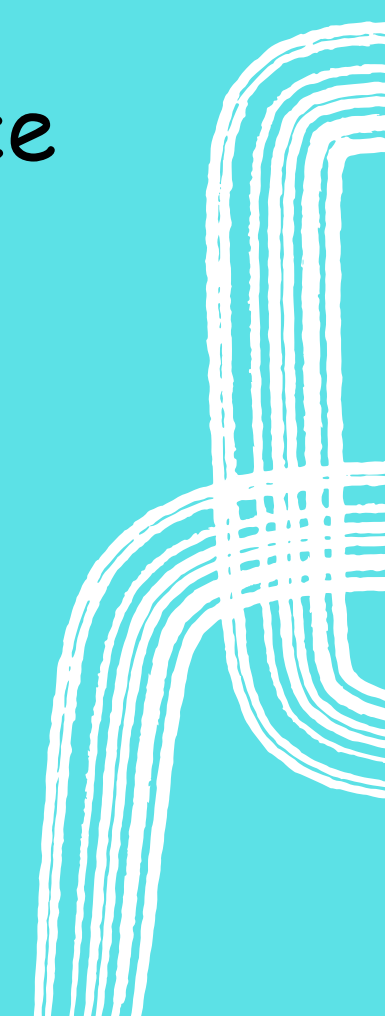
## EPIDEMIOLOGY AND ETIOLOGIES:

- Etiologies vary depending on the age of onset as Seizures have a U-shaped distribution in age of onset , they are more common in the very young and the very old ages .
  - In infants, a variety of neonatal infections, hypoxic-ischemic insults, genetic syndromes, and congenital brain malformations are common causes of seizures.
- 

# Febrile seizures :

- They are the most common cause of seizures in children between 6 months and 5 years of age and affecting up to 3% to 9% of this age group.
- It occur in the setting of a febrile illness without evidence of intracranial infection and are usually generalized in onset. Most children with febrile seizures do not have neurologic deficits.
- to be considered as febrile seizure the fever may be present before the seizure or must develop in the immediate postictal period.



- 
- In older children seizures can develop from head injury, meningitis, encephalitis, or vascular diseases, and genetic syndromes as significant etiology in this age group.
  - Among young adults, head injury, substance use, and excessive alcohol use are common causes of new-onset seizures, but brain tumors and strokes become more common etiologies by middle age
  - In the elderly, strokes become the most common etiology, but substance abuse and alcohol are not uncommon causes.
  - Metabolic disturbances from systemic problems such as severe hypo- or hyperglycemia, hepatic failure, or renal failure are also frequent causes.
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# Classification of seizures and epilepsy

By: Omar  
Alwikhyan



# classification

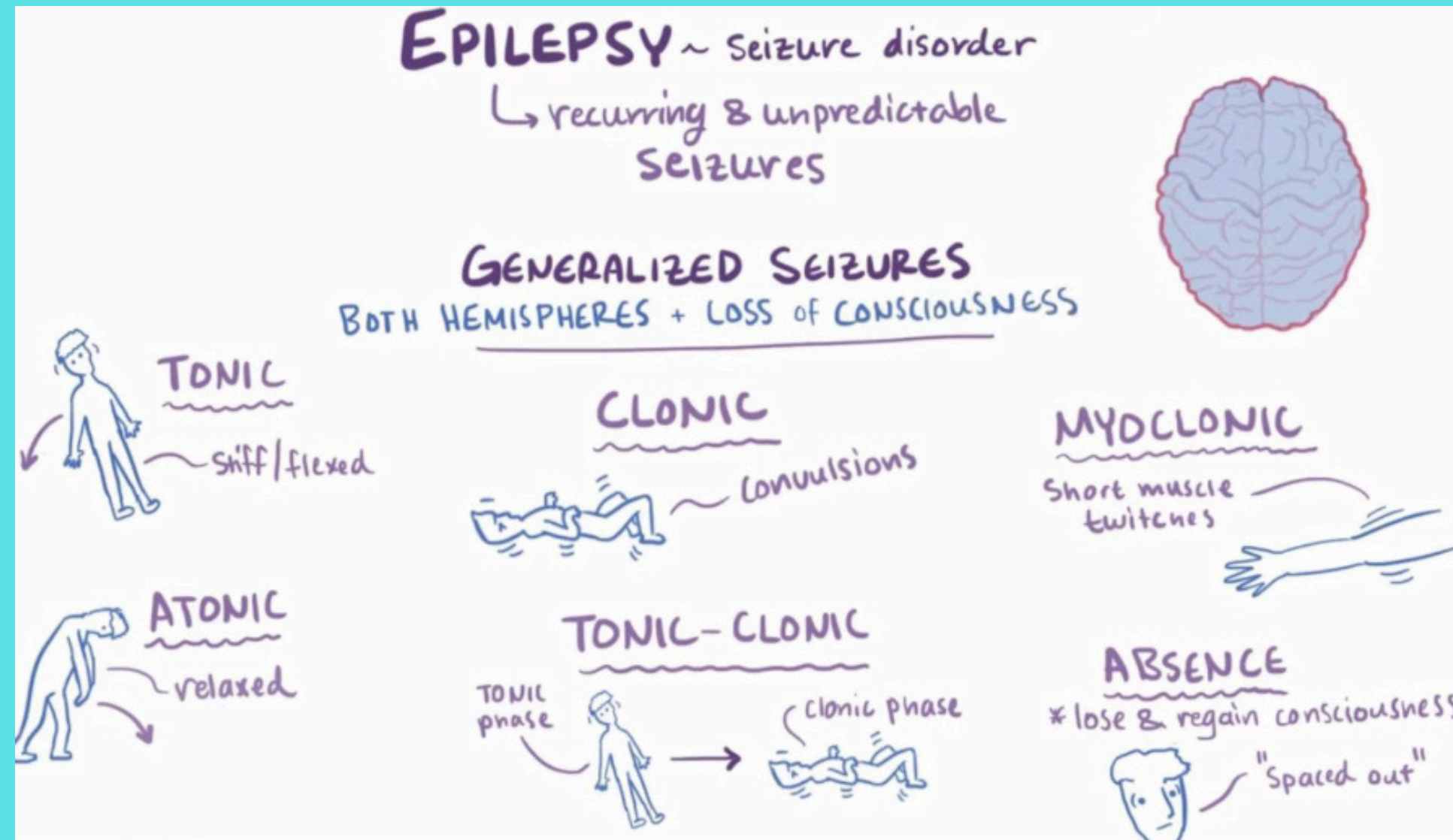
**Epileptic seizures are broadly classified by whether their onset is focal(partial) or generalized.**

**Focal (partial):** Abnormal electrical activity arises from a discrete region most commonly originate in **medial temporal lobe** or ( multiple discrete regions) of the brain. It can involve motor, sensory, autonomic, or psychic features (eg, fear, hallucinations). Aura is common (auditory, visual, olfactory, or tactile hallucinations). Automatisms like lip smacking, picking, and swallowing are common. A postictal focal neurologic deficit (eg, hemiplegia/hemiparesis) is possible and usually resolves within 24 hours. It can be **simple** or **complex**.

