



# The Art of Managing Seizures

# Introduction:

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No Disclosures

Registered Nurse for 37 years

Acute Care Nurse Practitioner for 22 years: experience in Internal Medicine, Hospitalist Medicine, Cardiology, Cardiothoracic Surgery, Outpatient Neurology, and Neuro Hospitalist.

# Epilepsy Statistics: (The Epilepsy Network)

1 in 26 Americans will develop epilepsy in their lifetime.

It is estimated that 3 million Americans and 65 million people worldwide currently live with epilepsy.

Each year 200,000 people are diagnosed with epilepsy.

In two-thirds of diagnosed epilepsy patients the cause is unknown.

Epilepsy affects more people than MS, CP, MD, and PD combined....yet receives fewer federal dollars per patient than each one of these.

It is estimated that 50,000 deaths occur in the US each year from status epilepticus.

SUDEP accounts for 34% of all sudden deaths in children.

Epilepsy costs the US 15.5 billion dollars each year.



# Seizure –vs– Epilepsy

- ▶ **Seizure**: an individual occurrence of abnormal synchronized electrical activity in the brain. There are many causes of seizures; also known as provoked seizures.
- ▶ **Epilepsy**: is an abnormal neurologic condition in which you experience recurrent seizures. However, there is no known underlying cause. There is no provoked cause and there may be abnormal or unexplained synchronized electrical impulses in your brain.

(Huff & Murr, 2021)



# ILAE Definition of Epilepsy:

**Epilepsy is a disease of the brain defined by any of the following conditions:**

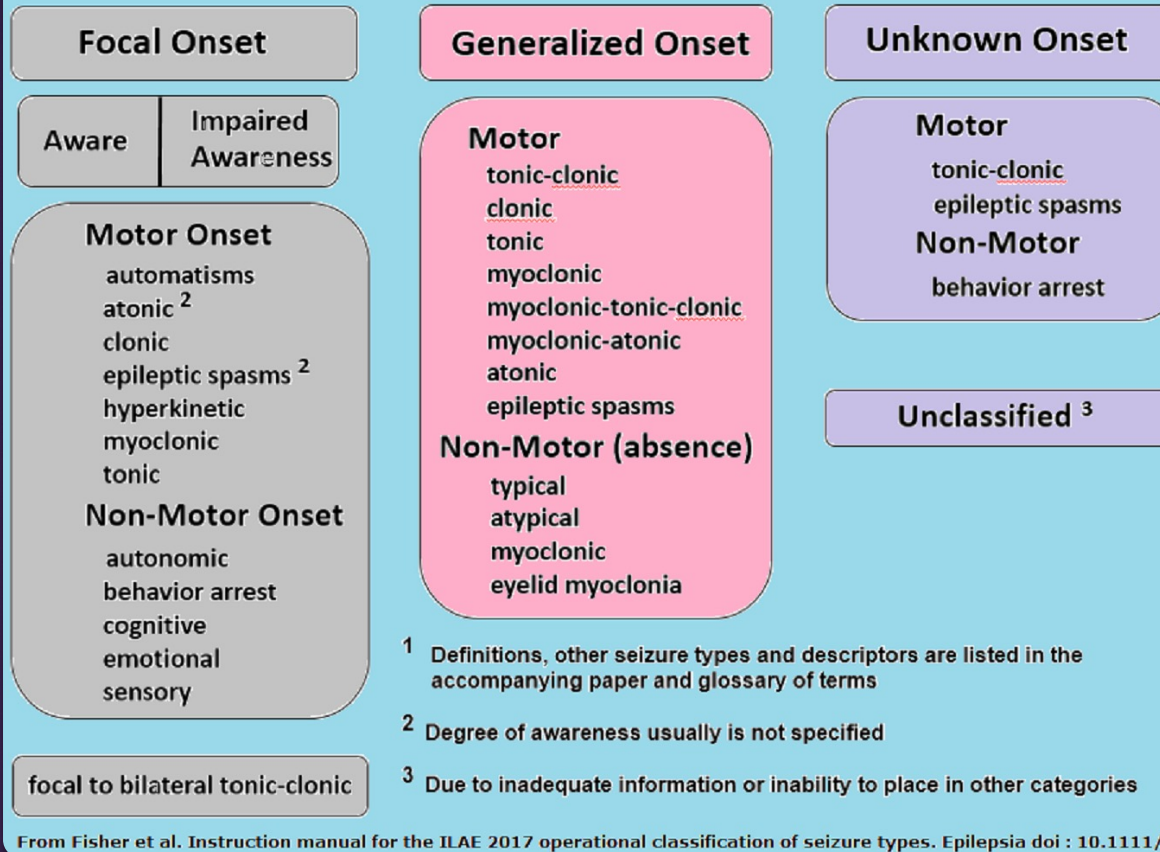
- ▶ At least 2 unprovoked seizures occurring > 24 hours apart.
- ▶ One unprovoked seizure and a probability of further similar seizures of at least 60 % after 2 unprovoked seizures occurring over the next 10 years.
- ▶ The diagnosis of an epilepsy syndrome (Dravet, Lennox-Gastaut).



