

The Causes and Treatments of Neurological diseases: GB and MG in Children and Adults Involved Infection, relying on drug therapy and incidence of stroke and epilepsy in patients with point of of Radiological imaging

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Abstract

This study investigated the causes and treatment of neurological epilepsy in children and adults involved in infection and occurrence of stroke in patients. In the present study, the issue was investigated by reviewing more than 69 articles and by searching for key words such as treatment of neurological epilepsy, infection and occurrence of stroke. Epilepsy can start at any age, but it usually starts in childhood or in people over 60. The condition is often lifelong, but sometimes it can improve slowly over time. The impact of seizures and the abnormal neural substrate underlying adult and pediatric epilepsy differ in the developing and mature brain. In children, epilepsy occurs in a more dynamic nervous system, and its neuropsychological consequences reflect the continuous changes of maturity, flexibility at the behavioral and structural level, and the impact of environmental and social factors on development. The results of this study showed that seizures occur when one or more parts of the brain have abnormal electrical signals that interrupt normal signals. There are different types of seizures, each of which can cause different types of symptoms. These symptoms range from slight body movements to loss of consciousness and seizures. Epilepsy is diagnosed when a person has 2 or more unprovoked seizures. Epilepsy is treated with medication. In some cases, it may be treated with VNS or surgery. In the case of epilepsy, it is very important to avoid anything that causes seizures, and the sleep of people with epilepsy, especially children, should be normal and appropriate, because lack of sleep and disorders are one of the important factors in the occurrence of seizures.

Key words: Epilepsy, Infection, Electronic Signal, Seizure, Drug.

Introduction

Epilepsy is the fourth most common and chronic disease in the world [1]. This disease is classified as brain and nerve diseases [2]. In Iran, about one percent of the population is suffering from this disease [3]. Epilepsy is a set of chronic neurological disorders that are usually characterized by epileptic attacks. Epilepsy attacks usually occur frequently and have no fixed and clear causes. It should be noted that not all convulsions and attacks can be considered an epileptic attack [4-6]. Epileptic attacks are usually caused by brain damage caused by drugs and alcohol, and in some cases by brain cancer [7]. Seizures occur when cortical or membrane cell activity in the brain is too abnormal. This disease is one of the diseases that has no definite cure, but up to 70% of epileptic attacks can be controlled by taking medicine [8-10].

In the present study, the issue was investigated by reviewing more than 69 articles and by searching for key words such as treatment of neurological epilepsy, infection and occurrence of stroke (Figure 1).