- **Aware:** Previously called simple partial seizures. **No impaired level of consciousness.**
- **Impaired awareness:** Previously called complex partial seizures. **Impaired level of consciousness**

**Those that arise from one portion of the brain can evolve and spread to involve the whole brain (secondarily generalized)**

**Generalized seizure:** Seizure activity that involves both cerebral hemi- spheres, resulting in impaired level of consciousness. Classified as motor (tonic-clonic, other motor) or nonmotor (absence) type



# Types of seizures

By: Habib  
Mahmoud





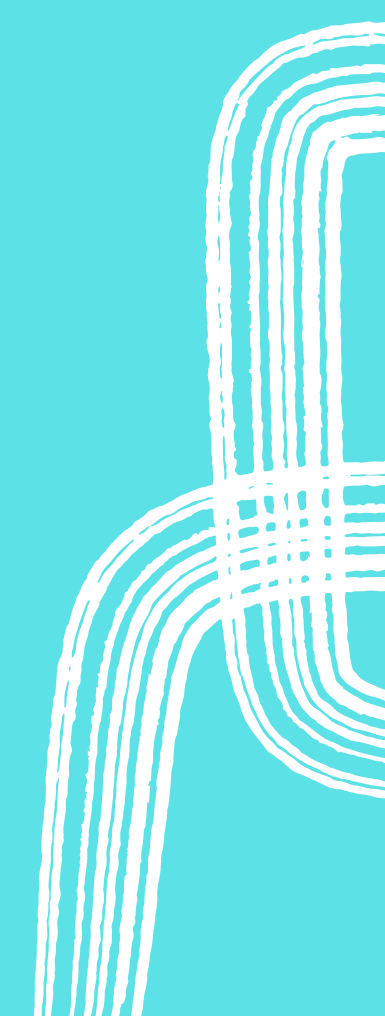
1-Myoclonic: sudden, forceful contractions of single or multiple groups of muscle.

2-Clonic: longer rhythmic jerking activity.

3-Tonic-clonic: alternate contraction(tonic phase) and relaxation(clonic phase) of muscles, a loss of consciousness, and abnormal behavior.

4-Atonic: loss of muscle tone; person suddenly drops.

5-Absence: loss of consciousness with vacant stare or unresponsiveness.



# Focal seizures:

## Motor

- Myoclonic
- clonic
- Tonic
- Hypermotor
- Epilepsia partialis continua
- focal onset with secondary generalization.

## Non-motor

- Focal-onset with impaired awareness.
- Focal-onset with altered cognition, or emotions.
- sensory.**
- Autonomic.**

# Generalized-onset:

## Motor

- Generalised tonic-clonic.
- Myoclonic.
- Tonic.
- Atonic.

## Non-motor

- Absence.
- Myoclonic-Absence.
- Generalised non-convulsive seizures in comatose or ICU patients.
- Autonomic

- 
- Deja vu seizure: seizure occurs in the temporal lobe, especially in the memory area. You feel something that you have experienced this before.

- Jamais vu seizure: characterized by a momentary feeling of unfamiliarity towards familiar things, as if seeing them for the first time.
- 

# Clinical manifestations

By : ZAID  
DAYYEH



# History :

- The diagnosis of epilepsy is primarily clinical. Most commonly the patient is seen after an event has occurred, and the diagnosis must be made on the history alone.
- The patient (and more importantly, witnesses, if the seizure was generalized in onset) must be questioned for an exact description of the event itself (and especially the onset), any premonitory symptoms, and the character of the recovery period in order for the clinician to decide whether the event was a seizure, and, if so, what type of seizure it was.
- The clinical details should allow for the differentiation of seizures from other paroxysmal neurologic events .



# PHYSICAL EXAMINATION :

- The neurologic examination is most helpful diagnostically in the instances in which the patient is observed during the event or shortly thereafter.
  - Abnormalities on neurologic exam may also suggest the presence of a focal brain lesion.
  - The general physical exam may yield findings suggestive of infection or other systemic disease that might explain a new-onset seizure. In particular, signs of meningitis should be sought in any patient who has had a seizure.
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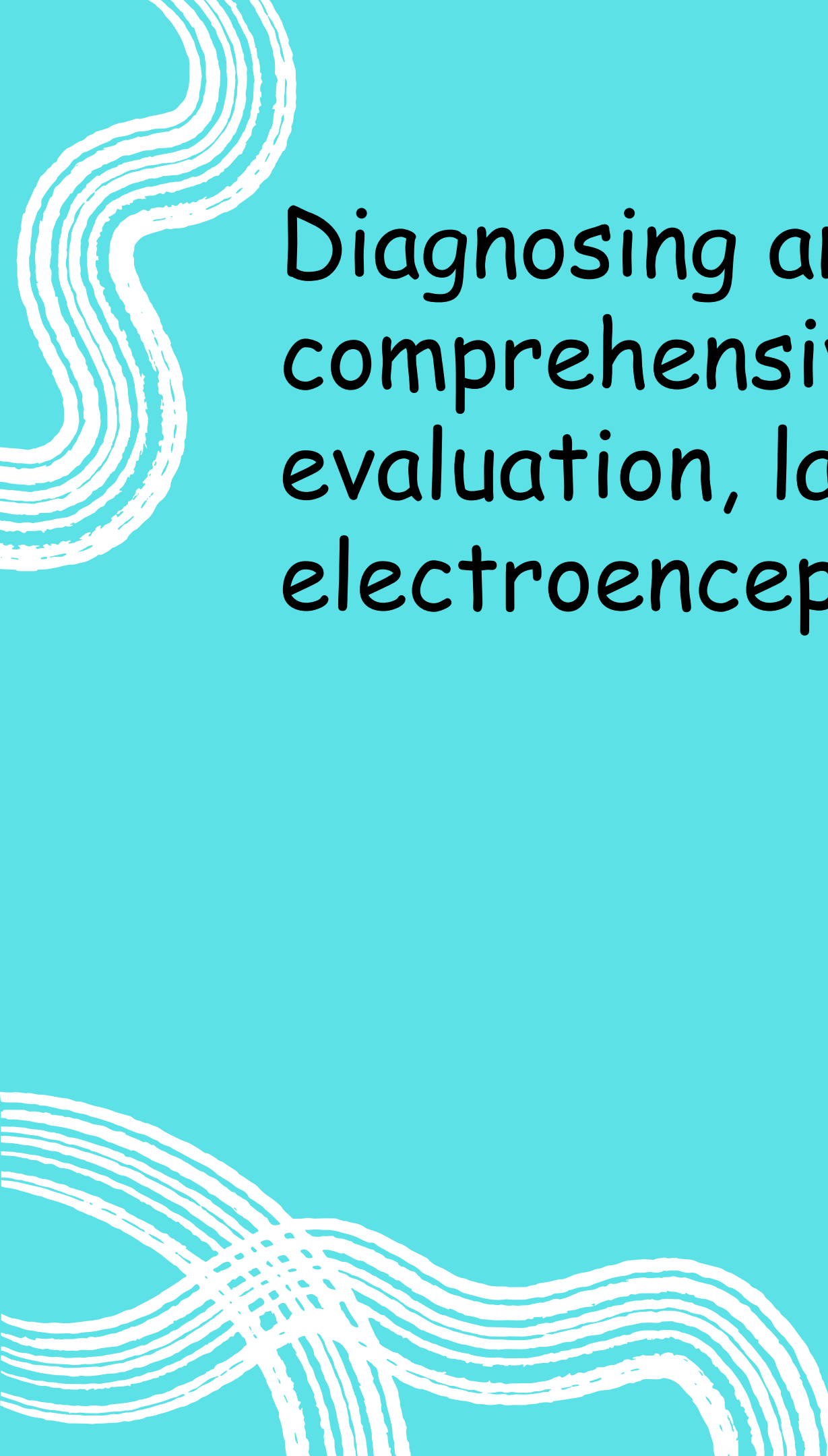
# PHYSICAL EXAMINATION :

-The physical examination of patients with seizure may reveal: lateral tongue bites, nuchal rigidity or asterixis, bruises or scrapes on the body after falls, signs of a neurocutaneous syndrome associated with epilepsy on the skin, back pain, transient or persistent focal weakness or asymmetry, and urinary incontinence .