# Remember:

YOU CAN HAVE SEIZURES WITHOUT EPILEPSY, BUT  
YOU CANNOT HAVE EPILEPSY WITHOUT SEIZURES!

## ILAE 2017 Classification of Seizure Types Expanded Version <sup>1</sup>



From Fisher et al. Instruction manual for the ILAE 2017 operational classification of seizure types. *Epilepsia* doi : 10.1111/epi.13671

# Seizure Classifications (ILAE 2017):



# 3 Main Types of Focal Seizures:

- ▶ **Aware**
- ▶ **Impaired Aware**
- ▶ **Focal to Bilateral Tonic-Clonic**



# Figure of 4

Flamenco Dancer



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# 6 Main Types of Generalized Seizures:

- ▶ Tonic
- ▶ Clonic
- ▶ Tonic-Clonic
- ▶ Myoclonic
- ▶ Atonic
- ▶ Absence



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# Rules for Classifying Seizures:

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**Type:** Focal or generalized?

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**Awareness:** for focal seizures, alert or impaired?

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**Onset of seizures:** classify the onset if seen, otherwise unknown.

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**Behavior arrest:** focal behavior arrest, behavior is the feature during the entire seizure.

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**Motor/Non-motor:** focal aware or impaired aware seizure can be classified as motor or non-motor.

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**Bilateral -vs- general:** bilateral starts in one hemisphere and then moves to the other. General starts in both.

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**Clonic -vs- myoclonic:** clonic is rhythmic jerking and myoclonic is non-rhythmic jerking.

# Can You Classify This Seizure?

- ▶ A 25 y/o woman describes a “seizure” beginning with an intense feeling of familiar music playing. It lasts approximately 40 seconds and then quickly resolves. She recalls hearing people talking in the background but is unable to determine what they were saying. She is a little “drowsy” and “confused” but then reorients herself within 15 to 20 minutes.



