



Anticonvulsants

Seizures

- D Abnormal or uncontrolled neuronal discharges in the brain
- D Affect
 - C Consciousness
 - C Motor activity
 - C Sensation
- D Symptom of an underlying disorder

Convulsion

- Involuntary violent spasm of large muscles of face, neck, arms, and legs
- Not synonymous with seizure

Epilepsy

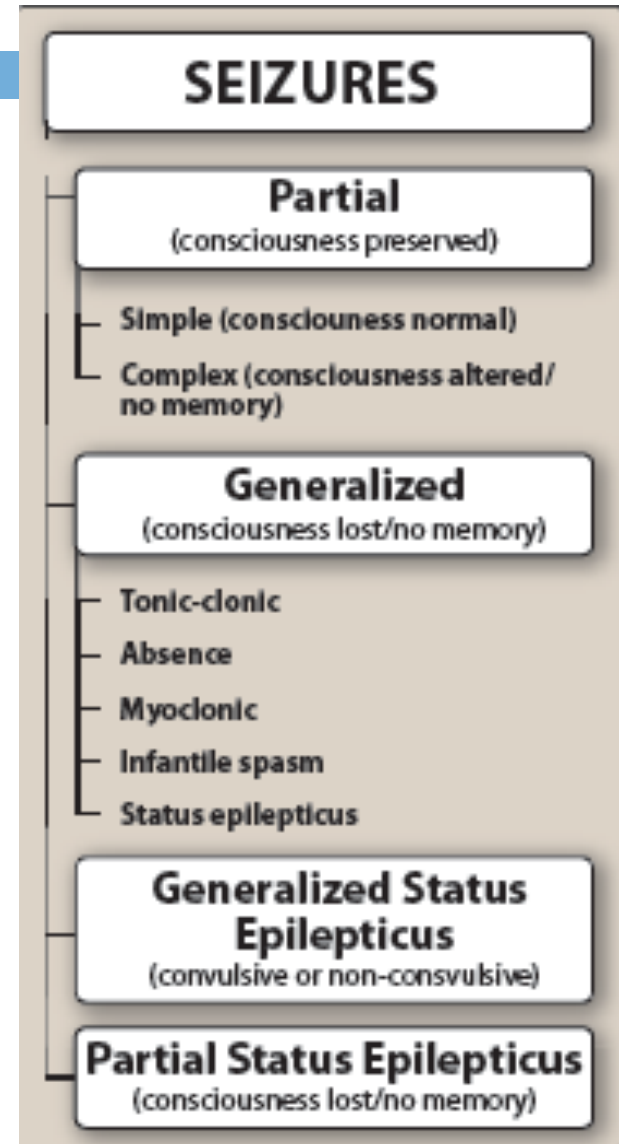
- D Seizures occurring chronically
- D International Classification of Epileptic Seizures
 - C Partial (focal)
 - C Generalized
 - C Special epileptic syndromes

Epilepsy

- ▣ Epilepsy can cause
 - ▣ Loss of consciousness
 - ▣ Abnormal movements
 - ▣ Atypical or odd behavior
 - ▣ Distorted perceptions
- ▣ The site of origin of the abnormal neuronal firing determines the symptoms that are produced
- ▣ If the motor cortex is involved, the patient may experience abnormal movements or a generalized convulsion
- ▣ Seizures originating in the parietal or occipital lobe may include visual, auditory, and olfactory hallucinations

Classification of seizures

- D Seizure classification determines treatment
- D Seizures have been classified by:
 - IJ Site of origin
 - IJ Etiology
 - IJ Electrophysiologic correlation
 - IJ Clinical presentation



Generalized seizures

1. Tonic-clonic seizures:

- ▢ Result in loss of consciousness, followed by tonic (continuous contraction) and clonic (rapid contraction and relaxation) phases

2. Absence seizures:

- ▢ Involve a brief, abrupt, and self-limiting loss of consciousness
- ▢ The patient stares and exhibits rapid eye-blinking for 3-5 seconds

Generalized seizures

3. Myoclonic seizures:

- Short episodes of muscle contractions that may recur for several minutes

4. Febrile seizures:

- Young children may develop seizures with illness accompanied by high fever

5. Status epilepticus:

- Life-threatening and requires emergency treatment
- Two or more seizures occur without recovery of full consciousness between them