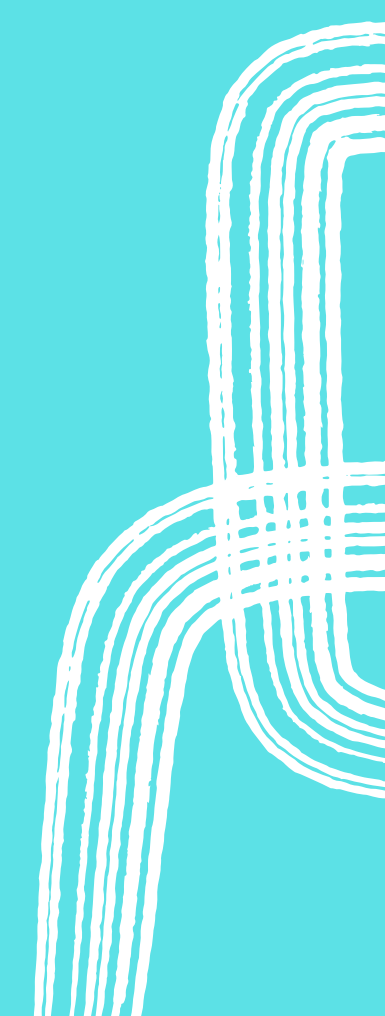
# Investigation Tools for Seizure Patients

Leen Naimi





Diagnosing and managing seizures requires a comprehensive approach that includes clinical evaluation, laboratory studies, brain imaging, and electroencephalography (EEG).



# • Laboratory Studies

## *Initial Laboratory Testing*

*Common Tests:* CBC, serum electrolytes (calcium, sodium), glucose, liver function tests, renal function tests, urinalysis.

*Lactic Acidosis*

*Toxicology Screen*

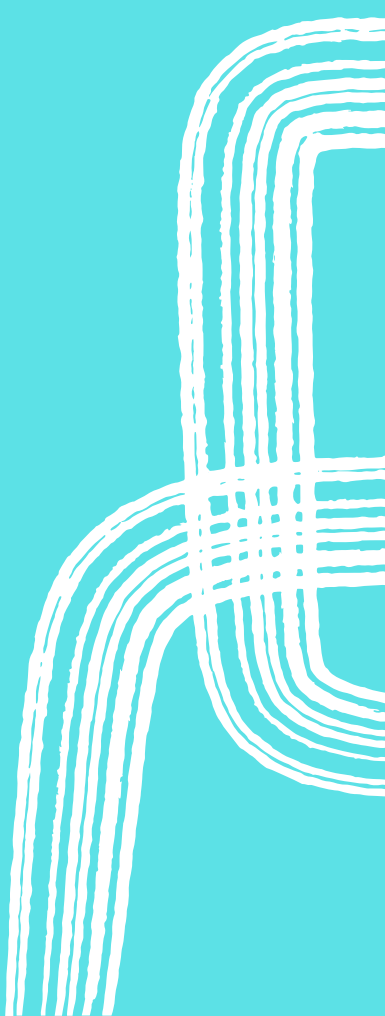
*Pregnancy Test*

*Prolactin*

## **Additional Testing**

*Lumbar Puncture:* Indicated if CNS infection is suspected.

*Drug Levels:* Check antiseizure medication levels in patients with known seizure disorders.



# Brain Imaging

- Imaging is crucial in the evaluation of patients with new-onset seizures to identify potential structural abnormalities in the brain that may be causing the seizures.

- **MRI (magnetic resonance imaging)**

MRI is the diagnostic tool that identifies structural changes in the brain that may cause seizures or be associated with epilepsy. Being able to look at brain structures is important for the treatment of patients with epilepsy in several distinct ways:

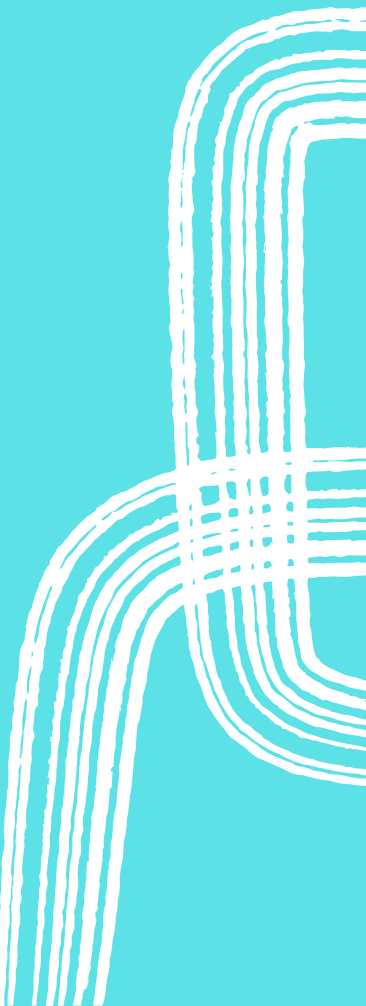
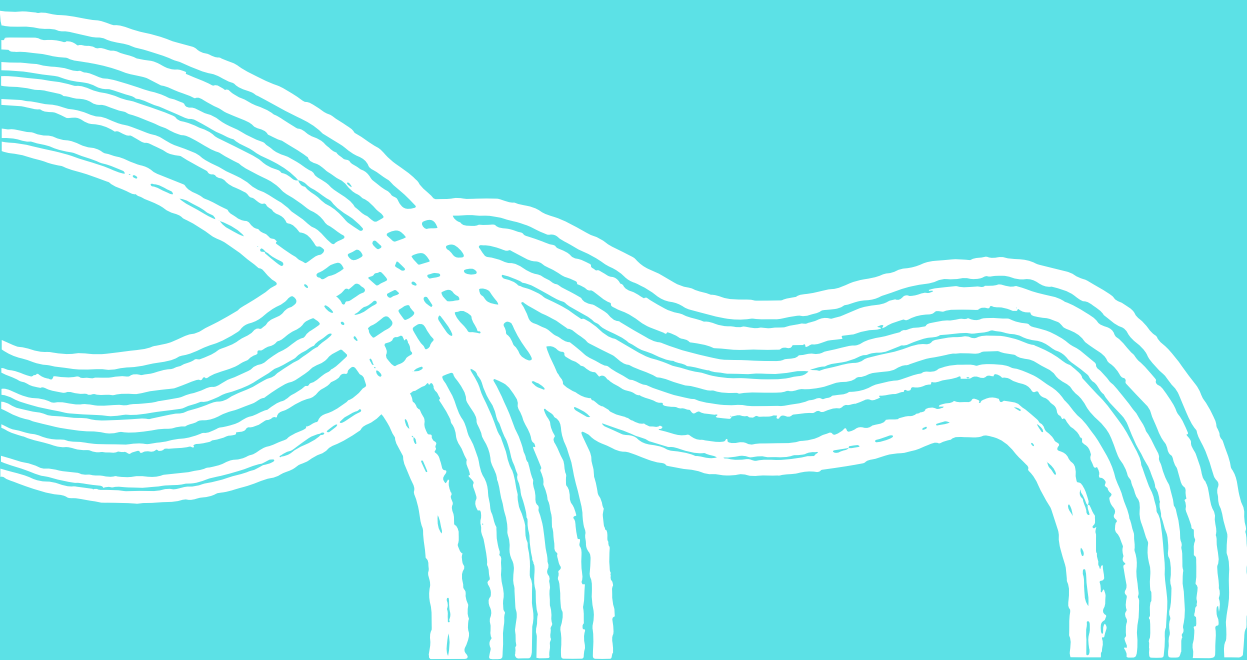
After the first seizure, MRI can be used to identify any serious disorder that may have provoked the seizure, such as a brain tumor or arteriovenous malformation (a blood vessel abnormality).

It can help determine the proper seizure type and syndrome.

Information from MRI is used to evaluate the likelihood that surgery would be effective in controlling a person's seizures. For example, it can identify mesial temporal sclerosis or cavernous angioma and malformations of cortical development (which have a less favorable prognosis for seizure control after surgery).

## MRI vs. CT

- MRI: Considered more sensitive than CT for detecting structural abnormalities like tumors, scarring, and vascular malformations. MRI is especially crucial for the evaluation of non-urgent, first-time seizures because it provides detailed images of brain structures and potential causes of seizures.
- CT Scan: Often used in urgent or emergency settings due to its speed. While it's less sensitive than MRI for certain abnormalities, it's crucial in ruling out acute conditions like brain hemorrhages, fractures, or large masses, especially in trauma or status epilepticus situations.



