

Seizure Disorder

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THE STORY IN ONE SENTENCE

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“Long-term seizure care means picking the right anti-seizure medicine for the seizure type, teaching the person how to stay safe, and watching for the medicine's side effects.”

Normal anatomy — the body's job

The brain is a network of billions of nerve cells (neurons) that send tiny electrical pulses to each other in a balanced, organized rhythm—excitatory signals tell the next cell to fire, and inhibitory signals tell it to stay quiet, so the whole system hums along in tune.

BODY'S JOB

Nerve cells in the cortex (the wrinkled outer layer of the brain) use excitatory messengers like glutamate to pass signals forward and inhibitory messengers like GABA (the brain's main calming chemical) to put the brakes on, keeping the electrical rhythm steady so you can think, move, sense, and stay aware without any cell firing out of control.

1. A nerve cell gets a signal and decides whether to fire based on the balance of 'go' (glutamate) and 'stop' (GABA) messages hitting it.
2. When it fires, a wave of sodium and potassium flows across the cell's wall, creating a tiny electrical pulse that travels down the cell's wire (axon).
3. That pulse reaches the end of the wire and releases a messenger chemical into the gap (synapse) between this cell and the next.
4. The next cell picks up the messenger, weighs all its 'go' and 'stop' signals, and decides whether to fire—keeping the rhythm organized and preventing any runaway chain reaction.

What breaks

A seizure happens when the balance between 'go' and 'stop' signals tips too far toward 'go,' so a group of nerve cells fires wildly all at once instead of in an organized rhythm—like a spark jumping across dry grass instead of staying in a campfire ring.

CLINICAL TERM

Seizures result from excessive, hypersynchronous neuronal discharge due to an imbalance favoring excitation (glutamate-mediated) over inhibition (GABA-mediated), caused by structural lesions (stroke, tumor, cortical dysplasia, hippocampal sclerosis, traumatic brain injury), genetic channelopathies (sodium, potassium, or chloride channel mutations), metabolic derangements (hypoglycemia, low sodium (hyponatremia), low calcium (hypocalcemia), severe waste buildup in the blood (uremia)), infections (meningitis, encephalitis), autoimmune encephalitis (anti-NMDA receptor, anti-LGI1), or with no known cause (idiopathic) mechanisms.

How the body compensates

Between seizures the brain tries to restore the 'go' and 'stop' balance, and vital signs can look completely normal—but the underlying trigger (scar, tumor, chemical imbalance, gene defect) is still there, so without treatment another seizure will happen, and each seizure can lower the threshold for the next one (a process called kindling).

1. Right after a seizure (the in the groggy phase after a seizure (postictal) period), the person is confused, sleepy, or weak because the nerve cells are exhausted from firing so hard—this recovery phase can last minutes to hours.
2. The brain gradually pumps up GABA and pumps down glutamate to calm the overactive cells and restore the normal rhythm.
3. Blood sugar and oxygen are burned up during the seizure, so the body works to restock glucose and clear out lactic acid (the waste product from muscles working without enough oxygen).
4. Between seizures the person can feel and act completely normal, and vital signs (heart rate, blood pressure, oxygen) look fine—this calm window is deceptive because it hides the fact that the seizure trigger is still there.
5. Without treatment, the next seizure can come in hours, days, or months—each seizure can make the brain more excitable (kindling), raising the risk of more seizures and making them harder to stop.

6. The team watches for the dangerous crash points: status epilepticus (a seizure that will not stop) (a seizure that will not stop), SUDEP (sudden death during or after a seizure, often from a breathing or heart pause in sleep), serious head injury from a fall, drowning, or a life-threatening drug rash like Stevens-Johnson syndrome (blisters on skin and inside the mouth).

