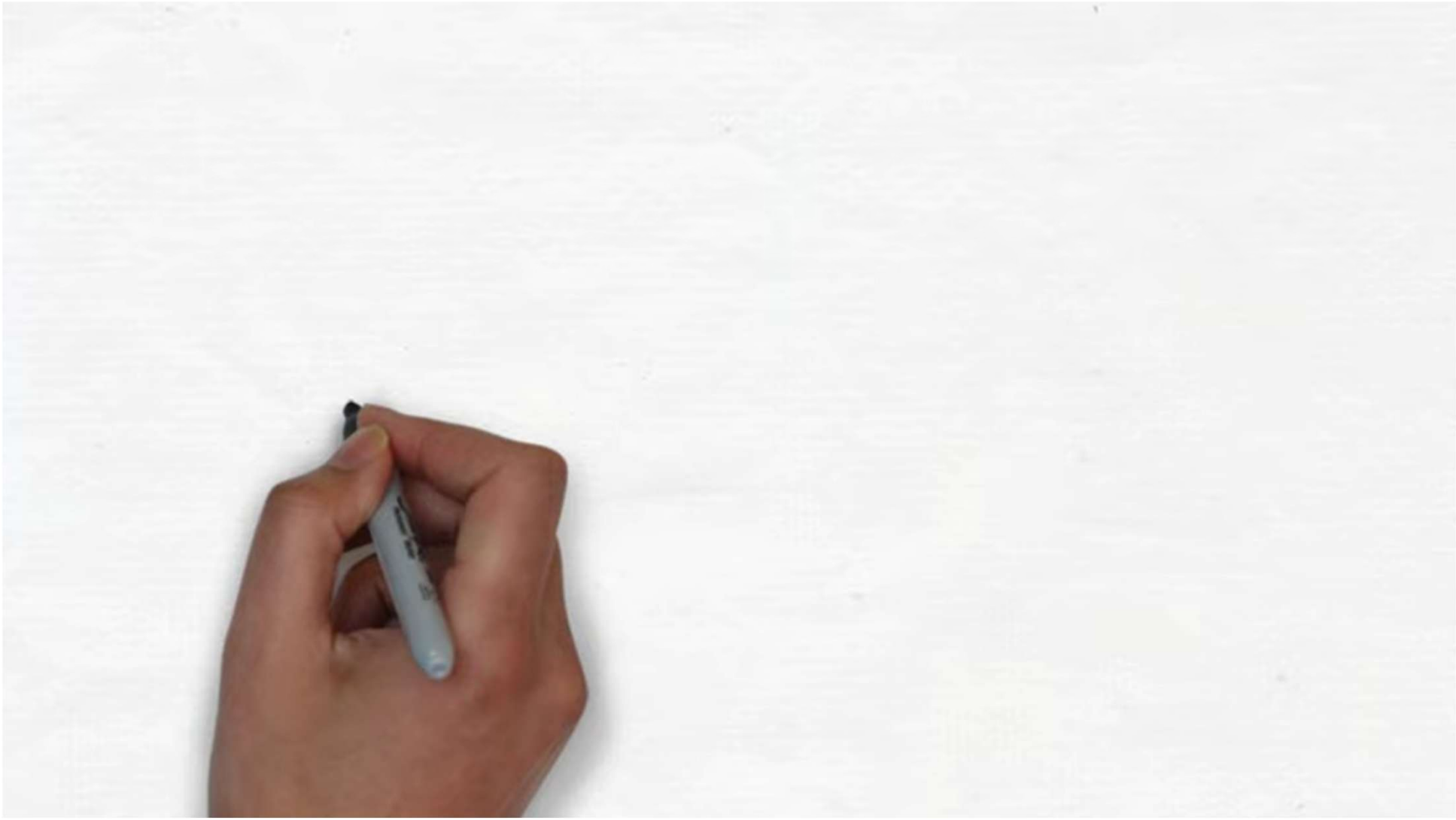
Seizure Disorders

Dr. David Shepherd

8/10/25

2 Minute Epilepsy



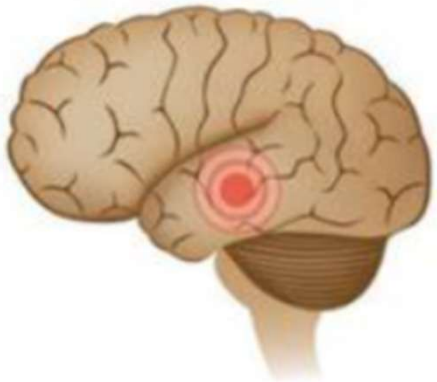
https://youtu.be/OGFQhLPaaOQ

What is a seizure?

Generalized Seizure

- Uncontrolled electrical discharges of brain neurons

- Transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain



Focal Seizure

Seizure Facts

- **Seizure = one event**
- **Epilepsy = chronic condition with recurrent unprovoked seizures**
- **Serial Seizures = status epilepticus = medical emergecy**
- Epilepsy – Greek for to take or to seize.
    - "a taking hold of," "being seized upon"
    - Sudden unpredictable fits
    - Ancient belief that epilepsy was caused by external "forces" of devine or demonic nature.
- Affects 0.65% of adults worldwide
- Incidence 23-61 per 100,000 person years.
- **After a first unprovoked seizure recurrence can be as high as 60%**
- **Epilepsy Diagnosis:**
    - after 2 unprovoked seizures more than 24 hrs apart OR single seizure in a person at high risk of recurrence.
- Increased chance of recurrence:
    - Abnormal EEG
    - Abnormal neurologic status
    - Second seizure
    - Stratify risk into low, medium, high
- **Generalized, focal, unknown -** Seizures are classified according to what type
- Presentation depends on where in the brain the electrical activity is and the pattern of spread.
    - Generalized – widespread electrical activity
    - Focal – electrical activity in a localized brain region

Generalized Seizure

Focal Seizure

Is it a Seizure?

- **Seizure**
  - **Provoked vs non-provoked**
  - **Multiple types**
- Ruel out Syncope
  - Reflex, orthostatic, cardiac
  - Drug related
  - Parkinsons dz
- CVA, TIA
- Psychogenic nonepileptic seizure
  - Functional Neurologic Disorder
- Other conditions that can mimic seizure

What Might Cause a Seizure?

Provoked Seizure

V	Vascular	CVA, Hypertension, head bleed
I	Infection	Meningitis, encephalitis
T	Toxins Trauma	Etoh/Benzos, cocaine, amphetamines, (rarely opioids) TBI
A	Autoimmune	Vasculitis
M	Metabolic	Low glucose !!!! High Na, Ca, Mg Low Na
I	Idiopathic	Unknown cause. ? Epilepsy?
N	Neopolasm	Brain mets

Drugs that lower the seizure threshold

- Polypharmacy with high anticholinergic load (diphenhydramine, hydroxyzine, + others on Beers List…
- *Bupropion* and Venlafaxine lower seizure threshold
- *Clozapine* - dose dependent, increased with rapid titration
- Olanzapine, quetiapine, risperidone
- Stimulants: amphetamines, methylphenidate, modafinil
- Tramadol (serotinergic + noradrenergic + opioid activity)
- Antibiotics: Beta lactams, imipenem, flouroquinolones, isoniazid
- Theophylline
- Many, many, more

Provoked Seizure

- Illicit drugs – cocaine, meth
- Metabolic disturbances:
  - HYPOGLYCEMIA !!!!!!! (< 50)
  - HypOnatremia (< 120)
  - HypERnatremia
  - HypERcalcemia
  - HypERmagnesemia