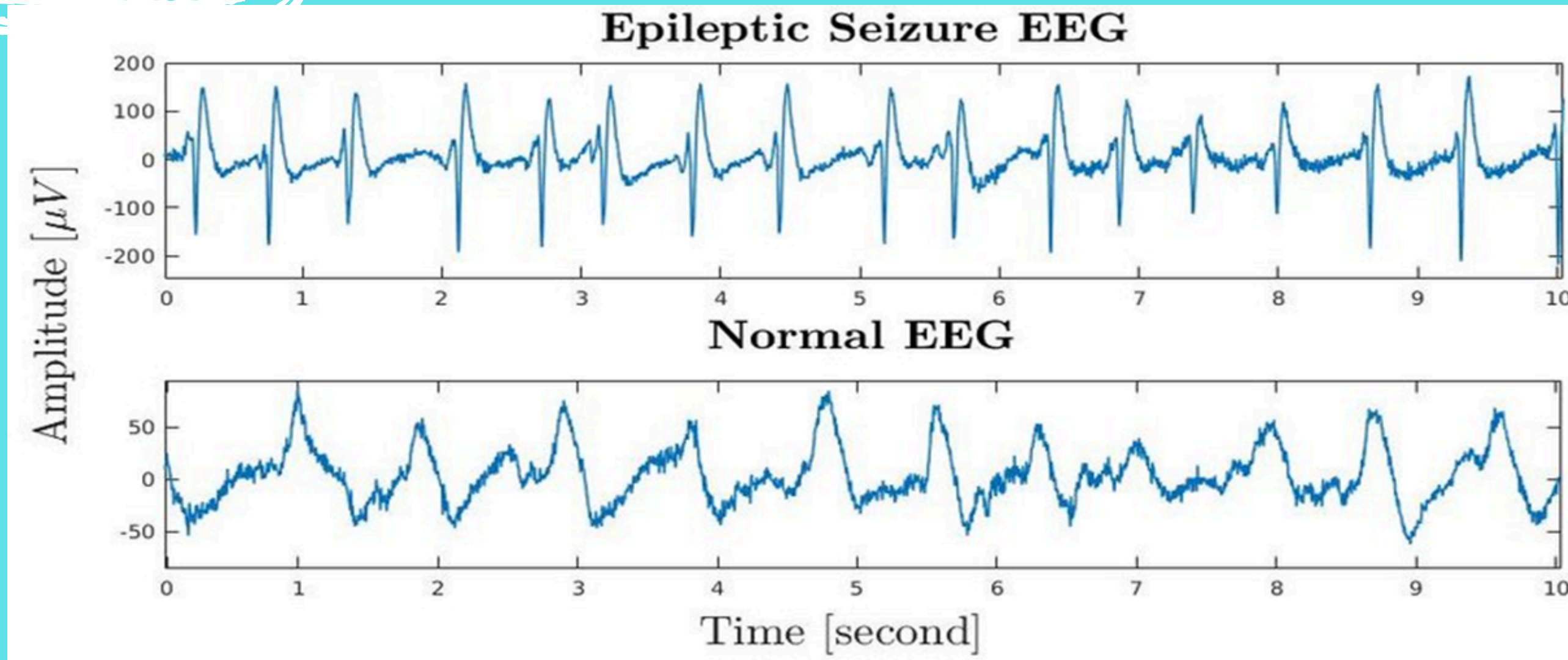
# Electroencephalography (EEG)

EEG is an essential diagnostic tool in epilepsy, providing a non-invasive method to record the brain's electrical activity and detect abnormalities associated with seizures. In epilepsy, these recordings often reveal specific patterns such as spikes, sharp waves, or spike-and-wave discharges, which signify excessive, synchronized neuronal firing. These patterns can be seen during or between seizures, known as interictal epileptiform activity.

Activation procedures, such as hyperventilation or photic stimulation, can enhance the likelihood of finding abnormalities by provoking epileptiform discharges during the recording.

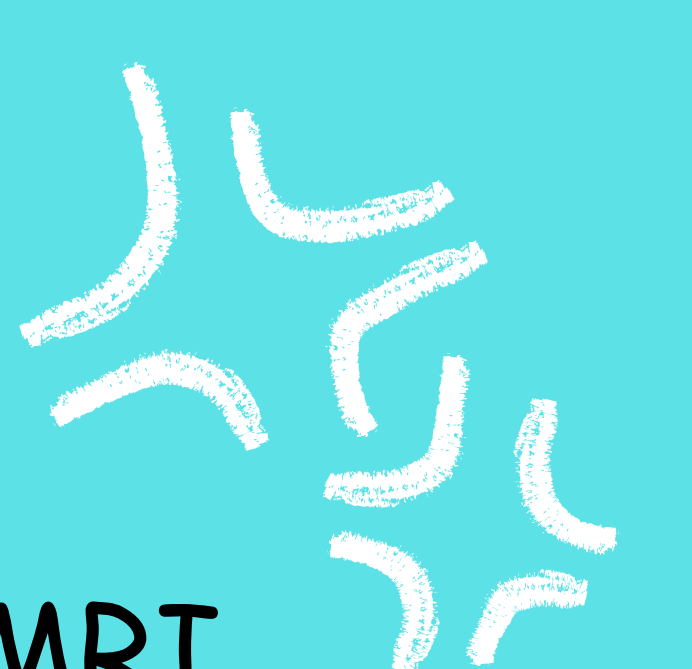
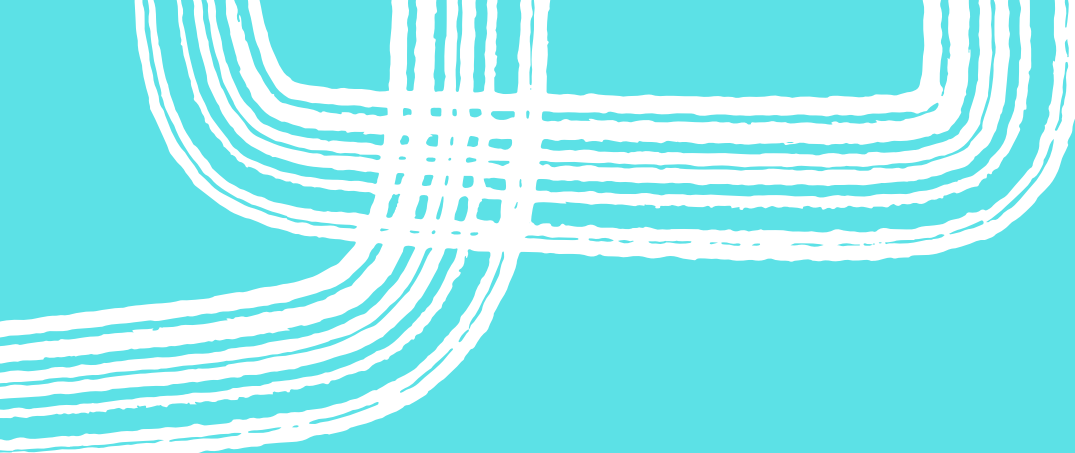
However, **limitations** exist in EEG's diagnostic capabilities. Many patients with epilepsy show no abnormalities on repeated EEGs between attacks (interictal EEG). In fact, up to **50% of routine EEGs** in patients with known epilepsy can be normal. This means that while EEG is a useful tool, a normal result does not rule out epilepsy, necessitating further diagnostic workups such as imaging or repeat EEG studies.

- **Advanced EEG techniques**, including long-term video EEG monitoring .

