

# Epilepsy

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## Key Points

- Frequency and causes of epilepsy
- Major types of epilepsy and seizures
- Effects on performance of daily life tasks and mental health
- Medications and therapies use to treat epilepsy

Epilepsy is an electrophysiological disorder of the brain, characterized by recurrent seizures. Epilepsy directly affects 50 million people worldwide, approximately 0.6–1.5% of the world's population. Infection in brain, high fever, tumor and stroke can cause epilepsy in addition to genetic factors. Epilepsy imposes a great economic burden on the health care systems of countries also there is stigma and discrimination against the patient and their family in the community, workplace, school and home. Severe emotional distress, extreme social isolation and behavioral disorders affect many patients with epilepsy.

Electroencephalogram (EEG) is a test that records the abnormalities in the brain waves and measures electrical activity of the brain, and is mostly used in the diagnosis and analysis of epileptic seizures.<sup>1</sup>

## Causes of Epilepsy

The causes of epilepsy are unknown. The word epilepsy (Greek word epilambanein that means *to be seized*) does not specify anything about the cause's epilepsy or about the severity of seizures, sometimes epilepsy is caused due genetic factors, but epilepsy can also outcome from brain injuries caused by hard blows to the head, stroke, tumors, high fever or infections.<sup>2</sup> In young children genetics plays an important role in causing epilepsy, but it can be a factor for people of any age.<sup>3</sup> The genetic causes of neonatal epilepsy can be grouped into the following categories:

- Deformities of cortical development

Abnormal formation of the cortical plate caused by abnormalities in the cerebral cortex can cause epilepsy.<sup>4</sup>

- Genetic–syndromic

Epilepsy genes: genes that cause epilepsies or syndromes with epilepsy (OMIM, HGMD, and Epilepsy Gene)<sup>5</sup>

- Genetic–cellular

Cellular alterations that can cause epilepsy include neurodegeneration, dendritic remodeling, gliosis, neurogenesis, incursion of inflammatory cells, axonal injury, angiogenesis axonal sprouting, changes in extracellular medium, and abnormally developed channelopathies.<sup>6</sup>

- Genetic–metabolic

An increased risk of epilepsy development due to metabolic abnormality in affected individuals. Metabolic epilepsy cannot be treated by commonly used antiepileptic drugs as they do not address its root cause.<sup>7</sup>

- Genetic–vascular

Epilepsy is related to not only to neuronal cells but also to other brain cells, such as glial cells and vascular cells. Both glial cells and endothelial cells express VEGF receptors thus, these cells are likely affected by increases in VEGF during seizures, which in turn causes vascular abnormalities.<sup>8</sup>

During the development of epilepsy, the presence of paroxysmal discharges in the epileptic human dentate gyrus provides a physiologic basis for hyperexcitability

which may initiate seizures.<sup>9</sup> Seizures may be caused by abnormality of potassium conductance, deficiency in the membrane ATPases related to ion transport may cause neuronal membrane to become unbalanced or a defect in the voltage activated ion channels.<sup>10</sup> Causes of Idiopathic epilepsies are mutations in genes that encode for ligand gated ion channels, which are mainly involved in synaptic transmission or ion channels or voltage-gated ion channels, which are important for action potential generation and accessory subunits.<sup>11</sup> Acquired epilepsy is caused by Traumatic brain injury (TBI), and it can intensify the seizure severity in individuals with pre-existing epilepsy. TBI is an example of the process of epileptogenesis in neurology.<sup>12</sup>

## Major types of Epilepsy

### Generalized epilepsy

Seizures arise suddenly in a generalized fashion all over the brain.<sup>13</sup>

### Focal epilepsy

Localized epileptic discharge in a small group of neurons. Temporal lobe epilepsy most common type of focal epilepsy.<sup>14</sup>

## Types of Seizers

### Simple Focal Seizures

Simple focal seizures occur for a short amount of time lasting less than one minute.

### Complex Focal Seizure

Patients may stare blankly into space, or experience automatisms.

