



A Systematic Review on Epilepsy and Its Management

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ABSTRACT

Epilepsy is a group of non-communicable neurological disorders characterized by recurrent epileptic seizures. Epilepsy is a neurological condition that causes unprovoked, recurrent seizures. A seizure is a sudden rush of abnormal electrical activity in your brain. A disorder in which nerve cell activity in the brain is disturbed, causing seizures. Epilepsy may occur as a result of a genetic disorder or an acquired brain injury, such as a trauma or stroke. During a seizure, a person experiences abnormal behaviour, symptoms and sensations, sometimes including loss of consciousness. There are few symptoms between seizures. Epilepsy is usually treated by medication and in some cases by surgery, devices or dietary changes.

Key word: Epilepsy, Seizure, Generalized seizures, Focal seizures

INTRODUCTION:

WHAT IS EPILEPSY?¹

Epilepsy is a long-term (chronic) disease that causes repeated seizures due to abnormal electrical signals produced by damaged brain cells. A burst of uncontrolled electrical activity within brain cells causes a seizure. Seizures can include changes to your awareness, muscle control (your muscles may twitch or jerk), sensations, emotions and behavior. Epilepsy is also called a seizure disorder. Anyone, of any age, race or sex, can develop epilepsy.

In the U.S., about 3.4 million people have epilepsy. Of this number, 3 million are adults and 470,000 are children. There are 150,000 new cases of epilepsy in the U.S. each year. Worldwide, about 65 million people have epilepsy.

WHAT HAPPENS IN YOUR BRAIN WHEN YOU HAVE EPILEPSY?¹

The cells in your brain send messages to and receive messages from all areas of your body. These messages are transmitted via a continuous electrical impulse that travels from cell to cell. Epilepsy disrupts this rhythmic electrical impulse pattern. Instead, there are bursts of electrical energy — like an unpredictable lightning storm — between cells in one or more areas of your brain. This electrical disruption causes changes in your awareness (including loss of consciousness), sensations, emotions and muscle movements.

TYPES OF EPILEPSY & SEIZURE DISORDERS

NYU Langone specialists at the Comprehensive Epilepsy Center have expertise in recognizing the many types of epilepsy and seizure disorders affecting adults.

Epilepsy is a neurological disorder in which a person has two or more unprovoked seizures that occur more than 24 hours apart. A seizure is an excessive surge of electrical activity in the brain that can cause a variety of symptoms, depending on which parts of the brain are involved. “Unprovoked” seizures are those that are not brought on by a clear cause, such as alcohol withdrawal, heart problems, or hypoglycemia, which is when a person has extremely low blood sugar levels.²

Seizures may be the result of genetics or a brain injury, but often their cause is unknown. The words “seizure disorder” and “epilepsy” are often used interchangeably. However, “provoked” seizures, such as those due to severe hypoglycemia, are not considered to be forms of epilepsy.²

The type of seizure depends on which part and how much of the brain is affected and what happens during the seizure. The two broad categories of epileptic seizures are generalized seizures (absence, atonic, tonic-clonic, myoclonic) and partial (simple and complex) seizures. Within these categories, there are several different types of seizures in children, including:³

- **Focal seizures.**³Focal seizures take place when abnormal electrical brain function occurs in one or more areas of one side of the brain. Focal seizures may also be called partial seizures. With focal seizures, particularly with complex focal seizures, the child may experience an aura before the seizure occurs. The most common aura involves feelings such as déjà vu, impending doom, fear, or euphoria. Visual changes, hearing abnormalities, or changes in the sense of smell can also be auras. Two types of partial seizures include:

- **Simple focal seizures.**³ The child may show different symptoms depending upon which area of the brain is involved. If the abnormal electrical brain function is in the occipital lobe (the back part of the brain that is involved with vision), the child's sight may be altered. However, more commonly, a child's muscles are affected. The seizure activity is limited to an isolated muscle group, such as fingers or to larger muscles in the arms and legs. Consciousness is not lost in this type of seizure. The child may also experience sweating, nausea, or become pale.
- **Complex focal seizures.**³ This type of seizure commonly occurs in the temporal lobe of the brain, the area of the brain that controls emotion and memory function. This seizure usually lasts one to two minutes. Consciousness is usually lost during these seizures. Losing consciousness may not mean that a child passes out--sometimes, a child stops being aware of what's going on around him or her. The child may look awake but have a variety of behaviors. These behaviors may range from gagging, lip smacking, running, screaming, crying, and/or laughing. When the child regains consciousness, he or she may complain of being tired or sleepy after the seizure. This is called the postictal period.
- **Generalized seizures.**³ Generalized seizures involve both sides of the brain. There is loss of consciousness and a postictal state after the seizure occurs. Types of generalized seizures include the following:
 - **Absence seizures (also called petit mal seizures).**³ These seizures are characterized by a brief altered state of consciousness and staring episodes. Typically the child's posture is maintained during the seizure. The mouth or face may move or the eyes may blink. The seizure usually lasts no longer than 30 seconds. When the seizure is over, the child may not recall what just occurred and may go on with his/her activities, acting as though nothing happened. These seizures may occur several times a day. This type of seizure is sometimes mistaken for a learning problem or behavioral problem. Absence seizures almost always start between ages 4 to 12 years.
 - **Atonic (also called drop attacks).**³ With atonic seizures, there is a sudden loss of muscle tone and the child may fall from a standing position or suddenly drop his/her head. During the seizure, the child is limp and unresponsive.
 - **Generalized tonic-clonic seizures (also called grand mal seizures).**³ The classic form of this kind of seizure, which may not occur in every case, is characterized by five distinct phases. The body, arms, and legs will flex (contract), extend (straighten out), tremor (shake), a clonic period (contraction and relaxation of the muscles), followed by the postictal period. Not all of these phases may be seen with every one of this type of seizure. During the postictal period, the child may be sleepy, have problems with vision or speech, and may have a bad headache, fatigue, or body aches.
 - **Myoclonic seizures.**³ This type of seizure refers to quick movements or sudden jerking of a group of muscles. These seizures tend to occur in clusters, meaning that they may occur several times a day, or for several days in a row.
 - **Infantile spasms.**³ This rare type of seizure disorder occurs in infants from before six months of age. There is a high occurrence rate of this seizure when the child is awakening, or when they are trying to go to sleep. The infant usually has brief periods of movement of the neck, trunk, or legs that lasts for a few seconds. Infants may have hundreds of these seizures a day. This can be a serious problem, and can have long-term complications.
 - **Febrile seizures.**³ This type of seizure is associated with fever and is not epilepsy, although a fever may trigger a seizure in a child who has epilepsy. These seizures are more commonly seen in children between 6 months and 5 years of age and there may be a family history of this type of seizure. Febrile seizures that last less than 15 minutes are called "simple," and typically do not have long-term neurological effects. Seizures lasting more than 15 minutes are called "complex" and there may be long-term neurological changes in the child.

SIGNS AND SYMPTOMS⁴

Characteristics of seizures vary and depend on where in the brain the disturbance first starts, and how far it spreads. Temporary symptoms occur, such as loss of awareness or consciousness, and disturbances of movement, sensation (including vision, hearing and taste), mood, or other cognitive functions.

People with epilepsy tend to have more physical problems (such as fractures and bruising from injuries related to seizures), as well as higher rates of psychological conditions, including anxiety and depression. Similarly, the risk of premature death in people with epilepsy is up to three times higher than in the general population, with the highest rates of premature mortality found in low- and middle-income countries and in rural areas.

A great proportion of the causes of death related to epilepsy, especially in low- and middle-income countries, are potentially preventable, such as falls, drowning, burns and prolonged seizures.

CAUSES⁴

Epilepsy is not contagious. Although many underlying disease mechanisms can lead to epilepsy, the cause of the disease is still unknown in about 50% of cases globally. The causes of epilepsy are divided into the following categories: structural, genetic, infectious, metabolic, immune and unknown. Examples include:

- Brain damage from prenatal or perinatal causes (e.g. A loss of oxygen or trauma during birth, low birth weight);
- Congenital abnormalities or genetic conditions with associated brain malformations;
- A severe head injury;
- A stroke that restricts the amount of oxygen to the brain;
- An infection of the brain such as meningitis, encephalitis or neurocysticercosis,
- Certain genetic syndromes; and
- A brain tumour.

