

## Epilepsy Basics

Carla Fedor, RN, CDDN  
Continuum of Care  
UNM-SOM Pediatrics

---

---

---

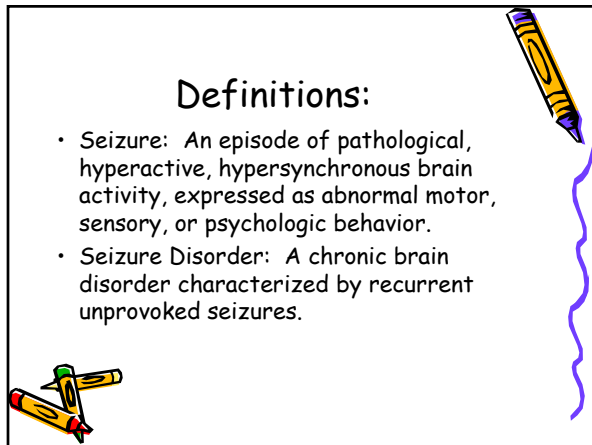
---

---

---

---

---



### Definitions:

- Seizure: An episode of pathological, hyperactive, hypersynchronous brain activity, expressed as abnormal motor, sensory, or psychologic behavior.
- Seizure Disorder: A chronic brain disorder characterized by recurrent unprovoked seizures.

---

---

---

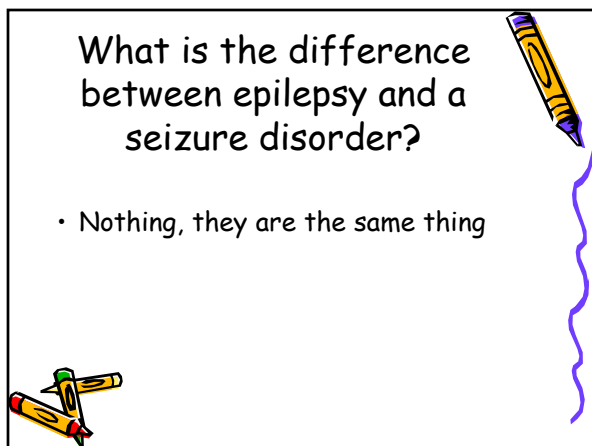
---

---

---

---

---



### What is the difference between epilepsy and a seizure disorder?

- Nothing, they are the same thing

---

---

---

---

---

---

---

---

## Prevalence

- Single Seizure: 9%
- Recurrent Seizures: 0.5%



---

---

---

---

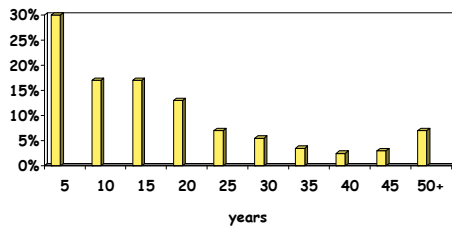
---

---

---

---

## Age of onset



---

---

---

---

---

---

---

---

What are some of the known causes of epilepsy?



---

---

---

---

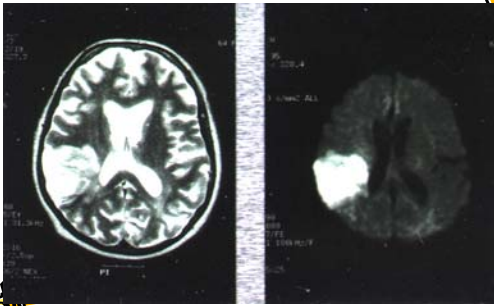
---

---

---

---

### Cerebrovascular Disease



---

---

---

---

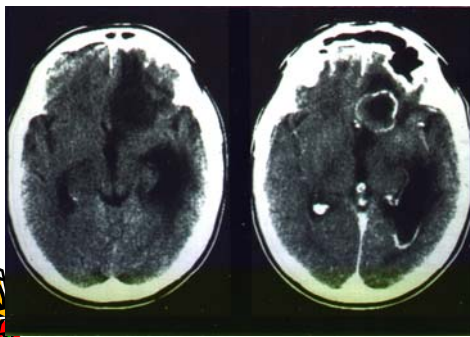
---

---

---

---

### Bacterial infections



---

---

---

---

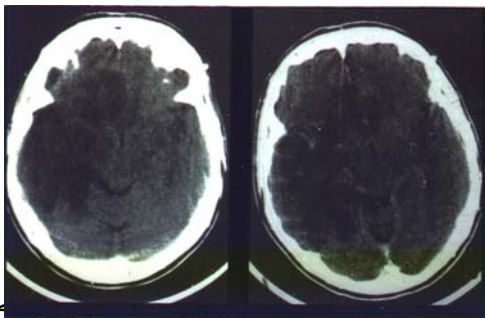
---

---

---

---

### Encephalitis



---

---

---

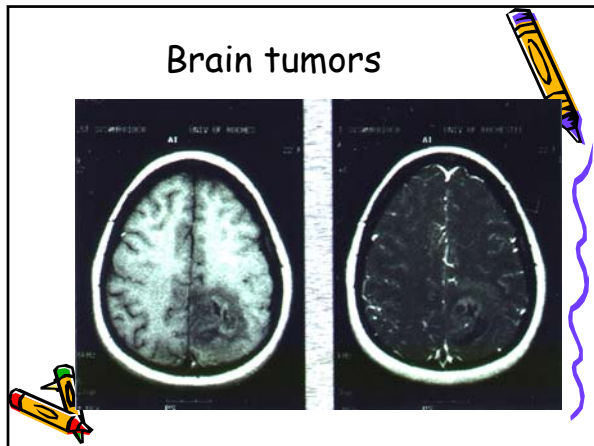
---

---

---

---

---



---

---

---

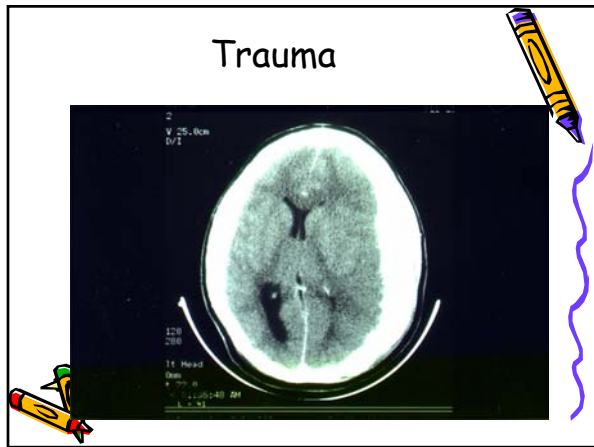
---

---

---

---

---



---

---

---

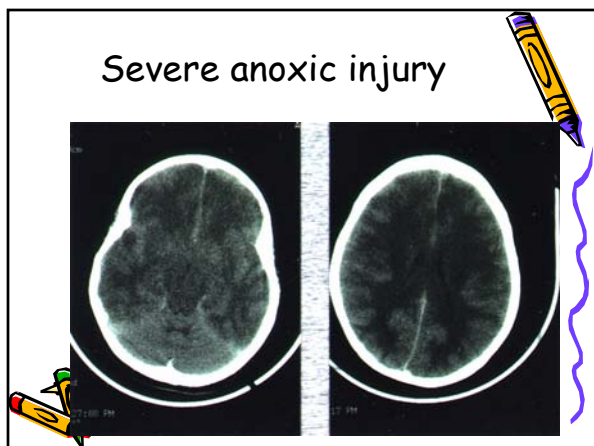
---

---

---

---

---



---

---

---

---

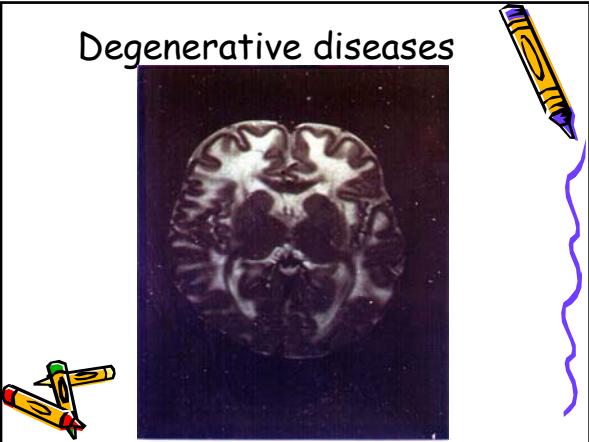
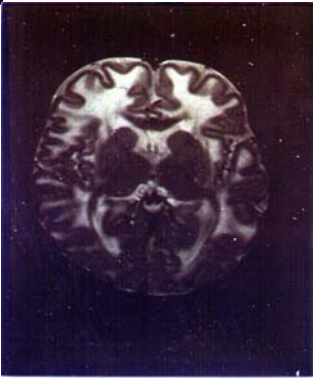
---