Domino effect

1. The balance between excitatory signals (glutamate) and inhibitory signals (GABA) tips too far toward excitation in a group of nerve cells. — Normally, GABA (the brain's main calming messenger) keeps glutamate (the 'go' signal) in check—but a stroke scar, tumor, gene defect, or chemical imbalance can weaken GABA or boost glutamate, so the cells fire too easily.
2. One group of nerve cells begins firing wildly and in sync, and that abnormal burst either stays local (focal seizure) or spreads across both sides of the brain at once (generalized seizure). — If the trigger is in one spot—like a scar in the hippocampus (the memory-sorting center deep in the brain) or a tumor in the frontal lobe (the front part that controls movement and planning)—the seizure starts focal; if the whole brain's wiring is too excitable (genetic or metabolic), the seizure is generalized from the start.
3. During the seizure, the person loses control of movement, awareness, or both, depending on which brain regions are involved. — If the motor cortex (the strip that controls movement) fires abnormally, you get shaking or stiffening; if the temporal lobe (the side part that handles memory and emotion) fires, you get strange feelings, déjà vu, or automatisms (repetitive actions like lip-smacking); if both sides of the thalamus (the brain's relay station deep in the middle) fire, you lose awareness and stare or shake all over.
4. The seizure burns through glucose and oxygen faster than the blood can deliver them, and muscles working without enough oxygen produce lactic acid (a waste product that makes muscles sore). — Nerve cells firing nonstop need huge amounts of energy—if the seizure lasts more than a few minutes, the brain runs low on fuel and oxygen, which can damage cells permanently, especially in the hippocampus.
5. After the seizure stops (the in the groggy phase after a seizure (postictal) period), the person is confused, exhausted, or weak because the nerve cells are depleted and need time to recharge and clear out waste. — The brain has just sprinted a marathon—it takes minutes to hours to restore glucose, clear lactic acid, and pump the sodium and potassium back to normal levels so the nerve cells can fire in rhythm again.

6. Between seizures the brain tries to re-balance 'go' and 'stop' signals, but the underlying trigger (scar, tumor, gene, chemical imbalance) remains, so another seizure will happen without treatment. — Each seizure can strengthen the abnormal electrical pathways (kindling), making the brain more excitable and the next seizure easier to trigger—this is why early treatment matters.
7. Rare but life-threatening complications include status epilepticus (a seizure that will not stop) (seizure lasting longer than five minutes, risking brain damage), SUDEP (sudden death from breathing or heart pause during or after a seizure, especially in sleep), serious injury from falls, and Stevens-Johnson syndrome (a severe drug rash). — Status epilepticus (a seizure that will not stop) is an emergency because the brain runs out of glucose and oxygen, killing cells; SUDEP happens when the seizure disrupts the brainstem centers that control breathing and heart rhythm; and a few anti-seizure medicines (especially lamotrigine, carbamazepine, phenytoin) can trigger a dangerous immune reaction in the skin.

Symptoms · what the patient feels, and why

- Sudden jerking movements that the person cannot control: A burst of electrical signals fires through the brain all at once (like a lightning storm in the wiring), making muscles clench and relax over and over without the person choosing to move.
- Staring spell with no response when you talk to them: The electrical storm locks up the thalamus (the brain's relay station that keeps you aware and awake), so the person cannot notice or answer you even though their eyes are open.
- Confusion or sleepiness right after the event: The burst of electricity drains energy from neurons (brain cells) and floods the brain with extra potassium and waste chemicals, so the brain needs time to clear the mess and recharge—like rebooting after a power surge.
- Loss of bladder or bowel control during the event: The electrical storm spreads to the motor cortex (the part of the brain that tells muscles when to squeeze and when to relax), so the sphincter muscles (the rings that hold urine and stool in) let go without warning.
- Tongue biting on the side during the event: The jaw muscles clench hard and fast during the jerking, and the tongue gets caught between the teeth—bites on the side of the tongue (not the tip) are a strong clue it was a real seizure.
- Feeling a strange smell, taste, or rising feeling in the belly right before: The electrical storm starts in a small spot—often the temporal lobe (the brain area near your ear that handles smell, taste, and gut signals)—before it spreads, so the person gets a warning sensation called an aura.

- Seizure lasts longer than 5 minutes or a second one starts before the person wakes up: The brain's normal braking system (GABA, the main calming signal, and inhibitory neurons that quiet the storm) fails to shut the electrical burst down, so the seizure keeps firing and can damage brain cells from exhaustion and low oxygen.
- First seizure ever in an adult, especially over age 25: New seizures in adults often mean something structural is wrong—like a tumor, stroke scar, brain infection, or blood vessel tangle—rather than the inherited electrical tendency seen in childhood epilepsy, so imaging and work-up are urgent.