TREATMENT⁴

Seizures can be controlled. Up to 70% of people living with epilepsy could become seizure free with appropriate use of antiseizure medicines. Discontinuing anti-seizure medicine can be considered after 2 years without seizures and should take into account relevant clinical, social and personal factors. A documented etiology of the seizure and an abnormal electroencephalography (EEG) pattern are the two most consistent predictors of seizure recurrence.

- In low-income countries, about three quarters of people with epilepsy may not receive the treatment they need. This is called the “treatment gap”.
- In many low- and middle-income countries, there is low availability of antiseizure medication. A recent study found the average availability of generic antiseizure medicines in the public sector of low- and middle-income countries to be less than 50%. This may act as a barrier to accessing treatment.
- It is possible to diagnose and treat most people with epilepsy at the primary health-care level without the use of sophisticated equipment.
- WHO pilot projects have indicated that training primary health-care providers to diagnose and treat epilepsy can effectively reduce the epilepsy treatment gap.
- Surgery might be beneficial to patients who respond poorly to drug treatments.

PREVENTION⁴

An estimated 25% of epilepsy cases are preventable.

- Preventing head injury is the most effective way to prevent post-traumatic epilepsy.
- Adequate perinatal care can reduce new cases of epilepsy caused by birth injury.
- The use of drugs and other methods to lower the body temperature of a feverish child can reduce the chance of febrile seizures.
- The prevention of epilepsy associated with stroke is focused on cardiovascular risk factor reduction, e.g. measures to prevent or control high blood pressure, diabetes and obesity, and the avoidance of tobacco and excessive alcohol use.
- Central nervous system infections are common causes of epilepsy in tropical areas, where many low- and middle-income countries are concentrated. Elimination of parasites in these environments and education on how to avoid infections can be effective ways to reduce epilepsy worldwide, for example those cases due to neurocysticercosis.

FIRST AID FOR ANY TYPE OF SEIZURE⁵

It's important to note that most seizures don't require emergency medical attention, and you can't stop a seizure once it's in progress.

When you're with somebody having a mild seizure:

- Stay with the person until their seizure ends and they're awake.
- Once they're awake, guide them to a safe place and tell them what happen.
- Stay calm and try to keep other people calm.
- Speak calmly.
- Check for a medical bracelet.
- Offer to help the person get home safely.

If the person is having a tonic-clonic seizure, which causes uncontrolled shaking or jerking:

- Ease the person to the ground.
- Turn them gently onto their side to help them breathe.
- Clear any dangerous objects away from them.
- Put something soft under their head.
- If they wear glasses, remove them.
- Loosen any clothing, such as a tie, that may affect breathing.

When someone is having a seizure, it's critical to *never*:

- Hold the person down or try to stop their movements
- Put anything in their mouth
- Give them mouth to mouth
- Offer the person food or water until they're fully alert

WHAT TRIGGERS AN EPILEPTIC SEIZURE?⁵

Some people identify things or situations that trigger their seizures.

A few of the most common known triggers are:

- Lack of sleep
- Illness or fever
- Stress
- Bright lights, flashing lights, or patterns
- Caffeine, alcohol or alcohol withdrawal, medications, or illegal drugs
- Skipping meals, overeating, or specific food ingredients
- Very low blood sugar
- Head injury

Identifying triggers isn't always easy. A single incident doesn't always mean something is a trigger. Often, a combination of factors triggers a seizure. A good way to find your triggers is to keep a seizure journal. After each seizure, note the following:

- Day and time
- What activity you were involved in
- What was happening around you
- Unusual sights, smells, or sounds
- Unusual stressors
- What you were eating or how long it had been since you'd eaten
- Your level of fatigue and how well you slept the night before

You can also use your seizure journal to determine if your medications are working. Note how you felt just before and just after your seizure, and any side effects.

Bring the journal with you when you visit the doctor. It may be useful for your doctor if adjusting your medications or exploring other treatments is, or becomes, necessary.

