Seizure and Epilepsy classification

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Dr. Abdelmoity is Professor of Child Neurology at the University of Missouri at Kansas City. He is Director of the Division of neurology, and Chief of the Section of Epilepsy and Clinical Neurophysiology at Children’s Mercy Hospital, also in Kansas City.

Dr. Abdelmoity earned his medical degree from Cairo University in Egypt. He then completed his residency in child neurology at the University of Texas Southwestern Medical Center in Dallas, a residency in pediatrics at Texas A&M University/Driscoll Children’s Hospital in Corpus Christi, and a residency in child neurology at Baylor College of Medicine in Houston, Texas. Dr. Abdelmoity completed his fellowship in physiology research at the University of Texas Southwestern Medical Center and in clinical neurophysiology at Baylor College of Medicine. He is board certified in Neurology with Special Qualifications in Child Neurology, Clinical Neurophysiology and in Epilepsy.

Dr. Abdelmoity serves as Chair of the advisory board for the Epilepsy Foundation, Missouri and Kansas Chapter. His educational didactics on epilepsy is in the Epilepsy Compendium, a compilation of resources for providing care to children and youth with epilepsy, in partnership with the American Academy of Pediatrics. He also has a number of publications in treatment of drug resistant epilepsy.

Doctor Abdelmoity is the founder and medical director of the NeuroDiagnostic Technology program at Johnson County Community College for EEG technologists.
Disclosures

- All proper consents were obtained for all videos in this presentation.
Learning Objectives

- Seizure types
- Workup for patients with seizures
- Treatment options
- Managing Status Epilepticus
- Febrile seizures
Is it really a seizure?

- Breath holding spells, syncope
- Movement disorder (choreoathetosis, tics, dystonia, paroxysmal torticolis)
- Posturing
- Benign paroxysmal vertigo, spasmus nutans
- GER, behavioral tonic stiffening
- Stereotypies, head banging
- Jitteriness, infantile shuddering attacks, startle
- Parasomnias: night terrors, sleep walking, sleep myoclonus, cataplexy
- Pseudoseizure (Psychogenic Non-Epileptic Events) or factitious seizure
- Migraines – particularly confusional
- Rage attacks, staring spells, inattention
Cause of seizures

- EPSPs
- Na+ Influx
- Ca++ Currents
- Paroxysmal Depolarization

- IPSPs
- K+ Efflux
- Cl- Influx
- Pumps
- Low pH

Seizure!!!!

Control
Seizure Types

- Generalized
- Focal onset
- Generalized/focal onset
- Unknown
Incidence Rates by Age*

*Data from Rochester, MN (1975-84)
Generalized Seizures

- Generalized Seizures (can be up to 100% on EEG)
- Generalized Hypersynchronous excitability of neurones, with many types:
  - Myoclonic
  - Tonic
  - Clonic
  - Tonic/Clonic
  - Absence
  - Epileptic spasms
  - Atonic
3 Hz Spike and Wave
Absence Epilepsy

- 9.6 per 100,000 with 20% after age 10 yo\textsuperscript{1}
- Characteristic 3 Hz spike and wave EEG pattern
- GTC seizures frequently associated (~80%) and may have myoclonic sz especially in the JAE type

Treatment
- Ethosuximide
- Valproic
- Lamotrogine

Prognosis: 80% become seizure free.

\textsuperscript{1} Hauser, 1975
Myoclonic epilepsy

- Progressive myoclonic epilepsy
  - Infancy to toddler age, can be later
  - Progressive worsening of EEG background
  - Progressive cognitive/Dev. Regression
  - Examples: NCL, SMEI, EMEI, Lafora body, Sialidosis, ULD

- Non progressive myoclonic epilepsy
  - Infancy to puberty
  - No worsening of EEG background or development
  - Examples: Doose, JME
    - Wilfong 2001
Juvenile Myoclonic Epilepsy