### Absence Seizure

Absence seizure cause blank outs for a few seconds. These are also known as petit mal seizures. Most commonly occur in children but don't have any long-term effects. Period of hyperventilation set of these seizures.<sup>8</sup>

### Atonic Seizure

Sudden loss of muscle strength is characteristic of atonic seizures.

### Tonic-Clonic Seizure

A seizure involving both tonic (stiffening) and clonic (twitching or jerking) segments of muscle activity.

### Myoclonic Seizure

A brief seizure with shock-like jerks of a muscle or a group of muscles.<sup>9</sup>

## Effects on performance of daily life tasks and mental health

For thousands of years people living with epilepsy suffer from stigma that is based on misunderstandings, misinterpretations and myths. Loneliness and social avoidance are negative attitudes that prevail in adolescents and adults in both school and workplace. Having unstable mental health, antisocial issues and being potentially violent toward others are common views on people with epilepsy. 25 percent of adults having epilepsy describe social stigma as a result of their epilepsy. Fear of rejection and shame or loneliness are common emotions that come with epilepsy diagnosis. It has significant psychosocial and social impact.<sup>15</sup>

Increased risk of mortality is associated with epilepsy; however, it is rarely due to the epilepsy itself.

Suicide is the principal cause of death among persons with epilepsy. From 30 studies comprising of 51,216 persons showed, 188 people committed suicide and died.<sup>3</sup>

## International classification of epileptic seizures<sup>8</sup>

(A) Focal seizures (seizures that begin locally)

- **Simple** (without unconsciousness)
  - Accompanied by motor, special sensory and psychic symptoms.
- **Complex** (with impairment of consciousness)
  - Partial beginning followed by impairment of consciousness with or without automatisms.
  - Impaired consciousness at onset with or without automatisms.
- **Secondarily generalized** (partial epilepsy evolving generalized tonic clonic seizures)

(B) Generalized seizures (without local onset)

(C) Unclassified seizures

#### (D) Status epilepticus

In low-income countries or third world countries the burden of epilepsy is more than twice that in high-income countries, due to higher incidence of risk factors. Most deaths in low-income countries are related to untreated epilepsy.<sup>15</sup>

Substantial stigma is associated with epilepsy in low-income countries, acts as a barrier for accessing biomedical treatment and becoming integrated within society. Inexpensive antiepileptic drugs can be used to control seizures to a great degree, but in underprivileged areas the supply and quality of these drugs can be inconsistent and unreliable.

#### Medications and therapies use to treat Epilepsy

20-30% of epileptic patients whose seizures are not fully controlled with available antiepileptic drugs (drug resistant epilepsy), have an increased risk of death. Adverse effects from antiepileptic drugs include psychiatric and somatic comorbidities. Newer drugs are more effective have brought more treatment options. Drugs such as levetiracetam cause fewer drug interactions and less hypersensitivity than older ones. Though, the risk of

drug resistance epilepsy is not averted. Development of epilepsy in patients at high risk, such as those with a traumatic brain injury is also not averted.<sup>16</sup>

Approximately 25% of patients with generalized epilepsy and 30% of patients with focal epilepsy have epilepsy that is not controlled by medications. These patients are given multiple AEDs, which have adverse effects including disabling seizures and side effects. Second-generation AEDs are much safer and better tolerated by epileptic patients than the older AEDs. For those patients whose seizures are not controlled by AEDs surgery and Vagus nerve stimulator can be important therapeutic options.<sup>17</sup>

#### Management of Epilepsy

The terms antiepileptic and anticonvulsant are used interchangeably. An agent that blocks experimentally produced seizures in laboratory animals is called anticonvulsant and a drug used medically to control epilepsies is an antiepileptic drug.

1. Any causative factors of epilepsy must be treated first, e.g., cerebral neoplasm.

2. The patient should be educated about the disease, the duration of treatment and need for compliance.

3. Triggering factors must be avoided, e.g., sleep deprivation, emotional stress and alcohol.

4. Natural variation should be anticipated, e.g., seizures may occur particularly or exclusively around periods in women.

5. Antiepileptic drug should be given only if required (seizure type and frequency), i.e., more than one fit every 6-12 months.<sup>18</sup>

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