Pediatric seizures

Jennifer A. Vickers MD
Associate Professor of Neurology
Conflict of Interest Disclosure
Speaker: Jennifer A. Vickers, MD

1. I do not have any potential conflicts of interest to disclose, OR

2. I wish to disclose the following potential conflicts of interest:

<table>
<thead>
<tr>
<th>Type of Potential Conflict</th>
<th>Details of Potential Conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant/Research Support</td>
<td></td>
</tr>
<tr>
<td>Consultant</td>
<td></td>
</tr>
<tr>
<td>Speakers’ Bureaus</td>
<td></td>
</tr>
<tr>
<td>Financial support</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

3. The material presented in this lecture has no relationship with any of these potential conflicts, OR

4. This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:

1. 
2. 
3.
Definitions
Types of seizures
New onset seizures
Breakthrough seizures
Seizure mimics
Who needs to be referred?
Definitions:

- **Seizure**: A transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.

- **Epilepsy**: A disorder of the brain characterized by an enduring predisposition to generate epileptic seizures, and by the neurobiologic, cognitive, psychological, and social consequences of this condition.

- **Epilepsy versus Seizure disorder**. What’s the difference?
  
  Nothing, they are the same.
26 yo man with mild developmental disability found down on his bed with convulsive activity.

Onset was not witnessed.
All 4 limbs equally involved.
Neither head or eye deviation was noted.
Urinary incontinence, and tongue laceration associated.

Duration: 1 - 2 minutes.

At baseline on arrival to ED.
Further information

- Family history, non-contributory.
- Birth history, non-contributory.
- Review of systems:
  - Seasonal allergies
  - Not sleeping well recently
  - Otherwise unremarkable.
- Exam:
  - Mentally, consistent with mild intellectual impairment.
  - Otherwise normal exam.
Evaluation (general)

Blood testing
- Chemistries – yes.
  - Assess for metabolic disturbances.
- CBC – yes.
  - Assess for infection.
- UDS – always
  - People can get into anything.
- UA – yes for girls, only if complaints in boys.
- Pregnancy test
  - In post pubertal females – yes.

Lumbar Puncture
- Infection or bleeding.
Further work up

- Imaging studies
  - not necessarily emergent.
  - MRI preferred over CT.
- EEG
  - Maybe......
Seizure Classification

Seizure description + EEG findings

Focal onset seizures

Generalized seizures
Focal onset seizures

Focal onset with alteration of awareness

To bilateral involvement

Focal onset without alteration of awareness
Generalized Seizure types

- Tonic clonic
- Clonic
- Tonic
- Myoclonic
- Atonic
- Absence or Atypical Absence
- Behavioral arrest (Not staring spells)
Focal seizure types

- Unilateral clonic
- Behavioral arrest (Not staring spells)
- Unilateral or focal Myoclonic seizures
- Unilateral or focal tonic seizures
- Focal atonic
Should we treat?

- Risk after first unprovoked seizure?
- Risk after repetitive seizures?
  - Less than 24 hours.
  - Greater than 24 hours.
- Risk after status epilepticus?
ILAE consensus statement

- Traditional definition:
  - At least 2 unprovoked seizures occurring > 24 hours apart.

- Added definition:
  - One unprovoked seizure with probability of further seizures (making the risk similar to the above).
  - Diagnosis of a specific epilepsy syndrome.

Recurrence risk after 1st unprovoked seizure

Immediate treatment – 204 patients
- 7% at 3 months
- 8% at 6 months
- 17% at 12 months
- 25% at 24 months

Deferred treatment – 193 patients
- 18% at 3 months
- 28% at 6 months
- 41% at 12 months
- 51% at 24 months

60% reduction in the rate of relapse for immediate versus deferred treatment

Recurrence risk after 1st unprovoked seizure

Immediate treatment – 722 patients
- 22% at 6 months
- 37% at 2 years
- 48% at 5 years
- 52% at 8 years

Deferred treatment – 721 patients
- 33% at 6 months
- 48% at 2 years
- 58% at 5 years
- 61% at 8 years