---

---

---

Degenerative diseases



---

---

---

---

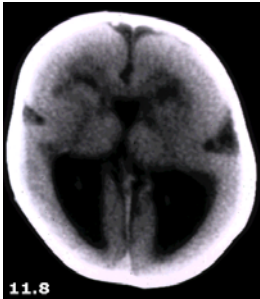
---

---

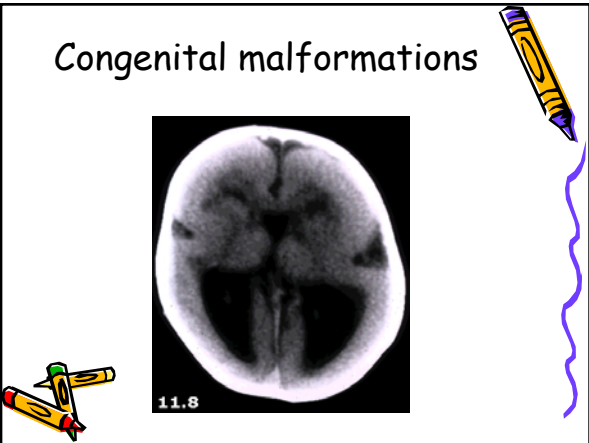
---

---

Congenital malformations



11.8



---

---

---

---

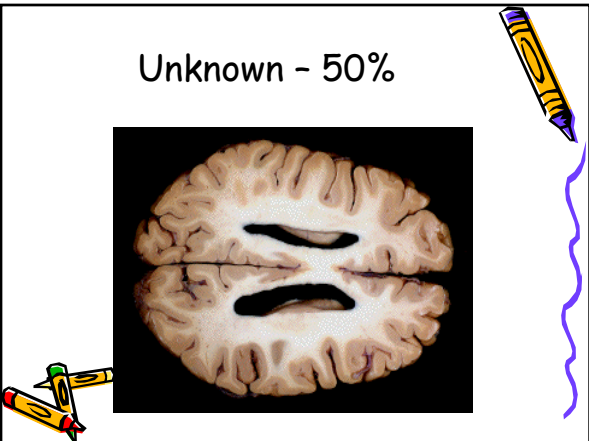
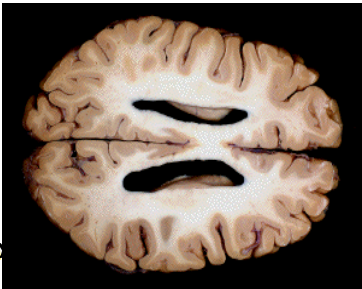
---

---

---

---

Unknown - 50%



---

---

---

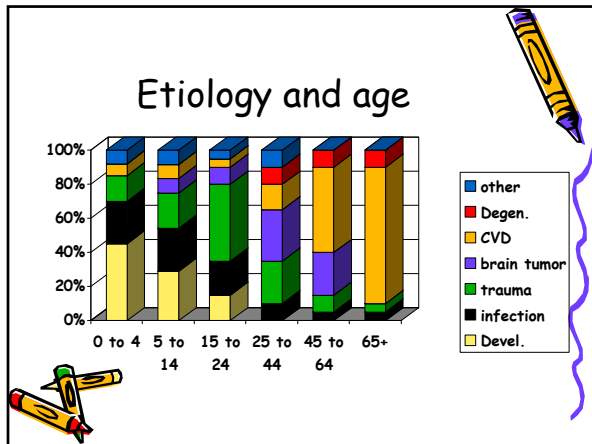
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

### ILAE 2010 Revised Classification of Seizures

- Concepts and terminology that reflected the advances in knowledge
- Does not change diagnoses or treatment of patients

---

---

---

---

---


---

---

---

### Etiology Concepts Old versus New Terms

Old	New
<b>Etiology</b> <ul style="list-style-type: none"><li>• Idiopathic (Possible genetic cause)</li><li>• Symptomatic (Known cause)</li><li>• Cryptogenic (Unknown cause)</li></ul>	<b>Etiology</b> <ul style="list-style-type: none"><li>• Genetic</li><li>• Structural/Metabolic</li><li>• Unknown</li></ul>
Localization related (partial)	Focal seizures



---

---

---

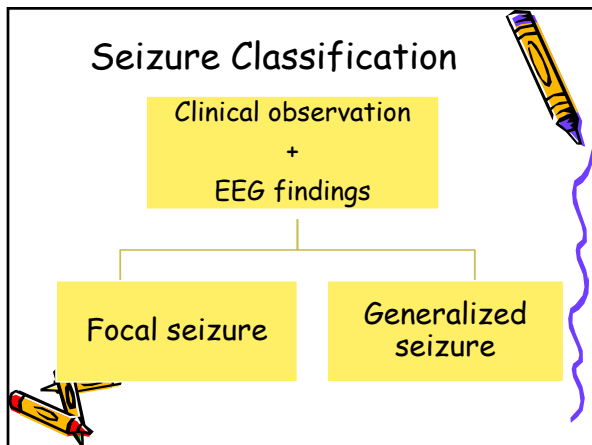
---

---

---

---

---



---

---

---

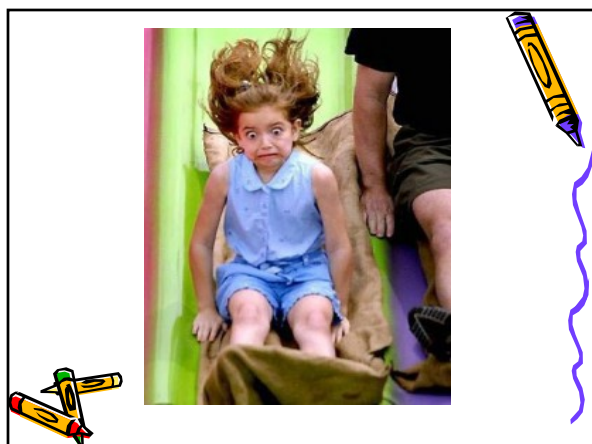
---

---

---

---

---



---

---

---

---

---

---

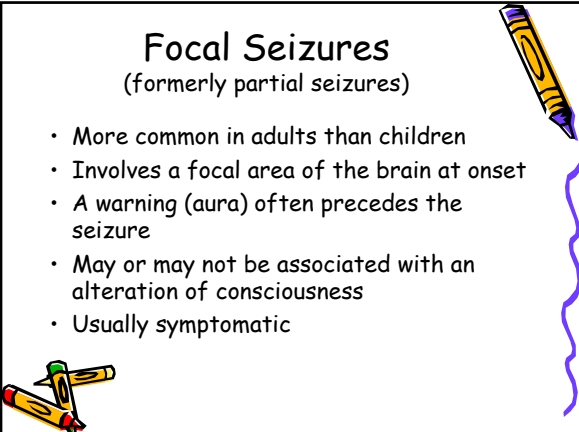
---

---

### Focal Seizures

(formerly partial seizures)

- More common in adults than children
- Involves a focal area of the brain at onset
- A warning (aura) often precedes the seizure
- May or may not be associated with an alteration of consciousness
- Usually symptomatic



---

---

---

---

---

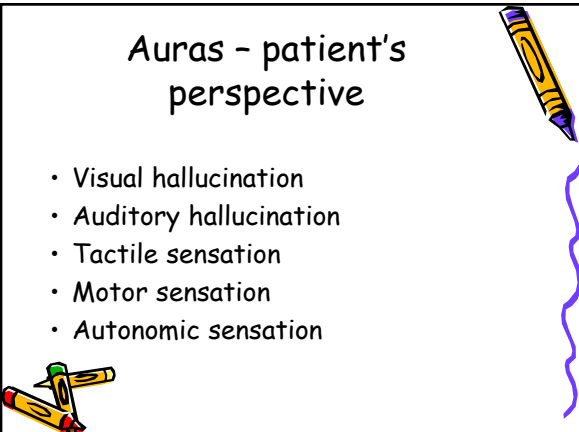
---

---

---

### Auras - patient's perspective

- Visual hallucination
- Auditory hallucination
- Tactile sensation
- Motor sensation
- Autonomic sensation



---

---

---

---

---

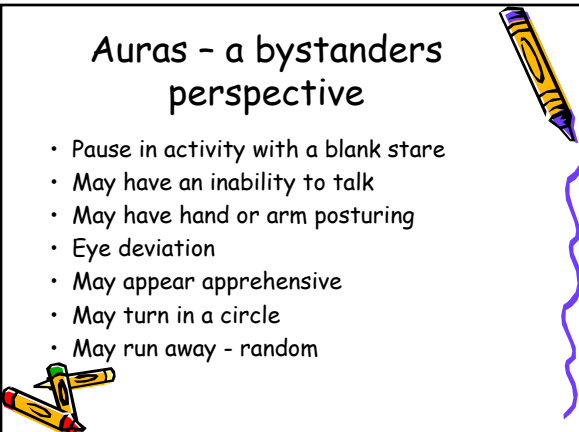
---

---

---

### Auras - a bystanders perspective

- Pause in activity with a blank stare
- May have an inability to talk
- May have hand or arm posturing
- Eye deviation
- May appear apprehensive
- May turn in a circle
- May run away - random



