What is a Seizure?

- Caused by abnormal brain electrical activity
- Brain’s electrical system malfunctions:
  - Uncontrolled electrical discharges
  - Brain cells keep firing causing abnormal surge of energy
- Brain cells often require time to recover from their fatigue
Seizure Features:
Related to Area of Brain Involved
What Does a Seizures Look Like?

- People having a seizure can be:
  - Conscious & aware of their environment
  - Staring & unresponsive with an alteration of consciousness
  - Unconscious
What Does a Seizures Look Like?

- Seizures can involve many parts of the body
  - Unilaterally
  - Bilaterally
- Motor movements:
  - Shaking
  - Jerking
  - Stiffening, clenching
  - Twitching
What Does a Seizures Look Like?

- People having a seizure can have:
  - Drooling or foam-like saliva
  - Color changes: dusky, gray, bluish
  - Slower and shallow breathing
    - They do not stop breathing
  - Unusual noises:
    - gurgling
    - groaning
    - sighing
How Long do Seizures Last?

- Only a few seconds
- Several minutes
- Most last < 2 minutes
- Status epilepticus
  - Medical emergency
Status Epilepticus

- > 30 minutes of continuous seizing or sequential seizures without recovery
- Can be life threatening or permanently disabling
- 1/3 represents the initial presentation of epilepsy
- 20% of epilepsy patients will experience status epilepticus in the first 5 years of diagnosis
How Common are Seizures?

- United States:
  - 25,000-40,000 children per year experience a seizure
Why do Seizures Happen?
Etiology

- Provoked: A result of an acute condition
  - Head trauma
  - Central nervous system infection
  - Tumor
  - Hypoxia
  - Metabolic imbalance
Why do Seizures Happen?

Etiology

Unprovoked

- Symptomatic
  - Pre-existing brain problem (injury, malformation, insult)
- Cryptogenic
  - No known cause
- Idiopathic
  - Genetic
  - Development & brain normal


- Structural or Metabolic
- Unknown cause
- Genetic or presumed
- Immune
- Infectious
<table>
<thead>
<tr>
<th>New</th>
<th>Old</th>
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<tbody>
<tr>
<td>Focal</td>
<td>Partial or localization related</td>
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<tr>
<td>Generalized</td>
<td>Same</td>
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<td>II</td>
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## New Terminology: Mode of Onset

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
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<tbody>
<tr>
<td>Focal → → → →</td>
<td>Partial or localization related</td>
</tr>
<tr>
<td>Generalized → →</td>
<td>Same</td>
</tr>
<tr>
<td>Unknown if focal →</td>
<td>No category</td>
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<tr>
<td>or generalized</td>
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</tbody>
</table>
Partial Seizures
- Simple
- Complex
- Secondarily generalized

Generalized seizures
New Classifications

Original Source: www.epilepsy.org.au, revised ILAE, 2010

Seizure Classification

Partial
(seizure activity originates in one part of the brain)

Generalised
(seizure activity involved entire brain)

Focal

Simple

Complex

w/o alteration of consciousness

w/alteration of consciousness

Absence

Myoclonic

Tonic clonic

Tonic

Atonic

typical, atypical, special features

myoclonic, atonic, tonic

Epileptic Spasms
Focal Seizure Focus
New Terminology: Focal Seizure Classifications

- Originates “within networks limited to one hemisphere”
- Based upon describing characteristics:
  - Aura +/-
  - Motor movements unilateral
  - Autonomic features
- Unaltered or altered consciousness
New Terminology: Focal Seizure Classification

- Can spread to involve both hemispheres and result in a “bilateral convulsive seizure”
- Old term: Secondarily generalized
Generalized Seizure
New Generalized Seizure Classification:

- Tonic
- Clonic
- Tonic-Clonic
- Absence
  - Typical
  - Atypical
  - Special features:
    - Myoclonic absence
    - Eyelid myoclonia

- Myoclonic
  - Myoclonic
  - Myoclonic atonic
  - Myoclonic tonic

- Atonic
  - Drop attacks

- Epileptic spasms
Definition: First Seizure (ILAE):

- International League Against Epilepsy:
  - Non-febrile
  - No obvious provocation
  - Seizure type:
    - Focal with or without alteration of consciousness
    - Focal with spread to involve both hemispheres
    - Generalized tonic or clonic-tonic
Definition: First Seizure (continued)