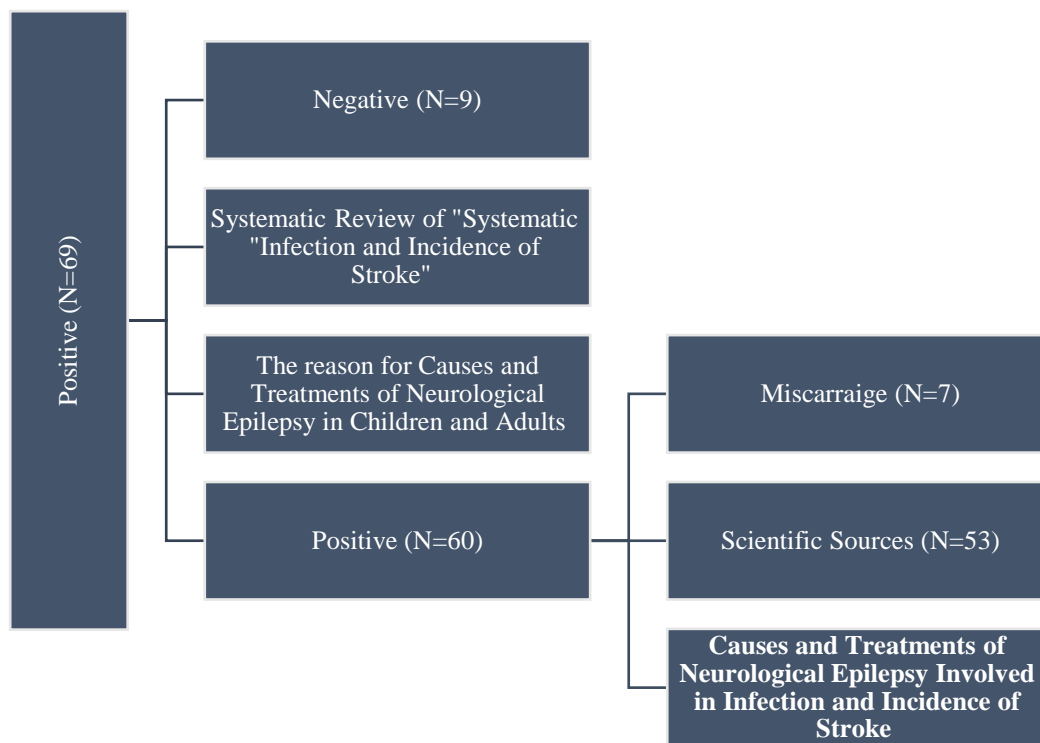


Figure 1. Flow chart of included subjects

Types of epilepsy

Doctors divide epilepsy and convulsions into several types according to how abnormal brain activity starts. In the following, we will examine various seizures and epileptic attacks:

1- Focal seizure or partial epilepsy: If the seizure is due to abnormal activity of one of the brain areas, focal seizure, partial epilepsy or partial seizure occurs [11]. In partial epilepsy, not all parts of the brain are involved, and only a certain part of the brain causes the symptoms of epilepsy. Partial epilepsy is divided into two groups:

- ✓ **Partial epilepsy with deficit in consciousness:** In this type of seizure, the person loses consciousness and may stare at one point for a period of time and not respond correctly to the voices of those around him [12]. In this type of seizure, the patient may perform movements such as rubbing hands together, walking in a circle, chewing and swallowing [13].
- ✓ **Partial epilepsy without loss of consciousness:** In this type of seizure, the level of consciousness of the patient does not decrease [14], it is even possible that the patient is completely awake and alert. He may even, after the seizure, be able to remember the events that happened during the seizure [15]. During a focal seizure, the person is unable to respond to others without losing consciousness [16]. In general, current seizures without loss of consciousness are very brief and last less than two minutes.

2- Mild epilepsy: The duration of mild epilepsy or mild seizures is shorter than severe seizures and lasts less than 15 seconds [17]. A mild seizure usually occurs in children and causes a person's brain processes to stop for a short period of time. In mild epilepsy, the person does not fall to the ground and his body does not tremble [18]. In the mild type, the affected person may be stuck to one point for a while, or the affected person's organs may experience movement disorders [19]. For example, a person bites his lip, or a person's eyelids jump.

3- Diffuse seizures or grand epilepsy: Diffuse seizures, also known as grand epilepsy, involve all parts of the brain. Diffuse seizures are divided into six different types [20], which we will examine each of them below:

- ✓ **Silent seizures:** This seizure usually occurs in children, the characteristics of this seizure include staring at a point, making movements such as squirming or blinking [21]. Sometimes, a silent seizure may lead to loss of consciousness in a person [22].
- ✓ **Atonic seizures:** In this type of seizure, muscle control is lost and the person may suddenly fall to the ground [23].
- ✓ **Tonic convulsions:** Tonic convulsions are associated with the tightening of the muscles of the back of the arms and legs [24]. The tightening of the muscles causes the person to fall down and his body trembles.

- ✓ **Clonic seizures:** clonic seizures usually involve the arms, neck and face. These types of seizures usually cause sudden muscle movements [25-27].
- ✓ **Myoclonic seizures:** Myoclonic epilepsy or myoclonic seizures cause muscles to contract suddenly and involuntarily [28-30]. Usually, this type of seizure is more common in children and teenagers. In this type of seizure, the arms and legs move suddenly and repeatedly on both sides of the body [31].
- ✓ **Tonic-clonic seizures:** Tonic-clonic seizures are among the most inflammatory epileptic seizures [32]. These types of seizures cause a person to suddenly lose consciousness. Trembling and stiffening of the body and in some cases loss of urinary control or tongue biting are the characteristics of this type of seizure [33-35].

Stimulation of the vagus nerve

One of the common methods of treating epilepsy is vagus nerve stimulation surgery. In this method, a device is surgically implanted near the clavicle and in this way a wire is connected to the vagus nerve [36-38]. This device stimulates the nerve to transmit the signal [39]. Vagus nerve stimulation is a final solution for those who have not been able to control the frequency of seizures and nervous attacks through medication and diet therapy [40]. In this type of surgery, which takes an hour and can be done on an outpatient basis. It is up to the doctor to choose the type of anesthesia [41]. After the surgical recovery, the doctor turns on the generator and controls the electric waves.

Resective surgery

In resective surgery, according to the doctor's diagnosis, the part of the brain that causes seizures is removed [42].