---

---

---

---

---

---

---

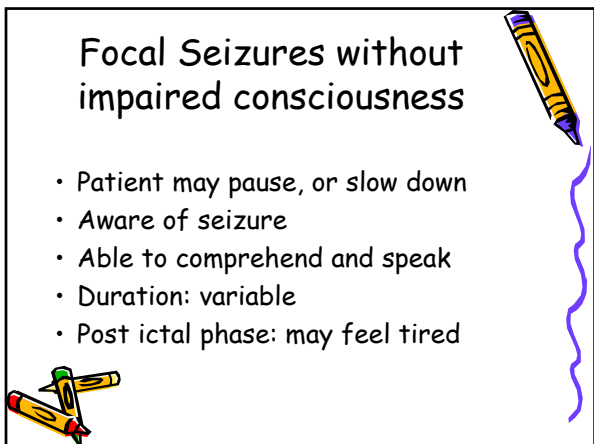
---





### Focal Seizures without impaired consciousness

- Patient may pause, or slow down
- Aware of seizure
- Able to comprehend and speak
- Duration: variable
- Post ictal phase: may feel tired



---

---

---

---

---

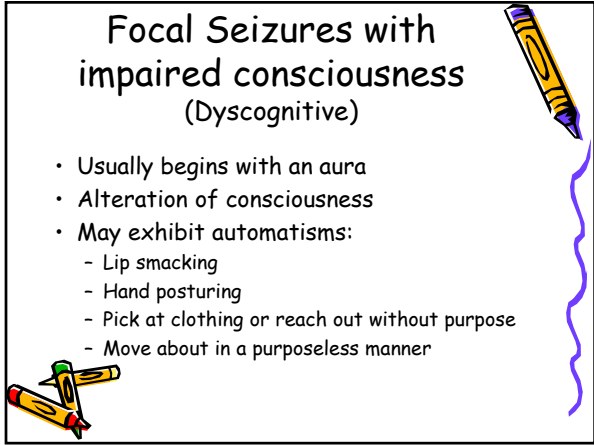
---

---

---

### Focal Seizures with impaired consciousness (Dyscognitive)

- Usually begins with an aura
- Alteration of consciousness
- May exhibit automatisms:
  - Lip smacking
  - Hand posturing
  - Pick at clothing or reach out without purpose
  - Move about in a purposeless manner



---

---

---

---

---

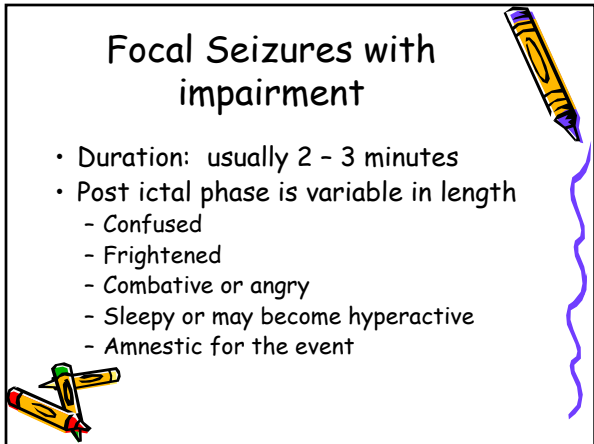
---

---

---

### Focal Seizures with impairment

- Duration: usually 2 - 3 minutes
- Post ictal phase is variable in length
  - Confused
  - Frightened
  - Combative or angry
  - Sleepy or may become hyperactive
  - Amnestic for the event



---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

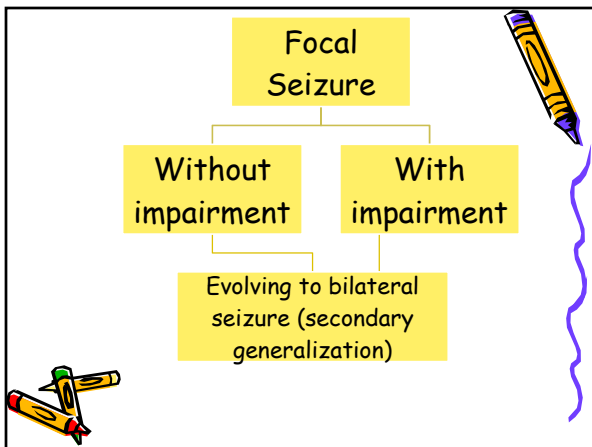
---

---

---

---

---



---

---

---

---

---



---

---

---

### Generalized Onset

- Occur in 20 - 40%
- More common in children
- Genetic cause suspected with most
- They begin without warning
- Always associated with an alteration of consciousness



---

---

---

---




---

---

---

---

### Generalized Onset



---

---

---

---



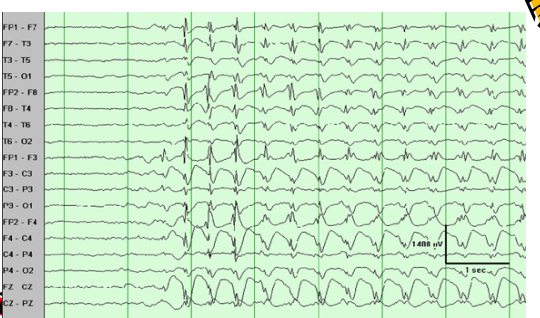
---

---

---

---

### Generalized onset



---

---

---

---

---

---

---

---

## Generalized Onset Types

- Tonic clonic
- Clonic
- Absence or Atypical Absence
- Myoclonic
- Tonic
- Atonic



---

---

---

---

---

---

---

---

## Tonic Clonic seizures: aka Grand mal Seizures

- Abrupt onset
- Loss of consciousness
- Stiffening of the extremities
- Decreased ability to breathe
- Rhythmic jerking
- Duration: 1 - 3 minutes (usually)



---

---

---

---

---

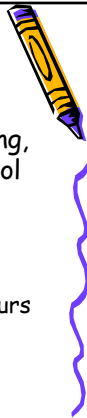
---

---

---

## Tonic Clonic seizures

- Often associated with tongue biting,  
and loss of bowel or bladder control
- Post ictal phase
  - Confusion
  - Sleepy may sleep 30 minutes to 4 hours



---

---

---

---

---

---

---

---



---

---

---

---

---



---

---

---

### Absence seizures

- Brief loss of consciousness (10 - 20 seconds)
- Blank stare
- No post ictal period associated
- May have subtle twitching (myoclonic movements)
- May have simple automatisms



---

---

---

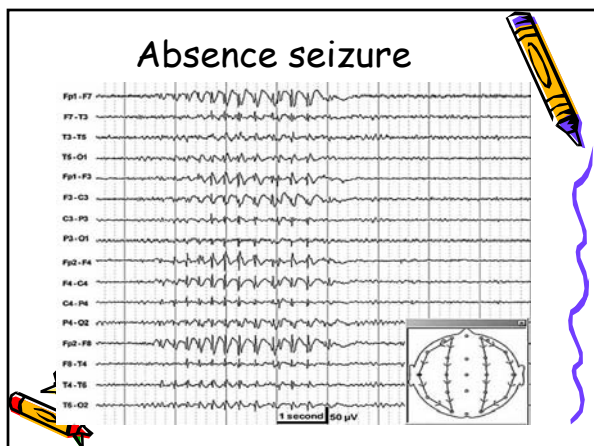
---

---

---

---

---



---

---

---

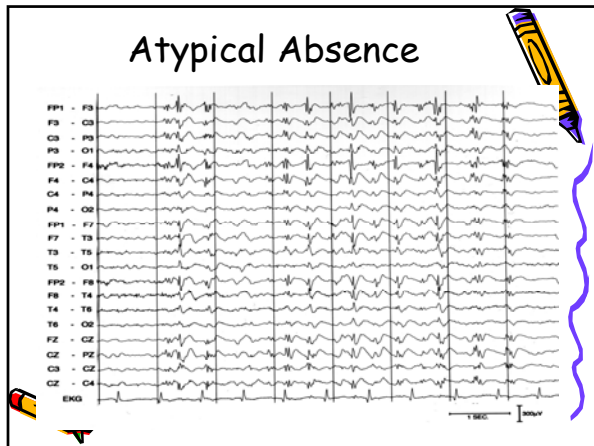
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

---

---

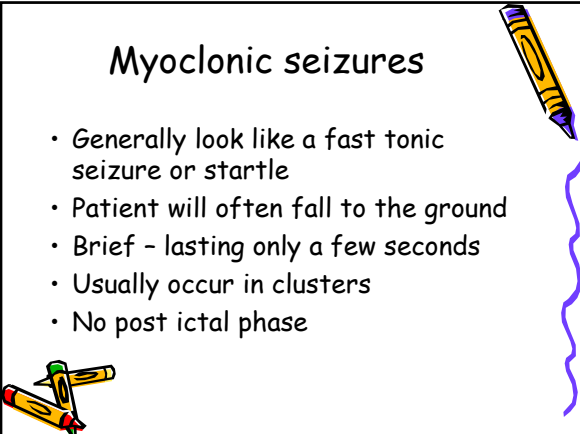
---

---

---

### Myoclonic seizures

- Generally look like a fast tonic seizure or startle
- Patient will often fall to the ground
- Brief - lasting only a few seconds
- Usually occur in clusters
- No post ictal phase



