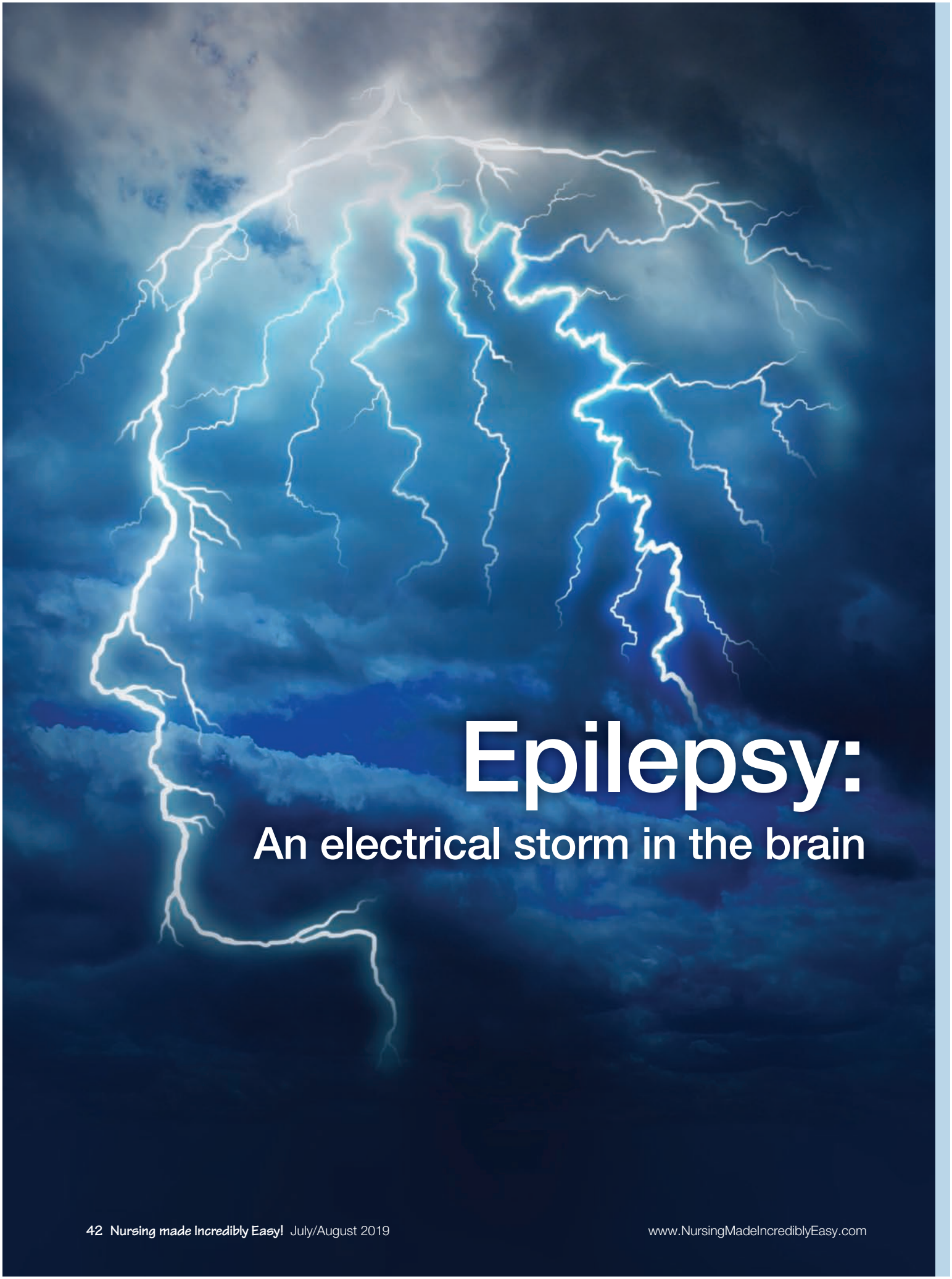

Epilepsy:

An electrical storm in the brain

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It's essential for nurses to understand this condition and know how to care for patients experiencing a seizure.

By Amanda Perkins, DNP, RN

A condition characterized by recurrent seizures, epilepsy is one of the most common neurologic diseases in the world, according to the World Health Organization (WHO). It's also one of the oldest medical conditions recognized, with records of epilepsy dating all the way back to 4000 BCE. According to the WHO, more than 50 million people worldwide have epilepsy. There are approximately 3.4 million people with epilepsy in the US, according to the CDC. Due to the significant number of individuals with this condition, many nurses will encounter patients with epilepsy.