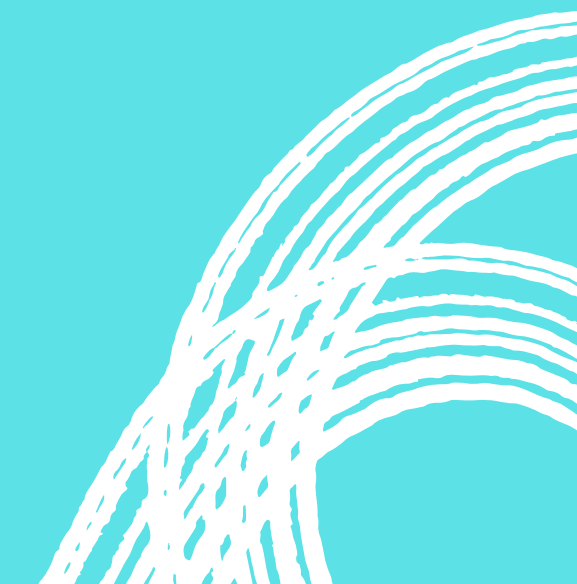


**Epileptic Seizure EEG:** The waveform shows high amplitude, sharp spikes that are frequent and rhythmic. These characteristics are typical of a seizure, indicating abnormal excessive neuronal activity.

**Normal EEG:** The waveform is smoother with more regular and lower-amplitude oscillations, indicating typical brain electrical activity without seizure activity.



Combining EEG findings with imaging techniques like MRI enhances the precision of diagnosis, helping guide decisions on medical or surgical treatment options. Advanced EEG modalities, such as high-density EEG and source localization techniques, can offer even more detailed insights, identifying specific neural networks involved in epileptic activity, thus contributing to a comprehensive understanding of the disorder and improving patient management



# TREATMENT & FIRST AID

By: OBADA  
ALTALLA



# ANTIEPILEPTICS

## Na<sup>+</sup> CHANNEL BLOCKERS

- VALPROATE
- PHOSPHENYTOIN
- TOPIRAMATE
- LAMOTRIGINE
- FOSPHENYTOIN
- CARBAMAZEPINE

## SV2A BLOCKERS

- LEVETIRACETAM (KEPPRA)

## Ca<sup>++</sup> CHANNEL BLOCKERS

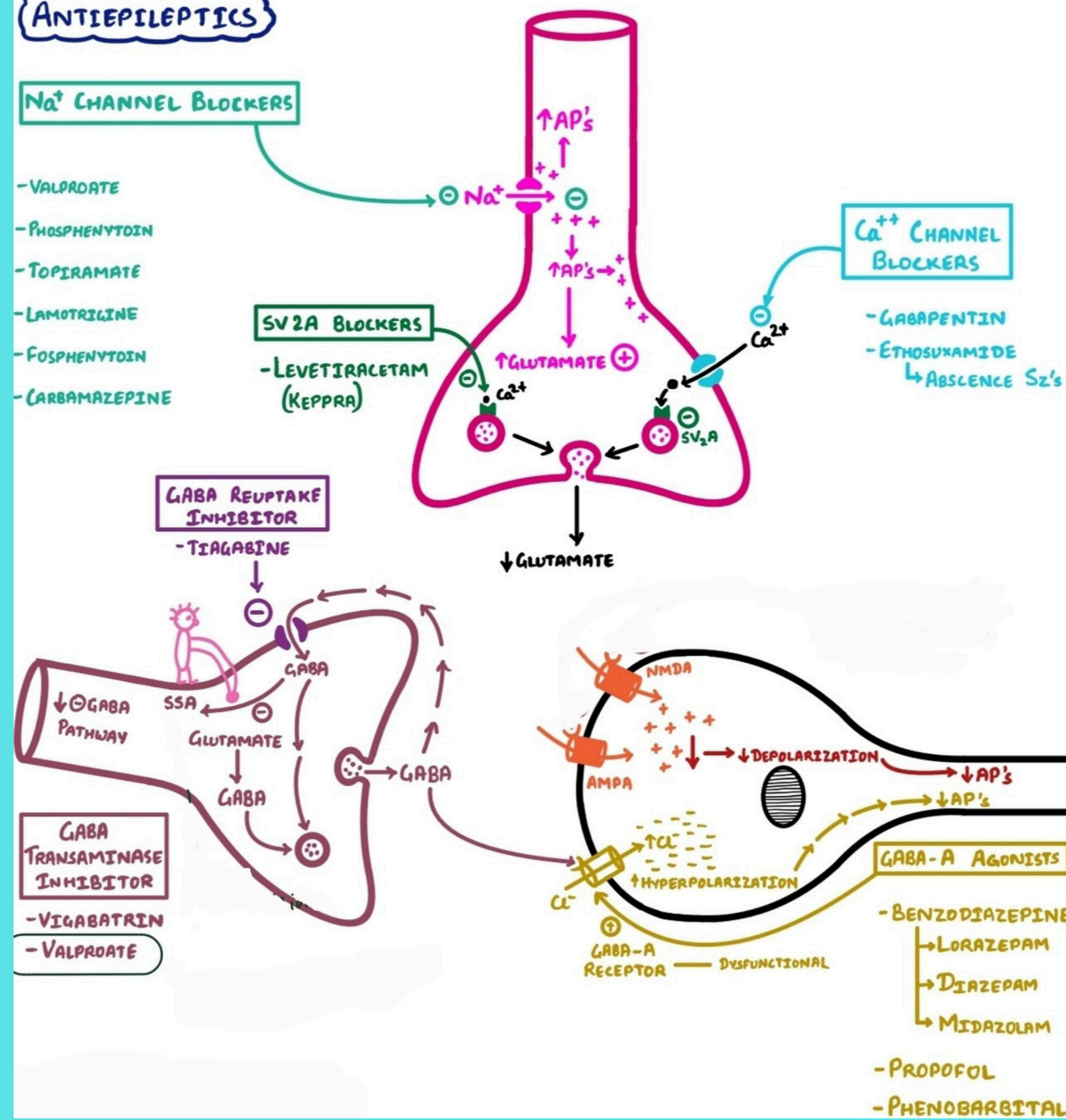
- GABAPENTIN
- ETHOSUXAMIDE  
↳ ABSENCE SZ's