- Multiple seizures within 24 hours with recovery between
- Excluded:
  - Recurrent afebrile seizures without provocation (epilepsy)
  - Seizures associated with head trauma, CNS infection, tumor
  - Febrile seizures
  - Neonatal (<28 days) seizures
  - Seizures > 30 minutes (status epilepticus)
  - Myoclonic and atonic seizures
Evaluation

- Elicit a detailed history
  - Determine if a seizure occurred
  - Rule out seizure-like non-epileptic events:
    - Breath holding
    - Syncope
    - Gastro-esophageal reflux
    - Pseudoseizure
    - Other: Non-epileptic
Evaluation

- Perform a through history & physical exam
- Determine if the seizure was provoked and related to an acute condition:
  - Hypoglycemia
  - Toxic ingestion
  - Intracranial infection
  - Trauma
  - Other precipitating factors
Evaluation:
Laboratory Testing

- History of vomiting, diarrhea, dehydration, or failure to return to baseline alertness:
  - Electrolytes
  - Glucose
  - Calcium
  - Magnesium
  - BUN
Laboratory Testing

- Toxicology screen (all ages)
  - Suggestion of:
    - Drug exposure
    - Substance abuse

- Lumbar puncture (if increased ICP suspected, scan first)
  - Of limited value unless a concern of:
    - Meningitis
    - Encephalitis
Other Diagnostics: EEG

- Optimal timing unclear
- Outpatient scheduling acceptable
- Helps determine:
  - Seizure type
  - Epilepsy syndrome
  - Risk for recurrence
  - Management decisions
  - Scanning
Other Diagnostics: Neuroimaging Studies

- **Emergent**: MRI if available or CT
  - Postictal focal deficit
    - Unresolved within one hour
  - Lack of a return to baseline within several hours
Other Diagnostics: Neuroimaging Studies

- **Non-Emergent MRI:**
  - Focal onset seizure
  - Evolves to bilateral brain involvement but normal exam
    - Old term: secondary generalization
  - Significant cognitive or motor impairment of unknown etiology
Other Diagnostics: Neuroimaging Studies

- **Non-Emergent MRI** (continued)
  - Unexplained abnormalities on neurological exam
  - An EEG finding other than:
    - Benign partial of childhood
    - Primary generalized epilepsy
  - Infants < one year of age
Differential Diagnosis

- Non-seizure paroxysmal event
  - Gastro-esophageal reflux
  - Shuddering attacks
- Provoked non-epileptic seizure:
  - Syncopal convolution
  - Febrile seizure
  - Breath holding spells
    - Cyanotic syncope
    - Pallid syncope
Differential Diagnosis

- Symptomatic provoked non-epileptic seizure:
  - Hypocalcemia
  - Hyponatremia
  - Hypoglycemia
  - Head Trauma
  - Hypoxia
  - CNS infection (meningitis, encephalitis)
  - Drug toxicity
- Psychogenic seizure (non-epileptic)
Management: Patient Education

- Recognize family and child’s concerns
- Discuss:
  - Evaluation & management
  - Recurrence risk (general)
    - 30-40% for 2nd unprovoked seizure
    - 70% for 3rd unprovoked seizure
Management: Patient Education

Factors that increase recurrence risk to 50%:

- Structural or metabolic etiology
  - Prematurity
  - Prior brain problem
- Focal seizure
- Abnormal neurological exam
- Intellectual disability
- Abnormal EEG
Management: Patient Education

- Factors that do not influence recurrence:
  - Starting medication early
  - Having > 1 seizures within 24 hrs.
- Timing of the 2nd seizure (if happens)
  - 50% in the first 6 months
  - Unlikely after 2 years

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Management: Patient Education

- Discuss:
  - First aid & activating EMS
    - 5 minute rule
    - Prolonged postictal period
  - Safety
  - Confidentiality and morbidity report for patients $\geq$ 14 yrs. (DMV)
  - School seizure safety plan
<table>
<thead>
<tr>
<th>Seizure First Aid: Tonic/Clonic</th>
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<tr>
<td><strong>Remain calm</strong></td>
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<tr>
<td><strong>Turn to the side</strong></td>
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<tr>
<td><strong>Time</strong></td>
</tr>
<tr>
<td><strong>Clear the area</strong></td>
</tr>
<tr>
<td><strong>Do not restrain</strong></td>
</tr>
<tr>
<td><strong>Loosen clothing around neck</strong></td>
</tr>
<tr>
<td><strong>Place something flat &amp; soft under the head</strong></td>
</tr>
</tbody>
</table>

| **Do not force mouth open** |
| **Do not put anything in the mouth** |
| **Don't start CPR unless breathless & pulseless** |
| **Stay until the seizure is over** |
| **Offer to contact someone** |
Seizure Safety