Unprovoked Seizure

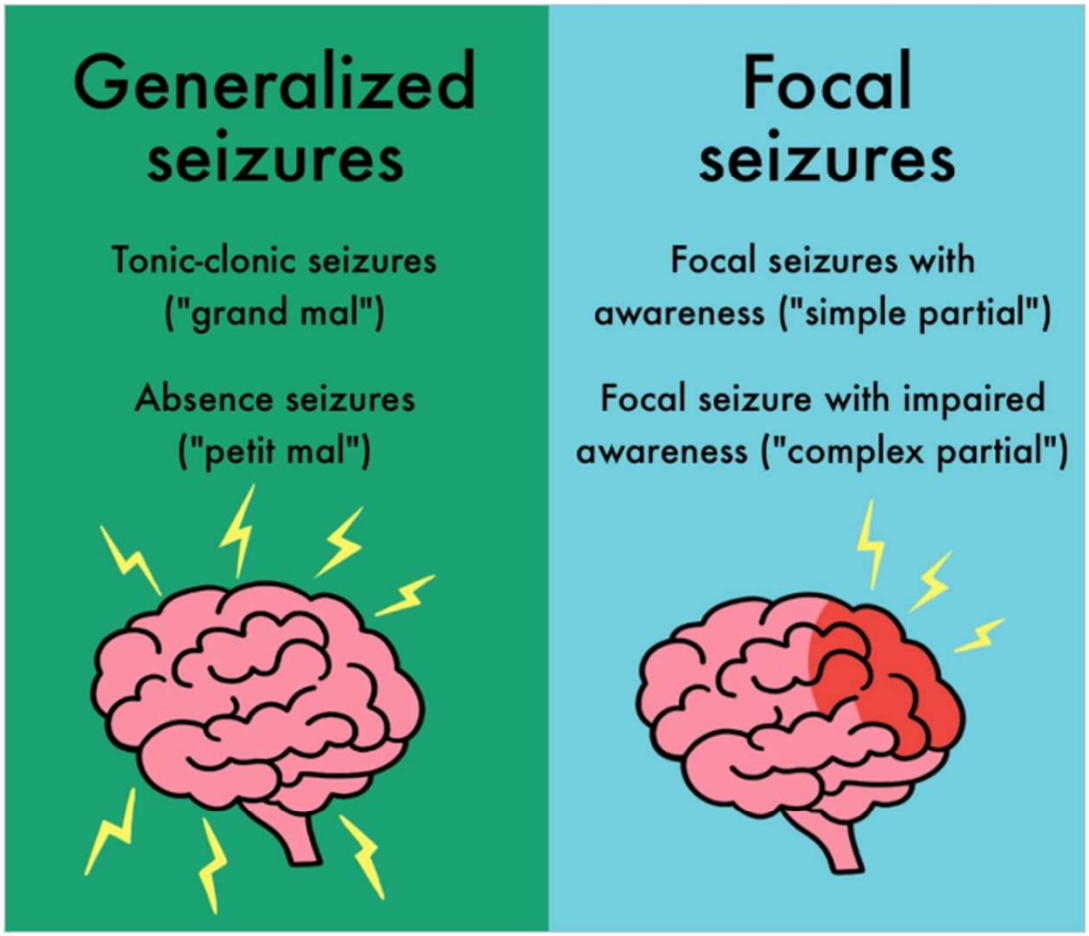
- No known trigger
- Epilepsy
  - Genetic Generalized Epilepsy
  - Uknown Etiology : aka Crytpogenic Epilepsy

Types/Classifications of Seizures

- Generalized
- Focal
- Unknown

- Dx of a Seizure is primarily a **clinical diagnosis** supported by clinical observations.
  - Rule out other causes with labs, imaging, and other studies

What are the 2 major types of seizures with epilepsy?

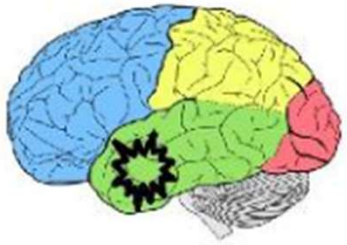


Types of Seizures

- Seizure can look like many things: staring, daydream, acting confused, tremor, twitch, fall, LOC
- General Descriptions:
  - **Myoclonic** – occasional, brief jerking, usually both sides of the body. Usually no LOC
  - **Clonic** – repeated rhythmic jerking, usually both sides of the body/face
  - **Tonic** – muscle stiffness. Typically, there is LOC
  - **Atonic** – muscles relax, especially the legs. "Drop attacks." Often fall to the ground if standing.

What Are The Types of Seizures With Epilepsy?

Types of Seizures



Focal Onset

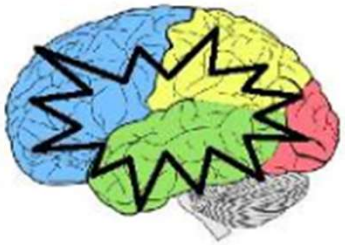
Classified to either:

- **Aware**
- **Impaired awareness**

- **Motor Onset**
- **Non-motor Onset**

May progress to:

Focal to bilateral tonic-clonic

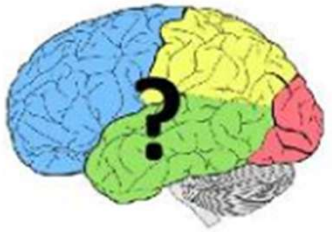


Generalised Onset

Classified to either

Motor
- Tonic clonic
- Other motor

Non-motor
(Absence seizures)



Unknown Onset

Classified to either

Motor
- Tonic clonic
- Other motor

Non-motor

Unclassified

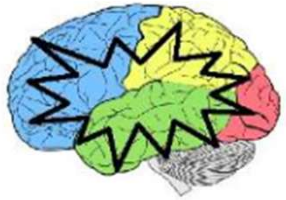
Aware = Awareness during the seizure, knowledge of self and environment, consciousness is intact.

Motor = Movement or motion

Unclassified = Seizures with patterns that do not fit into the other categories or there is insufficient information to classify the seizure

[Seizure Types and Classification - Epilepsy Action Australia]

Types of Seizures



Generalised Onset

Classified to either

Motor
- Tonic clonic
- Other motor

Non-motor
(Absence seizures)

Generalized

- Both sides of brain
- No aura, no warning signs
- **Loss of Consciousness is common**
- **Unaware of surroundings**
- **Duration usually 1-2 minutes**

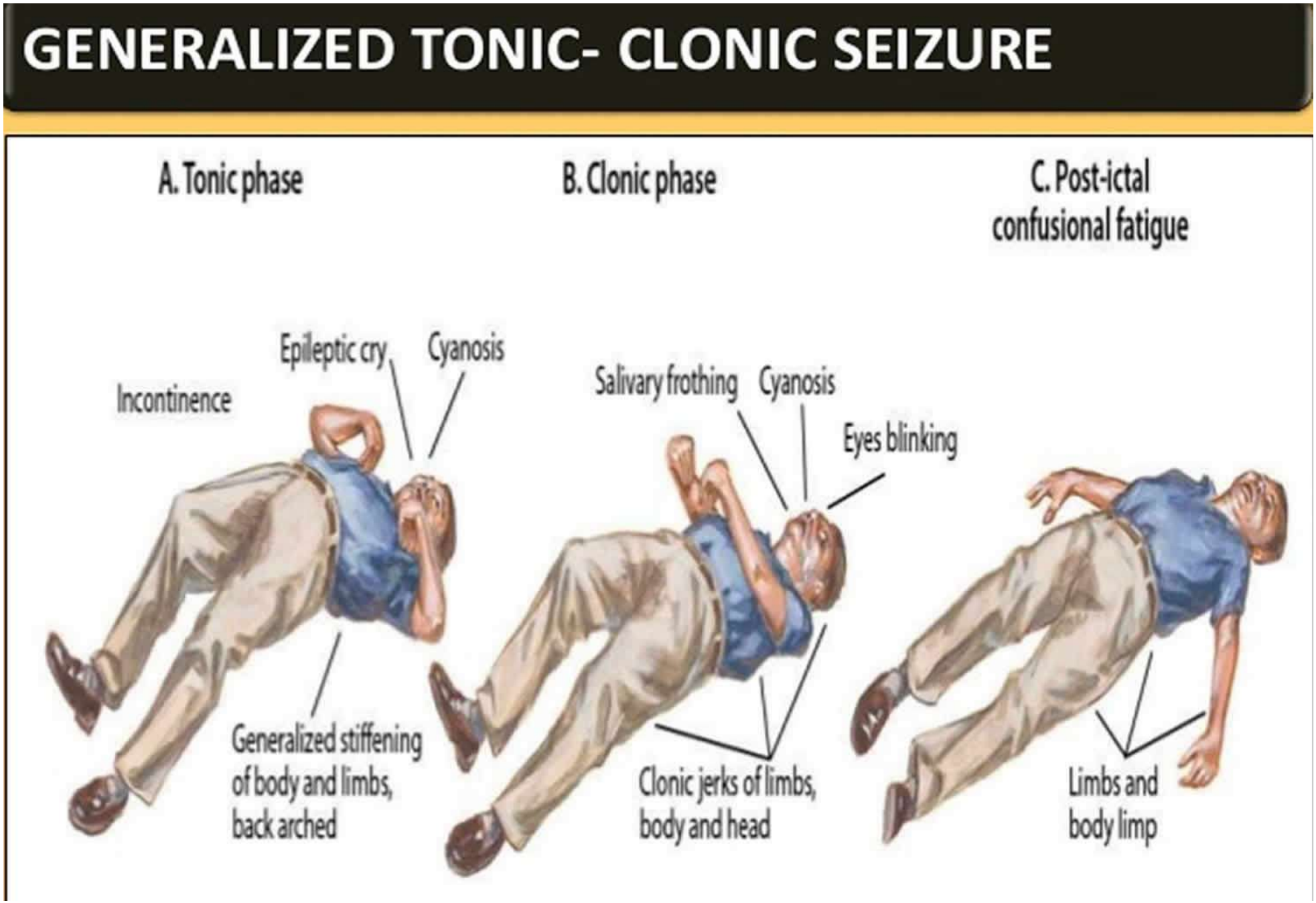
- **Motor: Tonic-clonic, Myoclonic, Atonic**
  - Aka "Grand mal"
  - Phases and last several minutes (~1-3 min)
    - Tonic phase – stiffen, LOC, fall
    - Clonic phase – jerking violently
    - Postictal phase – confused, disoriented, sleepy, weak. Lasts seconds to hours.
  - Fall injuries, tongue biting, incontinence
  - Etoh, Benzo withdrawal (w/in 48h)