Focused exam

- Ask what the person was doing right before the seizure started and whether they remember the beginning: If the person remembers the start — maybe smelling something strange, seeing flashing lights, or feeling their arm jerk first — the seizure began in one spot of the brain (focal onset). If they remember nothing and witnesses say the whole body stiffened or shook from the very start, the seizure fired across both sides of the brain at once (generalized onset). Knowing where the break starts tells you which medicine will actually quiet it down.
- Ask if they bit their tongue or wet themselves during the event: Real seizures hijack the muscles completely — the person cannot stop their jaw from clamping down (often biting the side of the tongue) or their bladder from emptying. Tongue bites and loss of bladder control are strong clues that the brain truly misfired, not a spell caused by stress or emotion (psychogenic nonepileptic seizure, or PNES).
- Ask how long they were confused after the event ended: After a real seizure, the brain is scrambled and needs time to reboot — this foggy, slow-to-respond phase is called the in the groggy phase after a seizure (postictal) state. The longer and deeper the confusion, the bigger the storm was. Generalized tonic-clonic seizures and focal seizures that spread widely usually leave someone confused for 15 minutes to an hour. A person who is alert and talking normally within seconds likely did not have a seizure.
- Look for a focal neurologic sign: weakness on one side, trouble speaking, or a visual field cut: Seizures often start because one piece of the brain is broken — a stroke scar, a tumor, a tangle of blood vessels, or a birth defect. That broken spot will show up as weakness, numbness, or vision loss on the opposite side of the body. Finding a focal sign tells you the seizure has a structural cause and you need imaging right away to see the break.
- Ask about triggers: missed sleep, flashing lights, stress, fever, low blood sugar, or skipped meals: The brain has a threshold for firing abnormally. Sleep loss, flashing lights (photosensitivity), stress, and low blood sugar all lower that threshold, making it easier for a seizure to happen. Identifying triggers helps the person avoid them and lowers the chance of another seizure.

- Check for a rash, especially in the first 8 weeks of starting a new anti-seizure medicine: Some anti-seizure medicines — especially lamotrigine, phenytoin, and carbamazepine — can cause a life-threatening allergic rash called Stevens-Johnson syndrome or DRESS (drug reaction with eosinophilia and systemic symptoms). The risk is highest in the first 2 months. A spreading rash with fever or mouth sores is an emergency — stop the medicine immediately.

Diagnostics · every test answers a question

- Electroencephalogram (EEG), routine and ideally sleep-deprived or prolonged → Does the brain show abnormal electrical firing between seizures, and if so, where does it start?
- MRI brain with and without contrast (or CT head if MRI not available) → Is there a structural break in the brain causing the seizures — a stroke scar, tumor, blood vessel malformation, or birth defect?
- Serum glucose → Is low blood sugar causing the seizure instead of true epilepsy?
- Serum sodium and calcium → Are severe electrolyte imbalances triggering the seizure?
- Urine drug screen or serum toxicology → Did a drug or toxin provoke the seizure?
- Serum prolactin, drawn within 10–20 minutes of the event → Was this a real seizure or a psychogenic nonepileptic seizure (PNES)?

Treatment logic

- Identify seizure type (focal vs. generalized) by witness description, patient memory, and EEG findings → Knowing where the seizure starts — one spot (focal) or both sides at once (generalized) — tells you which medicine will quiet the break. Focal seizures respond to levetiracetam, lamotrigine, or carbamazepine. Generalized seizures respond to valproate, lamotrigine, or levetiracetam. Picking the wrong type can make seizures worse (for example, carbamazepine can worsen absence or myoclonic seizures).
- Start a first-line anti-seizure medicine matched to seizure type: levetiracetam or lamotrigine for focal-onset; valproate (avoid in women of childbearing age) or lamotrigine for generalized-onset → These medicines stabilize the brain's electrical system by either boosting the brain's natural calming signal (GABA) or dampening overactive sodium or calcium channels. This keeps the abnormal electrical wave from spreading and causing shaking, staring, or loss of awareness. Most people (60–70%) become seizure-free on the first or second medicine tried.