This article provides a description of epilepsy, seizure types, signs and symptoms, diagnosis, complications, and management.

Epilepsy explained

When learning about epilepsy and seizures, it's important to understand that the two terms aren't synonymous. The result of abnormal electrical discharges in the brain, a seizure is a symptom of epilepsy or another condition, whereas epilepsy is characterized by recurrent seizures.

In epilepsy, the neuronal cell membranes are unstable. In many cases, the neuron membrane is easily activated due to increased permeability. Once they start, seizure discharges can spread to other areas of the brain, and these areas are responsible for the seizure's signs and symptoms. In most cases, the discharges will become less frequent until they stop.

Isolated seizures may be caused by electrolyte abnormalities, glucose abnormalities, medications, alcohol/drug withdrawal, head trauma, infections, fever, stress, or tumors.

Seizure types

In the past, seizures were classified as two types, generalized or partial, both of which were broken down into subcategories. Now, seizures are categorized as generalized, focal, and unknown onset (see *A closer look at focal and generalized seizures*).

Seizure type is classified based on the following:

- onset or area of the brain where the electrical activity starts
- level of awareness or consciousness
- movement (the motor symptoms that occur or lack of motor symptoms).

Generalized seizures affect both sides of the brain. There are a variety of generalized seizures, including, but not limited to, tonic-clonic, absence, and atonic. During a tonic-clonic seizure (previously referred to as a grand mal seizure), the patient will become rigid and stiff and may fall to the floor in the tonic phase and then experience twitching or jerking of the muscles in the clonic phase. Absence seizures (previously referred to as petit mal seizures) are seen more commonly in children. During an absence seizure, the patient will often stare into space for a period of time; in some instances, multiple times throughout the day. Atonic seizures may be referred to as "drop attacks" or "drop seizures." During this type of seizure, the patient will lose muscle tone, leading to a fall to the ground or, in some cases, a drop of the head.

Focal seizures (previously referred to as partial seizures) start on one side of the cerebral cortex. Focal seizures can be further subdivided into aware and unaware. During focal aware seizures (previously referred to as simple partial seizures), the patient is awake and aware. During focal unaware seizures (previously referred to

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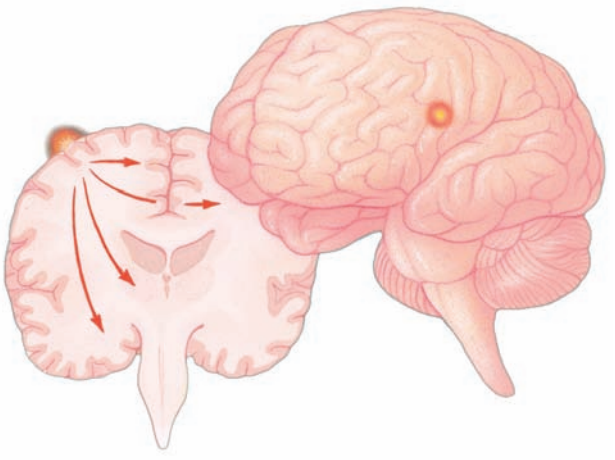
A closer look at focal and generalized seizures

Focal seizures

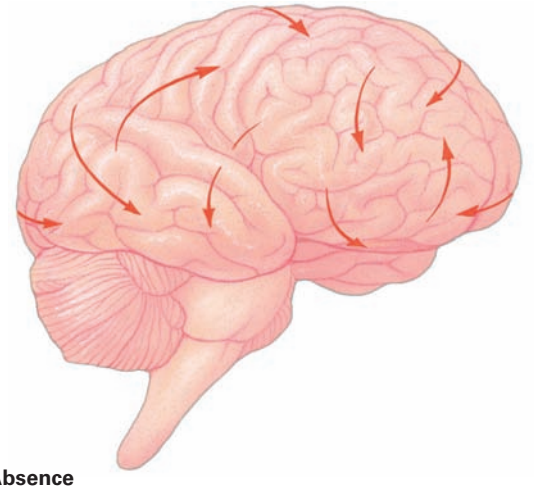


Aware
Consciousness isn't impaired, can involve senses (flashing lights or a change in taste or speech) or motor function (uncontrolled stiffening or jerking in one part of the body, such as the finger, mouth, hand, or foot), nausea, and déjà vu feeling.