## GABA REUPTAKE INHIBITOR

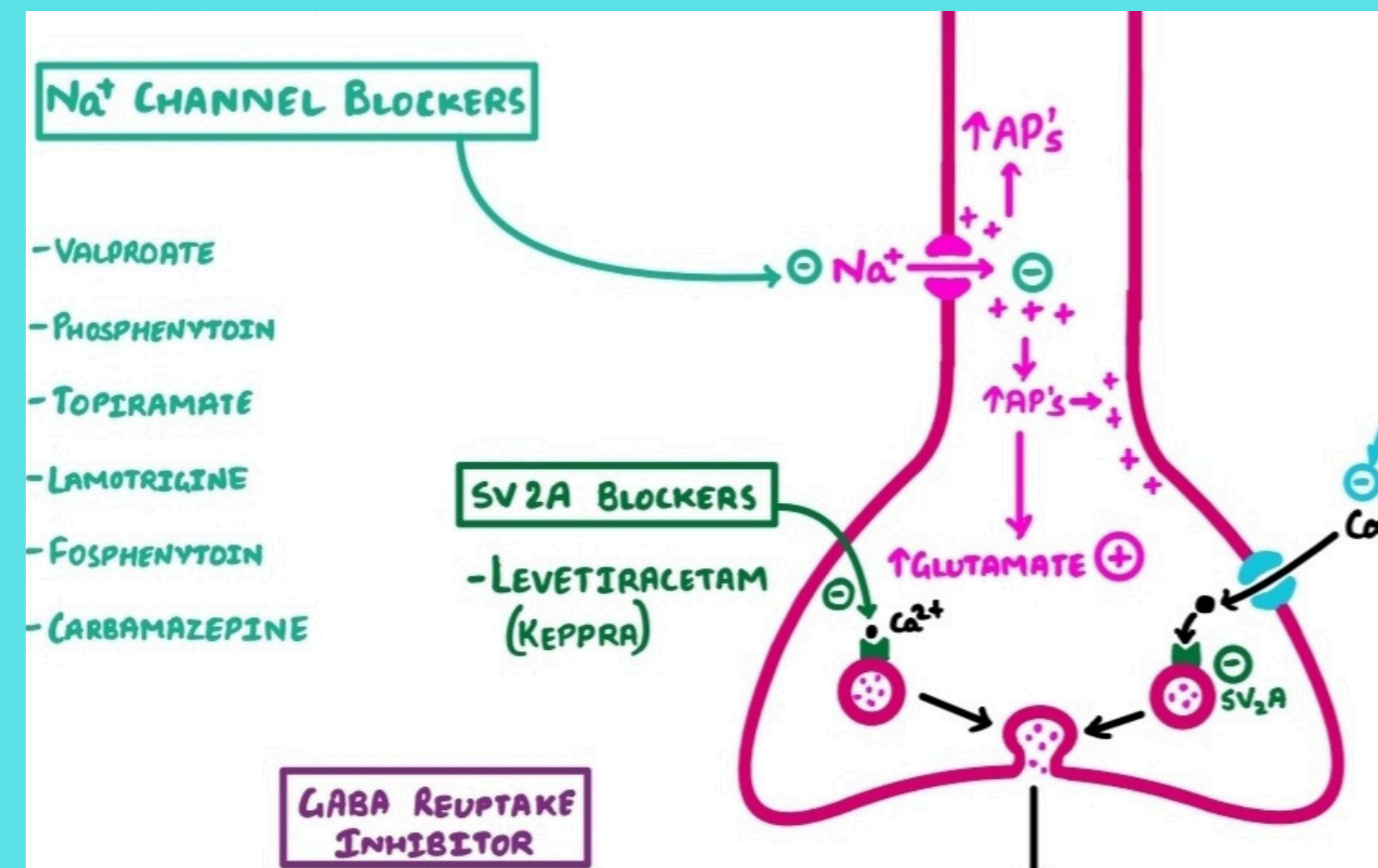
- TIAGABINE

## GABA TRANSAMINASE INHIBITOR

- VIGABATRIN
- VALPROATE



# DECREASE GLUTAMATE NA<sup>+</sup> CHANNEL BLOCKERS

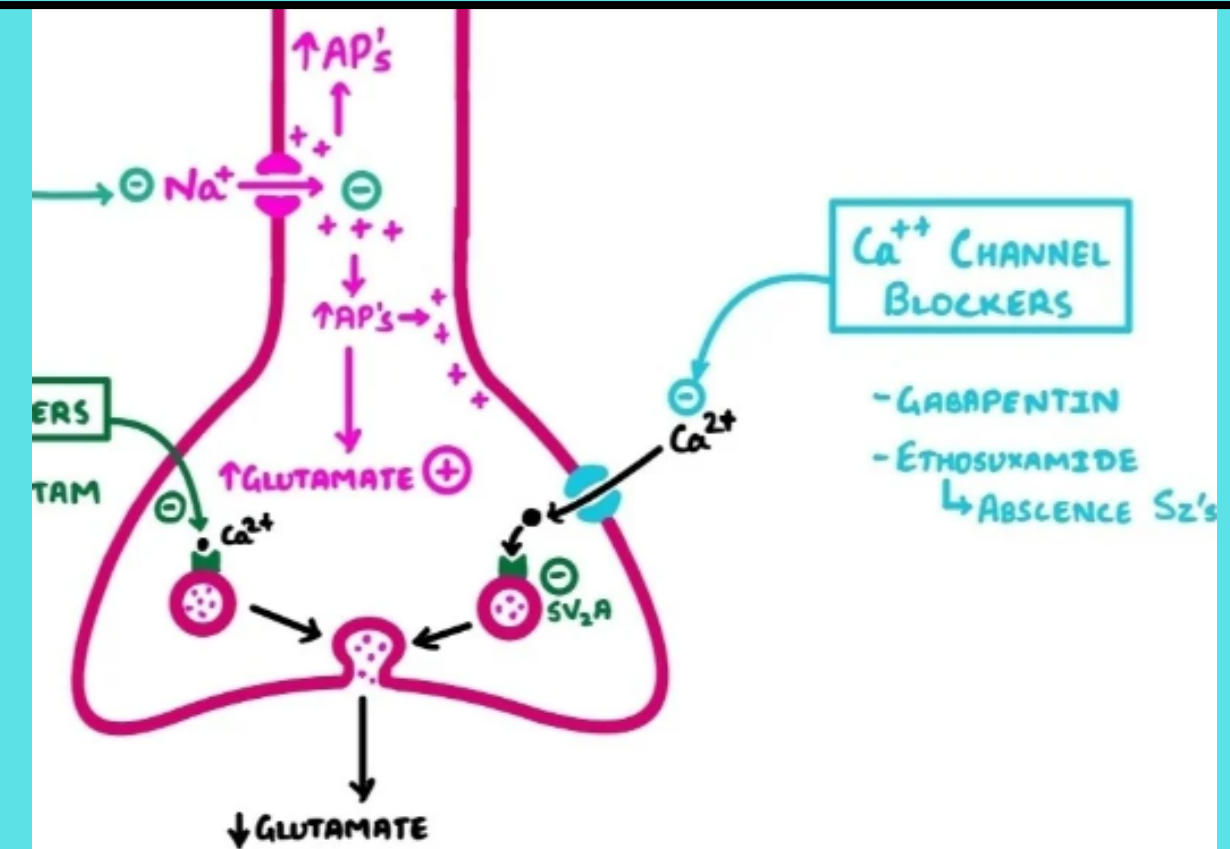


|                           |                                             |                    |                                                                                               |
|---------------------------|---------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------|
| Phenytoin (Dilantin)      | Na <sup>+</sup> channel                     | Focal <sup>a</sup> | Gingival hyperplasia, coarsening of facial                                                    |
| Carbamazepine (Tegretol)  | Na <sup>+</sup> channel                     | Focal              | Hyponatremia, diplopia                                                                        |
| Oxcarbazepine (Trileptal) | Na <sup>+</sup> channel                     | Focal              | Sedation, diplopia, hyponatremia                                                              |
| Valproic acid (Depakote)  | Na <sup>+</sup> channel, GABA receptor      | Focal, generalized | GI symptoms, tremor, weight gain, hair loss, hepatotoxicity, thrombocytopenia, teratogenicity |
| Lamotrigine (Lamictal)    | Na <sup>+</sup> channel, glutamate receptor | Focal, generalized | Diplopia, rash (rare Stevens–Johnson syndrome; more with rapid introduction)                  |

# NA<sup>+</sup> CHANNEL BLOCKERS

|                      |                                        |                    |                                                    |
|----------------------|----------------------------------------|--------------------|----------------------------------------------------|
| Topiramate (Topamax) | Na <sup>+</sup> channel, GABA activity | Focal, generalized | Word-finding difficulty, renal stones, weight loss |
| Lacosamide (Vimpat)  | Na <sup>+</sup> channel                | Focal              | Sedation, headache, syncope                        |

## CA<sup>2+</sup> CHANNEL BLOCKERS



|                         |                                                          |         |                                         |
|-------------------------|----------------------------------------------------------|---------|-----------------------------------------|
| Ethosuximide (Zarontin) | T-type Ca <sup>2+</sup> channel                          | Absence | GI symptoms                             |
| Gabapentin (Neurontin)  | Unknown, possibly voltage-gated Ca <sup>2+</sup> channel | Focal   | Sedation, weight gain (occasional)      |
| Pregabalin (Lyrica)     | Voltage-gated Ca <sup>2+</sup> channel                   | Focal   | Sedation, peripheral edema, weight gain |

# SV2A BLOCKERS

Levetiracetam (Keppra)