Non-motor

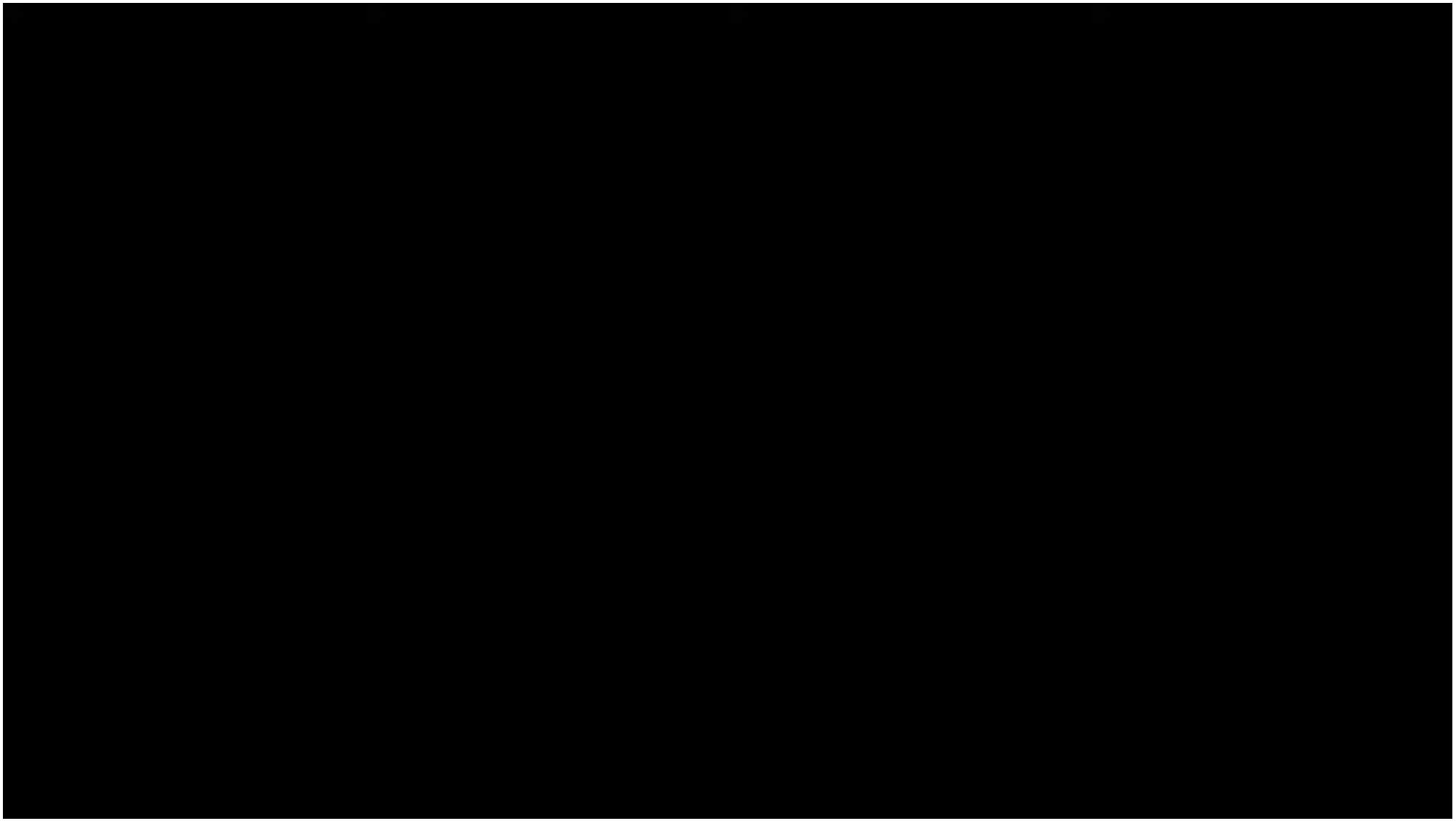
- Aka absence, "Petit mal"
- Abrupt onset/offset
- No aura
- Blank stare
- LOC for seconds
- Stare without expression (**5-10 sec**) *very short time*
- 1- 100s seizures /day
- Return to normal immediately after the seizure
- More common in **children**

What Are The Types of Seizures With Epilepsy?

Recognize Generalized Tonic Clonic Seizure

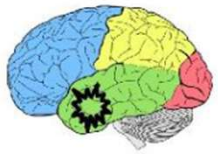


Tonic Clonic Seizure



Tonic Clonic Seizure

Types of Seizures



Focal Onset

Classified to either:

Aware

Impaired awareness

Motor Onset

Non-motor Onset

May progress to:

Focal to bilateral tonic-clonic

Focal

- Aka partial or localized
- 1 focus on 1 side of the brain
- **+/- Aura** (start of sz)
  - Precursor symptom to sz
  - Déjà vu, smell, GI sx
- **+/- Aware** of surroundings
- **Duration: < 2 min**

- **Focal with awareness**
  - Aka simple partial seizure
    - Duration: < 2 min
  - Sxs depend on area affected
    - Occipital lobe → vision changed, flashing lights
    - Hypothalamus → laughter
    - Temporal lobe → hallucinations, paranoid, déjà vu, odd smell, psychosis
  - +/- postictal confusion

Focal with impaired awareness

- Aka complex partial
  - **Most common in adults with epilepsy**
  - Duration: < 2 min
  - Gradual onset and offset
  - Initially aware, late not aware.
  - Stare into space Postictal confusion common
  - Automotisms – lip smacking, picking, chewing

Focal impaired awareness seizure = focal onset, longer, may have aura, often with postictal confusion.

Absence seizure = generalized onset, very brief, no aura, immediate recovery. Usually children.

What Are The Types of Seizures With Epilepsy?

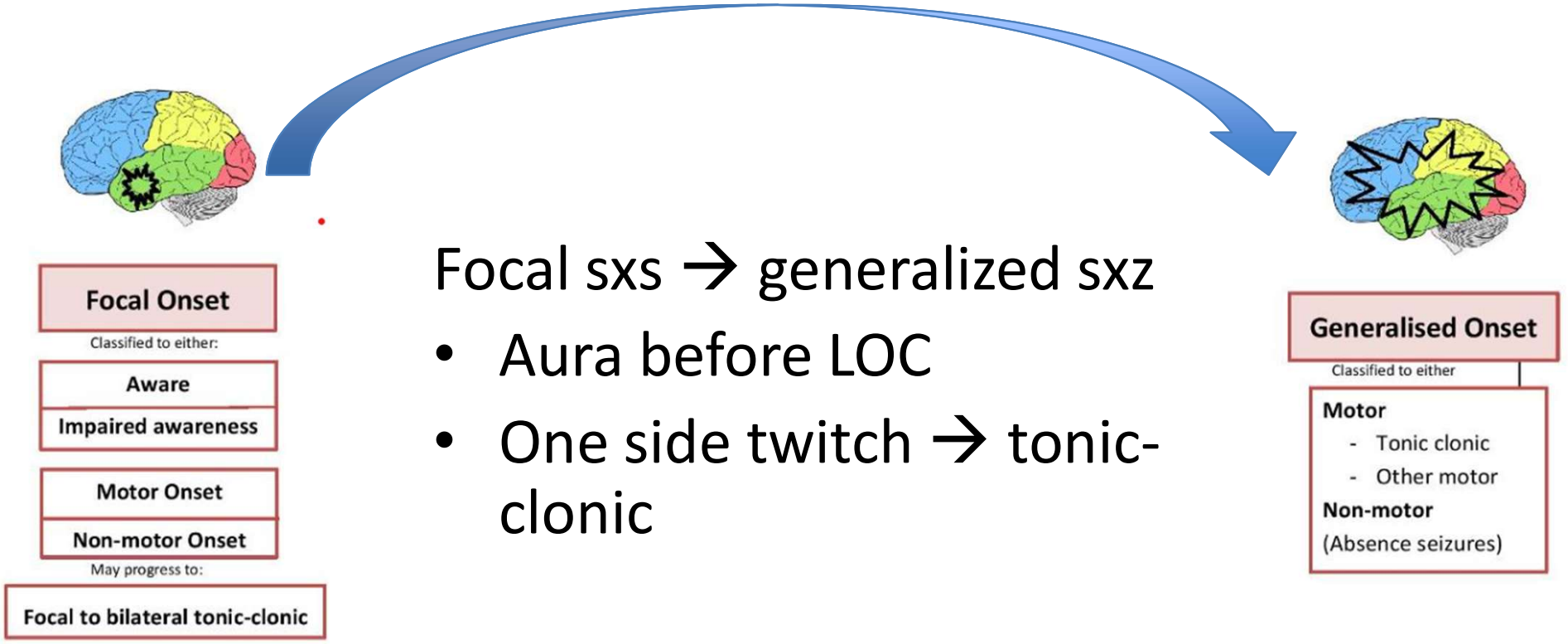
Focal Seizure with Impaired Awareness

Focal Seizures with Impaired Awareness - YouTube

Types of Seizures

It can get complicated

- Focal-to-bilateral
  - Aka Partial to secondary generalization seizure



Focal sxs → generalized sxz

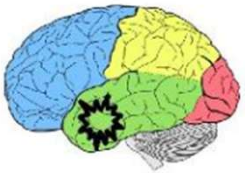
- Aura before LOC
- One side twitch → tonic-clonic