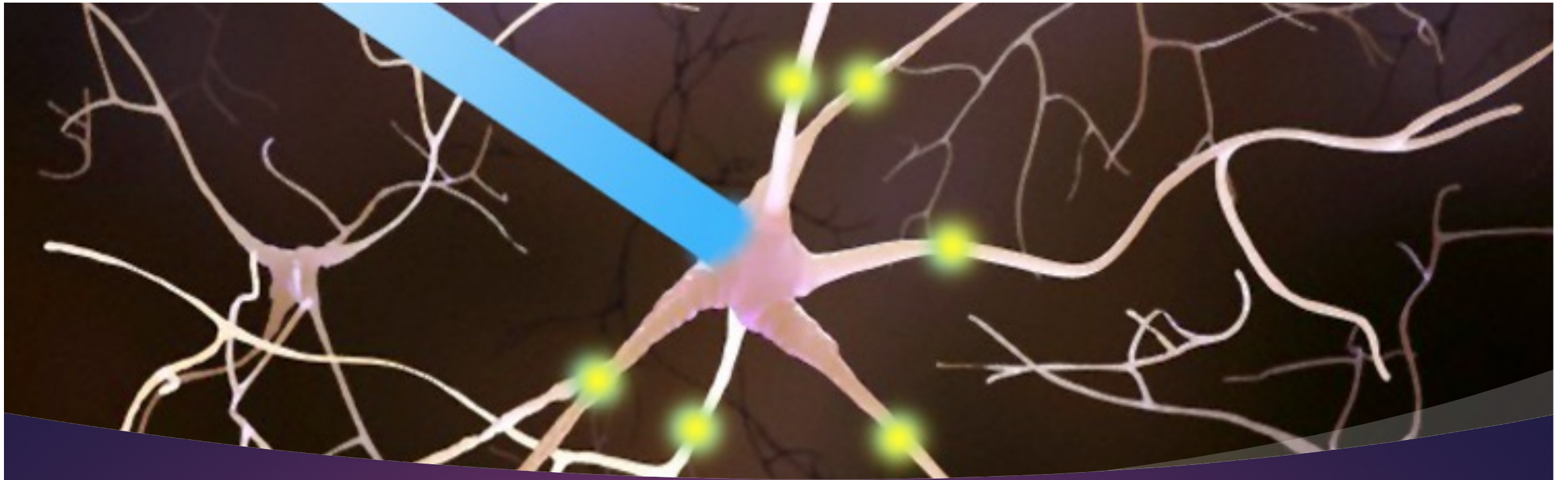




# Answer:

FOCAL SEIZURE WITH IMPAIRED AWARENESS





## Can You Classify This Seizure?

- ▶ A 25 year old male has a seizure beginning with a few non-rhythmic bilateral arm jerks, followed by stiffening of all limbs, and then rhythmic jerking of on the left side. This lasts for approximately 35 seconds and then he is unconscious. Stertorous breathing is noted and when he awakens in an hour he is confused.





# Answer:

GENERALIZED MYOCLONIC,  
TONIC-CLONIC SEIZURE



## Differences between seizures and syncope

<i>Seizures</i>	<i>Syncope</i>
<ul style="list-style-type: none"><li>▪ Any posture (e.g. in bed at night)</li><li>▪ Blue lips during attack</li><li>▪ Stiffness and tonic-clonic movements coincide with loss of consciousness and often last for several minutes</li><li>▪ Patient is rigid as falls to ground</li><li>▪ Urinary incontinence common</li><li>▪ Disorientated or headache afterwards</li><li>▪ Tongue biting and serious injuries are common</li><li>▪ Seizures arising from secondary generalisation may be preceded by an aura or recognisable partial seizure</li></ul>	<ul style="list-style-type: none"><li>▪ Occurs standing (or sitting if elderly)</li><li>▪ Pale and clammy</li><li>▪ Brief jerking movements may occur after loss of consciousness</li><li>▪ Patient loses tone then falls to ground</li><li>▪ Urinary incontinence can occur</li><li>▪ Quick recovery</li><li>▪ Tongue biting rarely; serious injuries occur in 5% of cases</li><li>▪ Often preceded by feeling warm and light headed</li></ul>