---

---

---

---

---

---

---

---



---

---

---

---

---

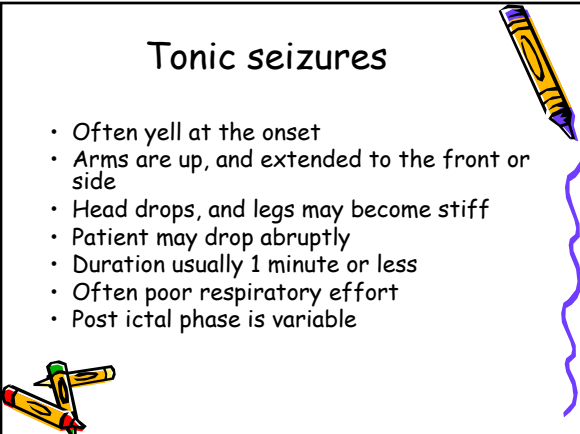
---

---

---

### Tonic seizures

- Often yell at the onset
- Arms are up, and extended to the front or side
- Head drops, and legs may become stiff
- Patient may drop abruptly
- Duration usually 1 minute or less
- Often poor respiratory effort
- Post ictal phase is variable



---

---

---

---

---

---

---

---





---

---

---

---

---

---

---

---

### Atonic seizures

- Sudden loss of muscle tone
- Fall to the ground
- No warning
- Duration: a few seconds

---

---

---

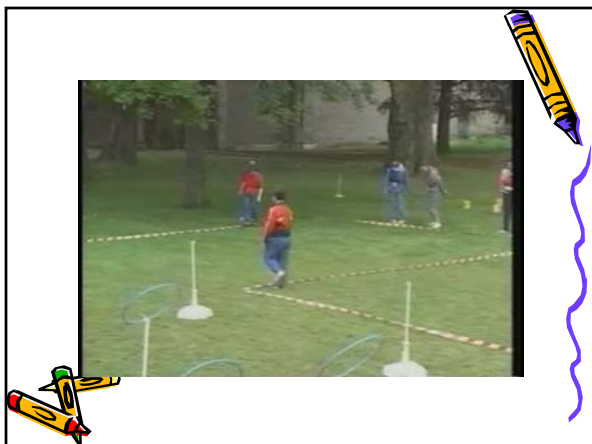
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

### Seizure Provoking Factors

- Insomnia
- Constipation
- Febrile illnesses
- Excessive excitement
- Excessive Stress
- Medication changes
- Hormonal changes
- Emotional changes

---

---

---

---

---

---

---

---

### Treatments

---

---

---

---

---


---

---

---

### Treatments

- Medications
- Surgery
- Dietary



---

---

---

---

---



---

---

---

### Phenobarbital 1912

- Used for any type of seizure
- Mostly used for children 2 years of age and younger
- Used to treat Status Epilepticus
- Activates the liver
- Affects other medications
- Half life is 72 to 96 hours



---

---

---

---

---



---

---

---

### Side Effects of Phenobarbital

- Sedation
- Irritability and hyperactivity
- Agitation and confusion in the elderly
- Depression
- Leads to Vitamin K, Vitamin D, and Calcium deficiency



---

---

---

---

---

---

---

---

### Phenytoin 1938

- Used for any seizure type
- Used in the treatment of Status Epilepticus
- Follows "zero order kinetics"
- Half life is approximately 24 hours
- Activates the liver
- Interferes with other medications



---

---

---

---

---

---

---

---

### Zero Order Kinetics

- **First order kinetics** - Drug elimination is proportional to its concentration
- **Zero order kinetics** - Drug elimination is independent of the drug's concentration

*Make changes slowly and in small doses*



---

---

---

---

---

---

---

---

### Side Effects of Phenytoin

- Sedation
- Dizziness
- Nystagmus
- Double vision
- Tremor
- Ataxia
- Gum hypertrophy
- Hirsutism
- Coarsening of facial features
- Liver problems
- Bone marrow problems
- Affects vitamin k, Vitamin D, and calcium
- Cerebellar atrophy



---

---

---

---

---

---

---

---

### Primidone 1954

- Has two different ways that it works but is not fully understood
- Most breaks down to phenobarbital
- May be used for any type of seizure



---

---

---

---

---

---

---

---

### Carbamazepine 1950's to 1974

- Most effective for focal onset seizures
- Activates the liver
- Affects other medication levels
- Breaks down to "10,11 epoxide"
- May make some seizures types worse
- Half life 6 - 14 hours



---

---

---

---

---

---

---

---

### Side Effects of Carbamazepine

- Sedation
- Behavioral changes
- Confusion
- Nystagmus
- Ataxia
- Heat intolerance
- Liver problems
- Bone marrow suppression
- Affects Vit. K, Vit. D, and calcium levels
- Hyponatremia



---

---

---

---

---

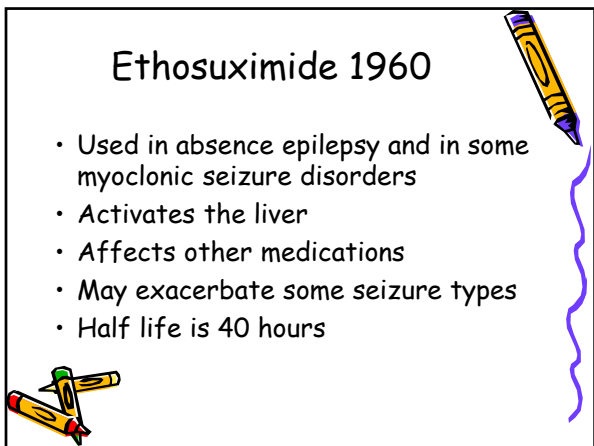
---

---

---

### Ethosuximide 1960

- Used in absence epilepsy and in some myoclonic seizure disorders
- Activates the liver
- Affects other medications
- May exacerbate some seizure types
- Half life is 40 hours



---

---

---

---

---

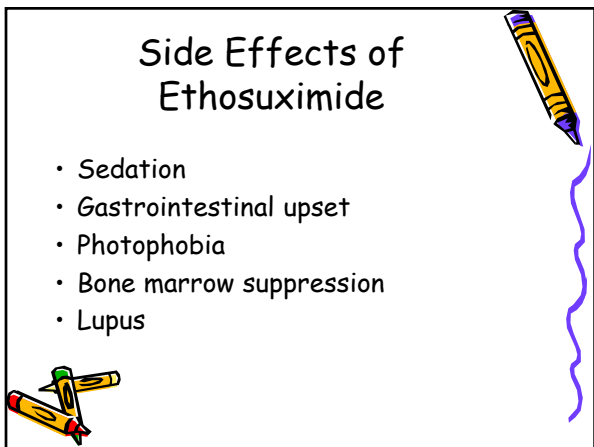
---

---

---

### Side Effects of Ethosuximide

- Sedation
- Gastrointestinal upset
- Photophobia
- Bone marrow suppression
- Lupus



---

---

---

---

---

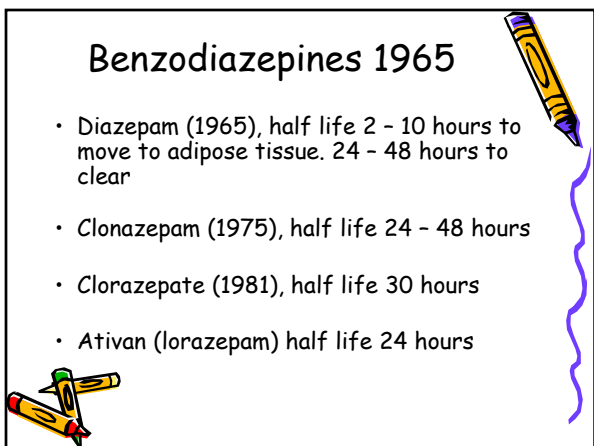
---

---

---

### Benzodiazepines 1965

- Diazepam (1965), half life 2 - 10 hours to move to adipose tissue. 24 - 48 hours to clear
- Clonazepam (1975), half life 24 - 48 hours
- Clorazepate (1981), half life 30 hours
- Ativan (lorazepam) half life 24 hours



---

---

---

---

---

---

---

---

## Side Effects of benzodiazepines

- Sedation
- Hyperactivity
- Irritability
- Depression and confusion
- Slurred speech
- Loss of muscle tone
- Decreased respirations
- Decreased blood pressure
- Additive effect with other sedating medications



---

---

---

---

---

---

---

---

## Valproate 1978

- Works in a different way from the older medications
  - Increases GABA (gamma-aminobutyric acid) which has brain calming effect
- Activates the liver
- Affects other medications
- Half life 9 - 18 hours
- Most effective for generalized seizure types



---

---

---

---

---

---

---

---

## Side Effects of Valproate

- Anorexia or appetite stimulant
- Hair loss
- Tremors
- Lower extremity edema
- Acne
- Bruising
- Liver problems
- Bone marrow suppression
- Pancreatitis
- Thrombocytopenia (platelets are too low)
- Polycystic ovary disease
- May affect personality