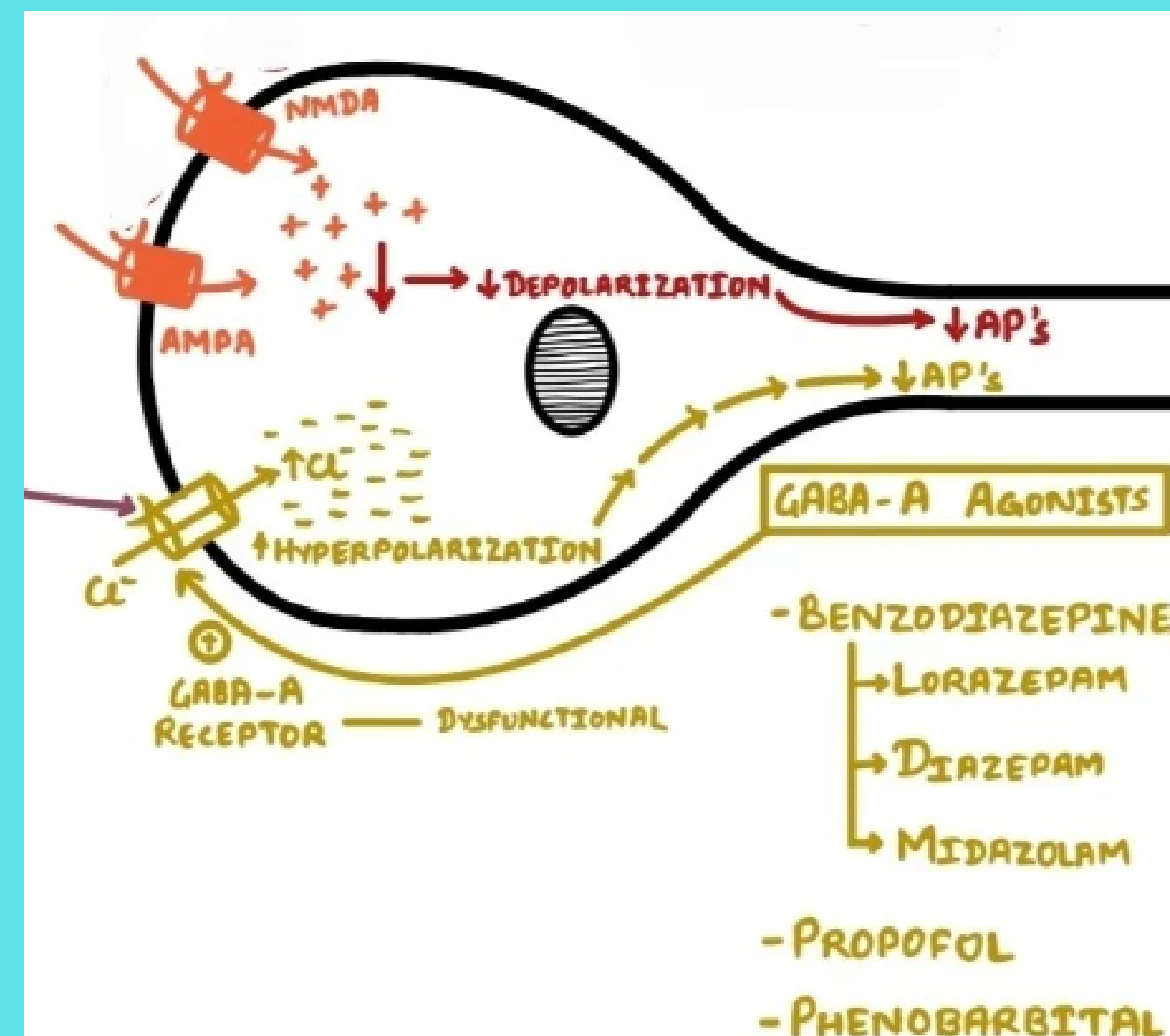
Poorly understood (synaptic vesicle modulation of neurotransmitter effects)

Focal, generalized

Insomnia, anxiety, irritability

## INCREASE GABA

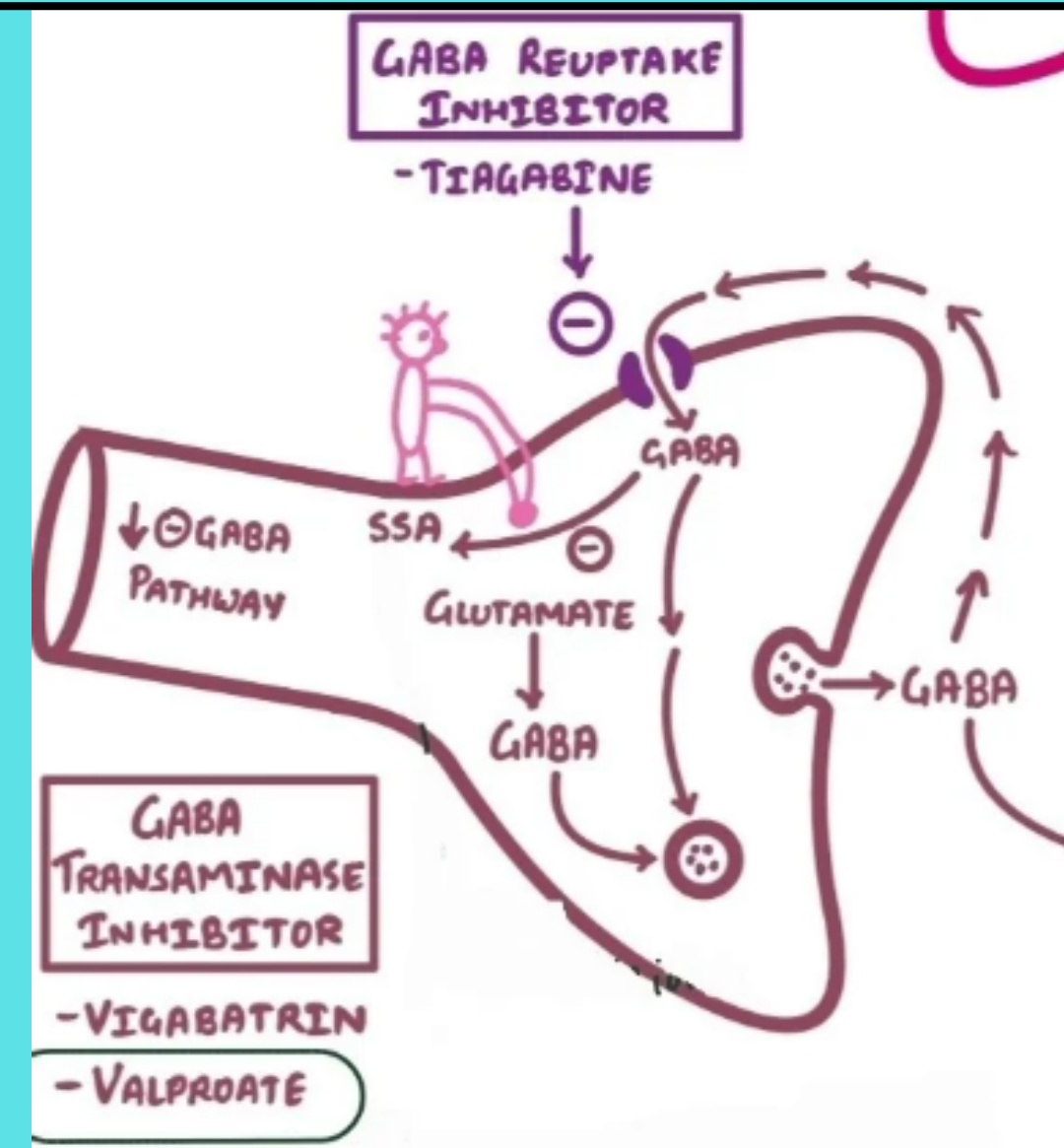
## GABA AGONISTS



# GABA AGONISTS

|                      |                                        |                    |                                                    |
|----------------------|----------------------------------------|--------------------|----------------------------------------------------|
| Phenobarbital        | GABA receptor                          | Focal, generalized | Sedation                                           |
| Topiramate (Topamax) | Na <sup>+</sup> channel, GABA activity | Focal, generalized | Word-finding difficulty, renal stones, weight loss |
| Clobazam (Onfi)      | Benzodiazepine receptor                | Generalized        | Sedation, mood symptoms, fever                     |

## GABA REUPTAKE INHIBITOR



# GABA REUPTAKE INHIBITOR

Tiagabine (Gabitril)

GABA reuptake

Focal

Sedation

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# GABA TRANSAMINASE INHIBITOR

Valproic acid (Depakote)

Na<sup>+</sup> channel, GABA  
receptor

Focal, generalized

GI symptoms, tremor,  
weight gain, hair loss,  
hepatotoxicity,  
thrombocytopenia,  
teratogenicity

An ASD is typically not started after a single seizure unless there is reason to believe that a second seizure is likely. This applies especially to symptomatic seizures, i.e., those due to a treatable or reversible condition, such as meningitis, alcohol withdrawal, or hyponatremia. Most neurologists would also not start an ASD after a single seizure for which no underlying cause is found. ASD treatment is usually begun after two seizures that are not provoked. The primary goals of ASD treatment are to eliminate seizures and avoid side effects, ideally with monotherapy—i.e., using a single drug. Most neurologists increase the dose of a single drug until either seizure control is achieved or adverse effects become intolerable. If the latter occurs, the dose is lowered and a second drug may be added. If seizure control is achieved, an attempt is often made to taper the first drug, leaving the second as monotherapy.