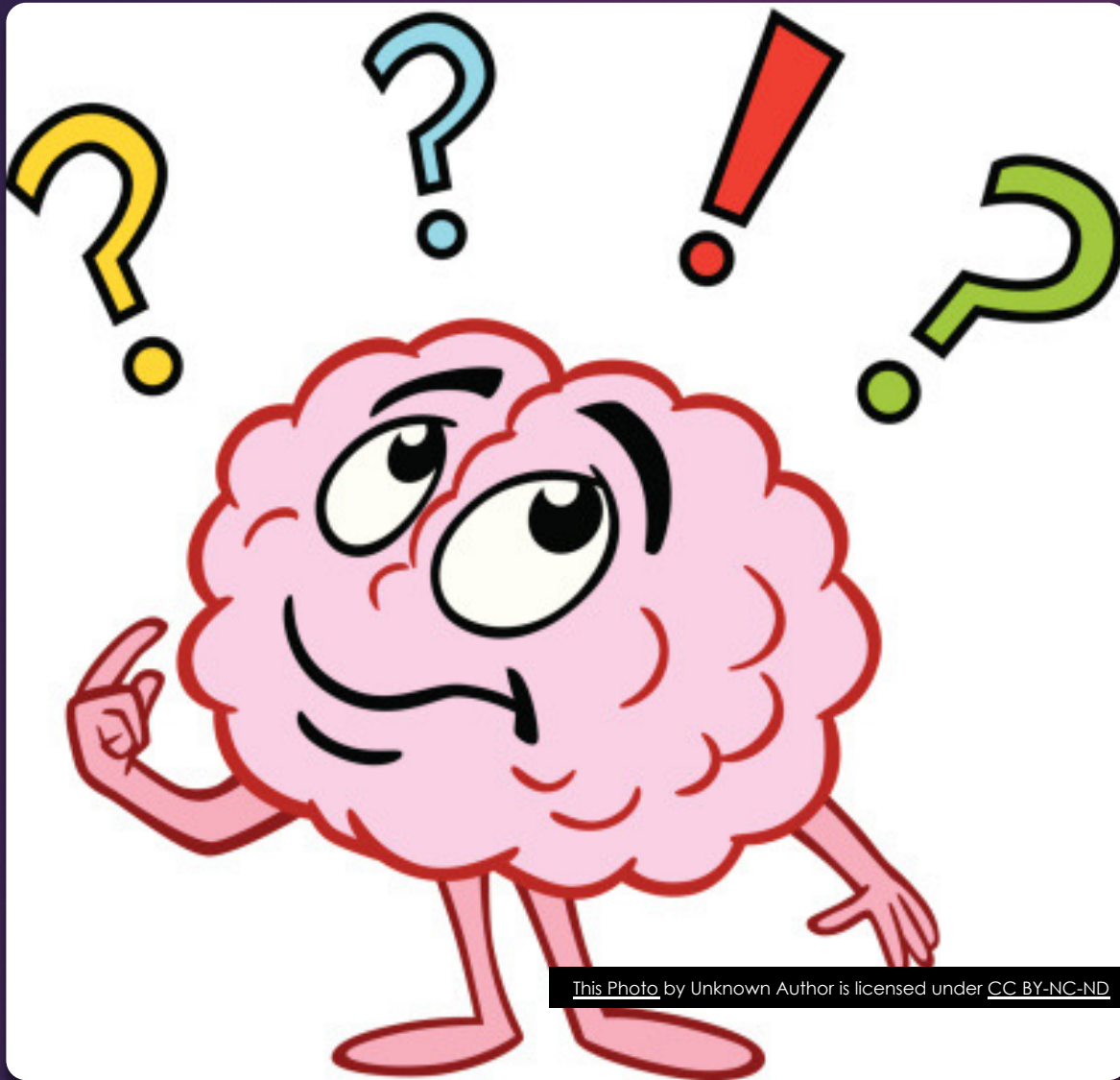
Seizures –  
vs –  
Syncope



	<b>PNES</b>	<b>Epileptic seizure</b>
<b>Timing</b>		
Directly induced by stress or confrontation	++	+
Waxes and wanes	++	-
Occurs in physician office	++	-
Worsens with witnesses in the room	++	-
<b>Semiology</b>		
Crying	+	-
Whispering	+	-
Stuttering	+	-
Opisthotonic posture	+	-
Full body shaking with preserved awareness	++	-
Ictal cry	-	++ (before GTC seizure)
Post-ictal buzz saw snore	-	++ (after GTC seizure)
Eyes closed	++	-
Head/body/eye version	-	++ (focal seizure)
Fencer's posture	-	++ (focal seizure)
Side-to-side head movement	+	-
Pelvic thrusting	+	+
Cyanosis	-	+ (during GTC seizure)
Severe injury or trauma (burns and fractures)	-	+ (during GTC seizure)

**Notes:** ++ represents "frequent", + represents "occasional", and - represents "absent."  
**Abbreviations:** PNES, psychogenic nonepileptic seizures; GTC, generalized tonic-clonic.

# PNES – vs– Seizure



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Do You  
Treat a  
First  
Seizure or  
Provoked  
Seizure?:

# What is a Provoked Seizure?

A seizure that has a physical cause of known cause. Treatment focuses on addressing the underlying cause of the event.

Epilepsy Foundation



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# Causes for Provoked Seizures:

- ▶ Non-compliance with seizure medications
- ▶ Electrolyte imbalances: hypoglycemia, hyponatremia, hypocalcemia, etc.
- ▶ Medications: antidepressants, antipsychotics, stimulants
- ▶ Withdrawal syndromes: alcohol, benzodiazepines, seizure meds
- ▶ Sepsis
- ▶ CNS infections
- ▶ Traumatic brain injury
- ▶ Stroke: ischemic or hemorrhagic
- ▶ Neoplasm
- ▶ Autoimmune: anti-NMDA receptor encephalitis, lupus cerebritis
- ▶ Sleep deprivation

(Huff & Murr, 2021)

# Which of the Following Meds is Least Likely to Lower the Seizure Threshold?

- ▶ A. Bupropion
- ▶ B. Levofloxacin
- ▶ C. Tramadol
- ▶ D. Diphenhydramine
- ▶ E. Cetirizine
- ▶ F. Imipenem



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**Answer:**

- ▶ **E. Cetirizine (Zyrtec).**
- ▶ Other medications include but the list is not exclusive: clozapine, lithium, meperidine, theophylline, tacrolimus, fluoroquinolones, metronidazole, and isoniazid.



