Seizures

Description/Etiology
A seizure is an episode of sudden, excessive electrical discharge in the brain that results in alterations in consciousness and/or uncontrollable motor activity. Seizures can manifest as disturbances in behavior, sensation, or perception, and can range from mild to incapacitating. Seizures usually occur without warning and last a few seconds to several minutes. The term epilepsy is used to describe a group of syndromes that are characterized by recurrent seizures (for information, see Quick Lesson About … Epilepsy: an Overview).

Seizures are classified as **generalized or partial** (also called focal). Generalized seizures affect both hemispheres of the brain and always result in loss of consciousness. Generalized seizures are classified as follows:

- **Generalized tonic-clonic seizures** (GTCS; formally called grand mal seizures) begin with a tonic phase in which the person vocalizes, loses awareness, and collapses with stiffened muscles; this seizure activity quickly progresses to a clonic phase in which the person exhibits jerking and twitching of the muscles in all four limbs. A GTCS usually lasts 1–3 minutes. The person can develop cyanosis due to respiratory depression, become incontinent of urine and/or stool, and/or salivate heavily. Severe headache can follow. GTCSs begin on both sides of the brain simultaneously; they are classified as secondary GTCSs if they occur following a brief partial seizure.

- **Absence seizures** (formerly called petit mal seizures) are often misinterpreted as daydreaming or inattentiveness because the affected person typically ceases activity, stares blankly (usually for less than 10 seconds), is unaware of his/her surroundings, and abruptly regains alertness, usually without realizing that anything has occurred. Rapid blinking sometimes accompanies an absence seizure, and the individual’s eyes might roll upwards. Some individuals experience as many as several hundred absence seizures in a 24-hour period. Absence seizures can be inherited and in some cases individuals with absence seizures begin having tonic-clonic seizures. Absence seizures most often begin in childhood and abate during adolescence, although cases that persist into adulthood have been reported.

- **Atonic seizures** cause a sudden loss of muscle tone that results in the person falling, dropping objects, and/or nodding the head involuntarily. Atonic seizures typically last for only a few seconds, but severe fall-related injuries (e.g., head injury) can result.

- **Myoclonic seizures** cause sudden jerking of one part of the body (e.g., the arm or leg), during or after which the person might fall. Myoclonic seizures are very brief but can result in severe fall-related injuries.

- **Partial seizures** affect a small area of the brain and might not always result in loss of consciousness. Partial seizures are classified as simple or complex.

- **Simple partial seizures** involve motor, sensory, autonomic, or psychic manifestations without loss of consciousness; only a finger or hand might shake or the mouth might twitch uncontrollably.

- **Complex partial seizures** are characterized by impaired consciousness and either motionlessness or automatic and inappropriate movement; excessive emotional reactions of fear, anger, or elation can occur (e.g., laughter, loud expression of profanity) and auditory or visual hallucinations can occur.

Seizures can be idiopathic (also called primary) or occur secondary to another condition. Genetics can contribute to the development of seizures, and seizures can occur secondary to...
many conditions including birth trauma; head injury; bacterial, viral, or parasitic infection; eclampsia; carbon monoxide or lead poisoning; circulatory malformation; congenital malformation; a metabolic/nutritional disorder; drug and/or alcohol intoxication or withdrawal; a brain tumor or abscess; stroke; or fever.

Treatment includes the use of pharmacologic agents (e.g., anticonvulsants) to control seizure activity and other interventions that are specific to an identified underlying cause. Surgery is indicated to treat any underlying cause of epilepsy including intracranial tumor, abscess, cyst, vascular anomaly, or to excise a discrete area of the brain (e.g., a focus area that is impaired after trauma or anoxia) identified as causing seizure activity. Surgical implantation of a vagus nerve stimulator (VNS; i.e., a generator that delivers electrical signals to the brain at timed intervals) can reduce partial seizure activity.