Unaware
Consciousness is impaired and variable (unconscious repetitive actions), with staring gaze and hallucination/delusion.

Focal evolving to generalized
Begins as focal seizure and becomes generalized.

Generalized seizures



Absence
Involves a loss of consciousness with vacant stare or unresponsiveness.

Myoclonic
Involves sudden, forceful contractions of single or multiple groups of muscles.

Clonic
Longer rhythmic jerking activity.

Tonic–clonic
Includes alternate contraction (tonic phase) and relaxation (clonic phase) of muscles, a loss of consciousness, and abnormal behavior.

Atonic
Loss of muscle tone; person suddenly drops.

Source: Drislane F. *Blueprint Nephrology*. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2018.

as complex partial seizures), the patient has an altered level of consciousness. Focal seizures can become generalized seizures if the electrical activity spreads from one side of the cerebral cortex to the other.

When a seizure is classified as unknown onset, it means that the starting point of the seizure is unknown.

Signs and symptoms

Epilepsy symptoms vary depending on the area of the brain that's involved. When a patient has a seizure, you may observe a variety of symptoms, including:

- rhythmic jerking (clonic movements)
- weak or limp (atonic) muscles
- rigid or tense muscles (tonic movements)
- muscle twitching (myoclonus)
- epileptic spasms
- aura
- tongue biting
- loss of bowel/bladder control
- repetitive motions (see *Automatisms*).

Not all patients with seizures experience an aura, but for those who do, the aura may warn of an impending seizure, allowing patients time to get themselves to safety. Auras experienced by patients

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can include visual disturbances or unusual odors.

The signs and symptoms associated with seizures can be broken down into motor and nonmotor symptoms. Motor symptoms associated with generalized seizures include clonic movements, atonic muscles, tonic movements, myoclonus, and epileptic spasms. Nonmotor symptoms associated with generalized seizures include myoclonus and the appearance that the patient is staring into space.

Motor symptoms associated with focal seizures include clonic movements, atonic muscles, tonic movements, myoclonus, epileptic spasms, and automatisms. Nonmotor symptoms associated with focal seizures include alterations in sensation, thinking, and autonomic functions such as gastrointestinal sensations. Additionally, the patient may have a lack of movement, which is known as a behavior arrest.

Unknown onset seizures are characterized by motor symptoms, such as tonic-clonic movements and epileptic spasms, and nonmotor symptoms such as behavior arrest.

Diagnosis

When a patient has a seizure for the first time, it should lead to a search for the cause, such as an electrolyte abnormality or structural lesion. Diagnosis is essential because it guides treatment. An appropriate diagnosis determines the type of seizure, where the seizure starts in the brain, and if there's an associated lesion.

An important diagnostic tool is an electroencephalogram (EEG). An EEG can show where the seizure starts and where, if applicable, it spreads to. The two types of EEG that may be used are routine and prolonged EEG. For both a routine and prolonged EEG, electrodes are attached to the scalp. These electrodes identify abnormal electrical activity in the brain and help determine the type of seizure that the patient is experiencing.

If a routine EEG doesn't show any abnormal activity, a prolonged EEG may be ordered. This requires admission to an epilepsy monitoring center/unit and involves continuous EEG monitoring paired with video monitoring, which may last for days. The hope is that the camera will capture the start of the seizure and what movements or activities happen during the seizure. The EEG is then compared with the video. The seizure threshold may also be determined with sleep deprivation and flashing lights.

Additional tests that may be ordered include MRI, functional MRI (fMRI), positron emission tomography (PET), and single photo emission computed tomography (SPECT). The MRI provides images of the brain, allowing for identification of areas with structural changes. fMRI pinpoints areas of the brain used for speech, memory, and movement that may be associated with seizure activity. The PET scan shows changes in brain metabolism and chemistry, and the SPECT detects changes in cell metabolism, blood flow, or transmission between brain cells during a seizure.

Automatisms

Automatisms occur with focal seizures and include repetitive purposeless behaviors, such as chewing, picking at clothing, clapping or rubbing hands together, and lip smacking. These behaviors have been mistaken for mental illness in some patients. Additionally, these behaviors may also be mistaken for drug or alcohol abuse and behavioral problems.

Complications

Stopping medications abruptly can lead to a condition known as status epilepticus, a serious complication associated with epilepsy. In status epilepticus, a patient has 30 minutes of repetitive seizure activity with no return of consciousness. This medical emergency can lead to neurologic injury if not addressed quickly and appropriately because cerebral metabolic needs for glucose and oxygen aren't being met.

