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EPILEPSY: CLINICAL MANIFESTATIONS, DIAGNOSTIC APPROACHES, AND MODERN TREATMENT MEASURES

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Abstract: This article analyzes the main clinical presentations of epilepsy, the methods used for its diagnosis, and modern treatment strategies. Epilepsy is a chronic disease of the central nervous system characterized by recurrent seizures. Through early detection and modern therapeutic approaches, patients' quality of life can be significantly improved.

Keywords: Epilepsy, clinical manifestations, diagnosis, modern treatment, antiepileptic drugs, neurostimulation

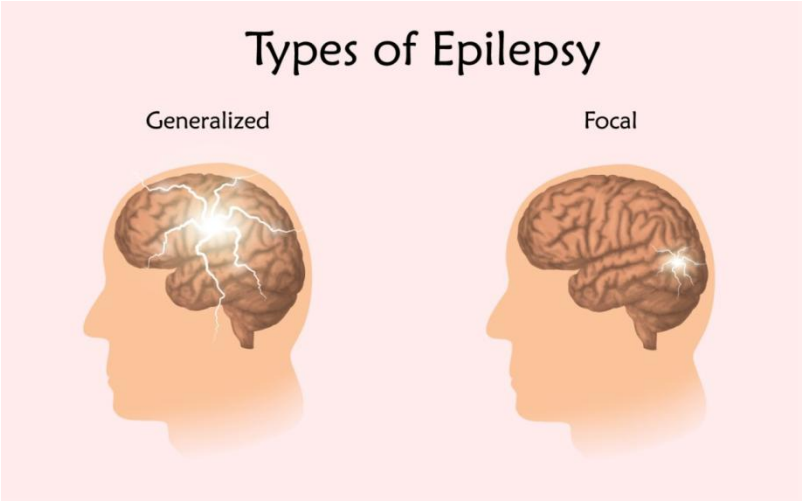
Introduction to Epilepsy. Epilepsy is a neurological disorder caused by excessive and sudden electrical activity of brain neurons. Worldwide, the disease affects about 1–2 out of every 100 individuals. Epilepsy not only produces physical symptoms but also psychological and social problems. Therefore, understanding, diagnosing, and treating this illness correctly is an important task in modern medicine.

Generalized seizures. Generalized seizures are those in which epileptic activity spreads simultaneously across both cerebral hemispheres. The patient usually loses consciousness completely and does not respond to external stimuli. These seizures are further classified into several clinical types:

1. Tonic-Clonic Seizure (Classic Grand Mal)
This is the most common and typically the most severe form.

- **Tonic phase (10–30 seconds):** The patient loses consciousness; all muscles stiffen suddenly and intensely, often causing a fall. Occasionally the patient may bite their tongue or make sounds.
- **Clonic phase (30–60 seconds):** Muscles begin to contract rhythmically—these jerking movements gradually decrease in frequency and intensity.

Postictal phase: After the seizure, the patient slowly regains consciousness. They may be lethargic, fatigued, or confused. This state can last from several minutes to several hours. Signs can include frothing at the mouth, urinary or fecal incontinence, labored breathing, cyanosis (due to hypoxia), and temporary disturbances of hearing or vision.
If you would like me to continue translating the remaining sections following exactly the same structure—such as absences, myoclonic and atonic seizures, focal seizures, diagnosis methods (EEG, MRI, CT), and modern treatment modalities—please let me know.



2. Absence Seizures (Petit Mal)

These are most common in children. There is a brief (5–15 seconds) loss of consciousness during which the child stares blankly; if speaking, the child stops mid-sentence. There is no pain or falling involved, and the child often doesn't remember the episode. These seizures can occur multiple times a day.

3. Myoclonic Seizures

These involve brief, sudden muscle jerks—especially in the arms and shoulders. They typically occur in the morning or under stress.

4. Atonic Seizures

Muscle tone suddenly drops, causing the patient to collapse. The head, legs, or arms may go limp. Although these seizures are very brief, they carry a high risk of injury.

5. Isolated Tonic or Clonic Seizures

- **Tonic:** Only muscle stiffening occurs (often at night).
- **Clonic:** Only rhythmic jerking movements are observed.

Generalized seizures generally pose greater risks due to the potential for falls and injuries. They can temporarily affect lung and heart function. If prolonged, they may lead to status epilepticus—a life-threatening condition of continuous seizure activity.

Focal Seizures

Focal seizures involve epileptic activity in only a specific part of the cerebral cortex, and do not immediately spread to the whole brain. Clinical signs vary depending on the region of the brain where the seizure begins.

Focal seizures are divided into two main types:

1. Simple (Focal) Seizures – Awareness Preserved

The patient remains conscious. Symptoms depend on the brain region involved:

- **Motor area:** Jerking or twitching in the arm, leg, or face
- **Sensory area:** Tingling, numbness, or electric-shock sensations
- **Visual field:** Flashes of light or colors in vision
- **Auditory area:** Hearing unusual noises or sounds
- **Olfactory:** Smelling strange or odd odors
- **Psychic changes:** Fear, a sudden sense of familiarity (déjà-vu)

These seizures typically last 30 seconds to 2 minutes and may go unnoticed by others.

2. Complex Focal Seizures – Impaired Awareness

Consciousness is lost or clouded. The patient may perform automatic movements such as:

- Chewing
- Lip-smacking
- Fiddling with clothing
- Staring into space

Communication breaks down, though the patient's eyes may remain open. Seizures usually last 1–2 minutes, followed by a period of confusion and fatigue.