[Seizure Types and Classification - Epilepsy Action Australia]

Types of Seizures

Bilateral (generalized) → Focal

- doesn't really happen



Focal Onset

Classified to either:

Aware

Impaired awareness

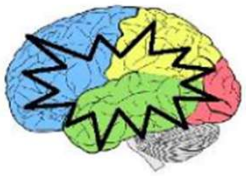
Motor Onset

Non-motor Onset

May progress to:

Focal to bilateral tonic-clonic

- Unequal involvement of brain regions can make it look focal-ish
  - Focal appearing signs during the seizure
- Todd's Paralysis – temporary weakness of sensory loss in one region after generalized seizure



Generalised Onset

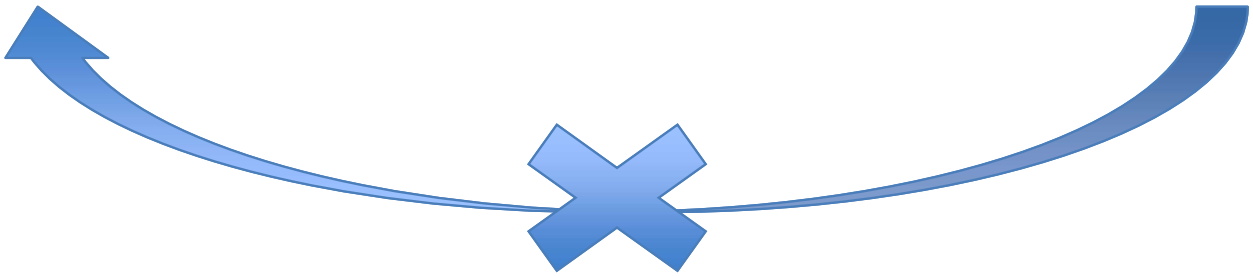
Classified to either

Motor

- Tonic clonic
- Other motor

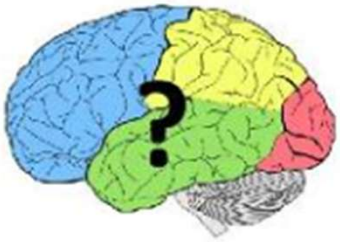
Non-motor

(Absence seizures)



[Seizure Types and Classification - Epilepsy Action Australia]

Types of Seizures



Unknown Onset

Classified to either

Motor
- Tonic clonic
- Other motor

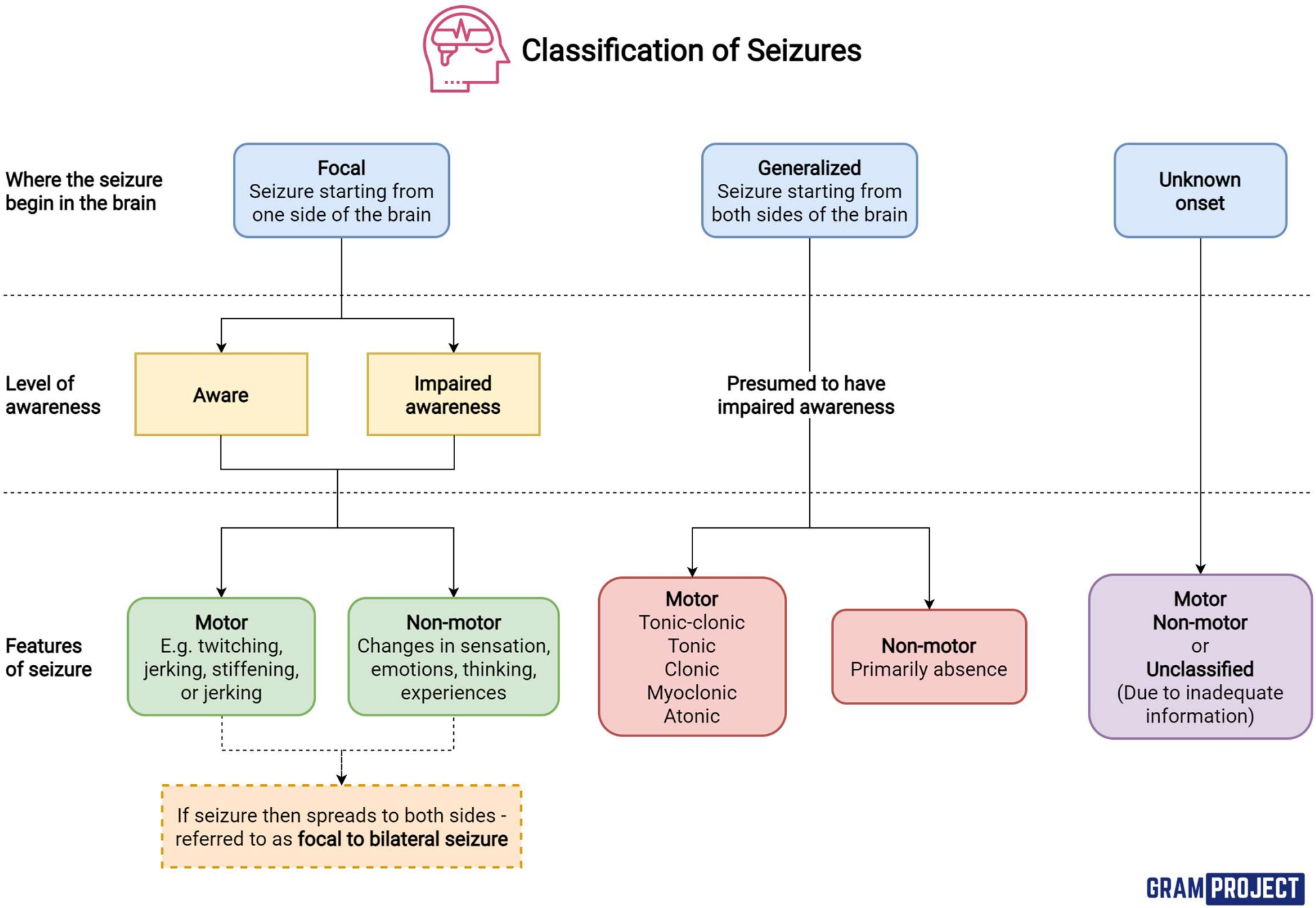
Non-motor

Unclassified

Look for a cause. Provoked?

V	Vascular	CVA, Hypertension, head bleed
I	Infection	Meningitis, encephalitis
T	Toxins Trauma	Etoh/Benzos, cocaine, amphetamines, (rarely opioids); TBI
A	Autoimmune	Vasculitis
M	Metabolic	Low glucose !!!! High Na, Ca, Mg Low Na
I	Idiopathic	Unknown
N	Neopolasm	Brain mets

[Seizure Types and Classification - Epilepsy Action Australia]



[Classification of Seizures - Gram Project]

Common Types of Seizures in Adolescents and Adults.