Medications used to treat status epilepticus may include diazepam or lorazepam,

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which are typically administered I.V. However, diazepam can be administered rectally. If these medications are ineffective, the patient may be given phenobarbital or, in severe cases, general anesthesia, with the goal of pharmacologic paralysis. The best way for patients to prevent status epilepticus is to be adherent with all prescribed medications.

A second and more severe complication is sudden unexpected death in epilepsy (SUDEP), which occurs for an unidentified reason. According to the Epilepsy Foundation, 1 out of 1,000 adults and 1 out of 4,500 children with epilepsy will die as a result of SUDEP each year. These numbers may be higher because deaths may not be correctly classified. The number of SUDEP deaths each year is double those attributed to sudden infant death syndrome (SIDS), yet awareness and education about SUDEP is significantly lacking when compared with SIDS.

SUDEP often occurs during or shortly after a patient experiences a seizure. In many cases, these patients are found dead face down in their bed. At this time, we don't know why this happens, but it's believed that breathing and heart rhythm may play a role. When patients have a seizure, they may experience apnea or, in some cases, their airway may become obstructed, decreasing oxygen levels. If this is prolonged, the body won't have enough oxygen to sustain life. In some cases, seizures can cause a dangerous heart rhythm or heart failure, both of which can lead to death.

Risk factors for SUDEP include:

- poorly controlled seizures
- frequent seizures
- generalized convulsive seizures
- onset of seizures at a young age
- having epilepsy for a long time
- nonadherence with medications
- alcohol use.

Patients with epilepsy should be taught about SUDEP, especially its prevention, because SUDEP is the number one cause of death for patients with poorly controlled seizures, according to the Epilepsy Foundation. Unfortunately, many patients, family members, and caregivers aren't educated about SUDEP. The number one way to prevent SUDEP is to adhere to the medication regimen. In addition to medication adherence, prevention techniques include the avoidance of triggers and alcohol, getting enough sleep, and making sure that people close to the patient know seizure first aid (see *Patient teaching: Seizure first aid*). Patients, family members, and caregivers should also be taught about monitoring devices (see *Monitoring devices*).

Patient teaching: Seizure first aid

When caring for patients who have epilepsy, educate both the patient and family members/caregivers about seizure first aid. Many people don't know what to do when a person has a seizure. Education will help these individuals maintain composure and keep the patient safe during a seizure. Teach family members and caregivers to do the following:

- stay with the patient until fully alert and oriented
- assist the patient to the floor if able
- move all objects surrounding the patient that could cause injury
- turn the patient onto his or her side
- loosen tight clothing and remove glasses
- stay calm
- assist the patient to safety after the seizure.

Family members/caregivers may want to immediately call 911, but this is often unnecessary. Educate family members that they may not need to call 911 unless the patient has never had a seizure before, if he or she has difficulty breathing, the seizure lasts more than 5 minutes, the patient is having recurrent seizures, if he or she is injured, or if the patient had the seizure in water.

Management

The goal of epilepsy management is stopping or preventing seizures. Antiepileptic drugs (AEDs) may be used to inhibit neuronal excitation or increase neuronal inhibition. These drugs play a role with the excitatory neurotransmitter glutamate or the inhibitory neurotransmitter gamma-aminobutyric acid. AEDs effectively control seizures in up to 70% of patients. Although these medications can effectively control seizures, they aren't a cure. Examples of AEDs include sodium valproate, carbamazepine, lamotrigine, levetiracetam, and oxcarbazepine. Some of these medications can harm the fetus, so this must be taken into

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consideration if the patient is pregnant or plans to become pregnant. AEDs may require periodic blood tests.

Medications are typically started at a low dose, with gradual increases until the patient is seizure-free. In some cases, additional medication may be needed. For all of these medications, adverse reactions can be bothersome but will often decrease over time. Common adverse reactions associated with AEDs include drowsiness, decreased energy, agitation, headache, tremor, hair loss, hair growth, swollen gums, and rashes. Patients should be encouraged to speak with their healthcare provider about bothersome adverse reactions because abruptly stopping medications may lead to complications, such as status epilepticus and SUDEP.

For up to 30% of patients with epilepsy, standard medical treatment may be ineffective and surgical intervention necessary. Surgery can reduce seizure frequency and improve quality of life for many patients. When surgery is performed, the goal is for the patient to be free from seizures, particularly seizures that are debilitating. After undergoing surgery, patients may need to continue to take AEDs.