Facts and Figures
Lifetime risk of experiencing at least one seizure is ~ 9%; lifetime likelihood of being diagnosed with epilepsy is almost 3%, but the prevalence of active epilepsy is ~ 0.8%. About 150,000 American adults experience a first unprovoked seizure each year. Without treatment, an estimated 21–45% of adults with a first unprovoked seizure experience recurrence within 2 years. More than 60% of patients treated with anticonvulsants achieve seizure-free status without adverse effects. When a patient is seizure-free for 2–5 years, the physician might consider discontinuing anticonvulsant therapy; however, 40–50% of adults and 25% of children experience relapse of seizure following discontinuation of anticonvulsant therapy. About 75% of these relapses occur during the first year after discontinuation of therapy. Risk of sudden death is increased 2.3-fold in patients with epilepsy compared to the general population.

Risk Factors
Risk factors for seizures include acquired brain disorders (e.g., substance abuse), a family history of seizures, cerebral palsy, mental retardation, traumatic brain injury (7–57% of patients with traumatic brain injury develop epilepsy and are diagnosed with posttraumatic epilepsy), and a history of stroke. Seizures can result from accidental or intentional overdose of antidepressants. Genetic syndromes associated with increased seizure risk include Angelman syndrome, Rett syndrome, Pitt-Hopkins syndrome, tuberous sclerosis, Prader-Willi syndrome, and Sturge-Weber syndrome. Febrile seizures are most often triggered by viral infection, particularly human herpes virus 6.

Signs and Symptoms/Clinical Presentation
Aura (i.e., experiencing a specific feeling or sensation immediately before seizure) symptoms can include a sinking or rising feeling, fear, déjà vu, detachment, hallucinations (e.g., seeing spots, smelling a specific odor), and headache. During a seizure, patients might bite their tongue or clench their jaws. Apnea, increased heart rate, dilated pupils, sweating, incontinence, salivation, blank staring, and lip smacking can occur. After a generalized seizure, confusion, headache, and fatigue are common.

Assessment
› Patient History
  • Ask about medical history, including details of seizure activity
› Laboratory Tests
  • Testing for underlying conditions can include
    – CBC, BUN, CSF analysis, and UA to assess for infection
    – blood glucose and electrolyte (e.g., calcium, magnesium, and sodium) levels to assess for metabolic disturbances
    – liver and renal function tests if organ failure is suspected
    – toxicology screening to assess for substances that when taken in excess or withdrawn can cause seizures
› Other Diagnostic Tests/Studies
  • Electroencephalogram (EEG) can identify the location of seizure activity in the brain and show abnormal brain waves for diagnosis and to help classify the seizure type and provide information for prognosis
  • CT scan or MRI can identify focal brain abnormalities (e.g., tumors or aneurysms)

Treatment Goals
› Reduce Risk for Injury/Complications, Improve Coping Mechanisms, and Educate
  • Assess physiologic status and for seizure activity; maintain a patent airway and provide suction, as ordered by the treating clinician. Monitor vital signs, neurologic and mental status, and laboratory/other diagnostic test results. Follow facility protocols for seizure and fall precautions to maintain patient safety and prevent injury, and frequently evaluate for injury
Position patient in a side-lying position with a pillow under the head, padded side rails, and lowered bed; remove constrictive clothing and glasses, limit activity, and reduce environmental stimuli

- Administer anticonvulsant agents (e.g., PHENobarbital, valproic acid, carBAMazepine), as ordered by the treating clinician; monitor closely for adverse drug effects, including drug toxicity
- Provide/assist with intake of fluids and nutrition, as ordered by the treating clinician
- If patient becomes a surgical candidate, follow facility pre- and postsurgical protocols; reinforce pre- and postsurgical education and verify informed consent. Monitor closely for postsurgical complications
- Assess patient anxiety level, coping ability, and for knowledge deficits regarding seizures; provide emotional support, educate, encourage discussion about seizure pathophysiology, potential complications, treatment risks and benefits, individualized prognosis, and lifestyle changes that decrease risk for injury (for details, see Red Flags and What Do I Need to Tell the Patient/Patient’s Family?, below)
- As appropriate, request referral to a mental health clinician for counseling regarding strategies for coping with the diagnosis, and to a social worker for identification of resources for support groups, in-home services, transportation, educational programs, and trusted Websites for additional information