Corpus callostomy surgery

In this surgery, the corpus callosum is cut [43]. The corpus callosum is a group of nerve fibers that connect the two sides of the brain and allow them to communicate with each other [44]. If it is cut off, a seizure that starts on one side of the brain cannot spread to the other side [45].

Steps before epilepsy surgery

In the surgical treatment of epilepsy, a neurologist who specializes in epilepsy performs tests to find the area of the brain where the seizures begin [46]. A group of medical professionals will then meet to discuss how to perform the surgery. This group includes:

- ✓ Epileptologists [47].
- ✓ Neurologists [48].
- ✓ Neurosurgeons [49].
- ✓ Neuropsychologists [50].

The need to see a neurologist

A neurologist will try one or more medications or a combination of medications based on your age, genetic history, and level of illness to find the best way to control your seizures and level of illness. Conditions that multiply the risk of developing epilepsy include:

- ✓ Providing a platform for epilepsy in babies who are born small for their age.
- ✓ Seizures in one-month-old babies [51];
- ✓ Babies who have abnormal areas in their brains at birth;
- ✓ Bleeding in the brain [52];
- ✓ The presence of abnormal blood vessels in the brain;
- ✓ Serious brain damage or lack of oxygen to the brain;
- ✓ Brain tumors [53];
- ✓ Brain infections such as abscess, meningitis or encephalitis;
- ✓ Stroke caused by vascular occlusion;
- ✓ Cerebral Palsy;
- ✓ Mental and developmental disabilities [54];
- ✓ Seizures that occur within days of a head injury;
- ✓ Family history of epilepsy or seizures associated with fever;
- ✓ Alzheimer's disease at the end of the disease [55];
- ✓ Autism spectrum disorder;
- ✓ Seizures associated with fever that are unusually long [56];
- ✓ Long episodes of seizures or repeated seizures called status epilepticus;
- ✓ Use of illegal drugs such as cocaine [57];

- ✓ Mild head injuries such as concussions with very brief loss of consciousness do not cause epilepsy. However, the frequent effects of mild head injury and epilepsy are unknown.

Why do people get epilepsy?

Epilepsy is a common disease that affects many people. Almost half of the people suffering from this disease do not know the cause of their disease. Sometimes, people may get this disease for various reasons [58]. Next, we will examine each of the causes of epilepsy:

1- Hit on the head: Sometimes it is possible to hit people's head due to a car accident or other incidents. It is possible for a person to get this disease after being hit on the head.

2- Family history: If there is a history of this disease in the family, the person is at risk of developing convulsive disorders and epilepsy [59].

3- Brain infections: Infections such as meningitis can cause inflammation of the brain and spinal cord. Inflammation of the brain and spinal cord increase the risk of epilepsy [60].

4- Stroke in other vascular diseases: stroke and some vascular diseases can damage the brain. Any damage to the brain can cause this disease [61].

5- Dementia or Dementia: Dementia or decrease in brain activity are other factors that may cause epilepsy. Usually, those who have Alzheimer's are at risk of developing this disease [62].

6- Infectious diseases: Some diseases such as AIDS and viral encephalitis cause people to get this disease. Viral encephalitis is a virus that causes brain tissue damage [63].

7- Prenatal injuries: If the mother has improper nutrition during pregnancy, or is placed in a place where there is a lack of oxygen, it increases the risk of epilepsy for her baby [64].

Diagnosis of epilepsy

1- Neurological examination: in this liquid, the neurologist examines the patient's brain functions, movement and behavioral ability.

2- CT scan: X-rays are used to prepare cross-sectional images of the brain. Abnormal events of the brain that may cause epilepsy are investigated in CT scan. Some of these factors include: tumors, bleeding and cysts [65].

3- Spect: If the exact area of seizure onset in the brain is not determined by MRI or EEG, the Spect method is used. In this method, blood flow activity is created by a detailed 3D map. In the Spect method, the activity of the blood flow in the brain is displayed in full detail for the doctor [66].

4- MRI and functional MRI: in this device, images and details of the brain are recorded using magnetic and radio waves. When a certain part of the brain is working, a functional MRI machine can record changes in blood flow [67]. Usually, this method is used to prevent damage to specific functional areas. This test is usually performed on the patient before surgery. The cost of treating epilepsy by surgery is approximately 15 to 30 million.

5- PET: In the PET method, a very small amount of radioactive substance is injected into the patient's vein to see the active areas of the brain and determine the abnormal parts [68].

