Types of Seizures and Common Epilepsy Syndromes in Children

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Types of Seizures

- Generalized
  - Absence, myoclonic, clonic, tonic, tonic-clonic, atonic, and combinations thereof
- Partial
  - Simple partial
  - Complex partial
  - Secondarily generalized
- Unclassified epileptic seizures

Classification of Epilepsy (ILAE 1989)

- Localization related
- Generalized epilepsies and syndromes
- Undetermined whether focal or generalized
- Special syndromes

Epilepsia, 30(4):389–399, 1989
Raven Press, Ltd., New York

Proposal for Revised Classification of Epilepsies and Epileptic Syndromes

Commission on Classification and Terminology of the International League Against Epilepsy

Idiopathic Focal

- Focal seizures
- Normal intellect/PE
- Normal EEG background
- Normal neuroimaging
- **Good Prognosis**

Ex: Benign Rolandic Epilepsy

Symptomatic Focal

- Focal seizures
- Gross/subtle cognitive and/or exam abnormalities
- Abnormal neuroimaging
- **Variable prognosis**

Ex: Temporal lobe epilepsy, Post-traumatic epilepsy

Idiopathic Generalized

- Generalized seizures
- Normal intellect/PE
- Normal EEG background
- Normal neuroimaging
- **Good prognosis**

Ex: Childhood Absence, Juvenile Myoclonic Epilepsy

Symptomatic Generalized

- Generalized seizures (many types)
- Subnormal intellect/ Abnormal exam
- Abnormal EEG background
- Abnormal neuroimaging
- **Poor prognosis**

Ex: Lennox-Gastaut syndrome

Source: Joshi and Shellhaas 2014

Problems with the "Old" System

- Difficult to apply the localization related/focal vs. generalized epilepsy paradigm in some cases
  - Eg: infant with infantile spasms who evolves to focal seizures
- Etiology: ***cryptogenic or symptomatic***
  - New onset focal epilepsy in an otherwise healthy young adult (normal imaging, abnormal EEG)
  - Developmentally delayed patient with generalized seizures (doesn't fit criteria for LGS), etiology not obvious
- Advances in neuroscience have improved the understanding and etiology of some epilepsies
  - Genetic
  - Neuroimaging
  -

New Organization of Epilepsies

Epilepsia, 51(4):676–685, 2010
doi: 10.1111/j.1528-1167.2010.02522.x

SPECIAL REPORT

Revised terminology and concepts for organization of seizures and epilepsies: Report of the ILAE Commission on Classification and Terminology, 2005–2009

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Etiology: New Concepts

Old terms

- Etiology
  - Idiopathic
  - Symptomatic
  - Cryptogenic
- Localization-related

New terms

- Etiology
  - Genetic
  - Structural/Metabolic
  - Immune
  - Unknown
- Focal (replaces localization related and partial)

In the New System…

- Terms no longer used
  - Simple partial
  - Complex partial
  - Secondarily generalized
- Replaced by
  - With or without impairment of consciousness/awareness
  - Dyscognitive
  - Evolving to a convulsive seizure

Some Common Childhood Epilepsy Syndromes

- Childhood Absence Epilepsy
- Benign Focal Epilepsies of Childhood
- Juvenile Myoclonic Epilepsy
- Infantile Spasms /West Syndrome
- Lennox Gastaut Syndrome

Epilepsy Syndromes

- Diagnosed based on:
  - History (type of seizure/s, age of onset, personal & family history)
  - Neurological examination (including cognition, development)
  - EEG ± Neuroimaging
  - Etiology (where known)
- Importance of syndrome identification
  - Better understand prognosis
  - Define appropriate work-up and treatment

Epilepsy Syndrome

- Formerly epilepsy syndromes were classified simply based on type of seizure and whether an etiology was known or not.
- New epilepsy classification considers genetic, metabolic, structural immune etiologies in describing type of epilepsy