- Buddy system
- Seizure precautions:
  - Water (bath tub, hot tub, swimming)
  - Power Tools
  - Biking (helmet)
  - Driving
Seizure Precautions: Low Risk Sports
(discuss seizure control with health care provider)

- Jogging
- Aerobics
- Cross-country skiing
- Dancing
- Hiking
- Golf
- Ping-Pong

- Bowling
- Field hockey (helmet)
- Most track & field events
- Baseball (wear a helmet)
Seizure Precautions: Medium Risk Sports (discuss seizure control with health care provider)

- Downhill skiing (with a buddy)
- Swimming (with a buddy and lifeguard)
- Horseback riding (helmet)
- Basketball
- Canoeing (life vest & helmet)

- Ice-skating or hockey (helmet)
- Tennis
- Gymnastics (need spotter)
- Roller-blading (helmet)

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<table>
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<tbody>
<tr>
<td>- Mountain or rock climbing</td>
</tr>
<tr>
<td>- Bungee jumping</td>
</tr>
<tr>
<td>- Scuba diving</td>
</tr>
<tr>
<td>- Sky diving</td>
</tr>
<tr>
<td>- Caving</td>
</tr>
<tr>
<td>- Football</td>
</tr>
<tr>
<td>(controversial)</td>
</tr>
<tr>
<td>- Boxing</td>
</tr>
<tr>
<td>- Hang gliding</td>
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<tr>
<td>- Surfing or windsurfing</td>
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<tr>
<td>- Solo flying</td>
</tr>
</tbody>
</table>
Management: Medication

- Provoked non-epileptic seizures (even if recurrent):
  - No medication usually

- Symptomatic provoked non-epileptic seizures:
  - Treat the underlying condition
Management: Medication

- Psychogenic seizure:
  - Refer to child psychiatry

- 1st afebrile non-focal & non-prolonged seizure:
  - No medication

- 1st afebrile focal & non-prolonged seizure:
  - No medication
  - Work-up different
Management: Medication

- Prolonged 1\textsuperscript{st} afebrile seizure presenting as status epilepticus:
  - Start on anti-epileptic drug (AED)
  - Consult child neurology
Management: Rescue AEDs

- **Indications:**
  - Prolonged seizures
  - Seizure flurries
  - Emergency medical services (EMS) unavailable (travel, rural areas)

- **Delivery:**
  - Oral
  - Rectal
  - Nasal
Management: Rescue AEDs

- Oral Benzodiazepines
  - Diazepam (Valium®)
    - FDA approved
      - Oral: > 6 months
      - Injectable > 30 days
  - Lorazepam (Ativan®) buccal, sublingual, injectable
    - Injectable only FDA approved adults status epilepticus
  - Clonazepam (Klonopin®)
Management: Rescue AEDs

- Rectal Benzodiazepine: Diazepam
  - Diastat®, AcuDial®
  - FDA approved 2 years and older
Management: Rescue AEDs

Nasal Midazolam (Versed®)

No FDA approval for treating status epilepticus or seizures adults or children

http://www.intranasal.net/seizure%20therapy%20at%20home%20directions/default.htm
http://www.intranasal.net/Home/default.htm
Summary

- First non-provoked, non-prolonged afebrile seizure
  - EEG
    - Determine further testing
    - Project recurrence risk
  - Medication is rarely indicated
    - Side effect profile significant
    - No prognostic benefit for epilepsy prevention
Two Editions: Comprehensive and Pocket

Revised Edition Coming October 2014

Order at www.acnn.org/books

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Resources

- Epilepsy Foundation of America: [wwwefa.org](http://wwwefa.org)
  - Books, Kits, Pamphlets and Videos
  - School:
    - Seizure Action Plan
    - Seizure Observation Record
    - Parent Questionnaire

- Association of Child Neurology Nurses:
  - Child Neurology Encounter Guides: [wwwacnn.org/books](http://wwwacnn.org/books)

- American Academy of Neurology: [www.aan.com](http://www.aan.com)

- American Epilepsy Society: [www.aesnet.org](http://www.aesnet.org)

- CDC Epilepsy website: [http://www.cdc.gov/Epilepsy/](http://www.cdc.gov/Epilepsy/)

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