6- Brain scan or EEG: The most common test that is performed on a sick person to diagnose a disease is the brain scan. In this test, electrodes are connected to the patient's skull. These electrodes record the electrical activities of the brain. If a person has epilepsy, there will be changes in the normal patterns of his brain waves. Changes in normal brain wave patterns occur when a person is not having a seizure [69].

How to diagnose seizures

Epilepsy affects every child differently. Diagnosing seizures can be challenging, especially in very young children, or in children who cannot communicate what is happening. Seizure diagnosis depends on many factors, including the age of the child and the type of epilepsy or seizures. For example, absence seizures are not easily detected, while GTC seizures are much easier to detect. Parents should supervise older children during inappropriate times such as during play, eating or conversation. Rapid blinking, staring, or confusion can also indicate a seizure [70]. A sudden loss of muscle tone that causes a fall is another clue. In infants, symptoms can be very mild. Parents can look for times when the baby shows symptoms:

- ✓ Changes in breathing patterns [71].
- ✓ Unusual facial expressions such as eyelid or mouth movements [72].
- ✓ Muscle movements including jerks, leg cycling or periods of stiffness [73].
- ✓ Loss of consciousness or difficulty in focusing the eyes are other symptoms of seizures in babies [74].

Diagnosis and treatment of epilepsy in children

If the doctor definitely diagnoses the child with epilepsy, the child will be treated with medication. The doctor prescribes control and anticonvulsant drugs for the child. Before anticonvulsant drugs are prescribed for the

child, the doctor checks the child's liver enzymes and prescribes medicine depending on the type of liver enzymes [75]. People suffering from epilepsy should never stop their medication on their own. Children with this disease must use prescribed drugs to control seizures for the rest of their lives. If the child regularly has seizures, it is necessary to be under the control of the parents. Because the child may have seizures while doing normal activities such as walking, cycling and running [76].

How to diagnose seizures caused by fever and epilepsy in a child?

1- Recurrent seizures: Children who suffer from epileptic seizures may experience prolonged seizures several times during the month.

2- Grinding in sleep: Among the symptoms of children's convulsions in sleep, it is possible to mention grinding of the child's mouth. It should be noted that all babies coo in their sleep, but as soon as the mother hugs the baby or moves him, this state disappears and the baby calms down. If the child continues to burp after hugging, it is necessary to see a doctor. Because the child may have had a seizure in his sleep [77].

3- Seizure duration: Children suffering from epileptic seizures may have seizures for more than ten minutes and have body tremors [78].

Treatment of epilepsy by surgery

Another way to treat epilepsy is surgery. Before surgery, the doctor performs tests on the patient. If it is determined during these tests that a small area of the brain is involved and does not interfere with some vital functions such as seeing, hearing and moving, the doctor performs surgery. After the surgery, the patient needs to take medicine again, but the amount and number of medicines used to treat epilepsy in the person who has surgery is reduced [79]. In very rare cases, it is seen that after the surgery, a person suffers complications such as changes in the ability to think and recognize.

Epilepsy and pregnancy

If pregnant women are suffering from this disease, they should take anti-epileptic and anti-seizure drugs. The effective dose of the drug for pregnant women is determined by the doctor and the patient should be under the supervision of the doctor while taking the drugs [80]. Taking anticonvulsant drugs is not dangerous for pregnant women and if the drug is not taken, it can affect the fetus. According to neurologist Dr. Parviz Bahrami, not taking anticonvulsants can cause internal bleeding in the brain, fetal seizures, and in some cases fetal death. Pregnant women with this disease can give birth naturally in most cases, but if they have convulsions in the last month of pregnancy, they may have to give birth by cesarean section [81].

Home treatment of epilepsy

1- Use of vitamins: Taking vitamin B6 along with magnesium and vitamin E can be useful for the treatment of epilepsy. Doctors also recommend the use of manganese to treat seizures caused by this disease [82]. The vitamin may also help improve thinking ability in people with epilepsy.