Case

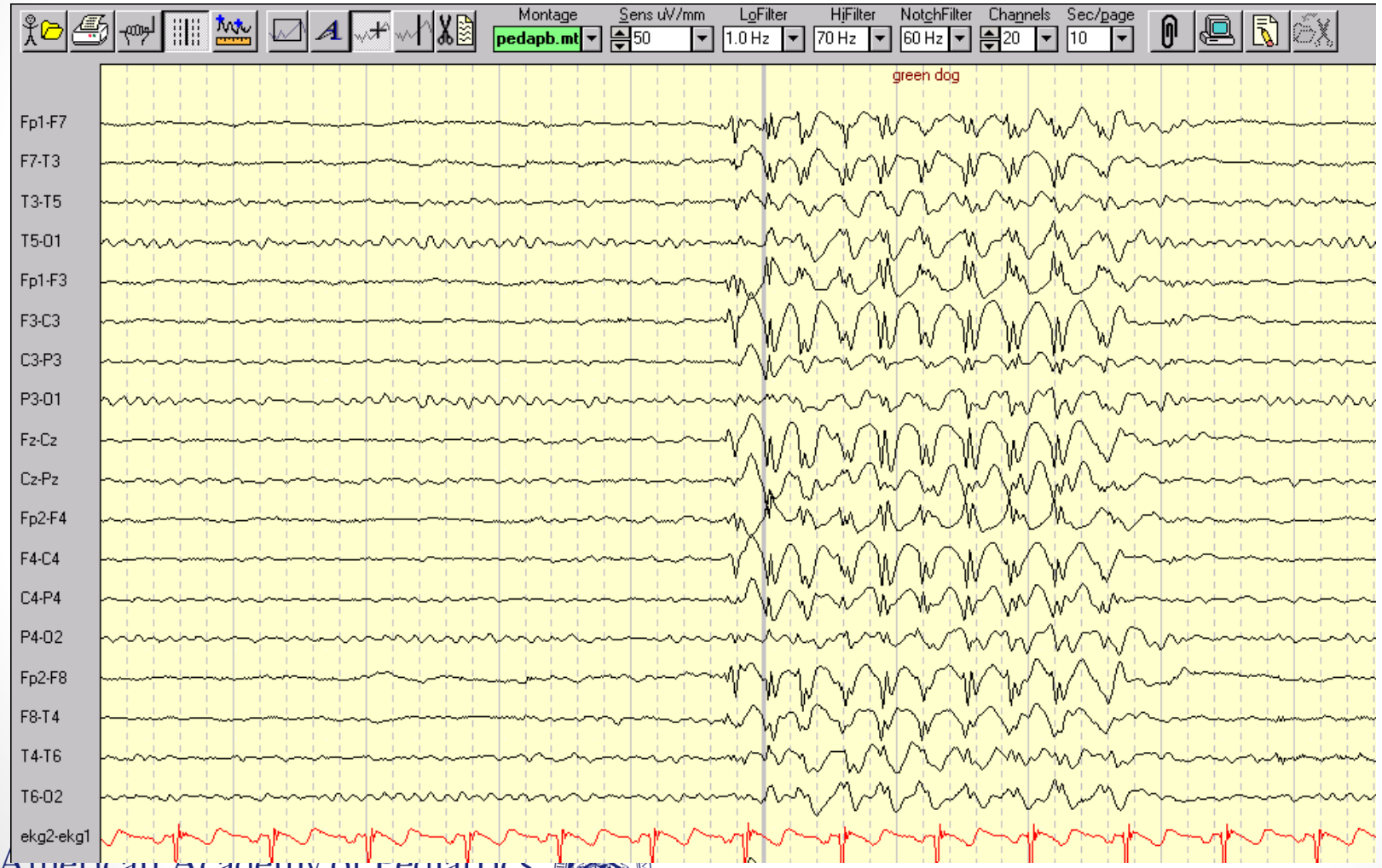
A 6 year old boy presented with frequent episodes of staring, during which he appeared to be “daydreaming.” The boy would abruptly stop whatever he was doing, stare straight ahead, and was totally unresponsive to verbal or mild physical stimulation. The episodes were quite brief, typically lasting 5-10 seconds, and occurred many times per day.

Diagnosis?