WHAT CAUSES EPILEPSY?⁶

Most of the time (in up to 70% of cases), the cause of seizures is not known. Known causes include:

- *Genetics.* Some types of epilepsy (like juvenile myoclonic epilepsy and childhood absence epilepsy) are more likely to run in families (inherited). Researchers believe that although there's some evidence that specific genes are involved, the genes only increase the risk of epilepsy, and other factors may be involved. There are certain epilepsies that result from abnormalities that affect how brain cells can communicate with each other and can lead to abnormal brain signals and seizures.
- *Mesial temporal sclerosis.* This is a scar that forms in the inner part of your temporal lobe (part of your brain near your ear) that can give rise

to focal seizures.

- *Head injuries.* Head injuries can result from vehicular accidents, falls or any blow to the head.
- *Brain infections.* Infections can include brain abscess, meningitis, encephalitis and neurocysticercosis.
- *Immune disorders.* Conditions that cause your immune system to attack brain cells (also called autoimmune diseases) can lead to epilepsy.
- *Developmental disorders.* Birth abnormalities affecting the brain are a frequent cause of epilepsy, particularly in people whose seizures aren't controlled with anti-seizure medications. Some birth abnormalities known to cause epilepsy include focal cortical dysplasia, polymicrogyria and tuberous sclerosis. There's a wide range of other brain malformations known to cause epilepsy.
- *Metabolic disorders.* People with a metabolic condition (how your body obtains energy for normal functions) can have epilepsy. Your healthcare provider can detect many of these disorders through genetic tests.
- *Brain conditions and brain vessel abnormalities.* Brain health issues that can cause epilepsy include brain tumors, strokes, dementia and abnormal blood vessels, such as arteriovenous malformations.

DIAGNOSIS AND TESTS⁶

What tests will be done to diagnose this condition?

Tests include:

- *Electroencephalography (EEG):* This test measures the electrical activity in your brain. Certain abnormal electrical patterns are related to seizures.
- *Brain scans:* Magnetic resonance imaging (MRI) to look for such things as tumors, infections or blood vessel abnormalities.

MANAGEMENT AND TREATMENT⁶

Treatments to control epilepsy include anti-seizure medications, special diets (usually in addition to anti-seizure medications) and surgery.

Anti-seizure medications

Anti-seizure medications can control seizures in about 60% to 70% of people with epilepsy. Anti-seizure medication treatment is individualized. The U.S. Food and Drug Administration (FDA) has approved more than 20 anti-seizure medications for treating epilepsy. Your healthcare provider may try one or more medications, doses of medications or a combination of medications to find what works best to control your seizures.

Choice of an anti-seizure medication depends on:

- Seizure type.
- Your prior response to anti-seizure medications.
- Other medical conditions you have.
- The potential for interaction with other medications you take.
- Side effects of the anti-seizure drug (if any).
- Your age
- General health.
- Cost.

Because some anti-seizure medications are linked to birth defects, let your healthcare provider know if you're pregnant or planning to become pregnant. If anti-seizure medications don't control your seizures, your healthcare provider will discuss other treatment options, including special diets, medical devices or surgery.

Diet therapy

The ketogenic diet and the modified Atkins diet — diets high in fat, moderate in protein and low in carbohydrates — are the two most common diets sometimes recommended for people with epilepsy. Diets are mostly recommended for children where medication was not effective and who aren't candidates for surgery. Low glycemic index diets may also reduce seizures in some people with epilepsy.

Surgery and devices

Your healthcare provider will consider surgery if anti-seizure medications don't control your seizures, and if your seizures are severe and debilitating. Epilepsy surgery can be a safe and effective treatment option when more than two anti-seizure medication trials fail to control your seizures. It's important to be evaluated at an epilepsy center to see if you're a candidate for epilepsy surgery if anti-seizure medications don't control your seizures.

Surgery options include surgical resection (removal of abnormal tissue), disconnection (cutting fiber bundles that connect areas of your brain), stereotactic radiosurgery (targeted destruction of abnormal brain tissue) or implantation of neuromodulation devices. These devices send electrical impulses to your brain to reduce seizures over time.

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