A close-up photograph of a silver ballpoint pen resting on a document with blurred text. The pen is positioned diagonally from the top right towards the center. The background is a light-colored page with out-of-focus text. A dark purple curved banner is at the bottom of the image.

Case Study:

## What Happened Here?

- ▶ A 35 y/o male was brought to your ED via EMS with the initial diagnosis of LOC and possible seizure. He was found in his car at a stop light unresponsive and breathing heavily. The driver behind him finally got out of his car and found him unresponsive. The EMS was activated by a 911 call. The patient's wife was notified is on her way to the hospital.
- ▶ The patient arrives and is placed in your room. VSS. Awake, but awareness is impaired. What do you do first?





## What Happened Here?

- ▶ Baseline: VS, Neuro exam, physical exam.
- ▶ Amnesia after the event, focal deficits, tongue biting, injuries, incontinence.
- ▶ Bedside EEG, MRI of the brain, CBC, CMP, urine & serum drug screen, etoh level, CPK, prolactin level.
- ▶ History from wife and EMS.



# Patient History:

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This is a very important part of the exam.

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You usually won't get a great history from the patient.

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It is extremely valuable if there is a bystander with the patient who witnessed the event.

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Don't "lead" the patient by asking specific questions.

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Patients may describe it as a "spell" (syncope, TIA, migraine aura, sleep disorder, intracranial HTN, or PNES).

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Not all seizure patient's bite their tongue or are incontinent. Also remember that a syncopal patient can be incontinent and even exhibit clonic movement.

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More reliable signs: excessive drowsiness after event, posterior shoulder dislocation, tongue biting on the side of the tongue, ictal cry, and stertorous breathing post-ictal.



# Physical Exam:

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Do a full physical exam and a complete neuro exam.

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Note any focal deficits.

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For patients with suspected seizure and persistent/and or intermittent alteration in consciousness, the possibility of subclinical status epilepticus or nonconvulsive status epilepticus should be considered. (facial twitching, extremity twitches, and nystagmic eye movement).

# Tests to Order:

- ▶ EEG
- ▶ Imaging of the brain (MRI is preferable)
- ▶ Lab tests: electrolytes, CBC with diff, LFT's, prolactin, CPK, AED levels
- ▶ Serum and urine drug screen
- ▶ Consider LP (possibly if encephalitis, immunosuppression, or SAH is suspected)



## Your Exam Revealed:

- ▶ VSS
- ▶ Neuro Exam Normal
- ▶ Physical Exam Normal
- ▶ Labs Normal
- ▶ MRI machine “down”
- ▶ CT of the head is normal
- ▶ No EEG, tech called in sick today
- ▶ Wife verifies hx of TBI last year, and she suspects he has had several nocturnal seizures.



# Treat?

- ▶ Treat the patient with an anti-seizure medication.
- ▶ Educate the patient and wife on the medication and seizures.
- ▶ Educate the patient on safety measures. No driving, etc.
- ▶ Schedule a FU with an outpatient neurologist ASAP.
- ▶ Schedule outpatient sleep deprived EEG and outpatient MRI of the brain.







So You  
Decided  
To  
Treat.....

# Considerations When Choosing A Seizure Medication:

Appropriate Medication?

Adverse Effects?

Pharmacokinetics?  
(metabolism & dosing)

Pharmacodynamics?  
(mechanism of action)

Pregnancy consideration?

Cost?





# Pharmacodynamics of Anti-Seizure Medications:

- ▶ Excitatory Post-synaptic potentials (glutamate mediated).
- ▶ Inhibitory Post-synaptic potentials (GABA mediated).
- ▶ Sodium Channel Inhibitors. Depolarization of the neuron itself (voltage gated).

