The ‘Fitting’ Child

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Objective

- Define relevant history taking and physical examination
- Classify the types of epilepsy in children
- Demonstrate the usefulness of investigations
- Define treatment strategies
Seizures in Children

- **Seizures** are among the most common pediatric neurological disorders.

- The overall prevalence of epilepsy is approximately 1%

- 5% of all children experience febrile seizures before the age of 6 years

- **Seizures** are caused by an abnormal and excessive discharge of neurons, usually accompanied by behavioral or sensorimotor manifestations

- Epilepsy is defined classically as the occurrence of two or more unprovoked seizures.
Taking a History
Taking a History

- Pregnancy history: Ultrasonography results, infections, medications, alcohol use, cigarette smoking, drug abuse, trauma, prematurity
- Prenatal history: Labor duration, spontaneous vaginal delivery or cesarean section, birth difficulties (resuscitation, intubation), birthweight, head circumference at birth
- Development: Fine motor, language, gross motor, and social skills
- School functioning
- General medical history: Head trauma, meningitis, stroke
Taking a History

- Family history: Epilepsy, febrile seizures, mental retardations

- Description of the events: aura; motor (myoclonic or clonic jerk, hypertonia, atonia, chewing movements), sensory (somesthetic, auditory, visual, gustatory), autonomic, or psychologic phenomena; automatisms; level of consciousness; tongue-biting; fecal or urinary incontinence; episode length; postictal state

- Age at event onset

- Event frequency

- Precipitating factors: Fever, sleep deprivation, stress, photosensitivity, drugs, alcohol withdrawal, or others

- Diurnal and nocturnal patterns
Physical Examination
Physical Examination

- State of consciousness, language, social interactions
- Observation of the events (if possible); hyperventilation sometimes can provoke absence seizures
- Global development
- Dyssmorphic features, limb asymmetry, neurocutaneous skin findings, organomegaly
- Head circumference
- Neurologic examination: Cranial nerves, motor strength and tone, reflexes, sensory and cerebellar function tests, gait
Differential Diagnosis of Epilepsy in Children
Differential Diagnosis of **Seizures**

- Syncope
- Daydreaming
- Migraine
- Breath-holding spells
- Transient ischemic events
- Vestibular disorders
- Gastroesophageal reflux
- Movement disorders (tics, paroxysmal choreoathetosis)
- Psychotic hallucinations and delusions
- Nonepileptic events (pseudo**seizures**)
- Panic attacks
Causes of Epilepsy in Children
Proportional incidences for symptomatic epilepsies according to age and etiology

Causes of Symptomatic Epilepsy

(1) Inherited Genetic
(2) Congenital (inherited or acquired)
(3) Acquired
Causes of Symptomatic Epilepsy

(1) Inherited Genetic

• Channelopathies, defined as mutations of neuronal ion channels (e.g., one sodium channel defect is associated with benign familial neonatal seizures)

• Chromosomal abnormalities

• Mitochondrial DNA disorders

• Metabolic disorders

• Hereditary neurocutaneous disorders
  — Tuberous sclerosis complex
  — Neurofibromatosis
  — Sturge Weber syndrome
Causes of Symptomatic Epilepsy

(2) Congenital (Inherited or Acquired)

- Developmental cortical malformations
- Cerebral tumor
- Vascular malformations
- Prenatal injury
Causes of Symptomatic Epilepsy
(3) Acquired

- Trauma
- Neurosurgery
- Infection
- Vascular disease
- Hippocampal sclerosis
- Tumors
- Neurodegenerative disorders
- Metabolic disorders
- Toxic disorders
Investigations
Investigations

- Electrophysiology
  - Electroencephalogram (EEG)

- Brain imaging
  - CT head
  - MRI
  - PET
  - SPECT
  - fMRI

- Video

- Neuropsychological evaluation
The EEG

• a normal EEG is noted in 10% to 20% of children who have epilepsy

• Hyperventilation can trigger epileptic discharges in 80% of patients who have generalized absence epilepsy

• photic stimulation induces EEG abnormalities in up to 40% of patients who have generalized epilepsy

• a sleep-deprived EEG

• Long-term video-EEG monitoring
Scalp electrode positions for EEG
Normal EEG tracing showing a reactive posterior alpha (9-Hz) rhythm in an 8-year-old boy who has no history of seizures
Classification of Epilepsy in Children
International Classification of Epileptic Seizures

1. Partial (Focal, Localized) Seizures
2. Generalized Seizures
3. Unclassified Seizures
Localization-related (Focal, Local, Partial)

- **Idiopathic (primary)**
  - Benign childhood epilepsy with centrotemporal spikes (Benign Rolandic Epilepsy)
  - Childhood epilepsy with occipital paroxysms
  - Primary reading epilepsy

- **Symptomatic (secondary)**
  - Temporal lobe epilepsies
  - Frontal lobe epilepsies
  - Parietal lobe epilepsies
  - Occipital lobe epilepsies
  - Chronic progressive epilepsia partialis continua of childhood
  - Syndromes characterized by seizures that have specific modes of precipitation

- **Cryptogenic, defined by**
  - Seizure type
  - Clinical features
  - Anatomic localization
EEG tracing showing frequent independent left and right centrotemporal spikes in an 8-year-old child who has benign partial epilepsy with centrotemporal spikes (also called benign rolandic epilepsy)
EEG tracing showing a right centroparietal spike (spikes observed in P4-O2, C4-P4, and F4-C4 leads) in a 12-year-old girl who has partial epilepsy
(2) Generalized **Seizures** (Convulsive or Non-convulsive)

