

Epilepsy

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Epilepsy is a disorder characterized by **spontaneously recurring seizures**.

A seizure results from an **excessive discharge of cortical neurons** and is characterized by **changes in electrical activity** as measured by the electroencephalogram (EEG).

Epilepsy is defined by the **occurrence of at least two unprovoked seizures with or without convulsions** (i.e., violent, involuntary contraction[s] of the voluntary muscles) **separated by at least 24 hours**.

Seizures can arise from a focal area of the brain (focal or partial seizures) or arise diffusely from both brain hemispheres (primary generalized seizures).

Classification of Epileptic Seizures

Partial Seizure (Focal)

Simple Partial Seizures (Without Impairment of Consciousness)

- Motor symptoms

- Special sensory or somatosensory symptoms

- Autonomic symptoms

- Psychic symptoms

Complex Partial Seizures (With Impairment of Consciousness)

- Progressing to impairment of consciousness

 - With no other features

 - With features as in simple partial seizures

 - With automatisms

- With impaired consciousness at onset

 - With no other features

 - With features as in simple partial seizures

 - With automatisms

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Generalized Seizures (Convulsive or Nonconvulsive)

Generalized Seizures (Convulsive or Nonconvulsive)

Absence Seizures

Typical seizures (impaired consciousness only)

Atypical absence seizures

Myoclonic Seizures

Clonic Seizures

Tonic Seizures

Tonic-Clonic Seizures

Atonic (Astatic or Akinetic) Seizures

Generalized Seizures (Convulsive or Nonconvulsive)

- Generalized tonic-clonic seizures are common.
 - The patient loses consciousness and falls at the onset.
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- Simultaneously, tonic muscle spasms begin and may be accompanied by a cry that results from air being forced through the larynx.
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 - Bilateral, repetitive clonic movements follow.
 - After the clonic phase, patients return to consciousness but remain lethargic and may be confused for varying periods of time (postictal state).
 - Urinary incontinence and tongue biting is common

➤ Generalized absence seizures are manifested by a sudden onset, interruption of ongoing activities, a blank stare, and possibly a brief upward rotation of the eyes.

➤ They generally occur in young children through adolescence. It is important to differentiate absence seizures from CP seizures

➤ Brief shock-like **muscular contractions of the face, trunk, and extremities** are known as **myoclonic jerks**. They can be isolated events or rapidly repetitive

➤ A sudden loss of muscle tone is known as an **atonic seizure**, which may present as a **head drop, the dropping of a limb, or a slumping to the ground**. These patients often wear protective head ware to prevent trauma.

➤ **Simple partial (focal motor or sensory) seizures** are localized in a single cerebral hemisphere or portion of a hemisphere.

➤ **Consciousness is not impaired** during these events.

➤ Various **motor, sensory, or psychic manifestations** may occur depending on the area of the brain that is affected.



➤ A single **part of the body may twitch**, or the patient may experience only an unusual sensory experience.

➤ **Complex partial seizures** result from the spread of focal discharges to involve a larger area.

➤ **Consciousness is impaired and patients may exhibit complex but inappropriate behavior(automatisms)** such as lip smacking, picking at clothing, or aimless wandering.

➤ A period of brief **lethargy or confusion** is common

PATHOPHYSIOLOGY

- ❖ Seizures result from **excessive excitation or from disordered inhibition of neurons**
- ❖ Initially, a **small number of neurons fire** abnormally.
- ❖ Normal membrane conductances and inhibitory synaptic currents then **break down, and excitability spreads locally (focal seizure) or more widely (generalized seizure).**

PATHOPHYSIOLOGY

❖ Mechanisms that may contribute to synchronous hyperexcitability include

- ❖ (1) alterations in the distribution, number, type, and biophysical properties of **ion channels in the neuronal membranes**
- ❖ (2) Biochemical modifications of **receptors**,
- ❖ (3) Modulation of **second messaging systems and gene expression**,

PATHOPHYSIOLOGY

- ❖ Mechanisms that may contribute to synchronous hyperexcitability include
- ❖ 4) changes in **extracellular ion concentrations**,

- ❖ (5) alterations in **neurotransmitter uptake and metabolism** in glial cells,
- ❖ (6) modification in the **ratio and function of inhibitory circuits**, and
- ❖ (7) **local imbalances between the main neurotransmitters** glutamate (excitatory) and γ -aminobutyric acid (GABA) (inhibitory) and **neuromodulators** (eg, acetylcholine, norepinephrine, and serotonin)

Pathophysiology of Epilepsy

- ✱ In normal brain inhibitory circuits limits synchronous discharge. GABA is particularly play this role.
- ✱ When GABA receptors blocked → Rhythmic and repetitive hypersynchronous discharge of neurons → seizures
- ✱ Excitatory NT → Ach , Aspartate and Glutamate also involved to develop seizures
- ✱ Intracellular recording shows burst of rapid action potential firing with reduction of transmembrane potential.
- ✱ ↓ inhibitory system + ↑ excitation → → genesis of seizures
- ✱ Abnormalities in Ion Channel (Na^+ , K^+ , Ca^{2+}) may cause seizures. (Prolongation of depolarization state)



Pathophysiology



Symptoms

Symptoms of a specific seizure will depend on seizure type.

- CP seizures can include somatosensory or focal motor features
- CP seizures are associated with altered consciousness
- Absence seizures can be almost non detectable with only very brief (seconds) periods of altered consciousness
- GTC seizures are major convulsive episodes and are always associated with a loss of consciousness