Causes of seizures

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There are many causes of seizures. The factors that lead to a seizure are often complex and it may not be possible to determine what causes a particular seizure, what causes it to happen at a particular time, or how often seizures occur.^[1]

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Historically

Ancient Greek thought pressing down onto possible causes of epilepsy, naturally found understanding of seizures within a divine origin and cause.^[2]

Diet

Malnutrition and overnutrition may increase the risk of seizures.^[3] Examples include the following:

- Vitamin B1 deficiency (thiamine deficiency) was reported to cause seizures, especially in alcoholics^{[4][5][6]}
- Vitamin B6 depletion (pyridoxine deficiency) was reported to be associated with pyridoxine-dependent seizures.^[7]
- Vitamin B12 deficiency was reported to be the cause of seizures for adults^{[8][9]} and for infants.^{[10][11]}

Folic acid in large amounts was considered to potentially counteract the antiseizure effects of antiepileptic drugs and increase the seizure frequency in some children, although that concern is no longer held by epileptologists.^[12]

Medical conditions

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Those with various medical conditions may suffer seizures as one of their symptoms. These include:

- Angelman syndrome
- Arteriovenous malformation
- Brain abscess
- Brain tumor
- Cavernoma
- Cerebral palsy
- Down syndrome
- Eclampsia
- Epilepsy
- Encephalitis
- Fragile X syndrome
- Meningitis
- Multiple sclerosis
- Systemic lupus erythematosus
- Tuberous sclerosis



Brain tumors are among many medical conditions in which seizures can be a symptom

Various other conditions have been associated not necessarily with the induction of seizures, but with lower seizure thresholds and/or increased likelihood of seizure comorbidity. Examples include depression, psychosis, obsessive-compulsive disorder (OCD), attention deficit hyperactivity disorder (ADHD), and autism, among many others.

Drugs

Adverse effect

Seizures may occur as an adverse effect of certain drugs. These include:

- Aminophylline
- Bupivicaine
- Bupropion
- Butyrophenones
- Caffeine (in high amounts of 500 mgs and above could increase the occurrence of seizures,^[13] particularly if normal sleep patterns are interrupted)
- Chlorambucil
- Ciclosporin
- Clozapine
- Corticosteroids
- Diphenhydramine
- Enflurane
- Estrogens
- Fentanyl
- Insulin
- Lidocaine
- Maprotiline
- Meperidine
- Olanzapine

- Pentazocine
- Phenothiazines (such as chlorpromazine)
- Prednisone
- Procaine
- Propofol
- Propoxyphene
- Quetiapine
- Risperidone
- Sevoflurane
- Theophylline
- Tramadol
- Tricyclic antidepressants (especially clomipramine)
- Venlafaxine
- The following antibiotics: isoniazid, lindane, metronidazole, nalidixic acid, and penicillin, though vitamin B6 taken along with them may prevent seizures; also, fluoroquinolones and carbapenems

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Use of certain recreational drugs may also lead to seizures in some, especially when used in high doses or for extended periods of time. These include amphetamines (such as amphetamine, methamphetamine, MDMA ("ecstasy"), and mephedrone), cocaine, methylphenidate, psilocybin, psilocin, and GHB.

If treated with the wrong kind antiepileptic drugs (AED), seizures may increase, as most AEDs are developed to treat a particular type of seizure.

Convulsant drugs (the functional opposites of anticonvulsants) will always induce seizures at sufficient doses. Examples of such agents, some of which are used or have been used clinically for various purposes, and others of which are naturally occurring toxins, include strychnine, bemegride, flumazenil, cyclothiazide, flurothyl, pentylenetetrazol, bicuculline, cicutoxin, and picrotoxin.

Alcohol

There are varying opinions on the likelihood of alcoholic beverages triggering a seizure. Consuming alcohol may temporarily reduce the likelihood of a seizure immediately following consumption. But after the blood alcohol content has dropped, chances may increase. This may occur, even in non-epileptics.^[14]

Heavy drinking in particular has been shown to possibly have some effect on seizures in epileptics. But studies have not found light drinking to increase the likelihood of having a seizure at all. EEGs taken of patients immediately following light alcohol consumption have not revealed any increase in seizure activity.^[15]

Consuming alcohol with food is less likely to trigger a seizure than consuming it without.^[16]

Consuming alcohol while using many anticonvulsants may reduce the likelihood of the medication working properly. In some cases, it may actually trigger a seizure. Depending on the medication, the effects vary.^[17]

Drug withdrawal

Various medicinal and recreational drugs can dose-dependently precipitate seizures in withdrawal, especially when withdrawing from high doses and/or chronic use. Examples include drugs that affect GABAergic and/or glutamatergic systems, such as alcohol (see alcohol withdrawal),^[18] benzodiazepines, barbiturates, and anesthetics, among others.

Sudden withdrawal from anticonvulsants may lead to seizures. It is for this reason that if a patient's medication is changed, the patient will be weaned from the medication being discontinued following the start of a new medication.