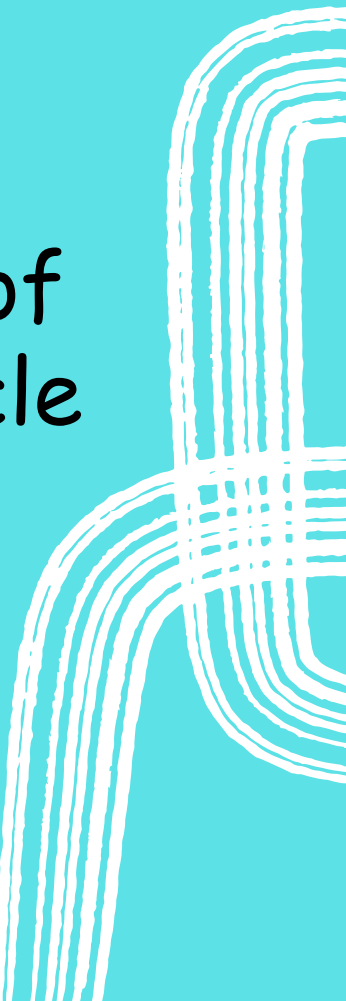


# KETOGENIC DIET

The ketogenic diet is a high-fat, high-protein, low-carbohydrate diet often considered for treatment of patients with epilepsy. It produces urine and plasma ketones, which are used for monitoring therapy. It can be effective in reducing the seizure frequency in both adult and pediatric patients. There are several epilepsy syndromes, mostly pediatric, for which there is good evidence of efficacy of the ketogenic diet. It can be difficult for patients to tolerate and is not known to be safe for other medical comorbidities, including lipid disorders

# VAGUS NERVE STIMULATION

The vagus nerve stimulator is a device shown to be effective in the treatment of partial and generalized seizures. It is implanted subcutaneously below the clavicle and stimulates the left vagus nerve through programmed electrical impulses delivered through leads placed in the neck



# SURGERY

Patients refractory to medical management may be candidates for epilepsy surgery. Exactly what constitutes being medically refractory will depend on an individual patient's circumstances; contributing factors typically include seizure type and frequency, tolerance of ASD therapy, number of ASDs tried, and the effect on the patient's quality of life. The most common surgical procedure is resection of the epileptogenic area, typically following a presurgical evaluation in which continuous video-EEG monitoring combined with neuroimaging and other tests is used to identify the focus of seizure onset. For seizures of medial temporal lobe origin (the most common target of epilepsy surgery), the rate of complete seizure freedom following resective surgery can be over 60%. Other less commonly used surgical procedures include corpus callosotomy, hemispherectomy, or multiple subpial transection



# FIRST AID

All physicians should be familiar with first aid measures for patients having a seizure. In general, the goal is to prevent the patient from becoming injured (and to prevent wellmeaning bystanders from intervening unwisely). The patient with complex partial seizures may wander or make semipurposeful movements; if necessary, he or she should be gently guided out of harm's way. More aggressive attempts at restraint may provoke a violent reaction. The patient with GTCs should be laid on his or her side, if possible, so that vomiting does not lead to aspiration. Tight clothing should be loosened. Nothing should be placed in the mouth. Most GTCs stop within 1 to 2 minutes; immediate medical attention should be sought if a seizure becomes more prolonged

# STATUS EPILEPTICUS

By: abdallah  
Hanini



# STATUS EPILEPTICUS (SE)

is an abnormal state in which either seizure activity is continuous for a prolonged period OR seizures are so frequent that there is no recovery of consciousness between them

# types of SE:

- 1) **Generalized Convulsive SE**-ongoing clonic movements of the limbs
- 2) **Subtle SE**-in which the patient may be unresponsive and might have subtle motor signs such as:
  - A) eyelid twitching
  - B) nystagmus

# Potential causes of SE:

- acute metabolic disturbances /Toxic insults / Infectious insults /hypoxic-ischemic brain damage underlying epilepsy.

# managment

SE is a medical emergency,the management centers on stopping the seizure activity and preventing the occurrence of systemic complications

**TABLE 15-5.** Management of Status Epilepticus

| Phases                       | Timing    | Steps                                                                                                                                                                                                                                       | Monitoring                                                                                                                                                                                                     |
|------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stabilization                | 0–5 min   | <ul style="list-style-type: none"><li>• Airway</li><li>• Breathing</li><li>• Circulation</li><li>• Oxygen</li></ul> Blood glucose (finger stick) <ul style="list-style-type: none"><li>• Thiamine and D5W if glucose &lt;60 mg/dL</li></ul> | <ul style="list-style-type: none"><li>• ECG</li><li>• IV access</li><li>• Labs studies: CBC, chemistry, toxicology screen, antiseizure drug level, if known to be on treatment</li></ul>                       |
| <b>If seizures continue:</b> |           |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                |
| Initial treatment            | 5–20 min  | Administer benzodiazepines.<br><i>One of the following:</i> <ul style="list-style-type: none"><li>• IM midazolam</li><li>• IV lorazepam</li><li>• IV diazepam</li></ul>                                                                     |                                                                                                                                                                                                                |
| <b>If seizures continue:</b> |           |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                |
| Second treatment             | 20–40 min | Administer antiseizure drug.<br><i>One of the following:</i> <ul style="list-style-type: none"><li>• IV fosphenytoin</li><li>• IV valproic acid</li><li>• IV levetiracetam</li></ul>                                                        |                                                                                                                                                                                                                |
|                              |           | <ul style="list-style-type: none"><li>• IV lacosamide</li><li>• IV phenobarbital</li></ul>                                                                                                                                                  |                                                                                                                                                                                                                |
| <b>If seizures continue:</b> |           |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                |
| Third treatment              | 40–60 min | Repeat treatments in second phase or sufficient continuous IV infusion of seizure-suppressing (“anesthetic”) medications: midazolam, propofol, or pentobarbital (or thiopental)                                                             | <ul style="list-style-type: none"><li>• Initiate continuous EEG monitoring</li><li>• Admit to ICU</li><li>• If continuous IV infusion of sedating drugs is administered, patient requires intubation</li></ul> |

These steps to stabilize a patient in status epilepticus are a suggested guideline; clinicians may and should adapt these steps appropriately to the individual patient’s presentation.

CBC, complete blood count; ECG, electrocardiogram; EEG, electroencephalogram; ICU, intensive care unit; IM, intramuscular; IV, intravenous.

- It is crucial to consider ongoing nonconvulsive seizures in patients whose convulsions have stopped but show no improvement in mental status or have mental impairment that is worse than expected based on other conditions.
- A cluster of frequent seizures may require aggressive management, as it can quickly progress to status epilepticus (SE).
- Morbidity from SE can be high
- outcomes of SE depends largely on **etiology** and **duration**
- There are evidence-based guidelines on how to approach adults and children in SE
- Finally, the EEG can help diagnose nonconvulsive status epilepticus as a cause of coma in cases in which this is (or is not) suspected clinically.

*Thank  
you!*

תודה  
רבה