- Obtain brain MRI to find structural causes (stroke, tumor, malformation, hippocampal sclerosis) → Imaging shows you the physical break causing the seizures. If you find a removable tumor, operable scar, or blood vessel tangle, surgery may cure the epilepsy instead of requiring lifelong medicine. If you find hippocampal sclerosis (common in temporal lobe epilepsy), you know surgery is an option if medicines fail.
- Titrate medicine dose slowly (especially lamotrigine) and recheck at 2–4 weeks; monitor for rash and measure drug levels if seizures continue → Slow titration prevents allergic rashes (Stevens-Johnson syndrome) and reduces side effects like dizziness and nausea. Measuring drug levels (for phenytoin, valproate, carbamazepine) tells you if the dose is too low to work or too high and causing toxicity. Levetiracetam and lamotrigine levels are less useful because their effect does not match blood level reliably.
- Counsel on safety: no driving until seizure-free per state law (usually 3–12 months), avoid swimming alone, avoid heights and heavy machinery, and shower instead of bath → Seizures can strike without warning. A seizure while driving, swimming, or on a ladder can cause death. State laws restrict driving after a seizure to protect the person and others. These rules prevent injury during the vulnerable period before seizures are controlled.
- Prescribe folate (at least 0.4–1 mg daily) for all women of childbearing age on anti-seizure medicines; discuss teratogenicity (especially valproate) and interaction with hormonal birth control → Anti-seizure medicines (especially valproate and phenytoin) raise the risk of birth defects — valproate causes spina bifida and developmental delays in 10% of pregnancies. Folate lowers neural tube defect risk. Some medicines (phenytoin, carbamazepine, oxcarbazepine) speed up birth control breakdown, making pills less effective. Switching medicine or adding barrier contraception prevents unplanned pregnancy and birth defects.
- If seizures continue despite trying two appropriate medicines at therapeutic doses, refer to an epilepsy center for drug-resistant epilepsy evaluation (surgery, vagus nerve stimulation, responsive neurostimulation, or ketogenic diet) → Surgery can remove the broken piece of brain (if seizures start in one removable spot), curing epilepsy in 60–80% of surgical candidates. Vagus nerve stimulation (VNS) or responsive neurostimulation (RNS) devices interrupt abnormal signals, reducing seizure frequency by 50% or more in people who are not surgical candidates. The ketogenic diet (very high fat, very low carb) changes brain metabolism and stops seizures in some people, especially children.

Medications

Levetiracetam (Keppra) · Antiseizure medication (works for both focal and generalized seizures)

Levetiracetam calms overexcited neurons (brain cells that send signals) by attaching to a protein called SV2A on the storage bubbles that hold neurotransmitters (the chemical messengers neurons use to talk to each other). When the drug locks onto SV2A, it slows down

the release of excitatory signals—like turning down the volume on neurons that are firing too fast—so the electrical storm of a seizure is less likely to start or spread.

1. Levetiracetam enters the bloodstream and crosses into the brain.
2. It binds to the SV2A protein on synaptic vesicles (the storage bubbles at the ends of neurons).
3. This binding changes how easily the vesicles release their excitatory neurotransmitters (the 'go' signals).
4. Fewer 'go' signals mean neurons fire less wildly, so abnormal electrical bursts—the root of a seizure—are less likely to ignite or spread.

SAFETY WATCH

Mood changes: Some people feel irritable, anxious, or sad. Call your doctor if you notice new anger, depression, or thoughts of hurting yourself. · Drowsiness or dizziness, especially in the first few weeks—be careful driving or using machinery until you know how you feel. · Rare but serious: Severe skin rash (stop the drug and get help right away) or low blood counts (fever, easy bruising, or infections that won't go away). · Generally safe in pregnancy (one of the preferred options), but always discuss with your doctor and take folic acid (folate) to lower the risk of birth defects. · Few drug interactions, so it usually plays well with birth control pills and other medications.

Lamotrigine (Lamictal) · Antiseizure medication (sodium-channel blocker; works for focal and many generalized seizures, including absence)

Lamotrigine blocks voltage-gated sodium channels—tiny gates on the surface of neurons that swing open to let sodium ions rush in and trigger an electrical spike. By holding these gates partly closed, lamotrigine keeps neurons from firing rapid bursts of signals. This dampens the runaway electrical activity that causes a seizure, especially in the cortex (the brain's outer layer where most seizures start).

1. Lamotrigine enters the bloodstream and crosses into the brain.
2. It binds to voltage-gated sodium channels on neuron membranes, especially when those channels are already open or recovering.
3. By slowing the channels' return to the ready state, lamotrigine makes it harder for the neuron to fire again quickly.
4. This reduces repetitive, high-frequency firing—the electrical pattern of a seizure—so abnormal bursts are less likely to start or spread.

SAFETY WATCH

Serious skin rash (Stevens-Johnson syndrome): Start at a very low dose and increase slowly—especially if you are also taking valproate, which raises lamotrigine levels. Any new rash, fever, or mouth sores means stop the drug and call your doctor immediately. · Dizziness, headache, blurred or double vision, especially when the dose goes up too fast. · Mood changes or insomnia in some people. · Generally safe in pregnancy (one of the preferred options), but take folic acid and discuss with your doctor. · Drug interactions: Valproate doubles lamotrigine levels (so you need a lower dose), and some other drugs (like birth control pills and certain other antiseizure medications) can lower lamotrigine levels (so you may need a higher dose).