The type of surgery is determined by the type of seizure and the affected area in the brain. Types of surgical procedures include:

- focal resection
- lesionectomy
- multiple subpial transection (MST)
- laser interstitial thermal therapy (LITT)
- hemispherectomy and hemispherotomy
- corpus callosotomy
- stereotactic radiosurgery
- neurostimulation device implantation.

The most common surgical procedure for patients with epilepsy, focal resection is the removal of the specific brain area that's causing the seizures. This procedure can't be carried out on vital areas of the brain, such as those areas that control speech or memory. The types of focal resection are temporal lobe, frontal lobe, parietal lobe, and occipital lobe resection.

Monitoring devices

With advances in technology comes the ability to more closely monitor the patient with epilepsy. Lower-tech options include baby monitors and video cameras, whereas high-tech options include watches that alarm family members and caregivers if a specific type of movement is detected. Additionally, apps that monitor seizure activity can be purchased, as well as monitors that go on a patient's bed.

Temporal lobe epilepsy is the most common type of epilepsy that's resistant to standard treatments and, therefore, more likely to need surgical intervention. According to the Epilepsy Foundation, 60% to 70% of patients will be free from debilitating seizures and up to 85% of patients will have a major improvement in the number of seizures they experience after temporal lobe resection. In frontal lobe resection, an area of the frontal lobe is removed, which results in approximately 50% of patients being free from debilitating seizures. Parietal and occipital lobe resections are performed when a lesion has been identified in these areas.

Lesionectomy is the removal of a lesion that's been identified as the cause of a patient's seizures. During this procedure, the lesion is removed in addition to the area surrounding it.

MST is performed when the starting point of seizures is in an area of the brain that can't be safely removed. During this procedure, the skull is opened and a series of cuts, also known as transections, are made in the gray matter. These transections interrupt the fibers that spread the electrical activity during a seizure.

LITT is a type of laser ablation surgery in which a laser is used to destroy the seizure starting point in the brain. One benefit of this surgery is that the skull doesn't need to be opened.

With hemispherectomy and hemispherotomy, the focal point of seizure activity is separated from the rest of the brain. These procedures are typically

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performed on children in whom seizures originate from one large area in one hemisphere. Eighty percent of patients have effective seizure control after hemispherectomy and hemispherotomy.

Corpus callosotomy is reserved for patients with severe generalized epilepsy. With this procedure, the main pathway between the hemispheres is cut.

Stereotactic radiosurgery involves the use of precisely focused radiation beams to treat focal points.

Lastly, neurostimulation includes vagus nerve stimulation (VNS), responsive neurostimulation (RNS), and deep brain stimulation (DBS). In VNS, the vagus nerve is stimulated. In RNS, seizure activity is recorded and provides stimulation to stop a seizure. And in DBS, signals are sent to the brain to stop seizures.

Pregnancy

Epilepsy is the most common neurologic disease occurring during pregnancy. It's important to identify women with epilepsy before conception because seizures can have a negative effect on both the mother and baby. Medical management of epilepsy can also negatively affect the developing fetus. Women with epilepsy should meet with a neurologist before conception. In addition, women with epilepsy who are considering pregnancy should be educated about internet use for medical information and what constitutes a reliable source. Of course, pregnancy may not be planned. Research has shown that up to 65% of pregnancies in women with epilepsy are unintended. Research has also shown that knowledge about epilepsy management during pregnancy is lacking.

The risk of death for a pregnant woman with epilepsy is 10 times higher than for women who don't have epilepsy. The highest risk is seen in women who are in their third trimester and those who've recently given birth. An increased risk can also be seen in women who've had a miscarriage or those who've terminated a pregnancy. Women should be educated that they may have an increased risk of adverse outcomes for up to 1 year after pregnancy.

Pregnancy can lead to unpredictably with seizure control. For this reason, pregnant women with epilepsy should have an emergency management plan in place, especially if they're at increased risk for status epilepticus. Family members should also be educated about seizure first aid.

Healthcare personnel should ask women considering pregnancy or those who are pregnant the following questions:

- How long has it been since you've had a seizure?
- Do you have a history of status epilepticus?
- Are you taking AEDs? If yes, what are you taking and how much? If no, did you stop the medication without seeking medical advice?
- Do you have a history of epilepsy during previous pregnancies?
- Do you have a history of substance abuse?