30% reduction in the rate of relapse for immediate versus deferred treatment

Problems

- Does seizure type matter?
- Does seizure duration matter?
- Abnormalities on EEG or imaging studies?
- Other medical co-morbidities?
Increased risk of recurrence

- Epileptic activity on EEG.
- Symptomatic cause.
- Abnormal neurologic exam.
- Arose from sleep.
Not related to increased risk of recurrence

- Age (child vs adult)
- Generalized vs focal onset seizures
  - based on EEG findings
- Multiple seizures < 24 hours
- Status Epilepticus
- Family history
- Prior febrile seizure
Third article

Concerns

- Most patients are seen by PCP or ED
- More than half the patients had a second seizure before being seen.
- Compliance

Recommendation: WAIT

- Employment becomes harder.
- Health insurance premiums increase
- Epilepsy has a very negative image.
- Potential for severe adverse reactions to medications.
- Cost of medications.

Lawn N et al. Epilepsia 2016;56(9):1425-1431
Conclusion
Consider AED for following

- Multiple seizures in 24 hours.
- History of significant CNS pathology.
- Family is “freaked out”.
- Prolonged seizure (5 minutes or longer).
- Concerns that this is not the first seizure.
New Classification

- Complex partial seizures
- Simple partial seizures
- Staring spells
- ...with secondary generalization
- Focal onset seizures with alteration of awareness
- Focal onset seizures without alteration of awareness
- Behavioral arrest
- ...to bilateral involvement
So what about case # 1!? 

- Onset not witnessed
- No lateralizing activity identified.
- Exam, mild intellectual impairment
- State of patient at onset unknown if awake or asleep.
“You caught a virus from your computer and we had to erase your brain. I hope you’ve got a back-up copy!”
Case 2

- 28 year old woman with medically intractable focal onset seizures to bilateral involvement.

- History of:
  - Traumatic brain injury due to NAT at 4 months of age.
  - Moderate intellectual impairment.
  - Right hemiplegic CP.

- Chief complaint:
  - Prolonged breakthrough seizure.
Case 2 continued
Questions to consider:

- Sleep?
- Eating?
  - Weight gain?
  - Weight loss?
  - Sudden increase in carbs?
- Bowel movements?
  - Constipation?
  - Diarrhea?
- Illness?
  - Anyone sick at home?
- Other Stressors?
- Change in medications?
  - New AED Rx?
  - Change in tablets?
  - New medication affecting AED level?
Does the medication need to be changed?

- Fix the underlying problem if possible.
- Consult the prescribing physician.
- Consider a clonazepam bridge.
Common non-epileptic mimics
883 patients under 18 years of age admitted to the PEMU at Cleveland Clinic from 1/1989 to 12/1995.

199 (22.5%) diagnosed with Non-Epileptic events.

134 (15.2%) had spells “captured” on EEG.

Grouped by age:
- 2 months to 5 years
- 5-12 years
- 12-18 years

- 66 patients had physiologic/organic disturbances
- 69 had psychiatric issues

## Results

<table>
<thead>
<tr>
<th></th>
<th>2 Months–5 Years</th>
<th>5–12 Years</th>
<th>12–18 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inattention/daydreaming</td>
<td>1</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Hypnic jerks</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Stereotyped movements</td>
<td>5</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Parasomnias</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Movement disorders</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Gastroesophageal reflux</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nonepileptic myoclonus</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Apneas</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Shuddering attacks</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Alternating hemiplegia</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Migraine</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hyperventilation attacks</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Syncope</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>6</td>
</tr>
</tbody>
</table>

19 of the 135 children (14 %) with non-epileptic spells also had a diagnosis of epilepsy.
Non-epileptic spells

- Syncope *
- Cardiac arrhythmia *
- Breath holding spell *
- Panic attacks
- Hypoglycemia *
- Esophageal reflux
- Movement disorder
- Cataplexy
- Sleep disorder
- Psychogenic episodes
- Trauma *
- Staring spells
- Infantile self-stimulation (aka masturbation)
Syncope or Cardiac Arrhythmia

- Onset is rapid
- Loss of consciousness (transient in syncope)
- Loss of postural tone
- Recovery in syncope, Spontaneous, Complete, Prompt.
- Convulsive activity may be seen with either
Breath holding spells

Pallid spells
Provoked by fright or pain.
Minimal crying.
Overstimulation of vagus nerve.
Decreased CNS perfusion.