Valproate (valproic acid, Depakote) · Antiseizure medication (broad-spectrum; works for focal and all types of generalized seizures)

Valproate works through several pathways at once. It blocks voltage-gated sodium channels (like lamotrigine does), slowing rapid neuron firing. It also blocks T-type calcium channels in the thalamus (the brain's relay station), which stops the rhythmic 3-Hz spike-and-wave pattern of absence seizures. Finally, it boosts GABA—the brain's main calming neurotransmitter—by blocking the enzyme that breaks GABA down and by helping convert glutamate (an excitatory signal) into GABA. Together, these actions quiet overexcited neurons and prevent seizures from starting.

1. Valproate enters the bloodstream and crosses into the brain.
2. It slows the recovery of voltage-gated sodium channels, making it harder for neurons to fire rapid bursts.
3. It blocks T-type calcium channels in the thalamus, breaking the rhythmic firing loop of absence seizures.
4. It increases GABA levels by inhibiting GABA transaminase (the enzyme that breaks GABA down) and by boosting glutamic acid decarboxylase (the enzyme that makes GABA from glutamate).
5. More GABA and fewer excitatory bursts mean the brain is less likely to slip into the electrical storm of a seizure.

SAFETY WATCH

AVOID in pregnancy: Valproate causes a high risk of birth defects (spina bifida, heart defects, cleft palate) and developmental delays in children. Women of childbearing age should use reliable birth control and discuss safer alternatives (like lamotrigine or levetiracetam) with their doctor. · Weight gain and increased appetite are common. · Tremor (shaking hands), hair loss (usually grows back), and nausea. · Liver damage (rare but serious): Get liver function tests before starting and regularly while on the drug. Watch for new fatigue, yellow skin or eyes, dark urine, or belly pain. · Pancreatitis (inflamed pancreas): severe belly pain, nausea, and vomiting—stop the drug and get help right away. · Low platelet count (makes you bruise or bleed easily) or high ammonia levels (causes confusion). · Drug interactions: Valproate raises levels of lamotrigine and some other drugs, so doses may need adjustment.

Lacosamide (Vimpat) · Antiseizure medication (sodium-channel blocker; used mainly for focal seizures)

Lacosamide enhances slow inactivation of voltage-gated sodium channels. Unlike other sodium-channel blockers that act on fast inactivation, lacosamide works on a slower, longer-lasting closed state of the channel. By keeping sodium channels shut for a longer stretch after they fire, lacosamide makes it harder for neurons to fire repetitively—like giving the 'off' switch a longer hold. This is especially effective at stopping the rapid, rhythmic bursts that characterize focal seizures.

1. Lacosamide enters the bloodstream and crosses into the brain.
2. It binds to voltage-gated sodium channels and promotes their slow inactivation—a state where the channel stays closed longer.
3. This prolongs the 'rest' period after each firing, preventing the neuron from firing again too quickly.
4. By selectively quieting hyperexcitable neurons, lacosamide stops the rapid, repetitive bursts that ignite and spread a focal seizure.

SAFETY WATCH

Dizziness, headache, blurred or double vision, especially when starting or increasing the dose. · Nausea and unsteadiness (ataxia)—be careful with activities that require balance or coordination. · Heart rhythm changes: Lacosamide can prolong the PR interval (a delay in the heart's electrical signal). Get an ECG before starting if you have heart disease or take other heart medications. · Rare but serious: Severe skin rash or liver problems—any new rash, fever, or yellow skin means call your doctor right away. · Mood changes or suicidal thoughts (as with all antiseizure drugs)—watch for new depression or anxiety and report it. · Few drug interactions, but always tell your doctor about all medications you take.

Carbamazepine (Tegretol) · Antiseizure medication (sodium-channel blocker; used for focal seizures and generalized tonic-clonic seizures; AVOID in absence and myoclonic seizures)

Carbamazepine blocks voltage-gated sodium channels on neurons, just like lamotrigine. By holding these channels in an inactive state, it prevents neurons from firing rapid, repetitive bursts of electrical signals. This is effective for focal seizures and generalized tonic-clonic seizures, which involve sustained high-frequency firing. However, carbamazepine can worsen absence and myoclonic seizures—types driven by different electrical rhythms—so it should NOT be used for those.

1. Carbamazepine enters the bloodstream and crosses into the brain.
2. It binds to voltage-gated sodium channels, stabilizing them in the inactive state.
3. This makes it harder for neurons to fire again quickly, dampening the repetitive bursts that drive focal and tonic-clonic seizures.
4. By quieting overactive neurons, carbamazepine reduces the chance of a seizure starting or spreading.

