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
Brain tumors

Trauma

Severe anoxic injury
Degenerative diseases

Congenital malformations

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
- Idiopathic (Possible genetic cause)
- Symptomatic (Known cause)
- Cryptogenic (Unknown cause)
- Localization related (partial)

New
- Genetic
- Structural/Metabolic
- Unknown

Seizure Classification

- Clinical observation + EEG findings
  - Focal seizure
  - Generalized seizure
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 bystander’s 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

Observable motor or autonomic changes (formerly simple partial)
Consciousness preserved

Observable motor or autonomic changes (formerly complex partial)
Consciousness impaired

Focal Seizure Types
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
Focal Seizure

- Without impairment
- With impairment

Evolving to bilateral seizure (secondary generalization)
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 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
Atypical Absence
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
Programming

- Generator started at low settings
- Increased slowly and as tolerated
- Cycles of 7-60 seconds on
- 7 seconds to 180 minutes off
- Swiping magnet will cause stimulation of generator – cannot “overstimulate”

VNS complications

- Hoarseness
- Coughing
- Gagging
- Tickling sensation
- Infection
Dietary Intervention

• Ketogenic Diet
• Modified Atkins Diet

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)

Ketogenic Diet Complications

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