- 6 cases per 100,000
- Myoclonic jerks, generalized tonic-clonic seizures (90%), and/or absence seizures (30%)
- Mean age of onset 14.6 yrs (12-18) 
- Sankar 1997
- Precipitating factors: sleep-deprivation, alcohol use, fatigue.
- Treatment: Valproic acid drug of choice with 86-90% seizure control. lamotrigine, levetiracetam, topiramate, or clonazepam  
  Glausuer et al 2009
- JME does not remit and requires lifelong treatment.
4-6 Hz polyspike and wave
Generalized Tonic clonic

- Primary: Genetic in nature, mostly K+ or Ca++ channelopathy
- Secondary: Structural/Metabolic in nature, eg: Lennox Gastaut syndrome
- Treatment: VPA, ZNS, TPM, LVT...etc.
Epileptic Spasms

- Onset: Typically 6-18 months of age
- Underlying significant epileptic encephalopathy (hypsarrhythmia)
- Treatment: ACTH, Vigabatrin, Hrachovy et al 2004
- Prognosis:
  - Symptomatic: The majority will develop Lennox Gastaut syndrome
  - Cryptogenic: 25% will develop normally
Hypsarrhythmia
Partial Seizures

- Partial seizures
Focal onset Seizures

- Focal (Partial Seizures)
  - Focal seizure without impaired awareness (Simple Partial seizure) (20-40 % +ve EEG)
  - Focal seizure with impaired awareness (Complex Partial seizures) (50 % 1 EEG, 70% 2 EEGs, 85 % 3 EEGs) Frost et al 1998

- Motor
- Sensory
- Psychogenic
- Autonomic
Temporal lobe epilepsy

- Most common type of focal epilepsy
- Lesional or non-lesional
- Aura of olfactory, or auditory hallucination. Occasionally Dejavu
- Aversive head deviation, followed by tonic clonic activity. Occasionally secondarily generalizing.
Frontal lobe epilepsy

- Semiology varies depending on origin
- Typically brief (under 3 minutes)
- More nocturnal
- Can be associated with personality/behavioral changes
- ADNFLE (necotinic acid receptor)
Benign Epilepsy with CentroTemporal spikes (Benign Rolandic Epilepsy)
Centro-temporal childhood Epilepsy

- Age of onset: 6-11 years (Normal development)
- Semiology: Grunting, drooling, facial twitch
- Frequency: 2-6/year but can be more
- Typical centrotemporal sharp waves, exacerbated by sleep
- Treatment: Usually none, unless frequent.
Gelastic Seizures

- Laughing (satanic laugh)
- Commonly associated with hypothalamic hamartomas
- Surgical treatment is helpful
Epilepsy

- “Tendency to have more than one unprovoked seizure over 24 hours apart”

  - ILAE: 2014
Evaluation for seizures

- New onset
  - Febrile
  - Non-febrile

- Second seizure
- Recurrent seizures
Febrile Seizure Workup

- No specific studies are indicated for a simple febrile seizure.
- Focus on cause of fever.
- CT: is not indicated
- EEG: is not indicated
- LP: if <1 yr, consider 1-1.5 yr, and only if signs of meningitis if > 1.5 yr.
- No Prophylaxis needed
Evaluation of new unprovoked seizure

- History
  - Character of seizure
  - Intercurrent illness or head trauma
  - Previous seizures
  - Medications and drug use
  - Family history
  - Social stressors

- Physical and Neurologic examination
Evaluation of new unprovoked SZ Cont’d

- A head CT scan if the following are suspected:
  - Hemorrhage
  - Midline shift (Especially in patients with VPS)
  - Mass lesion
- Blood glucose,
- Electrolytes
- Ca, Mg, P
- CBC
- LP if meningitis is suspected
  - Must: 0-6 months
  - Consider 6-18 months
  - If meningial signs present: 12 months and over
- EEG if unremitting Status epilepticus
Evaluation of new onset seizure

- **EEG**
  - Best performed about 1-2 weeks after event
  - Sleep should be recorded
  - Hyperventilation and photic stimulation may provide additional information
  - May help distinguish epileptic seizures from non-epileptic events.

- **Neuroimaging**
  - Depends on type of seizure
  - For partial seizures, consider obtaining MRI of the brain w/wo contrast
  - History of trauma, focal neurological signs, AMS.
Hippocampal sclerosis
1st time seizure

YES

H&P
Indicates metabolic derangement or infection?