SAFETY WATCH

Serious skin rash (Stevens-Johnson syndrome or toxic epidermal necrolysis): Risk is much higher in people of Asian descent who carry the HLA-B*1502 gene—get genetic testing before starting if you are of Asian ancestry. Any new rash, fever, or mouth sores means stop the drug and get help immediately. · Low sodium (hyponatremia): causes confusion, headache, nausea, or seizures. More common in older adults. · Dizziness, double vision, and unsteadiness, especially when starting or increasing the dose. · Bone marrow suppression (low blood counts): Get blood tests regularly. Watch for fever, sore throat, easy bruising, or unusual fatigue. · Liver problems (rare): yellowing of skin or eyes, dark urine, or belly pain—call your doctor. · Drug interactions: Carbamazepine lowers levels of many drugs, including birth control pills (so they may not work), warfarin, and other antiseizure medications. It also induces its own metabolism, so your dose may need adjustment over time. · Generally avoided in pregnancy (can cause birth defects); discuss safer alternatives with your doctor and take folic acid if you must use it.

Phenytoin (Dilantin) · Antiseizure medication (sodium-channel blocker; used for focal and generalized tonic-clonic seizures; also used for status epilepticus (a seizure that will not stop))

Phenytoin blocks voltage-gated sodium channels on neurons, preventing the rapid, repetitive firing that drives seizures. It works by keeping sodium channels in an inactive state after they fire, so the neuron cannot immediately fire again. This is especially effective for stopping focal seizures and generalized tonic-clonic seizures. Phenytoin is also one of the standard drugs for status epilepticus (a seizure that will not stop) (a prolonged, life-threatening seizure) because it works quickly when given intravenously.

1. Phenytoin enters the bloodstream (by mouth or IV) and crosses into the brain.
2. It binds to voltage-gated sodium channels and stabilizes them in the inactive state.
3. This prevents the rapid, high-frequency bursts of action potentials (electrical spikes) that characterize a seizure.
4. By selectively quieting overactive neurons, phenytoin stops seizures from starting or spreading.

SAFETY WATCH

Gum overgrowth (gingival hyperplasia): Practice good oral hygiene and see a dentist regularly. · Excess body hair (hirsutism) and coarsening of facial features with long-term use. · Dizziness, unsteadiness (ataxia), slurred speech, and double vision, especially if levels get too high. · Serious skin rash (Stevens-Johnson syndrome): More common in people of Asian descent with the HLA-B*1502 gene. Any new rash, fever, or mouth sores means stop the drug and get help immediately. · Bone health: Long-term use can lower vitamin D and weaken bones—consider vitamin D and calcium supplements. · Low folic acid: Take folic acid, especially if you are pregnant or planning pregnancy (though phenytoin carries a risk of birth defects, so discuss alternatives). · Many drug interactions: Phenytoin affects and is affected by dozens of medications, including birth control pills, warfarin, and other antiseizure drugs. Blood levels can swing unpredictably, so regular monitoring is essential. · IV phenytoin can cause severe tissue damage if it leaks outside the vein, and can cause low blood pressure or heart rhythm problems if given too fast.

Ethosuximide (Zarontin) · Antiseizure medication (T-type calcium-channel blocker; used specifically for absence seizures)

Ethosuximide blocks T-type calcium channels in the thalamus—the brain's deep relay station that coordinates rhythmic electrical activity. In absence seizures, neurons in the thalamus fire in a synchronized 3-Hz (three-per-second) spike-and-wave pattern, briefly disconnecting the cortex from awareness. By blocking the T-type calcium channels, ethosuximide breaks this abnormal rhythm and prevents the brief lapses in consciousness that define absence seizures. It does NOT work for other seizure types.

1. Ethosuximide enters the bloodstream and crosses into the brain.
2. It binds to and blocks T-type calcium channels on neurons in the thalamus.
3. This prevents the rhythmic, synchronized bursts of calcium-driven firing that create the 3-Hz spike-and-wave pattern.
4. Without this abnormal rhythm, the brief lapses in awareness (absence seizures) do not occur.

SAFETY WATCH

Stomach upset: nausea, vomiting, belly pain, or loss of appetite—taking it with food may help. · Headache, dizziness, or drowsiness. · Mood changes: irritability, trouble concentrating, or rarely depression or suicidal thoughts—watch for these and report them. · Rare but serious: Blood disorders (low white cells or platelets) or severe skin rash—get regular blood tests and call your doctor for any new rash, fever, sore throat, or easy bruising. · Generally considered safer in pregnancy than valproate, but always discuss risks and benefits with your doctor and take folic acid.