Secondary Generalization of Focal Seizures

At times, a focal seizure can start in a limited area but then spread to both hemispheres—evolving into a generalized tonic-clonic seizure. This process is called secondary generalization. Focal seizures can be difficult to recognize because they sometimes begin with mild or peculiar movements. They can interfere with daily activities such as working, driving, swimming, or being at heights.

Correct diagnosis requires tools such as EEG and MRI.

Methods for Diagnosing Epilepsy

Diagnosis of epilepsy is based on the patient's clinical presentation combined with medical testing. For early detection, several modern diagnostic methods are used. Below is detailed information on each:

1. Electroencephalography (EEG)

Electroencephalography (EEG) is a method to measure and analyze the brain's electrical activity. It records electrical impulses from neurons. Using EEG, the following can be detected:

- **Seizure onset:** Identifies where and how seizures begin and spread.
- **Focal vs. generalized seizures:** Focal seizures start in a specific area; generalized seizures involve symmetric activity across both hemispheres.
- **Normal vs. pathological waves:** EEG reveals epileptic activity as irregular electric impulses.
- **Real-time monitoring:** Provides insight into brain function as it occurs.

EEG is one of the most important tests for diagnosing epilepsy. However, its limitation is that it only measures surface brain activity and may miss deep-brain sources .

2. Magnetic Resonance Imaging (MRI)

MRI is a non-invasive technique used to detect structural brain changes. It provides detailed information on brain anatomy, including size, structure, and pathological changes:

- Detects tumors, hemorrhages, injuries, structural abnormalities (e.g., hippocampal alterations).
- Helps determine causes of some epilepsy types (e.g., tumors, focal lesions).
- Does **not** detect electrical activity itself .

3. Computed Tomography (CT)

CT is an X-ray based method to assess brain structure and condition. It identifies:

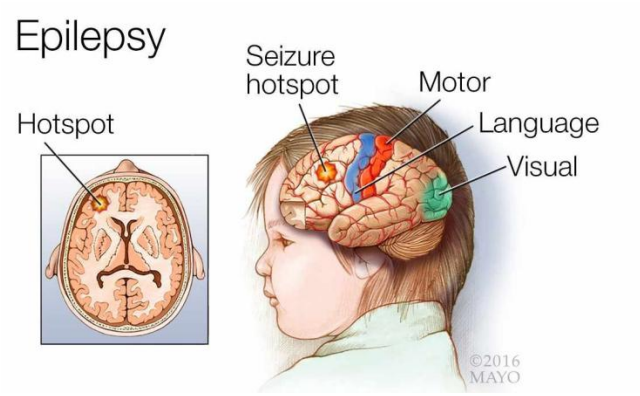
- Injuries, bleeding, tumors, and other organic abnormalities.
- Useful in rapid assessment of acute injury or hemorrhage.
- Detects tumors, infarctions, and structural anomalies..

4. Clinical and Anamnestic (Historical) Information

Diagnostic evaluation also relies on thorough clinical history and testing, which includes:

- **Seizure history:** Analysis of past seizures—their timing, duration, initiation, and features.
- **Trigger factors:** Such as stress, sleep deprivation, alcohol use, etc.
- **Overall health status:** Including psychological and neurological symptoms, comorbidities (e.g., heart disease, metabolic disorders).
- **Social and family history:** Family history of epilepsy, genetic predisposition.

These elements provide essential context for accurate diagnosis, help identify causes and types of epilepsy, and guide treatment planning.



Epilepsy is a neurological disorder caused by abnormal electrical activity in the brain, with clinical presentations and etiologies that vary widely , which sometimes leads to **misdiagnosis**—particularly when based solely on subjective patient-reported history .

Correct diagnosis and treatment of epilepsy are tightly interconnected: optimal outcomes rely on identifying the seizure type and underlying cause accurately .

Key Diagnostic Tools

- **Electroencephalography (EEG)**
  - The **most critical diagnostic tool** for epilepsy—detects onset and spread of seizures in real time, helps classify focal versus generalized seizures, and informs treatment decisions .
- However, EEG is limited to detecting surface brain activity and may miss deep-seated abnormalities
- **Magnetic Resonance Imaging (MRI) & Computed Tomography (CT)**
  - **MRI** detects structural brain issues—tumors, infarcts, hemorrhages, or focal lesions—thus correlating imaging with seizure origin .
  - **CT** is valuable in acute settings for identifying injury or bleeding, though it provides less detail than MRI and involves radiation exposure .
- Neither MRI nor CT assess electrical activity directly, so pairing with EEG is essential
- **Clinical and Anamnesis Data**
  - A detailed history—including seizure onset, duration, triggers, comorbid conditions, and family background—is vital This context helps determine the seizure type, etiology, and guide individualized treatment planning

Why early detection matters

Combining EEG, imaging (MRI/CT), and thorough history allows for early and precise classification of epilepsy types (e.g., focal vs. generalized), enabling tailored therapeutic strategies and patient engagement in care and rehabilitation .

Summary

Epilepsy is a complex, multifaceted condition. Effective treatment demands reliable diagnosis and personalized care plans. Modern diagnostic tools—EEG for functional assessment, MRI/CT for structural evaluation—combined with detailed clinical history, are all essential. Early detection of subtle presentations, especially in focal epilepsy, is crucial for better outcomes .

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