YES
Perform labs and treat accordingly

NO

NO

Neuro exam is negative and patient is at baseline

YES

EEG-May be done after 72 hours to predict recurrence and classify seizure type

NO

Neuroimaging
CT for emergency Todd's paresis
Not at baseline
Non urgent MRI for abnormal cognitive or motor skills or kids < 1 yr, or abnl EEG
2nd seizure

- H&P
- Neuroimaging: Only if indicated
- Labs: CBC, BMP, UDS...??
- EEG: If not already done.
- Start seizure meds
- Referral to Pediatric Neurology clinic
Maintenance Treatment

- Second seizure – Treatment depends on type of epilepsy
  - Focal – Trileptal, Tegretol, Keppra.
  - Generalized Epilepsy – Depending on the syndrome. Typically Valproic acid, Zonisamide, Topiramate, Lamictal (some syndromes), Felbatol
Seizure Prognosis

- After 1\textsuperscript{st} SZ, only 28\% of patients have a 2\textsuperscript{nd}
- After 2\textsuperscript{nd} SZ, 70\% of patients will continue to have SZs
  - Shinnar 1997
STATUS EPILEPTICUS

- Secondarily generalized GTC seizures in refractory patients usually last < 2 minutes
- First unprovoked seizure (Shinnar et al; 2001)
  - 5 min 50%
  - 10 min 29%
  - 20 min 16%
  - 30 min 12%
  - Two distributions: 76% with a mean of 3.6 min and 24% with a mean of 31 min.
Why stop seizures?

- **Status epilepticus is bad !!!:**
  - Mortality 3% in kids
  - 20-30% in adults
  - 10-15% significant morbidity at discharge

- **Point of controversy:**
  - Do shorter seizures harm the brain?

- **76% of seizures lasting >5min will continue to 30 min if not treated**
  
  Sankar et al 2009
Success With AED Regimens

Previously Untreated Epilepsy Patients (N=470)

- Seizure free with 1st drug: 47%
- Seizure free with 2nd drug: 13%
- Seizure free with 3rd or multiple drugs: 36%
- Not seizure free: 4%
Epilepsy Surgery
The ketogenic diet

- Typical American diet
- Atkins (induction phase)
- Classic ketogenic diet 4:1
- MCT ketogenic diet

**“Typical” Western diet**

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**Carbohydrate reduction**

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**Keto-adaptation**

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Neurostimulation
Pregnancy and Epilepsy

- Many of the AEDs are class C
  - Women taking AED are at a two to three times increased risk of neural tube defects.
  - 5% on one AED; 10% taking two drugs
  - Some new AEDs have better teratogenic effects.

- Should continue current AEDs for all unplanned pregnancies

- Encourage folic acid supplementation for all women of childbearing age.
  - Anderson et al: 2005
Illicit Drug Use

- Cocaine use has proconvulsant effects.
- Alcohol use and particularly alcohol withdrawal may cause increase in seizures or status epilepticus.
- Alcohol use is combined with sleep deprivation, is a well known cause for breakthrough seizures.
- Marijuana – may be anti-convulsant, but often forget to take AEDs\(^1\)
Driving

- Kansas & Missouri laws requires:
  - Seizure free for 6 months.
  - Nocturnal seizures only.
  - Breakthrough seizure due to medication change, but patient placed on previous AED.
  - Must be evaluated by physician annually

- Physicians are **not** required to notify DMV
Employment

- Americans with Disabilities Act (1990) prohibits discrimination on the basis of an individual's disability in employment, unless they are unable to perform the job.
- Individual evaluations should take into account the type of job, the required tasks, the degree of seizure control, the type(s) of seizures, whether the person has an aura (warning), the person's reliability in taking prescribed anticonvulsant medication, any side effects of such medication, and any accommodations which would help the person do the job.
Useful websites

- Epilepsy Foundation of America
  - [www.efa.org](http://www.efa.org)
- Epilepsy Foundation of Southeast Texas
- NINDS Epilepsy Page
  - [www.ninds.nih.gov](http://www.ninds.nih.gov)
- The Epilepsy Project
  - [www.epilepsy.com](http://www.epilepsy.com)
Questions?