6 – 24 months
Loss of consciousness.
Loss of postural tone.
Convulsive activity can occur. (pallid > cyanotic)

Cyanotic spells
Provoked by anger and frustration.
Vigorous crying is heard.
Pathophysiology unclear.
Anxiety or panic attacks

- 18 – 45 years (mean 24 years)
- Women 2 – 3 times more often

Co-morbidities
- Asthma (4.5 fold increase)
- Mitral valve prolapse
- Tension or migraine headaches
- Hypertension
- Epilepsy (6.5 %)

Pathophysiology – uncertain.
Hypoglycemia

Symptoms:
- Tremulousness
- Tachycardia
- Anxiety
- Sensation of hunger
- Weakness
- Fatigue
- Dizziness
- Inappropriate behavior
- Difficulty concentrating
- Confusion
- Blurred vision
- Loss of consciousness
Esophageal reflux

- Age < 24 months
- Related to feeding
- Sudden tonic posturing
- Opisthotonus
- Duration – up to 3 minutes.

Aka Sandifer’s syndrome
Movement disorders

- Onset at any age
- Without loss of awareness
- Atypical posturing
- Asymmetric
- Asynchronous
- Resolves with sleep
  - Except tics
Sleep disorders/catataplexy

- Sleepwalking
- Night terrors
  - First 30 – 90 minutes of sleep
  - Resume sleep immediately after
  - 5 years of age or less.
- Dream-enacting behavior
- Head banging
- Hypnic jerks

- Cataplexy
  - Sudden loss of muscle tone in response to significant emotional stimulus.
  - Narcolepsy is always associated.
- Nocturnal frontal lobe epilepsy
  - Stereotypic events
  - Can be seen any age.
Psychogenic spells

- Any age, but usually adolescents and older.
- Spells are:
  - Asynchronous movements
  - Eyes closed
  - Placid facial expression.
  - Trajectory of movements change frequently.
  - Rotational limb movements.
  - Pelvic thrusting.

- Form of conversion disorder.
- Patients are not "faking it".
- History of sexual abuse is high.
- Females > males affected.
- Need for both psychiatric and neurologic involvement.
- Treat as anxiety disorder acutely.

The activity observed, that tells us these spells are non-epileptic, is never discussed in front of the patient.
Nocturnal Frontal Lobe Epilepsy

- Hypermotor seizures
- Arise from sleep
- Very short duration
- Very violent movements
- REFER
Post-traumatic seizures

- Occur within one week of the head injury:
- Not an indication of new onset seizure disorder.
- Long term treatment is not necessary.
- Use of an antiepileptic medication following head injury will not prevent the development of Post-traumatic epilepsy.
Staring spells

- Sleep disorder
  - Microsleep.
- Attention deficit disorder – inattentive type
- Slow processing of information.
Infant self-stimulation.

- Associated with onset of sleep.
- Crosses and stiffens legs.
- Vibratory movements of the legs often seen.
- Minimal response to parents during spell.
- Once movement stops, child is asleep.
Etiologies

“Your x-ray showed a broken rib, but we fixed it with Photoshop.”
Bacterial infections
Encephalitis

Figure 1: Normal brain

Figure 2: Encephalitis
Brain Tumors
Traumatic Brain Injury
Cerebrovascular disease
Hypoxic Ischemic Injury
Congenital malformations
Degenerative diseases
unknown
Many different seizure types.
Many causes of seizures still a large group of unknown.
Many different seizure mimics.
Uncertain?
Please call!
Questions?

“I have a suspicious-looking mole on my shoulder.”