---

---

---

---

---

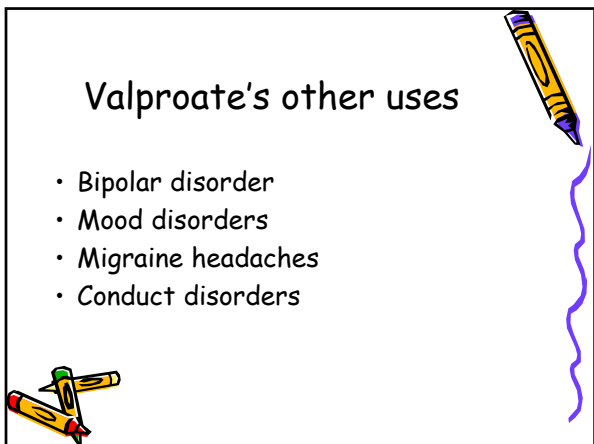
---

---

---

### Valproate's other uses

- Bipolar disorder
- Mood disorders
- Migraine headaches
- Conduct disorders



---

---

---

---

---

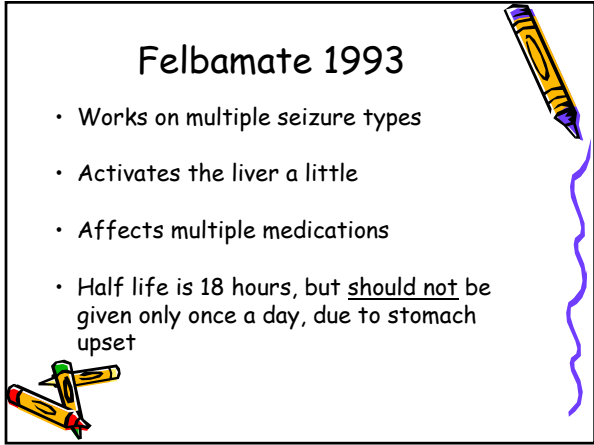
---

---

---

### Felbamate 1993

- Works on multiple seizure types
- Activates the liver a little
- Affects multiple medications
- Half life is 18 hours, but should not be given only once a day, due to stomach upset



---

---

---

---

---

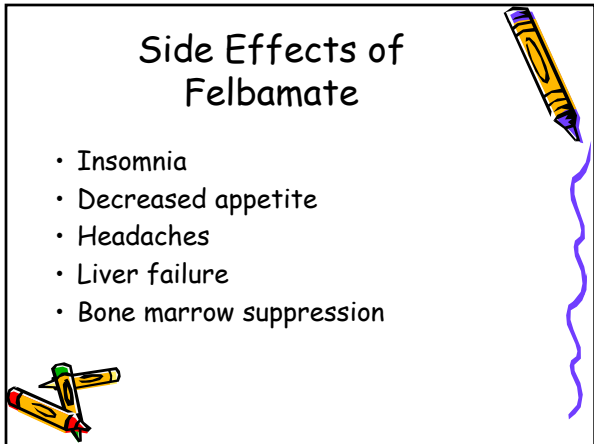
---

---

---

### Side Effects of Felbamate

- Insomnia
- Decreased appetite
- Headaches
- Liver failure
- Bone marrow suppression



---

---

---

---

---

---

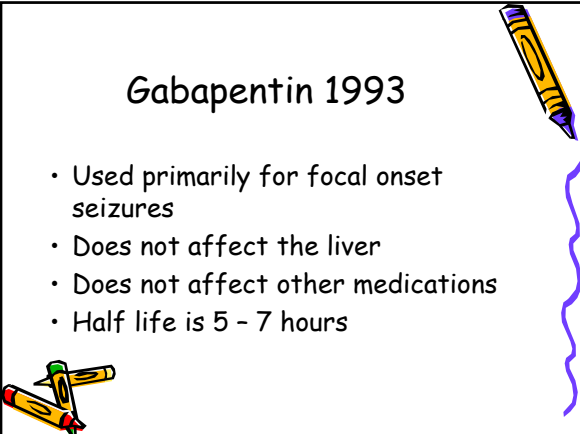
---

---



### Gabapentin 1993

- Used primarily for focal onset seizures
- Does not affect the liver
- Does not affect other medications
- Half life is 5 - 7 hours



---

---

---

---

---

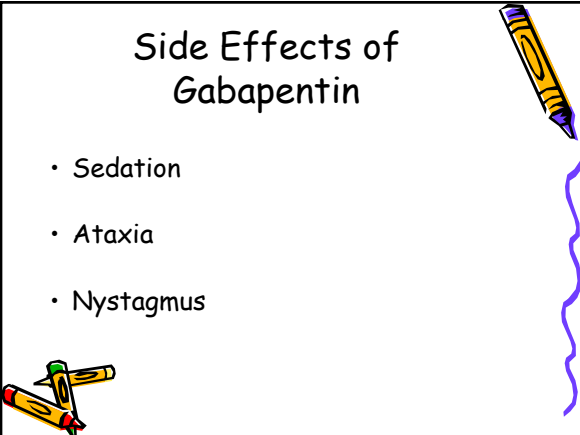
---

---

---

### Side Effects of Gabapentin

- Sedation
- Ataxia
- Nystagmus



---

---

---

---

---

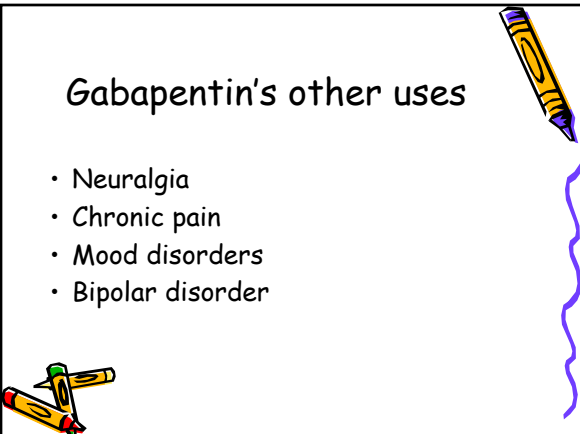
---

---

---

### Gabapentin's other uses

- Neuralgia
- Chronic pain
- Mood disorders
- Bipolar disorder



---

---

---

---

---

---

---

---

### Lamotrigine 1994

- Most effective for generalized seizures
- Thought to work on sodium channels
- May effect other medications
- Tends to interact with Valproate
- Half life is 24 hours



---

---

---

---

---

---

---

---

### Side Effects of Lamotrigine

- SKIN RASHES - may be seen up to 6 months after the last dosage change
- Headaches
- Depression
- Stomach upset
- Sedation



---

---

---

---

---

---

---

---

### Topiramate 1996

- Effective in multiple seizure types
- Does not seem to effect the liver
- May effect other medications
- Half life 21 hours, shorter in children



---

---

---

---

---

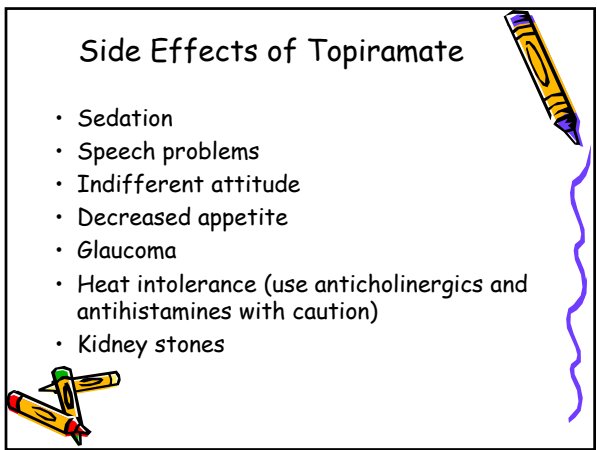
---

---

---

### Side Effects of Topiramate

- Sedation
- Speech problems
- Indifferent attitude
- Decreased appetite
- Glaucoma
- Heat intolerance (use anticholinergics and antihistamines with caution)
- Kidney stones



---

---

---

---

---

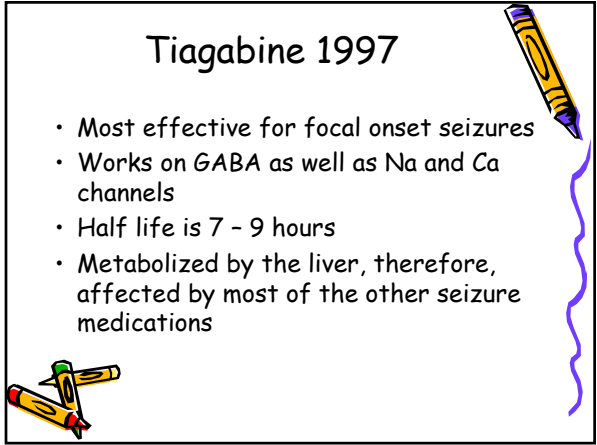
---

---

---

### Tiagabine 1997

- Most effective for focal onset seizures
- Works on GABA as well as Na and Ca channels
- Half life is 7 - 9 hours
- Metabolized by the liver, therefore, affected by most of the other seizure medications



---

---

---

---

---

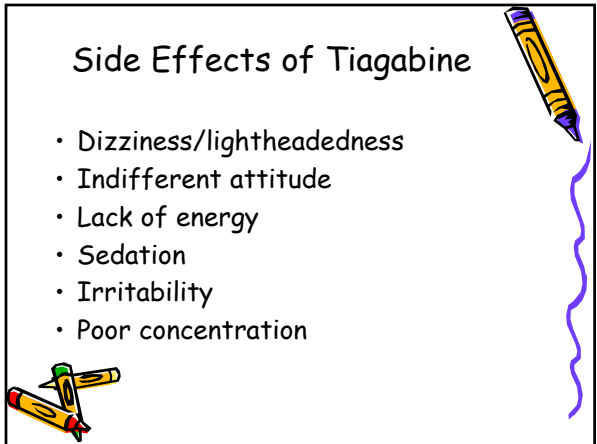
---

---

---

### Side Effects of Tiagabine

- Dizziness/lightheadedness
- Indifferent attitude
- Lack of energy
- Sedation
- Irritability
- Poor concentration