Women should be educated regarding the use of AEDs, specifically the danger that's associated with stopping medications without medical supervision. During pregnancy, adherence to AEDs can be a problem, with increased instances of incomplete adherence and self-discontinuation of medications. Decreased AED adherence is associated with increased mortality, morbidity, and healthcare costs for both the mother and baby. Women may stop AEDs due to a lack of knowledge regarding safety

did you know?

The ketogenic diet has been shown to prevent tonic-clonic seizures in children. Because tonic-clonic seizures are thought to be a precipitating factor in SUDEP, some healthcare professionals believe that the ketogenic diet may help prevent it. In the ketogenic diet, patients eat a large amount of fat (90%) and a low amount of carbohydrates and protein (10%). Consuming a ketogenic diet leads the liver to develop ketone bodies that are used by the body for energy as an alternative to glucose. This diet is typically recommended for patients who don't respond positively to AEDs and is most commonly used in children. Before initiation of the ketogenic diet, education is essential. Additionally, before the start of this therapy, children should be screened for metabolic disorders.

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during pregnancy and the risks associated with stopping AEDs without proper medical supervision. If nausea and vomiting are an issue during pregnancy, the patient may not be receiving enough medication and can experience adverse outcomes. Pregnant women taking AEDs should be educated about the importance of contacting their healthcare provider if they're vomiting. In general, education and counseling, especially when provided before conception, has been shown to improve adherence with AEDs during pregnancy.

AEDs are teratogens and have been associated with congenital heart disease, cleft lip and palate, urogenital abnormalities, and neural tube defects. However, major congenital malformations are rare. The AED with the highest risk is sodium valproate, which has been associated with decreased IQ levels and verbal abilities and an increased risk of autism. It's recommended that this medication be avoided in women of childbearing age. Lamotrigine and levetiracetam are the AEDs with the lowest risk. It's recommended to start folic acid supplementation before pregnancy and continue throughout because it's been shown to decrease the teratogenic potential of AEDs.

After the birth, mothers should be supported and assisted with the feeding of their baby, whether breastfeeding or bottle feeding. If a woman chooses to breastfeed, every effort should be made to make the breastfeeding experience a successful one. Women with epilepsy often lack knowledge regarding the use of AEDs while breastfeeding. If breastfeeding and taking AEDs, mothers should be taught to watch their baby for and report difficulty feeding, jaundice, rash, or lethargy/sleeping more than usual.

Nursing implications

When caring for a patient who's having a seizure, the top priority is preventing injury. Pad bed rails and move furniture out of the way. Don't restrain the patient and don't place anything in his or her mouth because this could result in injury to both the patient and you. It's also important to note the time that the seizure started, as well as what you observed before, during, and after the seizure. Note movement or lack of movement at the start of the seizure.

When a patient is admitted to a healthcare facility with the potential for seizures, seizure precautions should be instituted. Each facility has its own policies and procedures regarding seizure precautions, but, in general, seizure pads should be placed on bed rails, the patient shouldn't ambulate independently or be left alone in the bathroom, and oral temperatures shouldn't be obtained. Ensure that the healthcare provider has prescribed medications that can be used if a seizure occurs.

Educate patients with a history of seizures about safety precautions. For example, patients shouldn't operate a car, motorcycle, or other machinery until their seizures are under control. Safety measures should also be taken when in or near water, cooking, and sleeping. For example, instruct patients to shower instead of taking a bath, not to lock the bathroom door when showering, and never swim alone. Also teach patients about reducing triggers, such as anxiety and sleep deprivation.

Under control

Epilepsy affects millions of people worldwide and can result in significant injury or

on the web

American Association of Neurological Surgeons: www.aans.org/Patients/Neurosurgical-Conditions-and-Treatments/Epilepsy

CDC: www.cdc.gov/epilepsy/index.html

Epilepsy Foundation: www.epilepsy.com

Mayo Clinic: www.mayoclinic.org/diseases-conditions/epilepsy/symptoms-causes/syc-20350093

MedlinePlus: https://medlineplus.gov/epilepsy.html

National Institute of Neurological Disorders and Stroke: www.ninds.nih.gov/Disorders/All-Disorders/Epilepsy-Information-Page

World Health Organization: www.who.int/news-room/fact-sheets/detail/epilepsy

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death when not identified, addressed, and treated appropriately. With advances in technology, epilepsy can be controlled in most patients when they receive medical assistance and adhere to the treatment regimen. An effective way to assist patients with epilepsy is to ensure that they're properly educated about seizures and possible complications such as SUDEP. ■

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