Topiramate (Topamax) · Antiseizure medication (broad-spectrum; works through multiple mechanisms for focal and generalized seizures)

Topiramate works through several pathways. It blocks voltage-gated sodium channels (like lamotrigine and carbamazepine), preventing rapid neuron firing. It also boosts GABA—the brain's main calming signal—by acting on GABA-A receptors, and it blocks AMPA/kainate receptors for glutamate (the brain's main excitatory signal), further reducing overactivity. Finally, it weakly blocks carbonic anhydrase (an enzyme), which may help by shifting brain pH. Together, these actions quiet overexcited neurons and prevent seizures.

1. Topiramate enters the bloodstream and crosses into the brain.
2. It blocks voltage-gated sodium channels, slowing repetitive firing of neurons.
3. It enhances GABA-A receptor activity, increasing the calming GABA signal.
4. It blocks AMPA/kainate glutamate receptors, reducing excitatory drive.
5. It inhibits carbonic anhydrase, which may help stabilize neuron activity.
6. The combined effect dampens the electrical storms that cause seizures.

SAFETY WATCH

Cognitive side effects ('Dopamax'): trouble finding words, slowed thinking, memory problems, or confusion. These often improve if the dose is lowered or increased more slowly. · Tingling in hands and feet (from carbonic anhydrase inhibition). · Weight loss and loss of appetite (unlike many antiseizure drugs, which cause weight gain). · Kidney stones: Drink plenty of water. Watch for severe back or belly pain, blood in urine. · Rare but serious: Glaucoma (sudden eye pain, vision changes) or high acid in the blood (metabolic too much acid in the blood (acidosis))—call your doctor right away. · Birth defects: Topiramate increases the risk of cleft lip/palate. Women of childbearing age should use reliable birth control and take folic acid; discuss safer alternatives with your doctor. · Can lower levels of birth control pills, so they may not work as well—use backup contraception.

Oxcarbazepine (Trileptal) · Antiseizure medication (sodium-channel blocker; used for focal seizures; AVOID in absence and myoclonic seizures)

Oxcarbazepine is closely related to carbamazepine and works the same way: it blocks voltage-gated sodium channels on neurons, preventing the rapid, repetitive firing that drives focal seizures and generalized tonic-clonic seizures. It is often chosen over carbamazepine because it has fewer drug interactions and a lower risk of serious skin reactions, though it still should NOT be used for absence or myoclonic seizures.

1. Oxcarbazepine is converted in the body to its active form (MHD).
2. MHD crosses into the brain and binds to voltage-gated sodium channels.
3. It stabilizes the channels in the inactive state, making it harder for neurons to fire rapidly.
4. This dampens the repetitive bursts that ignite focal and tonic-clonic seizures.

SAFETY WATCH

Low sodium (hyponatremia): causes confusion, headache, nausea, or even seizures. More common in older adults. Get sodium levels checked regularly. · Dizziness, double vision, drowsiness, and unsteadiness. · Serious skin rash (Stevens-Johnson syndrome): Risk is lower than with carbamazepine but still present, especially in people with the HLA-B*1502 gene (more common in Asian populations). Any new rash, fever, or mouth sores means stop the drug and get help immediately. · Can lower levels of birth control pills, so they may not work—use backup contraception. · Generally avoided in pregnancy (can cause birth defects); discuss alternatives with your doctor and take folic acid if you must use it.

Clobazam (Onfi) · Benzodiazepine antiseizure medication (GABA enhancer; used as add-on therapy for focal and generalized seizures, and for Lennox-Gastaut syndrome)

Clobazam is a benzodiazepine that boosts the effect of GABA—the brain's main calming neurotransmitter. It binds to GABA-A receptors (the brake pedal on neurons) and makes them more sensitive to GABA, so each GABA molecule opens the chloride channel wider and longer. More chloride flowing into the neuron makes it harder to fire, which quiets overexcited neurons and prevents seizures. Clobazam is used as an add-on (adjunctive) medication, not usually as the only drug.

1. Clobazam enters the bloodstream and crosses into the brain.
2. It binds to a specific site on GABA-A receptors, separate from where GABA itself binds.
3. This binding changes the receptor's shape, making it more responsive to GABA.
4. When GABA binds, the chloride channel opens wider and stays open longer, letting more chloride ions flow in.

5. The neuron becomes more negatively charged (hyperpolarized) and less likely to fire, dampening the electrical bursts that cause seizures.