Known Causes of Seizures

- D Infectious diseases
- D Trauma
- D Metabolic disorders
- D Vascular diseases
- D Pediatric disorders
- D Neoplastic disease

Additional Known Causes of Seizures

- Medications
- High doses of local anesthetics
- Eclampsia
- Drug abuse
- Withdrawal syndromes from alcohol or sedative-hypnotic drugs

Seizures of Unknown Etiology

- D Lower tolerance to environmental triggers
 - IJ Sleep deprivation
 - IJ Flickering lights
 - IJ Fluid and electrolyte imbalances

Seizures in Neonates, Infants, and Children

- Congenital abnormalities of CNS
- Perinatal brain injury
- Metabolic imbalances

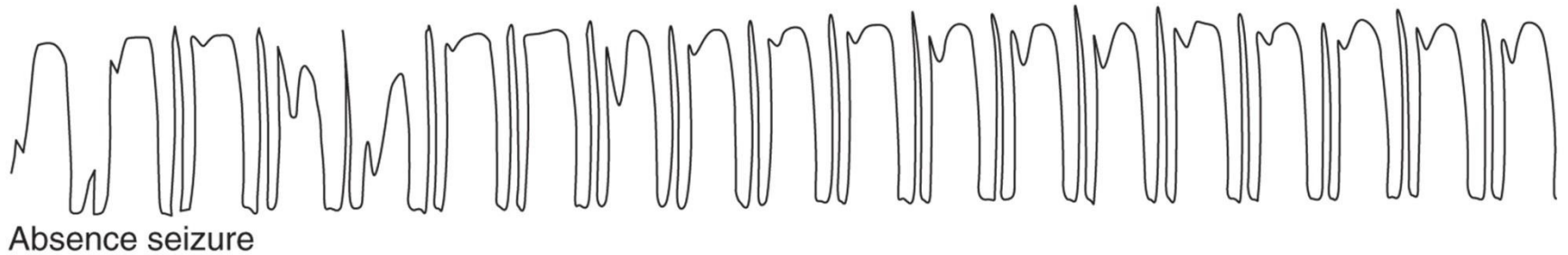
Later-Childhood Etiology

- D CNS infections
- D Neurological degenerative disorders

Adult Etiology

- D Cerebral trauma or neoplasm
- D Cerebrovascular disorders

EEG recordings showing the differences between normal, absence seizure, and generalized tonic-clonic seizure tracings.



Choice of Drug Depends Upon

- Type of seizure
- Client's history and diagnostic studies
- Pathologic process causing seizures

Mechanism of action of antiepileptic drugs

- Blocking voltage gated channels (Na^+ or Ca^{2+})
- Blocking excitatory glutamate transmission
- Enhancing inhibitory GABA impulses
- Some antiepileptic drugs appear to have multiple targets in CNS
- Antiepileptic drugs (AED) suppress seizures but do not “cure” or “prevent” epilepsy

TABLE 24.1 ■ Drugs for Specific Types of Seizures

Seizure Type	Drugs Used for Treatment	
	Traditional AEDs	Newer AEDs
PARTIAL		
Simple partial, complex partial, and secondarily generalized	Carbamazepine Fosphenytoin Phenobarbital Phenytoin Primidone Valproic acid	Eslicarbazepine Ezogabine Felbamate Gabapentin Lacosamide Lamotrigine Levetiracetam Oxcarbazepine Perampanel Pregabalin Tiagabine Topiramate Vigabatrin Zonisamide
PRIMARY GENERALIZED		
Tonic-clonic	Carbamazepine Fosphenytoin Phenobarbital Phenytoin Primidone Valproic acid	Lamotrigine Levetiracetam Perampanel Topiramate
Absence	Ethosuximide Valproic acid	Lamotrigine
Myoclonic	Valproic acid	Lamotrigine Levetiracetam Topiramate

AEDs, Antiepileptic drugs.