---

---

---

---

---

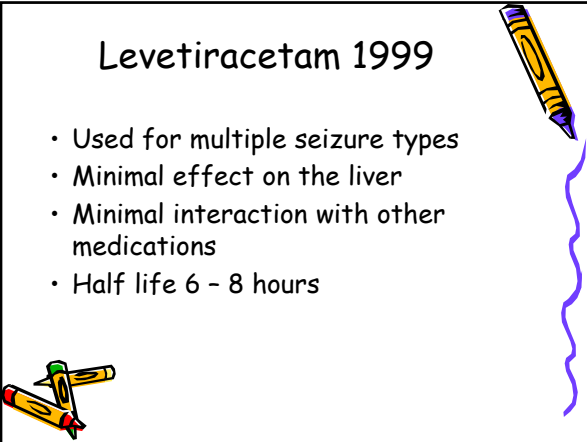
---

---

---

### Levetiracetam 1999

- Used for multiple seizure types
- Minimal effect on the liver
- Minimal interaction with other medications
- Half life 6 - 8 hours



---

---

---

---

---

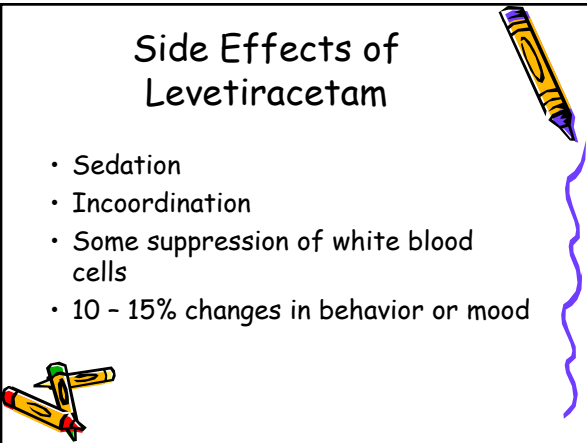
---

---

---

### Side Effects of Levetiracetam

- Sedation
- Incoordination
- Some suppression of white blood cells
- 10 - 15% changes in behavior or mood



---

---

---

---

---

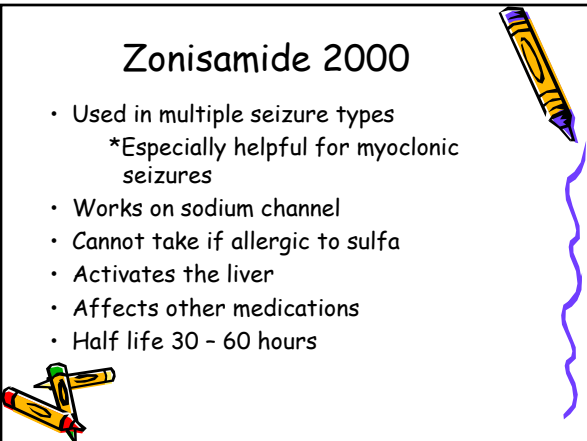
---

---

---

### Zonisamide 2000

- Used in multiple seizure types
  - \*Especially helpful for myoclonic seizures
- Works on sodium channel
- Cannot take if allergic to sulfa
- Activates the liver
- Affects other medications
- Half life 30 - 60 hours



---

---

---

---

---

---

---

---

### Side Effects of Zonisamide

- Sedation
- Ataxia
- Decreased appetite
- Confusion
- Heat intolerance
- Liver problems
- Bone marrow
- Suppression
- Kidney stones



---

---

---

---

---

---

---

---

### Oxcarbazepine 2000

- Carbamazepine's cousin
- Most effective for focal onset seizures
- Does not form 10,11 epoxide
- Works on Na, Ca and K channels
- Half life is 9 hours



---

---

---

---

---

---

---

---

### Side Effects of Oxcarbazepine

- Sedation
- Headaches
- Increased sweating
- Double or blurred vision
- Ataxia
- Low sodium levels, especially with certain blood pressure medications



---

---

---

---

---

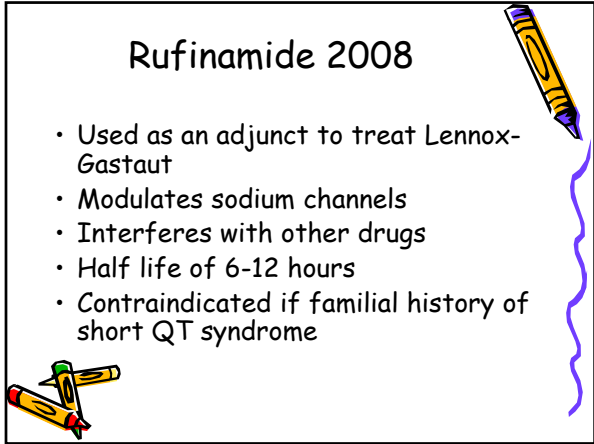
---

---

---

### Rufinamide 2008

- Used as an adjunct to treat Lennox-Gastaut
- Modulates sodium channels
- Interferes with other drugs
- Half life of 6-12 hours
- Contraindicated if familial history of short QT syndrome



---

---

---

---

---

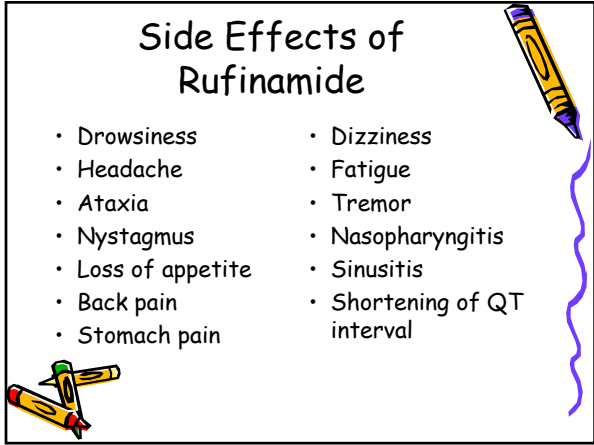
---

---

---

### Side Effects of Rufinamide

- Drowsiness
- Headache
- Ataxia
- Nystagmus
- Loss of appetite
- Back pain
- Stomach pain
- Dizziness
- Fatigue
- Tremor
- Nasopharyngitis
- Sinusitis
- Shortening of QT interval



---

---

---

---

---

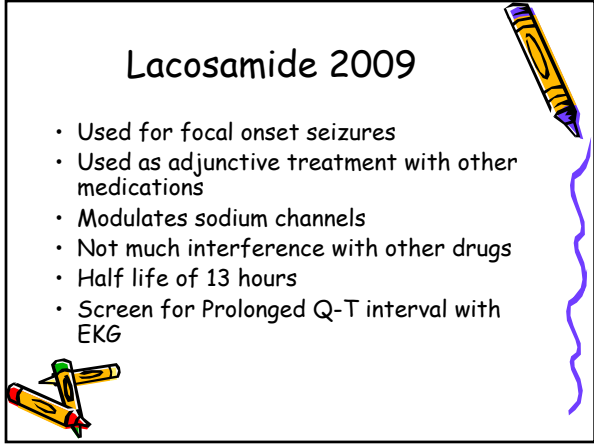
---

---

---

### Lacosamide 2009

- Used for focal onset seizures
- Used as adjunctive treatment with other medications
- Modulates sodium channels
- Not much interference with other drugs
- Half life of 13 hours
- Screen for Prolonged Q-T interval with EKG



---

---

---

---

---

---

---

---

### Side effects of Lacosamide

- Dizziness
- Headache
- Nausea
- Ataxia
- Fatigue
- Blurred vision
- Nystagmus
- Bradycardia
- Syncope
- Depression
- Suicidal thoughts
- Cardiac arrhythmia



---

---

---

---

---

---

---

---

### Vigabatrin 2009

- Primarily used for infantile spasms but can use as adjunct for adults with Dyscognitive seizures (CPS)
- Decreases effects of other drugs
- Half life of 120 hours



---

---

---

---

---

---

---

---

### Side Effects of Vigabatrin

- Drowsiness
- Dizziness
- GI upset
- Blurred vision
- Headache
- Interference with certain lab tests
- Weight gain
- Constipation
- Cough
- Personality changes
- Retinal toxicity
- Permanent loss of vision