Childhood Absence Epilepsy

- Age of onset 5-9 years
- Typical absence seizures
  - Simple absence (behavioral arrest & unresponsiveness)
  - Complex
    - With mild clonic or myoclonic component
    - With changes in tone
    - With automatisms
    - With autonomic components
- Intellect and neurological examination normal
  - Mild cognitive abnormalities may be found
- Neuroimaging studies normal (and usually not needed)
- EEG: 3Hz generalized spike wave

EEG in Absence Epilepsy



Source: Joshi and Shellhaas 2014

Childhood Absence Epilepsy

- Typical absence seizures remit in ~ 80%
  - Remission rates lower if generalized tonic-clonic seizures co-exist
  - Average age of remission = 10-11 years
- Favorable prognostic signs for “outgrowing” absence seizures:
  - Negative family history
  - Normal background EEG
  - Normal intelligence

Childhood Absence Epilepsy Treatment

- Drug of choice: Ethosuximide

- Randomized-controlled trial:
  - Ethosuximide = valproic acid for efficacy
  - Lamotrigine lower efficacy
  - Lamotrigine > ethosuximide > valproic acid for cognitive side effects

Source: Glauser TA et al. N Engl J Med 2010 Mar 4;362 (9): 843-5

Case

A 15-year-old girl was brought in following a generalized convulsion. It occurred shortly after waking up, while she was getting ready for school. The seizure lasted 45 seconds, followed by 30 minutes of confusion, and then recovery to her baseline. Birth, developmental, past medical, and family histories were normal.

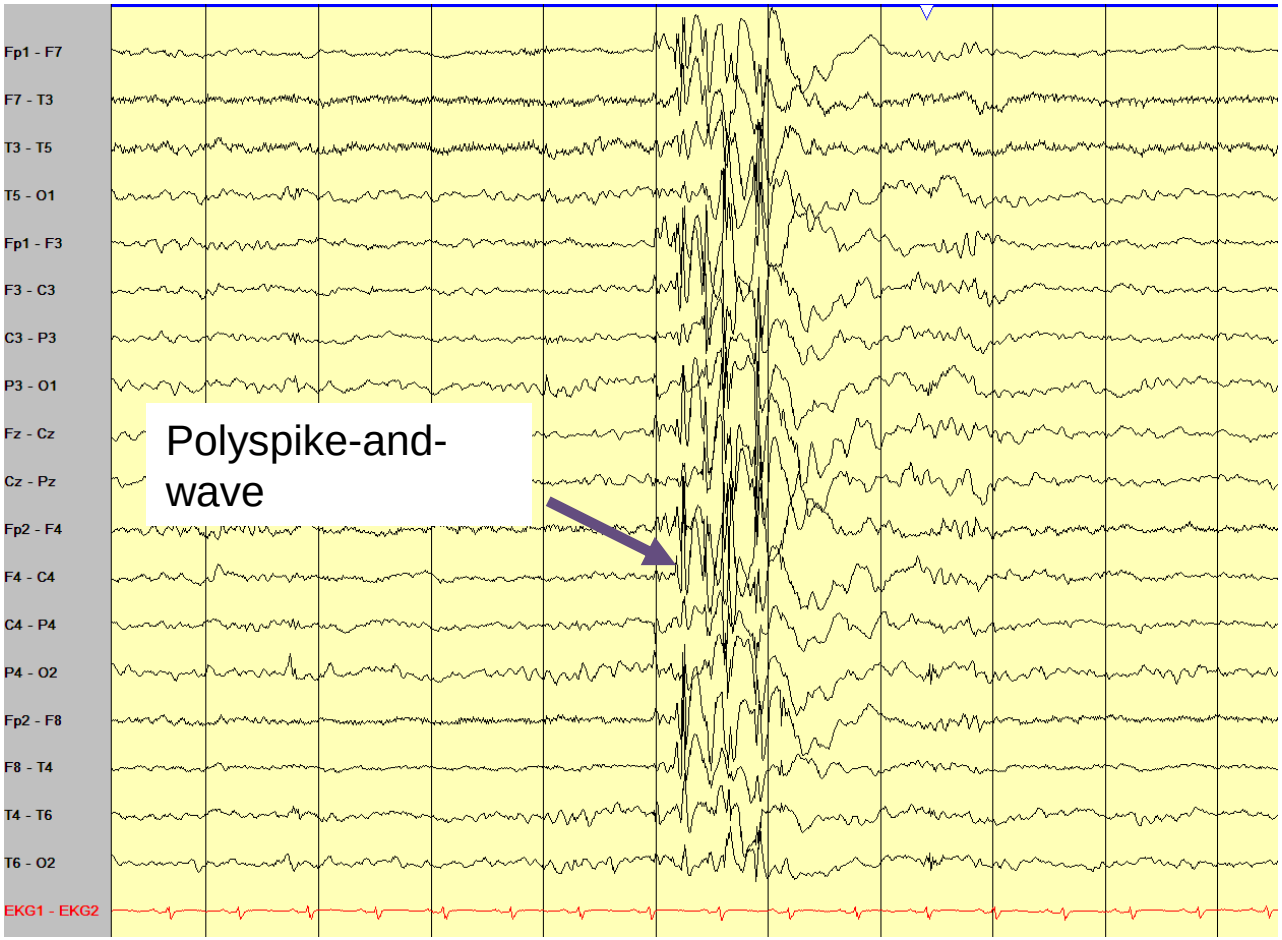
The girl also described feeling “shaky” in the morning. Her hands often jerked, and she had dropped her hair brush or cup on occasion. These symptoms were present for a few months preceding the convulsion.