2- Sufficient sleep: Lack of sleep can be seen as a cause of seizures and epilepsy, especially in idiopathic generalized epilepsy syndromes and temporal lobe epilepsy. People with this disease should try to have regular and continuous sleep and if they go to bed later than usual, they should wake up later the next morning. It is forbidden to consume some foods for a person suffering from this disease and it is better not to use them. Chocolate, orange, corn and soy can be mentioned among these foods [83].

epileptic attack with focal seizure; Symptoms of mild epilepsy in adults

In a focal seizure, only one part of the brain is involved. The symptoms of this seizure depend on the location of the attack in the brain. As a result, it affects the function of that part of the brain. There are two types of focal seizures:

1- Focal seizure without loss of consciousness: In this seizure, the person does not lose consciousness. It is just possible to experience unusual feelings. In some people, these symptoms appear as déjà vu or familiarity, nausea, unpleasant tastes or voice changes. Sensory symptoms such as mumbling, dizziness, or frequent blinking [84]. Also, involuntary shaking of a body part is one of the symptoms before a severe epileptic attack.

2- Focal seizure with loss of consciousness: this type of seizure is associated with impaired consciousness. The affected person may stare at a point for several minutes. After the attack, as if he was asleep, he has a confused state. Also, performing repetitive movements such as hand rubbing, lip biting, or walking in circles are among other symptoms of this type of seizure. The symptoms of focal seizures may be confused with other disorders such as migraine, narcolepsy or mental illness due to the similarity of the symptoms [85]. Therefore, you need to see a specialist to diagnose it. Depending on the patient's condition, the doctor may prescribe a drug such as vigabatrin to control focal epilepsies [7].

Epileptic attack with generalized convulsions; Symptoms of epilepsy in children

If the nerve attack affects both hemispheres of the brain, its symptoms appear in general. According to the doctor's opinion, according to the severity of the attack, epilepsy symptoms can be controlled with the help of drug treatment. Depending on the severity of the epileptic attack, the doctor controls the attack through medicinal methods such as prescribing Epilim syrup or Depakine tablets and non-medicinal methods such as stimulation of the vagus nerve.

There are six types of generalized seizures:

1- Absence seizure or petit mal: this attack often happens in children. The age at which epilepsy starts depends on the type of nerve attack. Petite Mal's seizure usually begins with staring at a spot along with eyelid twitching and lasts for about 5 to 10 seconds. This type of seizure, often accompanied by loss of consciousness, may occur many times during the day [9].

2- Tonic convulsions: these types of convulsions occur with muscle spasms in the legs, back or arms. In this case, the body suddenly stiffens for a short time and if the person is standing, it leads to him falling down [47].

3- Atonic seizure: This attack usually occurs as a sudden loss of balance and resolves quickly. In an atonic seizure, the possibility of injury is higher because the legs lose balance, causing the person to fall [38].

4- Clonic convulsions: clonic convulsions are associated with repetitive movements and continuous twitching of muscles. This type of seizure often involves the muscles of the neck, face and arms [15].

5- Myoclonic seizure: in this type of seizure, a person is faced with short-term sudden muscle movements. The effect of this attack often shows itself in a cluster or single form on the muscles of the upper body, arms and legs [39].

6- Tonic-clonic seizure: This seizure is a series of epileptic seizures known as grand mal seizures. Tonic-clonic seizures show several symptoms at the same time. In this type of epileptic attack, a person experiences loss of consciousness, body contractions and tremors. Also, a person may bite his tongue or lose control of his urine and feces [55].

Is not treating epilepsy a disability?

The Americans with Disabilities Act (ADA) prohibits discrimination against people with disabilities, including those with disabilities [29]. This applies to whether a person is able to control their seizures with medication or surgery (Table 1). People with this disease under the protection of the ADA have special job protections, which include the following:

- ✓ Employers may not ask about the medical conditions of job applicants, including this disease [22].
- ✓ Job applicants do not need to inform their employer of their illness, unless they need suitable accommodation during the application period [76].
- ✓ Employers may not rescind a job offer if the person can perform the essential duties of the job [33].
- ✓ According to the Social Security Administration, people with epilepsy may be eligible for disability benefits. This requires that people record the type and frequency of seizures while taking all prescribed medications [49].