---

---

---

---

---

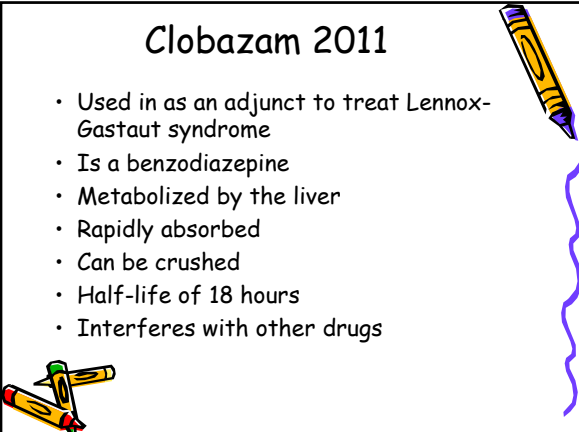
---

---

---

### Clobazam 2011

- Used in as an adjunct to treat Lennox-Gastaut syndrome
- Is a benzodiazepine
- Metabolized by the liver
- Rapidly absorbed
- Can be crushed
- Half-life of 18 hours
- Interferes with other drugs



---

---

---

---

---

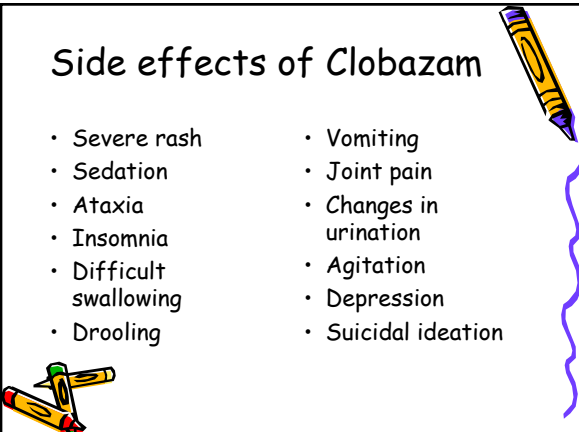
---

---

---

### Side effects of Clobazam

- Severe rash
- Sedation
- Ataxia
- Insomnia
- Difficult swallowing
- Drooling
- Vomiting
- Joint pain
- Changes in urination
- Agitation
- Depression
- Suicidal ideation



---

---

---

---

---

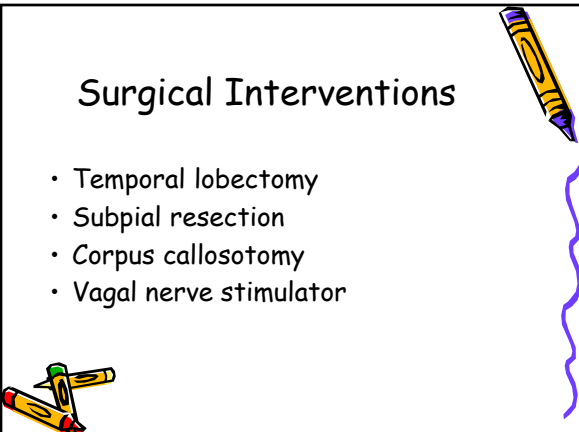
---

---

---

### Surgical Interventions

- Temporal lobectomy
- Subpial resection
- Corpus callosotomy
- Vagal nerve stimulator



---

---

---

---

---

---

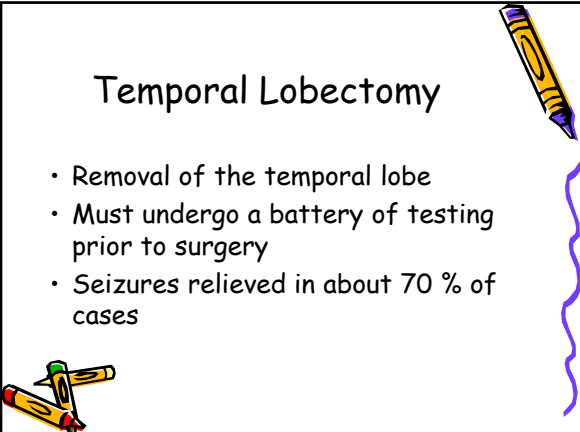
---

---



### Temporal Lobectomy

- Removal of the temporal lobe
- Must undergo a battery of testing prior to surgery
- Seizures relieved in about 70 % of cases



---

---

---

---

---

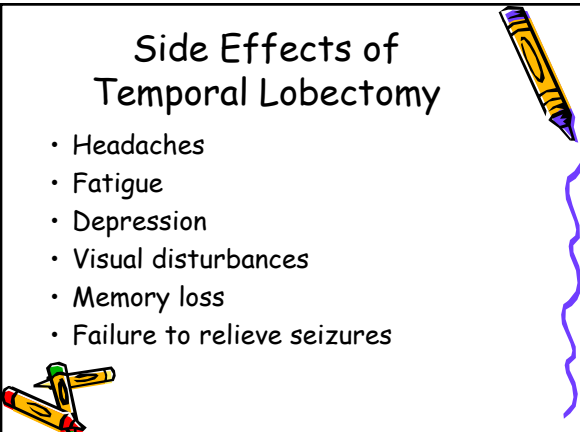
---

---

---

### Side Effects of Temporal Lobectomy

- Headaches
- Fatigue
- Depression
- Visual disturbances
- Memory loss
- Failure to relieve seizures



---

---

---

---

---

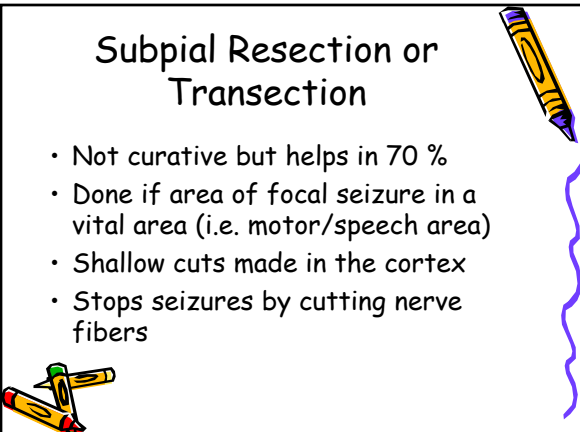
---

---

---

### Subpial Resection or Transection

- Not curative but helps in 70 %
- Done if area of focal seizure in a vital area (i.e. motor/speech area)
- Shallow cuts made in the cortex
- Stops seizures by cutting nerve fibers



---

---

---

---

---

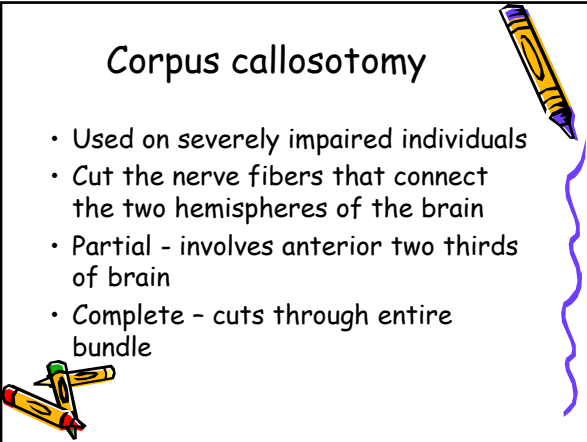
---

---

---

### Corpus callosotomy

- Used on severely impaired individuals
- Cut the nerve fibers that connect the two hemispheres of the brain
- Partial - involves anterior two thirds of brain
- Complete - cuts through entire bundle



---

---

---

---

---

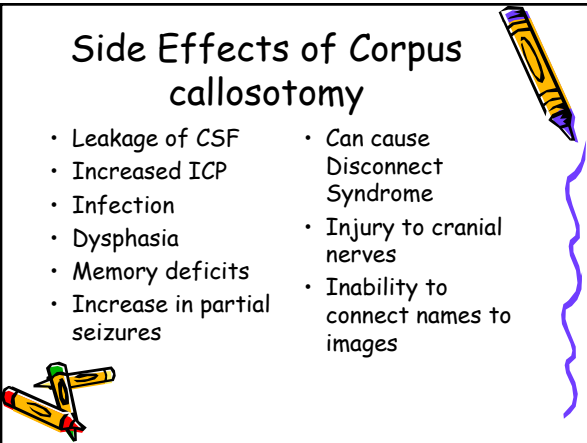
---

---

---

### Side Effects of Corpus callosotomy

- Leakage of CSF
- Increased ICP
- Infection
- Dysphasia
- Memory deficits
- Increase in partial seizures
- Can cause Disconnect Syndrome
- Injury to cranial nerves
- Inability to connect names to images



---

---

---

---

---

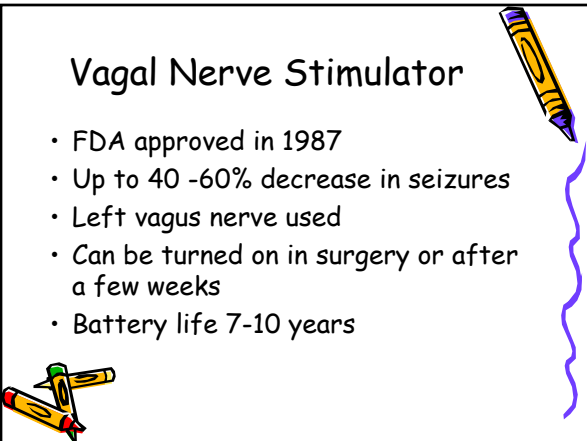
---

---

---

### Vagal Nerve Stimulator

- FDA approved in 1987
- Up to 40 -60% decrease in seizures
- Left vagus nerve used
- Can be turned on in surgery or after a few weeks
- Battery life 7-10 years