Smith PEM. N Engl J Med2021;385:251-263

Table 3. Common Types of Seizures in Adolescents and Adults.*

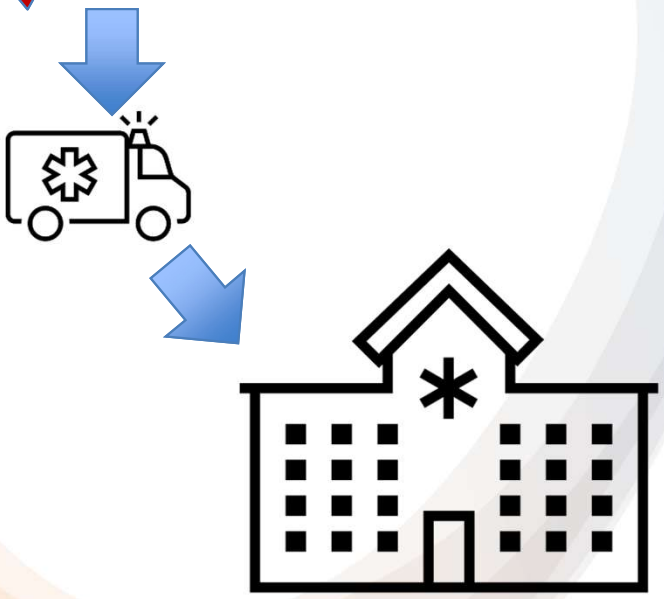
Seizure Type	Description and Common Examples
Generalized onset	The patient's symptoms or description of the seizure by a witness do not indicate an anatomical localization of the seizure. It is thought to start within and rapidly engage bilaterally distributed cerebral networks.
Motor	Myoclonic seizures manifest as involuntary "jumps" of the arms, legs, or head, especially shortly after waking and with sleep deprivation; generalized tonic–clonic seizures typically occur without warning, although they may follow myoclonic or absence seizures and are most likely to occur within 1 hr after waking and with sleep deprivation.
Nonmotor	Typical absences manifest as a brief loss of awareness, with an abrupt onset and offset, provoked by hyperventilation, often with eyelid flickering, and ictal 3-Hz generalized spike-and-wave activity on EEG; atypical absences have a less abrupt onset and offset, with an atypical, generalized spike-and-wave activity on EEG that is slower (<2.5 Hz) than that in typical seizures.
Focal onset	Most new-onset seizures in adults, including tonic–clonic seizures, are of focal onset. There is clinical evidence of seizure onset localized to one part of the brain, regardless of whether it subsequently involves the remainder of the brain. The site of onset determines the features: temporal lobe (epigastric "rising" sensation, déjà vu, and smell or taste), frontal lobe (features are often sleep-related, with adversive head turn, arm and leg jerking, and speech arrest), occipital lobe (elementary visual hallucinations in the contralateral visual field), parietal lobe (lateralized sensory symptoms, including pain), or insular cortex (laryngeal constriction, dyspnea, and contralateral somatosensory symptoms).
Awareness	In focal-onset aware (formerly called simple partial) seizures, awareness of the self or environment is retained; in focal-onset impaired awareness (formerly called complex partial) seizures, awareness of the self or environment is impaired.
Motor features	Motor seizures include automatisms (e.g., lip smacking and picking at clothes) and atonic, tonic, clonic, and myoclonic features; nonmotor seizures include autonomic, behavior arrest, cognitive, emotional, and sensory features.
Secondary generalization	In focal to bilateral tonic–clonic (formerly called secondarily generalized) seizures, the focal seizure develops into a tonic–clonic seizure. Such seizures often first occur during sleep.
Unknown onset	The origin of a seizure is often uncertain, especially after only one seizure.

* Data are from Fisher et al.[8]

Key Seizure Recognition Summary

- Generalized Onset
  - Tonic-Clonic: Stiffening + jerking.
  - Myoclonic: Brief jerks.
  - Atonic: Sudden limp/fall.
  - Absence: Brief pause, blank stare. (children)
- Focal Onset
  - Focal Aware: Preserved awareness.
  - Focal Impaired: Altered awareness + automatisms.

Red Flags for Urgent Evaluation



- Seizure lasting >5 minutes (status epilepticus).
- Multiple seizures without recovery.
- Severe head trauma, fever, pregnancy.
- New onset, First, seizure in an adult.
- Prolonged postictal state
- Trauma from seizure

Generalized Seizure > 3-5 minutes

Treatment

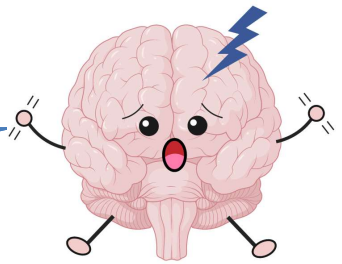
Generalized Tonic-Clonic Seizure

- Use Vagus Nerve Stimulator if present
- Give lorazepam/midazolam IM
  - If successful, you can monitor and look for causes
  - If known epilepsy, f/u with neurology

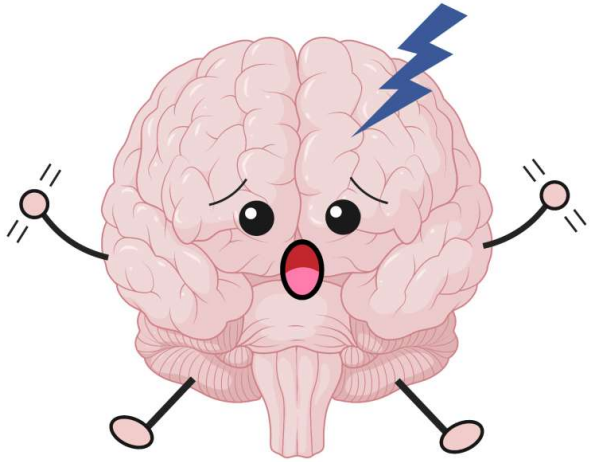
IF NOT SUCCESSFUL & > 3-5 minutes

- Call 911, get the patient to the hospital
- Give lorazepam/midazolam IM while waiting on EMS

Treat any seizure > 5 minutes as STATUS EPILEPTICUS



Mortality from Seizure



- Single, provoked seizure
  - Etoh, hypoglycemia, CVA, infection
  - Low risk of mortality
- Epilepsy: SUDEP
  - Sudden Unexpected Death in Epilepsy
    - 1 per 100,000 people per year (<1%)
    - Drug resistant epilepsy: 3-9 per 1,000 per year (~1%)

Status epilepticus: 10-30%

- **Medical emergency**
- **Seizure > 5 minutes or multiple back-to-back seizures**
- **Seizure > 30 min → permanent brain damage**

Seizure Activity!!

What Nurses Should Do Immediately?

- **Stay with the patient** and ensure safety (clear area, protect head, turn on side).
- **Note the start time** — duration matters.
- ABCs– turn head to the side
  - Avoid putting anything in the mouth
  - Do NOT restrain movements
- Give benzo (lorazepam, midazolam) at the 3-5-minute mark.
- If still seizing at 5 minutes, call EMS.
- Observe and **mentally record**:
  - Movements (type, side, pattern)
  - Eye position
  - Responsiveness
  - Breathing changes
  - Sounds (cry, grunting)
- After the event:
  - Check vital signs.
  - Give Oxygen if needed
  - Document the episode in detail.
  - Notify provider promptly.
  - If possible, **obtain video** (facility policy permitting) for provider review.

Workup

Rule out all causes that can provoke a seizure.

- Metabolic causes?
- Signs of CVA/TIA? Vascular causes?
- Cardiac cause for syncope?
  - Ekg – arrythmia, long QT
  - Orthostatic BP
  - Murmur
- MRI / CT brain
  - Bleed
  - Cancer
  - Mass
  - Encephalitis/Meningitis
- EEG
- Lumbar puncture?
- Neurology consult

V	Vascular	CVA, Hypertension, head bleed
I	Infection	Meningitis, encephalitis
T	Toxins / Trauma	Etoh/Benzos, cocaine, amphetamines, (rarely opioids) TBI
A	Autoimmune	Vasculitis
M	Metabolic	Low glucose !!!! High Na, Ca, Mg Low Na
I	Idiopathic	Unknown cause. ? Epilepsy?
N	Neopolasm	Brain mets

Treatment

Acute/Urgent Treatment of convulsive and nonconvulsive seizure and status epilepticus

- Brief Focal of Generalized seizures that terminate within 1-2 minutes, with no clustering, generally do not require benzodiazepine rescue therapy.
    - Supportive care, keep safe, place on side, nothing in mouth
- Any seizure lasting more than 3-5 minutes should be treated with benzodiazepine rescue therapy.
    - Midazolam 5-10mg IM/IV
    - Lorazepam (Ativan) 2-4mg IM/IV
    - Diazapem rectal get

Antiepileptic drugs (AED)

- Primarily indicated when risk of further seizures is > 60%
- >2 seizures
- Uncontrolled epilepsy increases the risk of SUDEP

- AEDs
    - Generalized onset seizure
        - Valproate and/or levetiracetam
    - Focal-onset seizures
        - lamotrigine and/or levetiracetam
        - Other options: Carbamazipine, Zanosamide
    - AEDs have lots of side effects
        - Valproate – teratogenic, tremor, sedation, neutropenia, thrombocytopenia, nausea/vomiting, hepatotoxicity, pancreatitis, rash, lethargy, slowed mentation
            - » Increased fall risk
            - » Monitor levels
        - Levetiracetam – severe mood changes, aggression, psychosis, anxiety, irritability, depression, fatigue, dizziness, somnolence, reduced coordination, headache, rash
            - » Less common cognitive side effects that other AEDs
            - » Increased fall risk
            - » No need to monitor levels
        - Lamotrigine – stevens johnson syndrome, dizziness, headache, ataxia, blurred vision, insomnia, poor sleep, rash
            - » Low cognitive impact
            - » Mood stabilizing
            - » No need to monitor levels

Treatment continued

- Ensure regular sleep
- Limit Etoh
- No illicit drug use
- Dx of epilepsy may be incorrect in up to 20% of patients without EEG confirmation
  - Later recognized to have psychogenic seizures
- AEDs started for etoh or drug withdrawal do not usually need to be continued lifelong.