Table 1. Forest plot showed the Causes and Treatments of Neurological Epilepsy in Children and Adults Involved in Infection and Incidence of Stroke in Patients

Study	Year	Proportion	Weight 98%	Weight %		
1	Bouloukaki et al.	2020		0.56	[0.11 – 0.66]	3.55
2	Bonyadi et al.	2009		0.66	[0.15 – 0.48]	3.33
3	Beiranvandi et al.	2022		0.48	[0.19 – 0.55]	6577
4	Bauer et al.	2022		0.64	[0.17 – 0.29]	5.03
Heterogeneity		$t^2=0.02, I^2=0.17, H^2=0.78$		0.82	[0.03 – 0.32]	
Test of $\Theta = \Theta, Q(4) = 3.02, P = 0.1$						

1	Azziz et al.	2020		0.97	[0.39 – 1.06]	5.11
2	Azhough et al.	2021		0.95	[0.54 – 1.02]	6.05
3	Baghestani et al.	2018		0.43	[0.63 – 1.01]	4.06
4	Beiranvandi et al.	2022		0.51	[0.25 – 1.08]	7.03
Heterogeneity $t^2=0.2$, $I^2= 0.04$, $H^2=0.59$				0.68	[0.22 – 1.07]	6.03
Test of $\Theta= \Theta$, $Q (4) =4.15$, $P= 0.14$						
1	Baghestani et al.	2018		0.84	[0.27 – 1.08]	6.08
2	Aldulaimi et al.	2020		0.76	[0.52 – 0.99]	5.82
3	Danesh et al.	2022		0.11	[0.54 – 0.89]	5.85
4	Gheisari et al.	2019		0.39	[0.12 – 0.99]	6.09
Heterogeneity $t^2=0.01$, $I^2= 0.14$, $H^2=0.69$				0.77	[0.19 – 1.00]	
Test of $\Theta= \Theta$, $Q (4) =3.14$, $P= 0.55$						

Conclusion

The fourth most common disorder is epilepsy. Epilepsy is directly related to the brain and is a disease of the nervous and mental diseases. In epilepsy, what happens to a person is an increase in the electrical activity of the brain and seizures. This disease sometimes causes loss of consciousness or abnormal behavior. Epilepsy is actually a type of seizure. What causes epilepsy is excessive electrical activity in the brain. Various factors can lead to the onset of seizures in this disease. A 2014 study identified stress, lack of sleep, and fatigue as the most common triggers among 104 participants. Flickering lights and heavy alcohol consumption can also cause attacks in people with this disease. Stress is one of the main causes of convulsions in people suffering from this disease, in order to treat epilepsy and control it, stressful factors must be removed from them first, but the reason is not clear. A 2016 study in the journal Science Signaling focused on this factor. The team found that the stress response of the brain in mice with this disease is different from other mice. The study also showed that a molecule that normally releases brain activity in response to stress can contribute to the onset of seizures. In 2013, researchers from the University of Oxford and University College London, both in England, reported that people with the disease were 11 times more likely to die prematurely than those without it. It seems that the risk is higher if a person has a mental illness. Suicide, accident and assault accounted for 15.8% of premature deaths. Our results have significant public health implications, says principal investigator Seena Fazel. Because about 70 million people around the world have this disease and need epilepsy treatment, and he emphasizes that careful evaluation and treatment of psychiatric disorders as part of the patient's epilepsy treatment process can help reduce the risk of premature death of these people. He added that our study also emphasizes the importance of suicide and non-vehicle accidents as the most preventable cause of death in people with this disease. Epilepsy research continues to provide new medical treatments to increase the number of people who can fully control seizures and to reduce the side effects of treatments. Seizures are the main symptom of epilepsy. In medical terms, Johns Hopkins defines the disease as two or more unprovoked seizures. Some people may have a seizure, or may experience seizures that are not due to the disease. It is even possible for doctors to misdiagnose non-epileptic seizures as epilepsy. However, this type of seizure does not originate from abnormal electrical activity in the brain. The reasons for these cases can be physical, emotional or psychological. There are different types of seizures that may be different in people with this disease. For example, in two people with this disease, the conditions may be different. For this reason, the CDC describes the disease as a reliable source spectrum disorder. The US National Institutes of Health has identified four major research initiatives related to epilepsy:

- 1- Epilepsy 4000:** This collaboration uses the genetic data of 4000 people with epilepsy to identify all the genetic components of this disease.
- 2- SUDEP Research Center:** This project seeks to understand sudden unexplained death in epilepsy.
- 3- EpiBios4Rx:** This research group is looking for ways to prevent epilepsy using animal and human studies involving traumatic brain injury and post-traumatic epilepsy.

4- Channelopathy-Related Epilepsy Research Center: This future plan uses sophisticated research methods to understand the genetic components involved in channelopathy-related epilepsy. Epilepsy has many effects on children. It is harder to diagnose in children than in adults, especially in children who cannot communicate what is happening. The diagnosis of epilepsy depends on factors such as the type of seizure or the age of the child. For example, GTC seizures are much easier to detect than absent seizures.

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