---

---

---

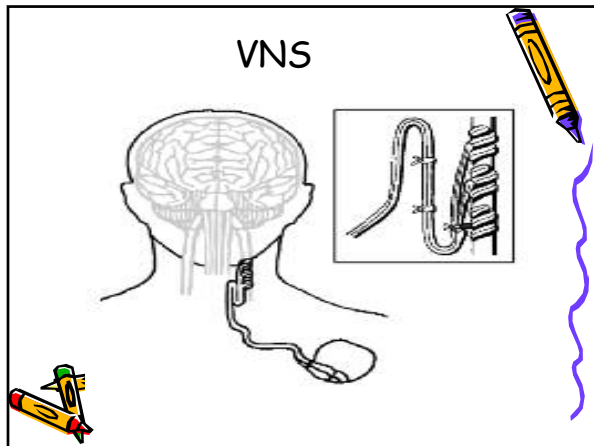
---

---

---

---

---



---

---

---

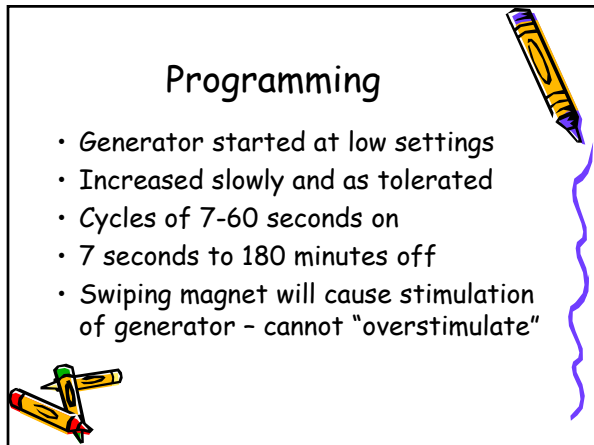
---

---

---

---

---



---

---

---

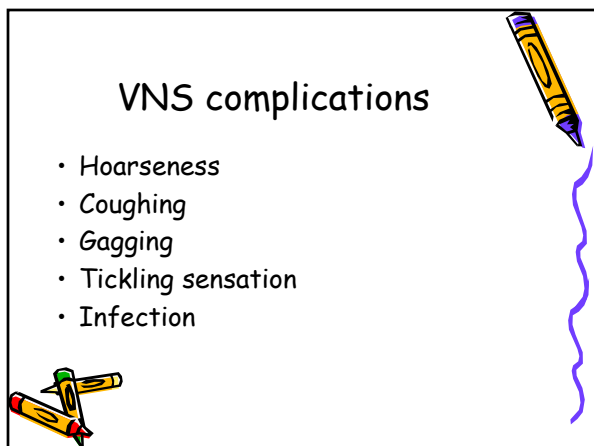
---

---

---

---

---



---

---

---

---

---

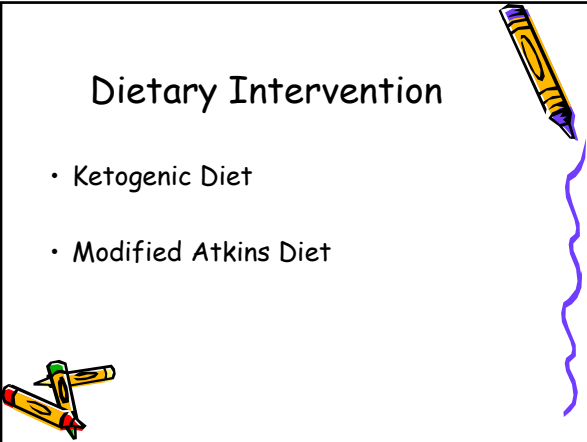
---

---

---

## Dietary Intervention

- Ketogenic Diet
- Modified Atkins Diet

A box containing the title 'Dietary Intervention', a bulleted list of 'Ketogenic Diet' and 'Modified Atkins Diet', and illustrations of three crayons in the bottom left and a yellow crayon with a purple wavy line in the top right.

---

---

---

---

---

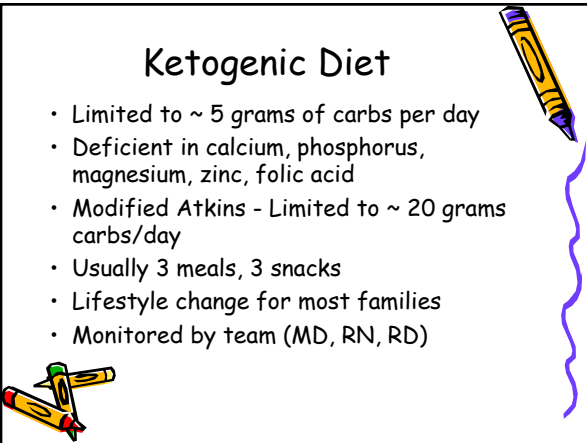
---

---

---

## Ketogenic Diet

- Limited to ~ 5 grams of carbs per day
- Deficient in calcium, phosphorus, magnesium, zinc, folic acid
- Modified Atkins - Limited to ~ 20 grams carbs/day
- Usually 3 meals, 3 snacks
- Lifestyle change for most families
- Monitored by team (MD, RN, RD)

A box containing the title 'Ketogenic Diet', a bulleted list of diet details, and illustrations of three crayons in the bottom left and a yellow crayon with a purple wavy line in the top right.

---

---

---

---

---

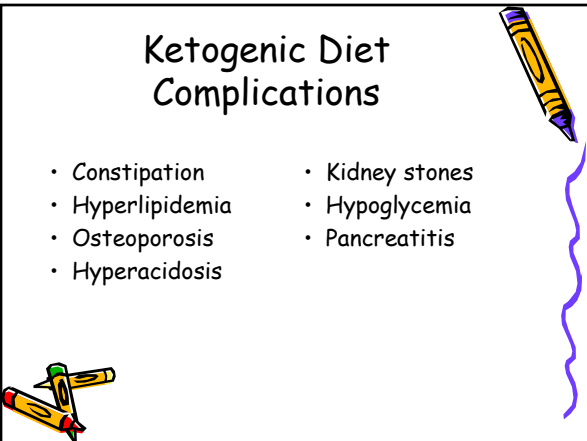
---

---

---

## Ketogenic Diet Complications

• Constipation	• Kidney stones
• Hyperlipidemia	• Hypoglycemia
• Osteoporosis	• Pancreatitis
• Hyperacidosis	

A box containing the title 'Ketogenic Diet Complications', a two-column bulleted list of complications, and illustrations of three crayons in the bottom left and a yellow crayon with a purple wavy line in the top right.

---

---

---

---

---

---

---

---

### Non epileptic events

- Syncope
- Cardiac arrhythmia
- Breath holding spell
- Panic attacks
- Movement disorder
- Hypoglycemic episodes
- Esophageal reflux
- Sleep disorder
- Benign nocturnal jerks
- Psychogenic episodes
- Menses
- Trauma



---

---

---

---

---

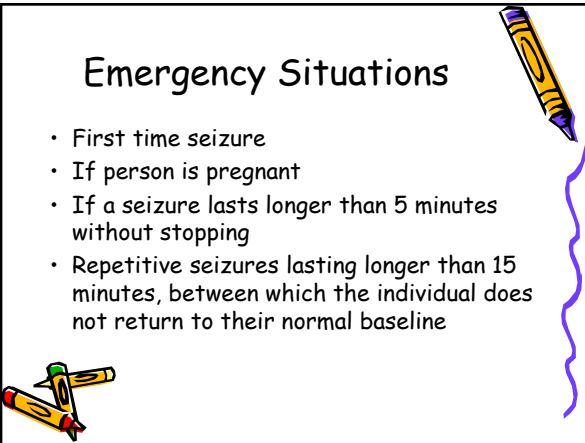
---

---

---

### Emergency Situations

- First time seizure
- If person is pregnant
- If a seizure lasts longer than 5 minutes without stopping
- Repetitive seizures lasting longer than 15 minutes, between which the individual does not return to their normal baseline



---

---

---

---

---

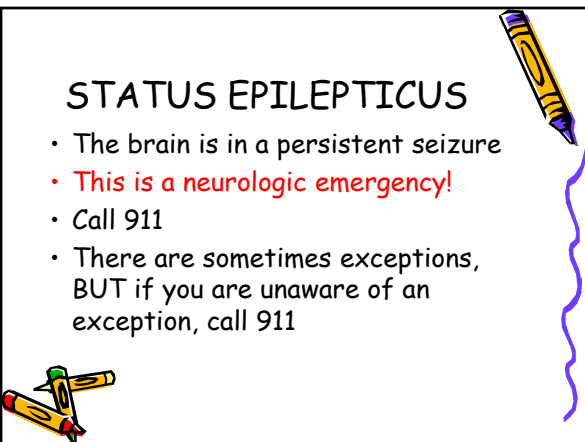
---

---

---

### STATUS EPILEPTICUS

- The brain is in a persistent seizure
- **This is a neurologic emergency!**
- Call 911
- There are sometimes exceptions, BUT if you are unaware of an exception, call 911



---

---

---

---

---

---

---

---

Questions?



---

---

---

---

---

---

---

---