References

- Epilepsy Foundation #1 trusted site for epilepsy and seizure news
- What Are The Types of Seizures With Epilepsy?
- Initial Management of Seizure in Adults | New England Journal of Medicine
- Seizure Types and Classification - Epilepsy Action Australia
- https://quizlet.com/ca/764823324/seizure-disorders-flash-cards/?i=6i36sl&x=1jqt
- Video of Focal Seizure with Impaired Awareness 1 - Focal Seizures with Impaired Awareness
- Vido Focal Seizure with Impaired Awareness 2 - Focal Seizures with Impaired Awareness (formerly Focal Dyscognitive or Complex Partial)
- Video of Myoclonic Seizure - Epilepsy in schools: what does a myoclonic seizure look like?
- What to Do If Someone Is Having a Seizure | Mass General Brigham
- Evidence-Based Guideline: Treatment of Convulsive Status Epilepticus in Children and Adults: Report of the Guideline Committee of the American Epilepsy Society - PMC

Supplemental Materials

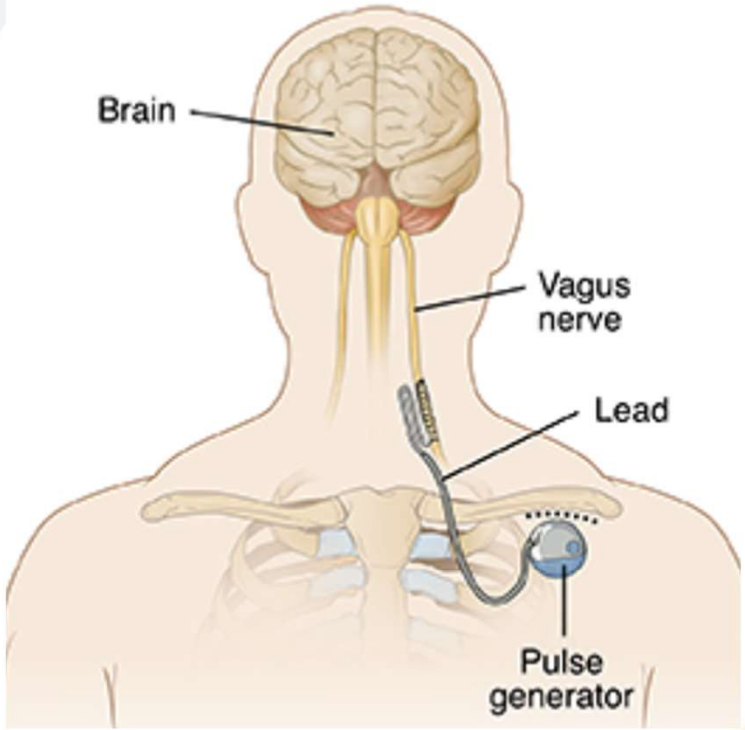
Table 2. Differential Diagnosis of Generalized Tonic–Clonic Seizure in Adults.*

Variable	Generalized Tonic–Clonic Seizure	Focal to Bilateral Tonic–Clonic Seizure	Frontal-Lobe Seizure	Reflex (Vasovagal) Syncope	Orthostatic Syncope	Cardiac Syncope	Psychogenic Nonepileptic Seizure	Panic Attack	Non-REM Parasomnia†
Typical demographic characteristics	Young (<25 yr); often no seizure history reported (although on direct questioning, patient may describe absences, myoclonus, photosensitivity, or all these symptoms)	Any age; often with previously unrecognized episodes of déjà vu, epigastric "rising" sensation, blank spells with automatism (e.g., lip smacking and picking at clothes), and tongue biting on waking	Any age, although patients are often children (median onset, 14 yr); possible family history of frontal-lobe seizure (autosomal dominant)	Young; often healthy, with history of fainting	Older age, especially in patients with autonomic failure (diabetes or autonomic neuropathy) or use of vasodilator medications	Older age, with vascular risk factors (especially previous myocardial infarction)	Any age; often with coexisting depression, panic disorder, drug or alcohol dependence, self-harm, or adverse childhood events	Any age; possibly with coexisting depression, anxiety, drug or alcohol dependence, self-harm, or adverse childhood events	Young; usually with onset in childhood and remittance in adolescence; often a family history of parasomnia
Occurrence in specific situations	Usually occurs within 1 hr after waking	May occur at any time, including during sleep	Usually occurs during sleep	Commonly situational (e.g., may occur in bathroom or restaurant) and often provoked (e.g., while standing, with the sight of blood, after exertion)	May occur with standing after lying down	Rarely situational, occasionally occurs during exertion	Commonly situational, especially when patient is awake and not alone; often occurs with stressful situations, but patient may report no trigger	Commonly occurs in stressful situations	Always occurs during sleep, especially during first third of the night; worse with sleep deprivation, alcohol use, and stress
Warning prodrome	Uncommon	Common, occurs with preceding minor seizure (aura)	None; occurs when patient is asleep	Common; preceding nausea is strongly suggestive; occurs in hot environment, with lightheadedness, visual blackout, or both	Common; occurs with lightheadedness, visual blackout, or both	Uncommon	Common; occurs with fear, panic, and altered mental state, or patient may report no warning	Almost invariable; occurs with fear, panic, and altered mental state	None; occurs when patient is asleep
Onset and signs	Sudden onset; highly stereotypical: tonic (stiffening) phase, then clonic (convulsing) phase, together lasting 1–3 min, typically with eyes open, apnea, and cyanosis	Gradual or sudden onset; stereotypical: aura or focal seizure may precede convulsion; in tonic phase, head and gaze deviation to the side contralateral to seizure focus, or "sign of four" (one arm extended, the other flexed)	Sudden onset; variable although highly stereotypical within an individual patient (e.g., dramatic presentation with screaming, semipurposeful motor automatism, including running, or asymmetric tonic posturing with kicking and cycling)	Gradual onset; brief loss of consciousness (<1 min), pallor, sometimes limb jerks and posturing	Gradual or sudden onset; brief loss of consciousness (<1 min), pallor, sometimes limb jerks and posturing	Sudden onset; usually brief but occasionally prolonged loss of consciousness, pallor, and sweating; sometimes limb jerks and posturing	Gradual onset; often prolonged (>2 min) with eyes closed, breathing and color maintained, rapid shaking (especially head and arms), back arching; fluctuating severity	Gradual onset; variable duration, with eyes closed, breathing maintained or rapid, and color maintained	Onset during sleep; variable complexity, not highly stereotypical, lasting seconds to 30 min; confusional arousals; sleepwalking with semipurposeful behavior (e.g., dressing or eating) or sleep terrors
Consciousness and responsiveness	Not during episode	Partial during warning (aura) but not during episode	May be at least partially retained	Not during episode	Not during episode	Not during episode	Variable, even within episode; stimulation can terminate episode	Variable; patient may be responsive	Patient poorly responsive during episode
Incontinence	Common	Common	Common	Occasional	Occasional	Occasional	Occasional	Rare	Rare
Injury	Common, including lateral tongue biting, facial injury, or posterior shoulder dislocation	Common, including lateral tongue biting; warning limits risk of injury	Common, despite retained awareness	Occasional minor, rare tongue biting	Uncommon (with warning)	Common, including tongue biting	Occasional tongue and cheek biting, wrist injury, carpet burn; occasional directed violence	Occasional minor tongue and cheek biting	Uncommon
Recovery	Slow; patient is drowsy, confused, and has muscle aches	Slow; patient is drowsy, confused, and has muscle aches	Rapid	Rapid regaining of consciousness, but patient often fatigued	Often rapid, unless patient remains in upright position during episode	Often rapid	Often slow	Usually rapid	Patient typically returns to sleep
Findings on examination and initial tests	Lateral tongue biting, facial injury; interictal EEG shows spike–polyspike-and-wave patterns; MRI of head normal, indicated particularly for atypical features (including persistence of seizures despite use of antiseizure medication); 12-lead ECG used to exclude propensity for cardiac arrhythmia mimicking seizure	Lateral tongue biting, cranial scars from previous injury or surgery, hemiatrophy (suggesting mild cerebral palsy); MRI of head may show underlying structural cause; interictal EEG may show focal sharp, spike, and slow waves; 12-lead ECG used to exclude propensity for cardiac arrhythmia mimicking seizure	Cranial scars from previous injury or surgery; MRI of head may show underlying structural cause; EEG may show focal sharp, spike, and slow waves or muscle artifact only, even during seizures (deep focus); video may capture typical event if frequent	Low blood pressure; bedside postural blood-pressure reading usually not necessary or helpful; 12-lead ECG used to exclude propensity for cardiac arrhythmia; head-up tilt-table test (if doubt remains after history, examination, and ECG) may show abrupt bradycardia and hypotension after 15–30 min	Bedside blood pressure decreases over a period of a few minutes while patient is in upright position, without compensatory tachycardia; 12-lead ECG used to exclude propensity for cardiac arrhythmia; ambulatory blood-pressure monitoring if doubt remains	Signs of congestive cardiac failure, ejection systolic murmur (aortic stenosis or hypertrophic cardiomyopathy), or both; 12-lead ECG used to identify propensity for cardiac arrhythmia (especially if patient has had previous myocardial infarction); transthoracic echocardiography used to identify underlying structural cardiac cause; consider urgent cardiology referral	Scars from self-harm; carpet burns; video of events if frequent to look for gradual onset, long duration; patient has eyes closed, rapid breathing, absence of cyanosis, limb thrashing, back arching; EEG may capture typical event (especially with photic stimulation) with only ictal movement artifact	Patient appears anxious; video of events if frequent to look for gradual onset, long duration; patient has partial awareness, anxious expression, eyes closed, rapid breathing; EEG may capture typical event (especially with photic stimulation) with only ictal movement artifact	Normal examination; video of events used to distinguish from frontal-lobe epilepsy; EEG while patient is asleep may capture typical event