Diagnosis?

Juvenile Myoclonic Epilepsy

- Onset: 12-18 years
- *Myoclonus*
  - Early morning / photic stimulation-induced
  - May be recognized only in retrospect
- *Generalized convulsive seizures* occur in almost all patients and often are the representing symptom
- *Absence* seizures in 15-40%
- Prognosis:
  - JME usually persists for life
  - AED withdrawal not recommended
- Treatment:
  - Valproic acid used to be the drug of choice
  - Recently levetiracetam, lamotrigine, zonisamide

EEG in JME



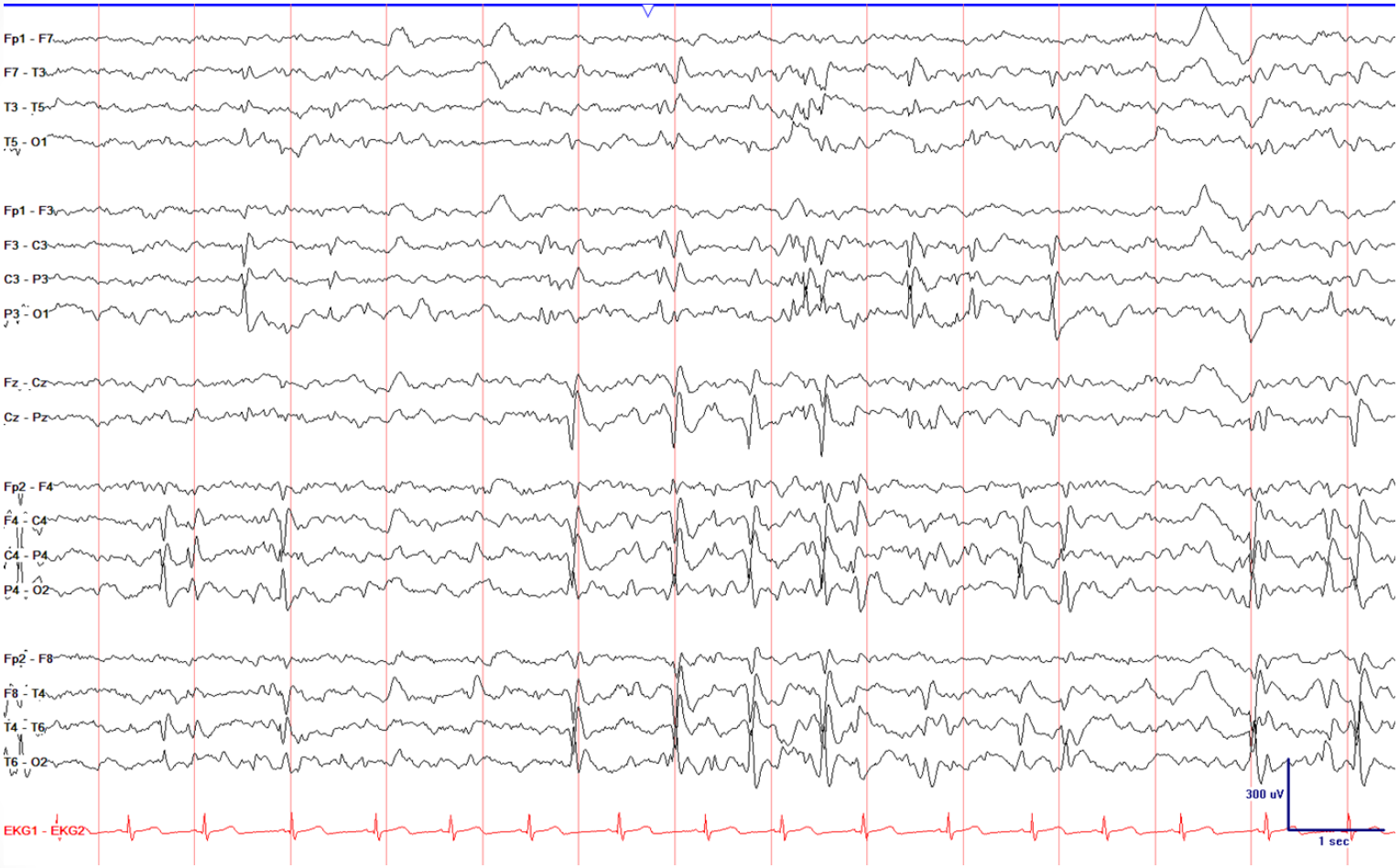
Source:
Joshi and Shellhaas 2014

Case

A 9 year old boy was referred because of possible seizures. He had been completely healthy until a month before, when he had awakened his parents by coming into their bedroom at 4:00 a.m. He looked somewhat frightened and appeared to be attempting to talk, but was able to make only unintelligible sounds. He was drooling from the right side of his mouth, which was twitching mildly. This continued for a few minutes, after which he gradually began to talk normally.

Case #3, continued

At that time, he said that he had awakened from a sound sleep, aware that he couldn't talk or swallow, and remembered that he had come into his parents' room. He returned to normal functioning after 20 minutes. He was brought to his pediatrician for evaluation after he had a similar episode two weeks later. He had a normal neurologic examination.



Source:
Joshi and Shellhaas 2014

Diagnosis?

Benign Rolandic Epilepsy
(Benign Childhood Epilepsy with Central-Temporal Spikes)

- Most common focal epilepsy in childhood
- Age of onset 3-13 years
  - Peak = 7-8 years
- Typical scenario:
  - Predominantly nocturnal seizures
  - Focal seizure with motor symptoms involving face and arm
  - Seizures often secondarily generalize
- Cognitively normal child
  - Except language-based learning disorders
- Normal examination