- Absence **seizures**
  - —Typical absences
  - —Atypical absences

- Myoclonic **seizures**

- Clonic **seizures**

- Tonic **seizures**

- Tonic-clonic **seizures**

- Atonic **seizures**
EEG tracing showing a generalized 3-Hz spike and wave discharge lasting 6 seconds in a 7-year-old girl who has generalized absence epilepsy
Generalised Seizures

- **Idiopathic (primary)**
  - Benign neonatal familial convulsions
  - Benign neonatal convulsions
  - Benign myoclonic epilepsy in infancy
  - Childhood absence epilepsy (pyknolepsy)
  - Juvenile absence epilepsy
  - Juvenile myoclonic epilepsy (Janz syndrome)
  - Epilepsies with grand mal seizures on awakening
  - Other generalized idiopathic epilepsies
  - Epilepsies with seizures precipitated by specific modes of activation

- **Cryptogenic or symptomatic**
  - West syndrome (infantile spasms)
  - Lennox-Gastaut syndrome
  - Epilepsy with myoclonic-astatic seizures
  - Epilepsy with myoclonic absences
EEG showing hypsarrhythmia in a 9-month-old girl who has infantile spasms
Generalised Seizures

- Special syndromes
  - Situation-related seizures
    - Febrile convulsions
    - Isolated seizures or isolated status epilepticus

- Seizures occurring only with an acute or toxic event, due to factors such as alcohol, drugs, eclampsia, and nonketotic hypoglycemia
Febrile Seizures

- Seizure occurrence between ages 3 months and 6 years of age
- Normal development and normal neurologic examination findings
- Duration <15 min
- Generalized tonic-clonic seizure
- Only one seizure during one febrile episode
- No postictal deficit (e.g., Todd paralysis)
- Not caused by a central nervous system infection
(3) Unclassified Epileptic Seizures

• With both generalized and focal seizures
  • — Neonatal seizures
  • — Severe myoclonic epilepsy in infancy (Dravet syndrome)
  • — Epilepsy with continuous spike and waves during slow-wave sleep
  • — Acquired epileptic aphasia (Landau-Kleffner syndrome)
  • — Other undetermined epilepsies

• Without unequivocal generalized and focal features

Neonatal Convulsion etiologies

- Hypoxic-ischemic encephalopathy
- Intraventricular hemorrhage
- Subarachnoid hemorrhage
- Hypoglycemia
- Hypocalcemia
- Intracranial infection
- Cerebral dysgenesis
Management
Treatment

- Educate parents and child about epilepsy
  - Precipitating factors
  - Seizure first aid
  - Sports

- Treatment strategies
  - Anti-epileptic drugs
  - Special diets
  - Surgery
  - Vagus nerve stimulation
First Aid for Seizures
(Convulsions, generalized tonic-clonic, grand mal)

Cushion head

Loosen tight neckwear

Turn on side

Nothing in mouth

Seizure Disorder

Look for I.D.

Don’t hold down

As seizure ends

... offer help
Anti-epileptic drugs

- Benzodiazepines
- Valporate
- Carbamazepine
- Phenytoin
- Phenobarbitone
- Ethosuximide
- Primidome
- Gabapentin
- Tiagabine
- Oxcarbazepine
- Lamotrigine
- Topiramate
Anti-epileptic drugs

- When to start?
- Monitoring
- When to stop?
Treatment of a Seizure
Treatment

- secure the airway
- placed on his or her side to prevent aspiration
- make sure that the upper respiratory airway is free
- oxygen is by mask
- Blood pressure and electrocardiographic monitoring
- blood should be drawn for a complete blood count, electrolytes, blood glucose, calcium, and magnesium and toxicologic screen
- intravenous (IV) line should be placed
Treatment

• start treatment with a benzodiazepine
• IV lorazepam at a dose of 0.1 mg/kg (0.15 mg/kg for patients already receiving a benzodiazepine) up to a maximum of 4 mg
• Diazepam at a dose of 0.3 mg/kg (0.5 mg/kg for patients already receiving a benzodiazepine) also is a good option and can be administered intravenously, intrarectally, or endotracheally
• Lorazepam or diazepam can be repeated at the same dose if the seizure does not stop after 5 minutes
The second step is to use IV phenytoin or phenobarbital.

Phenytoin is given at a dose of 20 mg/kg intravenously up to a maximum of 1,250 mg.

Phenobarbital is administered at a dose of 10 to 20 mg/kg, up to a maximum of 300 mg.
Status Epilepticus

• a continuous **seizure** or the occurrence of serial **seizures**, between which there is no return of consciousness, lasting more than 30 minutes

• a continuous **seizure** lasting more than 30 minutes potentially can harm the brain

• increased metabolic demand by constantly discharging neurons produces regional oxygen insufficiency that causes cell damage and necrosis
Treatment

• the third step is to induce a "barbiturate coma."

• intubation is mandatory, and an anesthesiologist should be involved

• use midazolam, valproic acid, or other anti-epileptic drugs
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International Classification of Epileptic Seizures
– (1) Partial (Focal, Localized) Seizure

- Simple partial seizures
  - With motor signs
  - With somatosensory or special sensory systems
  - With autonomic symptoms and signs
  - With psychic symptoms

- Complex partial seizures
  - Simple partial onset followed by impairment of consciousness
  - With impairment of consciousness at onset

- Partial seizures evolving to secondarily generalized seizures
  - Simple partial seizures evolving to generalized seizures
  - Complex partial seizures evolving to complex partial seizures evolving to generalized seizures
Generalised Seizures

• Symptomatic (secondary)
  • —Nonspecific cause
    • —Early myoclonic encephalopathy
    • —Early infantile epileptic encephalopathy with suppression burst
    • —Other symptomatic generalized epilepsies

• —Specific syndromes
  • —Epileptic seizures may complicate many disease states
Generalised Seizures

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- Without unequivocal generalized and focal features