* ECG denotes electrocardiography, MRI magnetic resonance imaging, and REM rapid eye movement.
† Data are from Derry.[7]

Vagal Nerve Stimulator

- A **vagus nerve stimulator (VNS)** works by sending **regular, mild electrical pulses** to the brain via the **left vagus nerve in the neck**, aiming to reduce seizure frequency and severity.

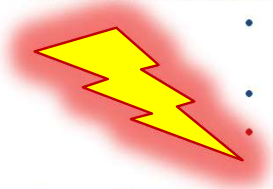


Vagal Nerve Stimulator

Implantation

- A small **pulse generator** (like a pacemaker) is surgically placed under the skin of the upper chest.
- A lead wire is tunneled under the skin and wrapped around the **left vagus nerve** in the neck.
  - **Left side** is chosen to avoid cardiac conduction effects from the right vagus.

Electrical stimulation



- The device delivers programmed pulses (e.g., 20–30 Hz for 30 seconds every 5 minutes).
- Stimulation is continuous in cycles, independent of seizure timing.
- **Patients/caregivers can trigger extra stimulation during an aura or at seizure onset using a handheld magnet.**

Neurophysiologic effect

- Vagus nerve → nucleus tractus solitarius (brainstem) → widespread projections to:
  - **Locus coeruleus** (norepinephrine system)
  - **Raphe nuclei** (serotonin system)
  - **Thalamus, limbic system, and cortex**
- Alters neurotransmitter release, increases inhibitory tone, and reduces cortical hyperexcitability.

Seizure control

- Exact mechanism not fully understood, but thought to:
  - Modulate abnormal neuronal firing patterns
  - Improve network stability in cortical and subcortical circuits
  - Possibly have anti-inflammatory and neuroplastic effects

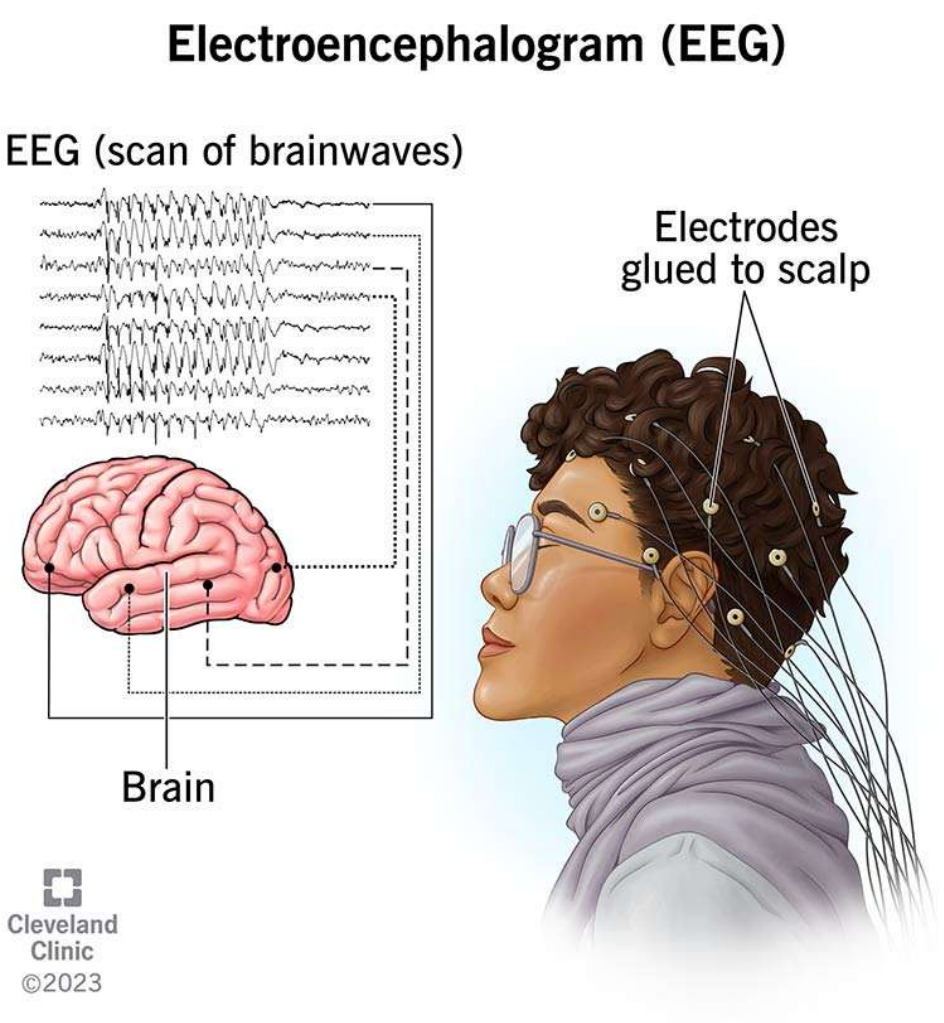
Clinical results

- Used for **drug-resistant epilepsy** when surgery is not an option.
- About **50–60% of patients** have ≥50% reduction in seizure frequency over time.
- May also reduce seizure severity and shorten recovery.
- Not usually curative — patients often remain on antiseizure meds.

Side effects

- Common: hoarseness, throat tingling, cough, shortness of breath during stimulation.
- Usually mild and diminish with time or parameter adjustment.

EEG



Purpose

Detect abnormal brain activity patterns.
Diagnose and monitor conditions such as:

- **Seizure disorders** (e.g., epilepsy)
- **Sleep disorders**
- **Encephalopathies** (metabolic, toxic, infectious)
- Brain injury
- Certain psychiatric or degenerative brain conditions.

How it Works

Nerve cells in the brain communicate using tiny electrical impulses.
Electrodes detect these impulses and send the signals to a computer.
The result is a tracing of wave patterns (alpha, beta, theta, delta waves) displayed as lines on a graph.

Procedure

Patient's scalp is cleaned, and electrodes are placed using paste or a cap.
The patient may be asked to:

- Rest quietly with eyes open and closed.
- Perform deep breathing (hyperventilation).
- Look at flashing lights (photostimulation).

Recording usually lasts 20–40 minutes (longer for sleep EEGs or video-EEG monitoring).

Results

Normal EEG: Brain waves show expected patterns for the patient's age and state (awake, asleep).
Abnormal EEG: May show spikes, sharp waves, slowing, or other changes that help pinpoint seizure types or other brain dysfunction.

Brief Overview

https://youtu.be/8kYJughJXbs

Seizure in Dementia

Dementia Type	Approximate Seizure Risk	Notes
Alzheimer's disease (AD)	10–22% over the disease course	Risk increases in advanced stages; younger-onset AD has higher risk.
Lewy body dementia (LBD)	~5–15%	Less frequent than in AD; may be underdiagnosed because events can be mistaken for fluctuations in alertness.
Vascular dementia	~8–15%	Risk related to stroke location and number; cortical strokes raise seizure likelihood.
Frontotemporal dementia (FTD)	~3–7%	Lower risk than AD, but still above general population.
General elderly population without dementia	~1–2%	Much lower baseline risk.

Seizure in Dementia

Patterns

- Seizures often occur **later** in the disease course, when there's more cortical neuronal loss and network instability.
- In dementia, seizures are more often **focal onset** (sometimes with secondary generalization) than primary generalized.
- Many are subtle — brief confusion, staring, or automatisms — and can be missed or mistaken for dementia progression.