SAFETY WATCH

Drowsiness, dizziness, and fatigue—be careful driving or using machinery. · Drooling, unsteadiness (ataxia), or slurred speech, especially in children. · Tolerance and dependence: Your body can get used to the drug, so it may work less well over time. Do NOT stop suddenly—withdrawal can trigger seizures. Always taper off slowly under your doctor's guidance. · Mood or behavior changes: irritability, aggression, or (rarely) depression or suicidal thoughts. Watch for these and report them. · Serious skin rash (Stevens-Johnson syndrome or toxic epidermal necrolysis): rare but can be life-threatening. Any new rash with fever or blisters means stop the drug and get help immediately. · Respiratory depression (slowed breathing): more likely if you also take opioids, alcohol, or other sedatives—avoid combining these.

Red flags

- Seizure lasts longer than 5 minutes or repeats without the person waking up in between (status epilepticus—a medical emergency that can kill brain cells)
- New seizure in an adult, especially over age 25 (raises worry for tumor, stroke, or infection)
- Fever, stiff neck, or severe headache with the seizure (may be meningitis or encephalitis—brain infection)
- Sudden weakness or numbness on one side after the seizure clears (could be a stroke instead of or along with the seizure)
- Person is pregnant (seizures can harm the baby, and eclampsia—dangerously high blood pressure in pregnancy—can cause seizures and needs immediate treatment)

Nursing priorities

1. Place the patient on continuous pulse oximetry and position them on their side if they have altered mental status or are still in the in the groggy phase after a seizure (postictal) period — Seizures cause tongue falling back and blocking the airway plus increased saliva, so side-lying prevents aspiration (breathing in saliva or vomit into lungs) and keeps oxygen saturation above 94 percent to protect the brain

2. Establish IV access and check fingerstick glucose immediately if the patient is still seizing or has not returned to baseline mental status within 10 minutes — Low blood sugar (Hypoglycemia) (low blood sugar below 70) mimics seizures and causes real seizures if severe, while IV access allows urgent medicine delivery if seizure continues into status epilepticus (a seizure that will not stop) (seizure lasting over 5 minutes), which causes permanent brain damage
3. Protect the patient from injury by padding bedrails, removing hard objects from the bedside, and staying within arm's reach during the first 24 hours after a witnessed seizure — Patients can have repeat seizures within the first day before anti-seizure medicine reaches therapeutic levels (effective blood concentration), and falls or head strikes during seizure cause skull fractures and intracranial bleeding (blood inside the skull)
4. Document exact seizure duration, body parts involved, eye movements, and responsiveness level every 2 minutes during the event using the hospital seizure flowsheet — Accurate description of focality (which body part started first) versus bilateral movements (both sides at once) guides the neurologist to classify seizure type correctly and pick first-line medicine, while duration over 5 minutes triggers status epilepticus (a seizure that will not stop) protocol with benzodiazepines
5. Hold all oral intake and keep the patient NPO until they can follow 3-step commands and swallow water without coughing — The in the groggy phase after a seizure (postictal) period causes depressed level of consciousness and weak gag reflex (throat protection), so eating or drinking before full alertness returns causes aspiration pneumonia (lung infection from food or liquid in airways)
6. Teach the patient and family seizure precautions including no driving, no swimming alone, no climbing ladders, and showering instead of bathing until seizure-free for the time required by state law — Sudden loss of consciousness during a seizure causes drowning in bathtubs, traffic accidents killing the patient and others, and traumatic falls from heights, so these restrictions prevent death until seizures are controlled for 3 to 12 months depending on location
7. Review the exact dosing schedule and emphasize taking lamotrigine at the same times every day, never doubling a dose if one is missed, and reporting any new rash within 24 hours — Lamotrigine causes Stevens-Johnson syndrome (life-threatening skin reaction with blisters and skin peeling) if dose is increased too fast or if patient misses doses then restarts, and consistent timing keeps blood levels stable to prevent breakthrough seizures
8. Schedule the 2-week follow-up appointment before discharge and confirm the patient knows to call the clinic if seizures increase, if they have more than 3 seizures in one week, or if side effects like dizziness prevent walking safely — Anti-seizure medicine blood levels must be checked at 2 weeks to ensure therapeutic range, and uncontrolled seizures or severe side effects require immediate dose adjustment or medicine change to prevent status epilepticus (a seizure that will not stop) and improve quality of life

Sources

- American Epilepsy Society
- American Academy of Neurology (AAN) seizure guidelines
- International League Against Epilepsy (ILAE)
- CDC Epilepsy Program

Last reviewed: 2026-07-07