Missed anticonvulsants

A missed dose or incorrectly timed dose of an anticonvulsant may be responsible for a breakthrough seizure, even if the person often missed doses in the past, and has not had a seizure as a result.^[19] Missed doses are one of the most common reasons for a breakthrough seizure. A single missed dose is capable of triggering a seizure in some patients.^[20]

Incorrect dosage amount: A patient may be receiving a sub-therapeutic level of the anticonvulsant.^[21] Switching medicines: This may include withdrawal of anticonvulsant medication without replacement, replaced with a less effective medication, or changed too rapidly to another anticonvulsant. In some cases, switching from brand to a generic version of the same medicine may induce a breakthrough seizure.^{[22][23]}

Fever

In children between the ages of 6 months and 5 years, a fever of 38 °C (100.4 °F) or higher may lead to a seizure known as a febrile seizure.^[24] About 2-5% of all children will experience such a seizure during their childhood.^[25] In most cases, a febrile seizure will not lead to epilepsy.^[25] Approximately 40% of children who experience a febrile seizure will have another one.^[25]

In those with epilepsy, fever can trigger a seizure. Additionally, in some, gastroenteritis, which causes vomiting and diarrhea, can lead to diminished absorption of anticonvulsants, thereby reducing protection against seizures.^[26]

Lights

In some epileptics, flickering or flashing lights, such as strobe lights, can be responsible for the onset of a tonic clonic, absence, or myoclonic seizure.^[27] This condition is known as photosensitive epilepsy, and in some cases, the seizures can be triggered by activities that are harmless to others, such as watching television or playing video games, or by driving or riding during daylight along a road with spaced trees, thereby simulating the "flashing light" effect. Some people can suffer a seizure as a result of blinking one's own eyes.^[28] Contrary to popular belief, this form of epilepsy is relatively uncommon, accounting for just 3% of all cases.^[29]

A routine part of the EEG test involves exposing the patient to flickering lights in order to attempt to induce a seizure, to determine if such lights may be triggering a seizure in the patient, and to be able to read the wavelengths when such a seizure occurs.^[28]



Flashing light, such as that from a disco ball, can cause seizures in some people

Head injury

A severe head injury, such as one suffered in a motor vehicle accident, fall, assault, or sports injury, can result in one or more seizures that can occur immediately after the fact or up to a significant amount of time later.^[30] This could be hours, days, or even years following the injury.

A brain injury can cause seizure(s) because of the unusual amount of energy that is discharged across of the brain when the injury occurs and thereafter. When there is damage to the temporal lobe of the brain, there is a disruption of the supply of oxygen.^[31]

The risk of seizure(s) from a closed head injury is about 15%.^[32] In some cases, a patient who has suffered a head injury is given anticonvulsants, even if no seizures have occurred, as a precaution to prevent them in the future.^[33]

Hypoglycemia

Hypoglycemia, or low blood sugar, can result in seizures. The cause is an inadequate supply of glucose to the brain, resulting in neuroglycopenia. When brain glucose levels are sufficiently low, seizures may result.

Hypoglycemic seizures are usually a complication of treatment of diabetes mellitus with insulin or oral medications. Less commonly, it can be the result of excessive insulin produced by the body (hyperinsulinemia), or other causes.

Menstrual cycle

In catamenial epilepsy, seizures become more common during a specific period of the menstrual cycle.

Sleep deprivation

Sleep deprivation is the second most common trigger of seizures.^[14] In some cases, it has been responsible for the only seizure a person ever suffers.^[34] However, the reason for which sleep deprivation can trigger a seizure is unknown. One possible thought is that the amount of sleep one gets affects the amount of electrical activity in one's brain.^[35]

Patients who are scheduled for an EEG test are asked to deprive themselves of some sleep the night before in order to be able to determine if sleep deprivation may be responsible for seizures.^[36]

In some cases, patients with epilepsy are advised to sleep 6-7 consecutive hours as opposed to broken-up sleep (e.g. 6 hours at night and a 2-hour nap) and to avoid caffeine and sleeping pills in order to prevent seizures.^[37]

Parasites and stings

In some cases, certain parasites can cause seizures. The Schistosoma sp. flukes that causes Schistosomiasis. Pork tapeworm and Beef tapeworm causes seizures when the parasite create cyst at the brain. Echinococcosis, Malaria, Toxoplasmosis, African Trypanosomiasis, and many other parasitic diseases can cause seizures. Seizures have also been associated with insect stings. Reports suggest that patients stung by red imported fire ants (*Solenopsis invicta*) and *Polistes* wasps suffered seizures because of the venom.^{[38][39]}

Stress

In one study, emotional stress was reported by 30-60% prior to their seizures.^[40] This may include stress over hard work one is trying to accomplish, one's obligations in life, worries, emotional problems, frustration, anger, anxiety, or many other problems.^[41]

Stress may trigger a seizure because it affects the hormone cortisol. Stress can also affect the part of the brain that regulates emotion.^{[42][43]} Although stress can alter levels of these hormones, it remains unclear whether or not stress can directly result in an increase in seizure frequency.

'Epileptic fits' as a result of stress are common in literature and frequently appear in Elizabethan texts, where they are referred to as the 'Falling sickness'.^[44]

Breakthrough seizure

A breakthrough seizure is an epileptic seizure that occurs despite the use of anticonvulsants that have otherwise successfully prevented seizures in the patient.^{[45]:456} Breakthrough seizures may be more dangerous than non-breakthrough seizures because they are unexpected by the patient, who may have considered themselves free from seizures and therefore, not take any precautions.^[46] Breakthrough seizures are more likely with a number of triggers.^{[47]:57} Often when a breakthrough seizure occurs in a person whose seizures have always been well controlled, there is a new underlying cause to the seizure.^[48] Rates of breakthrough seizures vary. Studies have shown the rates of breakthrough seizures ranging from 11–37%.^[49] The treatment for a breakthrough seizure involves measuring the level of the anticonvulsant in the patient's system, and may include increasing the dosage of the existing medication, adding another medication in addition to the existing one, or altogether switching medications.^[50] A person with a breakthrough seizure may require hospitalization for a period of time for observation.^{[45]:498}

Other

Acute illness: Some illnesses caused by viruses or bacteria may lead to a seizure, especially when vomiting or diarrhea occur, as this may reduce the absorption of the anticonvulsant.^{[47]:67} Malnutrition: May be the result of poor dietary habits, lack of access to proper nourishment, or fasting.^{[47]:68} In seizures that are controlled by diet in children, a child may break from the diet on their own.^[51]

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