Why Seizure Risk is Higher

- Neurodegeneration disrupts normal cortical electrical activity.
- Amyloid plaques and tau tangles in AD can create hyperexcitable brain regions.
- Prior strokes, microvascular disease, or brain injury add structural risk factors.

Questions

POC Questions

Q: How can seizures affect the human body?

New Onset of Any of the following. This is not an exhaustive list. There can be many idiosyncratic presentations.

- Confusion
- Loss of awareness of surroundings
- Staring into space
- Unable to speak
- Speech changes, slurring
- LOC
- Abnormal movements
- Stiff muscles (tonic phase)
- Rhythmic jerking (clinic phase)
- Lip smacking
- Cyanosis
- Irregular breathing
- Rapid heart rate
- Hypotension
- Sweating/flushing
- Pupil dilation
- Incontinence

Post ictal phase

- Confusion
- Headache
- Weakness
- Muscle soreness
- Todd's paralysis – weakness on one side
- Fatigue
- Sleepiness
- Emotional – anxiety, depression

Complications

- Status Epilepticus
  - Death → SUDEP
- Falls
- Head trauma
- Aspiration
- Cognitive decline

POC Questions

Q: How can we identify residents with seizures timely?

- **Know the patient's baseline**
- **Is there a seizure history?**
- **Early warning signs**
  - New onset of an Aura
    - Unusual smell/taste
    - Sudden / Acute changes
      - » Change in speech
      - » Facial expression
      - » Déjà vu
      - » Dizziness
      - » Vision changes
      - » Stops talking
      - » change in behavior
  - Motor symptoms
    - Stiffening (tonic)
    - Jerking (clonic)
    - LOC
    - Collapse/fall
  - Unresponsive to touch
  - Repetitive movements
  - Blank expression

POC Questions

Q: What is the staff's role with implementing the seizure care plan?

Proactive – Monitor for seizure activity, prevent harm

Reactive – recognize seizure quickly and respond quickly

If patient has a known seizure disorder:

- Seizure care plan:
  - Know typical seizure pattern and history
    - Observe patient regularly with this seizure pattern and history in mind.
  - Know typical seizure duration
  - Ensure rescue medication available – IM Ativan/Midazolam
  - Know basic seizure response plan
    - Time the duration of the seizure
    - Clear area of hazards.
    - Support head with soft object.
    - Turn resident on side to maintain airway.
    - Loosen restrictive clothing.
    - Do not put anything in the mouth or try to restrain movements.
    - If over 2-3 minutes, give rescue medication (Ativan)
      - » Record time, dose, response
    - If over 3-5 minutes and not responding to rescue treatment with Ativan, call EMS
    - Call doctor if time allows or have another staff member call the doctor.
  - Understand postictal behaviors if applicable
  - Have an emergency escalation protocol
    - For example: seizure > 5 minutes call EMS and send patient to the hospital.
  - Document the seizure
    - Date/time
    - Duration
    - Description of seizure (what you saw)
    - Response to therapy
    - Vital Signs before and after the seizure
    - Recovery observations
      - How long to recover to baseline
    - Possible triggers
    - Investigate if medication doses were missed
    - Investigate if any new medications were started
    - Consider tracking sleep if sleep deprivation is suspected
    - Call physician, describe the seizure, implement any new orders.

POC Questions

Q: What are the signs and symptoms of seizures and seizure-like activity that should be reported to the resident's nurse promptly?

- Sudden onset Tonic- Clonic activity – rigid muscles, rhythmic jerking
- Sudden onset Myoclonic activity – muscle jerking
- Atonic activity – drop attack
- Automatisms – lip smacking, chewing
- Staring into space
- Behavior changes - New onset paranoia, delusions, aggressiveness
- New neurologic deficit – face droop, slurred speech, pupil changes
- Same patterns as previous seizure

POC Questions

Q: What other important observations, when caring for residents with seizures or a history of seizures, should be reported to the resident's nurse.

- **Any change from the patient's baseline behaviors**
- Vital Signs
- Glucose
- Refusal of medications
- Concern for illicit substance use
- Falls
- New behaviors
- Speech changes
- Choking episodes
- Confusion
- Acute change in mentation
- Sleeplessness
- New weakness
- New abnormal movements
- Headaches

POC Questions - Nurses

Q: What circumstances that merit an impromptu resident assessment to check for residents with seizure-like activity?

- Any new onset change from baseline behavior or new neurologic symptoms
- Any neurologic or behavioral symptoms in a patient with known seizure
- Any seizure activity in a patient with known seizure disorder

- Sudden onset Tonic- Clonic activity – rigid muscles, rhythmic jerking
- Sudden onset Myoclonic activity – muscle jerking
- Atonic activity – drop attack, falls
- Automatisms – lip smacking, chewing
- Staring into space
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- Cyanosis
- Irregular breathing
- Rapid heart rate
- Hypotension
- Sweating/flushing
- Pupil dilation
- Incontinence

Any change from the patient's baseline behaviors

- Refusal of medications
- Concern for illicit substance use
- Falls
- New behaviors
- Speech changes
- Choking episodes
- Confusion
- Acute change in mentation
- Sleeplessness
- New weakness
- New abnormal movements
- Headaches

POC Questions - Nurses

Q: What trends and changes in seizure activity that should be reported to the resident's provider(s)?

- Any seizure
  - Especially, any seizure longer than 2-3 minutes
- Any change in known seizure pattern
    - Longer duration or repeated clusters of seizures
    - Increased frequency
    - Increased severity
    - New seizure characteristics
    - New trigger
- Change in Vital Signs
- Missed antiepileptic drug doses
- Trauma
- Not returning to baseline after seizure
- New behaviors during or after the seizure

POC Questions - Nurses

Q: How should we recognize when a physician's current order to address the seizure activity should be administered?

- Recognize new onset seizure or existing seizure pattern
- Follow physician order as written
    - Exactly when to give medication can vary depending on clinical scenario and physician preference but….
- General guidance for seizures
  - Give lorazepam or midazolam for any seizure > 3-5 minutes.
  - Consider ED transfer if seizure does not respond and > 3 minutes have elapsed
  - Recognize Status Epilepticus
    - Emergent transfer for any seizure > 5 minutes with no response to lorazepam or midazolam

POC Questions - Nurses

Q: How can we ensuring as-needed medications to treat seizures are available when needed, aware of where the medications are stored and how to access them?

- Audit medications at scheduled intervals
- Ask pharmacy to help track/audit the medications
- Include location and administration instructions in the care plan
- Training and competency checking on the care plan and what to do in case of a seizure.

POC Questions - Nurses

Q: What are the best practices for addressing seizure activity episodes in residents with a history of seizures?

- Know the care plan:
  - Seizure type(s), typical duration, known triggers, and usual recovery pattern.
  - Orders for rescue medications and criteria for use.
  - Emergency contact procedures.
- Ensure readiness:
  - Rescue medications readily accessible.
  - Staff trained in seizure first aid and rescue med administration.
  - Documented baseline mental status and physical abilities.

During an Active Seizure

- **Stay with the patient** and ensure safety (clear area, protect head, turn on side).
- **Note the start time** — duration matters.
- ABCs– turn head to the side
  - Avoid putting anything in the mouth
  - Do NOT restrain movements
- Know the care plan:
  - Seizure type(s), typical duration, known triggers, and usual recovery pattern.
  - Orders for rescue medications and criteria for use.
  - Emergency contact procedures.
  - Ensure readiness:
  - Rescue medications readily accessible.
  - Staff trained in seizure first aid and rescue med administration.
  - Documented baseline mental status and physical abilities. Avoid putting anything in the mouth
- Give benzo (lorazepam, midazolam) at the 3-5 minute mark.
- If still seizing at 5 minutes, call EMS.
- Observe and **mentally record**:
  - Movements (type, side, pattern)
  - Eye position
  - Responsiveness
  - Breathing changes
  - Sounds (cry, grunting)
- After the event:
  - Check vital signs.
  - Give Oxygen if needed
  - Document the episode in detail.
  - Notify provider promptly.
  - If possible, **obtain video** (facility policy permitting) for provider review.

POC Questions - Nurses

Q: What is the importance of documenting nursing observations and interventions for residents with seizures who are experiencing a condition change or deviation from baseline?

- Clinical safety and continuity of care
  - **Establish a patient baseline**
  - **Real- time info to guide dx and tx changes**
    - Tracking frequency, duration, characteristics, pattern of seizures
  - Tracks interventions and efficacy
  - Improves communication with all members of the care team
- Allows early identification of change in condition
  - Helps recognize changes in seizure pattern
    - may require workup for other triggers of seizure
    - Or, changes in treatment plan and medications
- Regulatory and legal
  - Demonstrates adherence to seizure care plan
  - Change in condition requires documentation
  - Documentation helps protect staff, facility, providers in case of audit or legal action