# Glutamate Mediated:

- ▶ Direct Calcium Channel Blockers:
- ▶ Topiramate (Topamax) also CAI
- ▶ Zonisamide (Zonegran) also CAI
- ▶ Magnesium
  
- ▶ Gabapentin (Gabapentin)
- ▶ Pregabalin (Lyrica)
  
- ▶ Levetiracetam (Keppra) SV2A binder inhibits Ca<sup>++</sup> channels
- ▶ Brivaracetam (Briviact) SV2A binder inhibits Ca<sup>++</sup> channels





# GABA Mediated:

- ▶ Benzodiazepines
- ▶ Phenobarbital
- ▶ Sodium Valproate
- ▶ Clobazam (Onfi)
- ▶ Vigabatrin (Sabril)



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# Sodium Channel Blockers:

- ▶ Phenytoin (Dilantin)
- ▶ Carbamazepine (Tegretol)
- ▶ Oxcarbazepine (Trileptal)
- ▶ Eslicarbazepine (Aptiom)
- ▶ Lamotrigine (Lamictal)
- ▶ Sodium Valproate (Depakote)
- ▶ Lacosamide (Vimpat).....delays inactivation of sodium channels



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# Generalized Seizures:

Brivaracetam (Briviact)

Clobazam (Onfi, Sympazan)

Sodium Valproate (Depakote)

Lamotrigine (Lamictal)

Levetiracetam (Keppra)

Phenytoin (Dilantin)

Topiramate (Topamax, Trokendi, Qudexy)

Zonisamide (Zonegran)

# Focal Seizures:

Carbamazepine

Oxcarbazepine

Lamotragine

Lacosamide (Vimpat)

Clobazam

Vigabatrin (Sabril)

Levetiracetam

Topiramate

Zonisamide

Sodium Valproate



# Anti-Seizure Meds That Affect BC:

These medications induce hepatic metabolism of BC (estrogen)

- ▶ 3-P's: Phenobarbital, Phenytoin, Perampanel
- ▶ 3-T's: Tegretol, Trileptal, Topamax
- ▶ And then there is Lamictal !!



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# Anti-Seizure Meds That Potentially Have Negative Psychiatric Side Effects:

- ▶ Levetiracetam
- ▶ Zonisamide



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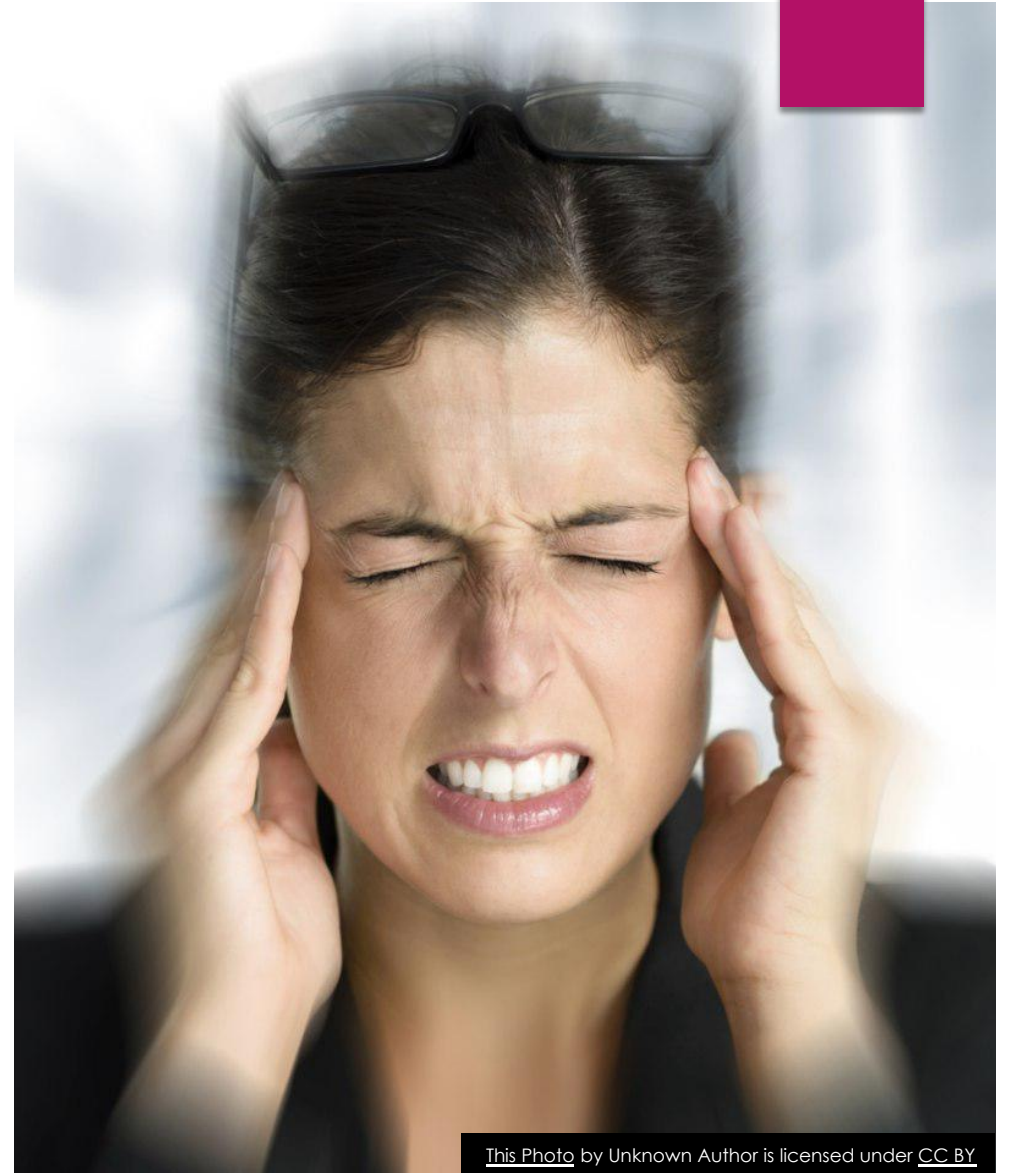
# Anti-seizure Meds That Are Utilized For Mood Stabilization:

- ▶ Sodium Valproate
- ▶ Lamotrigine
- ▶ Carbamazepine
- ▶ Oxcarbazepine



# Anti-Seizure Meds Used to Treat Migraine:

- ▶ Sodium Valproate
- ▶ Topiramate
- ▶ Lamotrigine



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# Anti-Seizure Meds That Can Cause Skin Rash:

- ▶ Lamotrigine
- ▶ Carbamazepine
- ▶ Phenytoin



## Understanding Lamotrigine:

- ▶ Is metabolized through a process called glucuronidation.
- ▶ Liver enzyme inducers (carbamazepine, phenytoin) increase the metabolism of lamotrigine and decrease its effectiveness by 50%.
- ▶ Estrogen contraceptives also increase the metabolism and decrease the effectiveness .



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# Understanding Lamotrigine

- ▶ Pregnancy will also increase the metabolism and decrease the effectiveness of lamotrigine.
- ▶ Lamotrigine metabolism is inhibited by sodium valproate and the levels increased.
- ▶ Levels are affected by other meds, age, pregnancy, and renal insufficiency.
- ▶ Can cause a severe rash.



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**Case Study:**



# What Would You Do Here?

- ▶ A 30 y/o female with a history of depression, was witnessed having generalized tonic-clonic seizure activity. When she becomes coherent, she mentions that she has been on Depakote, but ran out of her medication 2 days ago. What would you do in this situation?



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# Answer:

- ▶ It is known that she has seizures and she will need to be placed on anti-seizure medication.
- ▶ Childbearing age-Depakote is associated with severe birth defects.
- ▶ Levetiracetam-not good for depression.
- ▶ Lamotrigine-good choice. But use caution when mixing with Depakote. May need to start with the valproate adjunct starter pack (blue). Monitor levels.
- ▶ Recommend starting patient on folate supplement.



# Patient Education:

- ▶ No Driving for 6 months
- ▶ No swimming or bathing alone
- ▶ No rock climbing, hang gliding, or F-1 racing.
- ▶ You **MUST** be compliant with your medication
- ▶ You must take brand name only or the same brand of generic anti-seizure medication.
- ▶ If you are female and fertile; you must call the office if you are placed on BC or if it was discontinued. If you become pregnant you must call the office immediately.
- ▶ SUDEP



# SUDEP

- ▶ A person with epilepsy dies unexpectedly and was previously in their usual state of health.
- ▶ People with poorly controlled epilepsy are at highest risk.
- ▶ People with only absence or myoclonic seizures are not known to have an increased risk for SUDEP. Those at greatest risk have GTC seizures.
- ▶ It occur most often at night or during sleep when the death is not witnessed.
- ▶ Educate your patient on getting rest, taking medications as prescribed, avoiding alcohol, and following up with a neurologist if seizures are not under control.

(The Epilepsy Foundation)



*The End*

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