Seizures and Epilepsy: Classification
Seizures

- Definition: the clinical manifestation of an abnormal and excessive excitation of a population of cortical neurons
- Incidence: approximately 80/100,000 per year
- Lifetime prevalence: 9%
  (1/3 benign febrile convulsions)
Epilepsy

- **Definition:** a tendency toward **recurrent seizures unprovoked** by systemic or neurologic insults
- **Incidence:** approximately 45/100,000 per year
  Approximately 181,000 people will develop epilepsy each year
- **Point prevalence:** 0.5-1%  (2.5 million with epilepsy)
  - 14 years or younger: 13%
  - 15 to 64 years: 63%
  - 65 years and older: 24%
- **Cumulative risk of epilepsy:** 1.3% - 3.1%
- **Epilepsy refractory to AEDs:** 20-30%
Impact of Epilepsy on Adults

- 53% reported restrictions in activities of daily living
- 46% reported difficulties in concentration and memory
- 39% reported concern over having children
- 36% reported impaired ability to drive
- 28% reported difficulties in relationships with spouses and partners
- 21% reported sexual difficulties
- 16% reported discrimination at work

Epilepsy and Quality of Life

Recurrent seizures/side effects (44%)

No seizures/side effects (17%)

No seizures/no side effects (15%)

Not taking AED (3%)

No answer (2%)

Recurrent seizures/no side effects (19%)

Epidemiology of Epilepsy

Epilepsy: Incidence Rates by Seizure Type


Treatment Sequence for Pharmacoresistant Epilepsy

1st Monotherapy AED Trial

2nd Monotherapy AED Trial

3rd Monotherapy/Polytherapy AED Trial

Epilepsy Surgery/VNS Therapy Evaluation with videoEEG

- Sz-free with 1st AED
- Sz-free with 2nd AED
- Sz-free with 3rd AED/Polytherapy
- Pharmacoresistant

47%
13%
36%

Resective Surgery
VNS Therapy
Polytherapy AED Trials

Seizure Classification

**Partial**
Seizure activity starts in one area of the brain

- **Simple**
Retains awareness

- **Complex**
Altered awareness and behavior

  Secondary generalisation (spreading from one area to the whole brain)

**Generalized**
Seizure involves whole brain & consciousness is affected

- **Tonic Clonic**
“grand-mal” or convulsion
Loss of consciousness, stiffening of body then jerking of limbs

- **Absence**
“petit mal” or staring fit or trance like state

- **Tonic or Atonic**
“drop attack”
Abrupt fall, either with stiffening (tonic) or with loss of muscle tone (atonic or “astatic” attacks)

- **Myoclonic**
Sudden muscle jerks
ILAE Classification of Seizures

Seizures

Partial

Simple Partial

Complex Partial

Secondarily Generalized

Generalized

Absence

Myoclonic

Atonic

Tonic

Tonic-Clonic
Localization of Partial Seizure Focus

- 70% Seizures
  - 20% Simple Partial
  - 10% Complex Partial
  - 10% Secondarily Generalized

- 30% Generalized

Regions of Interest:
- Frontal Cortex
- Temporal Cortex
- Parietal Cortex
- Occipital Cortex
- Orbital Cortex
- Amygdala
- Hippocampus
- Thalamus
- Cerebellum
- Brain Stem
Partial (focal) Seizures

- **Simple Partial Seizure**
  - no loss of awareness
  - Auras
    - Temporal lobe:
      - Smell (uncus)
      - Epigastric sensation
      - déjà vu (hippocampus)
      - Fear/anxiety (amygdala)
    - Parietal lobe: Sensory
    - Occipital lobe: visual
  - Focal motor clonic mvmt

**Supplementary Motor Seizure**
- dystonic *posturing*
  - upper extremities (fencing)
  - lower extremities
- Bicycling
- Short duration 10-30 sec
Partial (focal) Seizures