Benign Rolandic Epilepsy continued

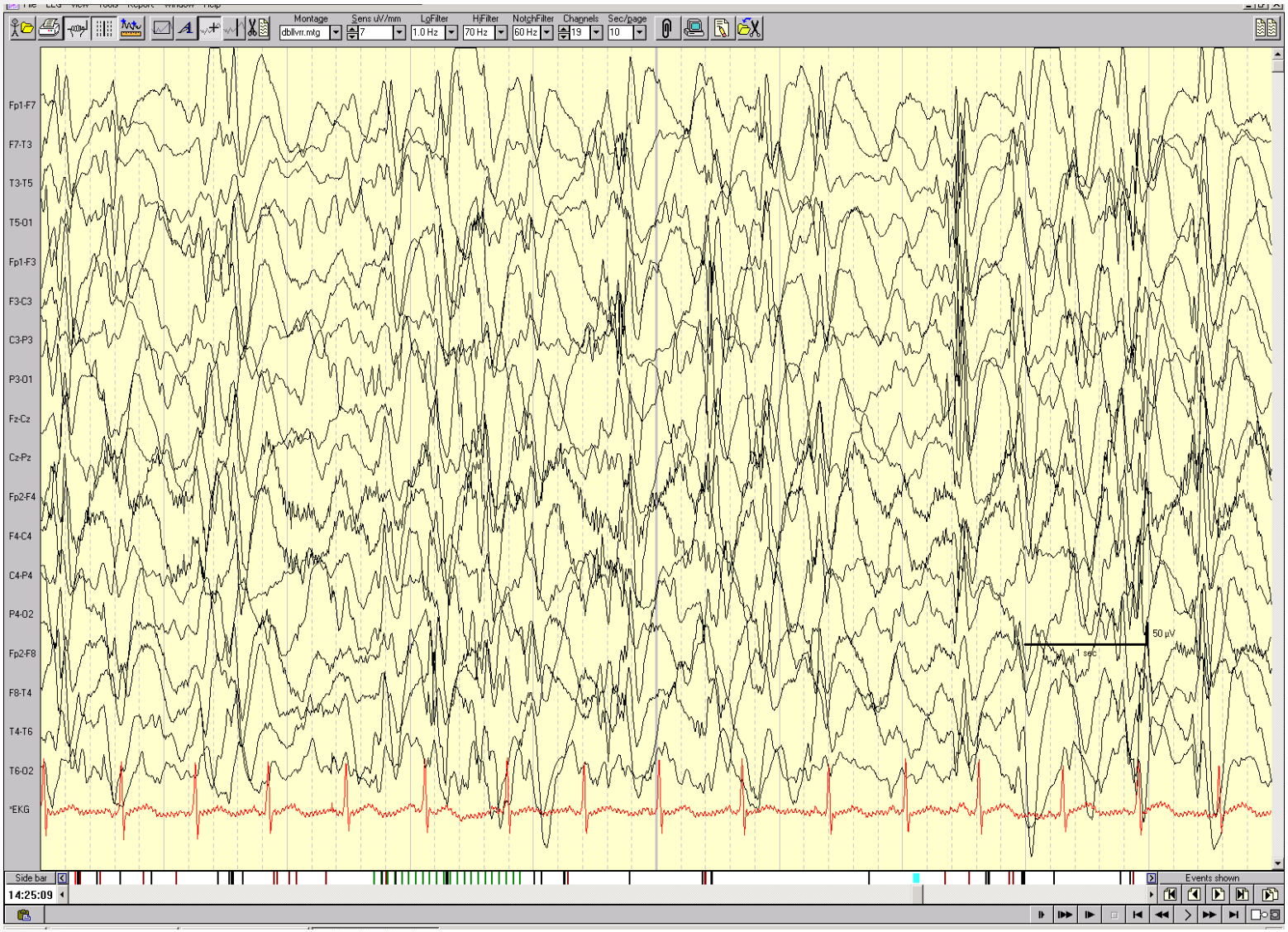
- EEG shows characteristic interictal central-temporal focal sharp waves, activated by drowsiness/sleep
- Normal neuroimaging studies
  - Not needed if EEG is characteristic
- Good response to AED treatment
  - Oxcarbazepine
- Remission always occurs in second decade
  - Learning difficulties may persist

Case

A 6-month-old infant presented with episodes of sudden forward bending at the waist during the two previous weeks. His mother worried that he was having abdominal pain, since he would let out a cry during the episodes. He had clusters of these episodes (with 10 or more in a cluster) several times per day, particularly upon awakening.

Case #4, continued

His development seemed normal previously, but ever since these episodes started, he had become lethargic and had stopped sitting up by himself. He did not seem as playful and interactive as he had been, and no longer showed much interest in his toys.



American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Source:
Joshi and Shellhaas 2014

Diagnosis?

Infantile Spasms

- Incidence: 1 in 4000-6000 live births
- Onset: usually 4-8 months
- Clusters of flexor > mixed flexor-extensor > extensor spasms,
  - *Often upon awakening*

Infantile Spasms

- Cryptogenic/Unknown etiology : 10-15%
  - Normal exam & development before onset of spasms, normal imaging, no known etiology
- Symptomatic
    - Genetic: Tuberous sclerosis, Down Syndrome & other chromosomal abnormalities, ARX mutations, CDKL5 mutations, etc.
    - Prenatal: cerebral dysgenesis, IU infections (CMV), stroke
    - Perinatal: HIE, CNS infection
    - Postnatal: inborn errors of metabolism (NKH), head trauma, CNS infection, HIE, ICH
- 85% have intellectual disability

West Syndrome

- Described by Dr. West in his own child
- Triad of:
  - Infantile spasms
  - Hypsar[r]hythmia
  - Mental retardation

Infantile Spasms - Treatment

- Earlier treatment = better prognosis
- ACTH or high-dose prednisone
- Other options:
  - Vigabatrin (indicated in TS)
  - Topiramate
  - Benzodiazepines
  - Valproic acid
  - Ketogenic diet
  - Pyridoxine