Food for Thought

- In November 2013, the U.S. Food and Drug Administration approved a new neurostimulation system for treatment of drug-resistant partial-onset epilepsy. The NeuroPace RNS System, a device that is implanted in the brain, senses and records brain activity and delivers electrical stimulation when abnormal electrical activity is detected
- Although a ketogenic diet is effective in some cases of refractory seizures, fewer than 10% of patients remain on the diet for more than 1 year. (For information regarding ketogenic diet, see the series of related Evidence-Based Care Sheets)
- Menopause can complicate epilepsy management for several reasons, including potential interactions between sex hormones and antiepileptic drugs and the need to use non-enzyme-inducing antiepileptic drugs (e.g., lamoTRIgine) in women at risk of osteoporosis; menopausal women with epilepsy should not be treated with systemic hormonal replacement therapy, but can use local low-dose estrogen
- Surgery is often considered in children with epilepsy that is unresponsive to other therapies and can result in long-term seizure control rates of 50–70% in appropriately selected patients. Laser ablation therapy is an emerging minimally invasive alternative to craniotomy that appears to be associated with fewer complications, better neuropsychologic outcomes, and similar short-term seizure control rates
- Cochrane reviewers analyzed data from six studies and concluded that immediate initiation of anticonvulsant therapy in patients with a first unprovoked seizure reduces the likelihood of relapse at 1 year by 51% and increases the probability of 5-year remission by 25%, compared to placebo, deferred treatment initiation, or no treatment (Leone et al., 2016)
- Iranian researchers evaluating 88 neonates with a history of neonatal seizures concluded that hypoxic-ischemic injury and hypoglycemia were the most common cause of seizures among the neonates, who experienced a mortality rate of 11.36% during a mean follow-up period of approximately 21 months. The investigators recommended that efforts be made to improve fetal and neonatal safety during labor and delivery, and to promote early breastfeeding (Nemati et al., 2018)
- A new Epilepsy Nursing Communication Tool (ENCT) might be a promising aid for nurses who are not epilepsy specialists to better manage care for patients with epilepsy. Researchers tested the tool with ten nurses, who gave median ratings of 4 to 4.5 of 5 points on ease of use, usefulness, and acceptability. The investigators concluded that the ENCT might help nurses provide more effective care for patients with epilepsy by facilitating discussion on important disease management topics (Buelow et al., 2018)
- Children with insufficient vitamin D might be at greater risk for development of febrile seizures. Investigators performing a cross-sectional study of 40 children with a history of febrile seizures found that 80% of the patients had insufficient serum levels of vitamin D. The researchers concluded that a lack of vitamin D could play a causal role in febrile seizures, and recommended further study of the issue (Shariatpanahi et al., 2018)

Red Flags

- Never restrain a patient during a seizure or force objects into the mouth
- Status epilepticus (SE), is a potentially life-threatening condition and seizure activity can continue up to 30 minutes; SE requires immediate interventions to prevent brain damage or death. SE can result from rapid withdrawal of anticonvulsants (for information, see Quick Lesson About ... Status Epilepticus)
- Use of agents containing valproate should be avoided in pregnant women with epilepsy unless other medications are not effective or are otherwise unacceptable
- A seizure can be a sign of a life-threatening condition such as stroke or meningitis
Certain anticonvulsants decrease the efficacy of oral contraceptives

**What Do I Need to Tell the Patient/Patient’s Family?**

- Lifetime medical surveillance is required to manage seizures. Strict adherence to the prescribed treatment regimen (e.g., medications, activity restrictions), moderate exercise, stress management, adequate sleep, and avoidance of alcohol, home safety precautions, and family education about safe seizure management are essential to appropriately manage patients with epilepsy.
- Patients with seizure disorders that are not well controlled by medication should avoid heights, swimming, driving and stimuli (e.g., flashing lights, loud sounds) that is known to trigger seizure activity.
- For information, visit the Epilepsy Foundation Web site at [https://www.epilepsy.com/](https://www.epilepsy.com/)

**References**