- **Complex Partial Seizure**
  - Impaired consciousness/ level of awareness (staring)
  - Clinical manifestations vary with origin & degree of spread
  - Presence and nature of aura
    - Temporal lobe: smell, epigastric sensation, deja vu
  - Automatisms (manual, oral)
  - Other motor activity
    - Frontal: bicycling and fencing posture
  - Duration (typically 30 seconds to 3 minutes)
  - Amnesia for event and confusion often after event
EEG: Partial Seizure

Right temporal seizure with maximal phase reversal in the right temporal lobe.
EEG: Partial Seizure

- Continuation of same seizure
- Right temporal seizure with maximal phase reversal in the right sphenoidal electrode
Secondarily Generalized Seizures

- Begins focally, with or without focal neurological symptoms
- Variable symmetry, intensity, and duration of tonic (stiffening) and clonic (jerking) phases
- Typical duration 1-3 minutes
- Postictal confusion, somnolence, with or without transient focal deficit
Childhood Absence Seizures

- Brief staring spells ("petit mal") with impairment of awareness
  - 3-20 seconds
  - Sudden onset and sudden resolution
  - Often provoked by hyperventilation
  - Onset typically between 4 and 7 years of age
  - Often resolve by 18 years of age
- Normal development and intelligence
- EEG: Generalized 3 Hz spike-wave discharges
EEG: Typical Absence Seizure
Juvenile Absence Seizures

- Brief staring spells with variably reduced responsiveness
  - 5-30 seconds
  - Gradual (seconds) onset and resolution
  - Generally not provoked by hyperventilation
  - Onset typically after 7-8 years of age
  - Absence seizures are far less frequent than in childhood onset absence seizures

- Often evolve into myoclonic and generalized tonic-clonic seizures

- Patients continue to have seizures lifelong
Myoclonic Seizures

- Brief, shock-like jerk of a muscle or group of muscles

- Epileptic myoclonus
  - Typically bilaterally synchronous
  - Impairment of consciousness difficult to assess (seizures <1 second)
  - Clonic seizure – repeated myoclonic seizures (may have impaired awareness)

- Differentiate from benign, nonepileptic myoclonus (e.g., while falling asleep)

- EEG: Generalized 4-6 Hz polyspike-wave discharges
Myoclonic Seizures
Tonic and Atonic Seizures

Tonic seizures

- Symmetric, tonic muscle contraction of extremities with tonic flexion of waist and neck
- Duration - 2-20 seconds.
- EEG – Sudden attenuation with generalized, low-voltage fast activity (most common) or generalized polyspike-wave.

Atonic seizures

- Sudden loss of postural tone
  - When severe often results in falls
  - When milder produces head nods or jaw drops.
- Consciousness usually impaired
- Duration - usually seconds, rarely more than 1 minute
- EEG – sudden diffuse attenuation or generalized polyspike-wave
Atonic Events Causing Falls
Epilepsy Syndrome

Grouping of patients that share similar:

- Seizure type(s)
- Age of onset
- Natural history/Prognosis
- EEG patterns
- Genetics
- Response to treatment
Epilepsy Syndromes

Epilepsy

Partial
- Idiopathic
- Symptomatic

Generalized
- Idiopathic
- Symptomatic
Differential Diagnosis of Seizures

Seizures

Nonepileptic

Cardiovascular
Drug related
Syncopal
Metabolic (glucose, Na, Ca, Mg)
Toxic (drugs, poisons)
Poison
Infectious
Febrile convulsions
Pseudoseizure
Alcohol/drug withdrawal
Substance abuse
Psychiatric disorders
Sleep disorders (parasomnias, cataplexy)

Epilepsy (recurrent seizures)

Idiopathic (primary)
Partial (focal)
Generalized

Symptomatic (secondary)
Psychogenic/Non-epileptic Events

- aka pseudoseizures
- Represent genuine psychiatric disease
- 10-45% of refractory epilepsy at tertiary referral centers
- Females > males
- Psychiatric mechanism: dissociation, conversion, most unconscious (unlike malingering)
- Association with physical, sexual abuse
- Epileptic and nonepileptic seizures may co-exist
- Video-EEG monitoring often helps clarify the diagnosis
- Once recognized, approximately 50% respond well to specific psychiatric treatment