Lennox Gastaut Syndrome

- Infantile spasm patients may evolve to LGS.
  - Age of onset 2-8 years; very poor prognosis
- Diagnostic Criteria:
  - Multiple seizure types, including: tonic, atonic, atypical absence, GTCs
  - EEG: interictal slow spike and wave (1.5 -2 Hz), generalized paroxysmal fast activity
  - Cognitive dysfunction/mental retardation
  - Often difficult to treat

PAROXYSMAL NON-EPILEPTIC EVENTS (PNEE)

PNEE: Overview

- Diagnostic challenge
- Relies on good description of events
- Difficult to get accurate description
  - Event can be frightening to witness, may not be the most reliable or accurate in their description (especially at night)
  - May not get first hand description (event occurs at school/daycare)
  - Terms like “shaking” “zone out” are non-specific

- Misdiagnosis can be as high as 39% (Uldall et al 2006)

PNEE

- Misdiagnosis
  - Unnecessary prescribing of AEDs
  - Lifestyle restrictions
  - Social (and other) stigma
- Accurate diagnosis is important
- Specific treatment
- Some PNES carry their own morbidity (e.g cardic arrhythmias mimicking seizures)

PNEE Events

- Can present with symptoms including shaking that mimic seizures
- Some distinguishing features of PNEE:
  - Longer duration (several minutes)
  - Often eyes are closed during a “convulsive” event
  - Symptoms can have a start-stop quality to them
  - Injury (tongue biting), bladder incontinence can occur with PNEE

PNEE Events

- May occur in patients with epilepsy
- Non-epileptic seizures in children seldom represent malingering
- Management should include collaboration between the neurology and psychiatry/psychology
- Important to recognize as a diagnostic entity to avoid overdiagnosis and/or in over-treatment and associated risks

Differentiating seizures from non-epileptic events

- Eyes are usually open during a seizure
- Negative phenomena : pallor, visual loss, bradycardia are less common with seizures
- Non-epileptic symptoms can co-exist with epilepsy

Spectrum of Non-epileptic events in children

- Breath holding spells
- BPPV
- Sandifer syndrome
- Self stimulatory behaviors
- Parasomnias
- Syncope and cardiac dysrhythmias
- Psychogenic events
- Hyperekplexia
- Alternating hemiplegia of childhood
- Migraine
- Movement d/o (tics, dystonia)
- Others...

Case

- A developmentally normal 18 month old presented with episodes of loss of consciousness. After a toy was taken away from her, she began crying and then became apneic and developed circumoral cyanosis and lost consciousness for 15-20 seconds. She also became stiff and had a few extremity jerks. When she awoke she seemed fine.

Breath Holding Spells

- Common PNEE in childhood
- Peak age of occurrence:
- Two types:
  - Cyanotic
  - Pallid

BHS: Work up and treatment

- Workup:
  - EEG, Neuroimaging: not required
  - CBC: Iron deficiency anemia
- Treatment
  - Parent education and reassurance
  - Iron supplements (5-6 mg/kg/day supplemental iron) can reduce frequency of cyanotic BHS if anemia present

Case

- A 9 month old is brought in for episodic of back arching, turning his head to one side irritability. This often happens around feeds. He is developmentally normal, but weight gain has been a little slow

Sandifer syndrome

- Dystonic posturing of the trunk +/- extremities or torticollis in association with gastroesophageal reflux.
- Typically presents in infancy (older ages have been described)
- May have associated hiatal hernia (not required for diagnosis)
- Reflux symptoms may not always be obvious

Case

- A 15 month old girl presents with episodes of leg stiffening. Several times a day, especially while seated in a chair or car seat, she extends and stiffens her legs for a few seconds at a time, sometimes repeatedly over a couple of minutes. She is awake and interactive during these, but unaware of what she is doing.

Self Stimulatory Behaviors

- Also described as (infantile) masturbation or self-gratification behaviors
- Commonly seen in toddlers and young children, more often in girls

Staring spells

- Common presentation in children
- Can be a sign of absence or focal seizures
- Also seen in behavioral inattention, ADHD, daydreaming
- Vigorous tactile stimulation can help to assess responsiveness