Hydantoins

- D **Prototype drug:** phenytoin (Dilantin)
- D **Mechanism of action:** to desensitize sodium channels
- D **Primary use:** treating all types of epilepsy except absence seizures
- D **Adverse effects:** CNS depression, gingival hyperplasia, skin rash, cardiac dysrhythmias, and hypotension

Phenytoin-Like Drugs

- D **Prototype drug:** valproic acid
- D **Mechanism of action:** to desensitize sodium channels
- D **Primary use:** for absence seizures
- D **Adverse effects:** limited CNS depression, visual disturbances, ataxia, vertigo, headache
- D **Additional adverse reactions:** gastrointestinal effects, hepatotoxicity, pancreatitis

Valproic acid and divalproex

- D Mechanisms of action:
 - IJ Sodium channel blockade
 - IJ Blockade of GABA transaminase (The enzyme that metabolizes GABA)
- D Broad spectrum of activity against seizures

Examples of Phenytoin-like Drugs

- Carbamazepine (for tonic-clonic and partial seizure)
- Felbamate (Broad spectrum anticonvulsant)
- Lamotrigine (effective for a wide variety of seizures)
- Valproic acid (Broad spectrum, can be used for absence seizures)

Hydantoins and Phenytoin-like Drugs

- Desensitize sodium channels
- Sodium movement is factor that determines whether neuron will undergo an action potential

Drugs That Potentiate GABA Action

- Include barbiturates, benzodiazepines, and miscellaneous GABA agents
- Suppress the firing ability of neurons

Barbiturates

- D **Prototype drug:** phenobarbital (Luminal)
- D **Mechanism of action:** changing the action of GABA
- D **Primary use:** controlling seizures
- D **Adverse effects:** dependence, drowsiness, vitamin deficiencies, laryngospasm

Examples of Barbiturates

- D Phenobarbital
- D Amobarbital
- D Secobarbital
- D Pentobarbital

Barbiturates & primidone:

- Only long-acting ones useful in epilepsy: phenobarbital & mephobarbital
- Can be usefully combined with phenytoin
- Broad spectrum
- More depressant than phenytoin
- Some tolerance develops
- Elevated seizure liability during withdrawal
- Primidone is second-line due to risk of agranulocytosis

Benzodiazepines

- D **Prototype drug:** diazepam
- D **Mechanism of action:** similar to that of barbiturates but safer
- D **Primary use:** for short-term seizure control
- D **Adverse effects:** drowsiness and dizziness

Examples of Benzodiazepines

- D Clonazepam
- D Clorazepate
- D Lorazepam
- D Diazepam

Examples of Miscellaneous GABA Agents

- D Gabapentin
- D Primidone
- D Tiagabine
- D Topiramate

Succinimides

Suppress seizures by delaying calcium influx into neurons

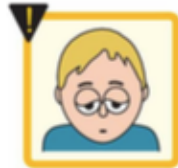
Examples of succinimides

- ▶ Ethosuximide Effective in treating only primary generalized absence seizures
- ▶ Methsuximide
- ▶ Phensuximide

Adverse effects of anti-seizure drugs



Nausea and vomiting



Sedation



Ataxia



Rash



Hyponatremia



Weight gain or weight loss



Teratogenicity



Osteoporosis

Status epilepticus

- Two or more seizures occur without recovery of full consciousness in between episodes
- May be focal or primary generalized, convulsive or nonconvulsive
- Requires emergency treatment
 - Fast-acting medication such as a benzodiazepine
- Slower-acting medication such as phenytoin,
 - Phenytoin is not compatible with most IV solutions, especially those containing dextrose.

Safety Alert

MANAGEMENT OF EPILEPSY DURING PREGNANCY

The risk to a fetus from uncontrolled seizures is greater than the risk from AEDs. Therefore, patients with major seizure disorders should continue to take AEDs throughout pregnancy. To minimize fetal risk, the lowest effective dosage should be determined and maintained, and just one drug should be used whenever possible.

To reduce the risk of neural tube defects that can occur with AEDs, pregnant patients should take supplemental folic acid before conception and throughout pregnancy. A dose of 2 mg/day has been recommended.

Maternal and fetal/infant bleeding risks are also a concern. *Phenobarbital*, *phenytoin*, *carbamazepine*, and *primidone* reduce levels of vitamin K–dependent clotting factors by inducing hepatic enzymes, increasing the risk of bleeding. To reduce the risk, pregnant patients should be given 10 mg of vitamin K daily during the last few weeks of pregnancy, and the fetus should be given a 1-mg IM injection of vitamin K at birth.