ASSISTING IN NEUROLOGY AND MENTAL HEALTH

SCENARIO
Mai Lee, CMA (AAMA), has been working in Dr. Kim Song's neurology practice for 2 years. Dr. Song has always been pleased with Mai's professional behavior toward all patients in the practice. She is conscientious about charting notes accurately for each of her patients. Dr. Song has just asked Mai to train a new medical assistant in the clinical procedures of the office. He is expanding his clinic hours and wants to have Mai more involved in assisting him with patients, particularly in patient education. She is excited to have additional responsibilities with Dr. Song's patients, and she is quite happy about the raise in salary that goes along with her new position.

While studying this chapter, think about the following questions:
- What is the basic anatomy and physiology of the neurologic system?
- Mai should familiarize herself with what neurologic disorders?
- What are the diagnostic and treatment procedures for typical nervous system disorders?
- What is the medical assistant's role in the neurologic examination?
- Is patient education a significant factor when working with patients diagnosed with either nervous system or mental health disorders?

LEARNING OBJECTIVES
1. Define, spell, and pronounce the terms listed in the vocabulary.
2. Apply critical thinking skills in performing the patient assessment and patient care.
3. Summarize the anatomy and physiology of the nervous system.
4. Differentiate between the central and peripheral nervous systems.
5. Identify the typical symptoms associated with neurologic disorders.
6. Distinguish among common nervous system diseases and conditions.
7. Describe the pathology of cerebrovascular diseases.
8. Identify the various types of epilepsy.
9. Compare and contrast encephalitis and meningitis.
10. Explain the dynamics of head and spinal cord injuries.
11. Summarize the neurologic diseases that affect mobility.
12. Differentiate among common mental health disorders.
13. Analyze the medical assistant's role in the neurologic examination.
14. Explain the common diagnostic procedures for the nervous system.
15. Outline the steps needed to prepare a patient for an electroencephalogram (EEG).
16. Describe the steps for preparing a patient for and assisting with a lumbar puncture.
VOCABULARY

anomalies (uh-noh'-muh-leez) Deformities or deviations from a normal condition, resulting from faulty development of a fetus.
ataxia (uh-taks'-e-uh) Failure or irregularity of muscle actions and coordination.
aura A peculiar sensation that precedes the appearance of a more definite disturbance.
benign Not cancerous and not recurring.
blood-brain barrier An anatomic-physiologic structure made up of astrocyte glial cells that prevents or slows the transfer of chemicals into the neurons of the CNS.
coma An unconscious state from which the patient cannot be aroused.
compression The state of being pressed together.
contralateral (kon-trah-lah'-tehr-uh-luh) Pertaining to the opposite side of the body.
cryptogenic (krip-tuh-jee'-nik) Pertaining to a disease with an unknown cause.
embolus A foreign material that blocks a blood vessel; frequently a blood clot that has traveled from some other part of the body.
ipsilateral (ips-uh-lah'-tehr-uh-luh) Pertaining to the same side of the body.

malignant Cancerous.
myelin sheath A segmented, fatty tissue that wraps around the axon of the nerve cell and acts as an electrical insulator to speed the conduction of nerve impulses.
occlusion Complete obstruction of an opening.
papilledema Swelling of the optic disc from increased intracranial pressure.
paresthesia (par-uhh-thee'-ze-uh) An abnormal sensation of burning, prickling, or stinging.
paroxysmal (par-ehk-siz'-uh-muhl) Pertaining to a sudden, recurrent spasm of symptoms.
plaque An abnormal accumulation of a fatty substance.
proprioception The sensation of awareness of body movements and posture; nerve impulses that provide the central nervous system with information about the position of body parts.
radiopaque A substance that can easily be visualized on an x-ray film.
thrombus A blood clot.
transsection Cross-section; a division made by cutting across.
turbid Refers to a cloudy solution.

The human brain weighs about 3 pounds, requires about the same amount of energy needed to light a 20-watt bulb, stores more than 100 trillion bits of information, and works better than any computer. The matter that makes up the brain is approximately 85% water and therefore has a soft texture. Early scientists believed that the brain’s function was to cool the blood. Today’s scientists have shown us that even though the brain receives 20% of the body’s blood supply, its function is much more complex than simply cooling blood.

Neurologists specialize in the diagnosis and treatment of medical disorders and conditions of the nervous system. A neurosurgeon provides surgical management and treatment for trauma and other conditions requiring surgery. A psychiatrist is a physician who treats behavioral disorders and neurologic conditions that affect behavior.

ANATOMY AND PHYSIOLOGY

The nervous system works with the endocrine system to integrate stimuli both from within the body and from the outside environment to regulate body systems so that homeostasis can be maintained. The nervous system is divided into two major parts: the central nervous system (CNS), which is made up of the brain and spinal cord, and the peripheral nervous system (PNS), which includes all the nervous tissue and neurologic responses found outside the CNS.

The brain is the “president” or “chief executive officer” of the body. It constantly receives information from the periphery, including all the organs and systems inside the body and on its surface. This information (i.e., stimuli) is carried to the brain by the peripheral nerves along the afferent, or ascending, tract. The brain monitors and interprets the stimuli received from the afferent nerves and sends appropriate responses back along efferent pathways to the organs or to the body’s surface. These responses from the brain cause a specific reaction in the organ, in the glands, or in skeletal muscles. These reactions keep the body running smoothly and allow it to react instantly to both external and internal stimuli.

The functioning cell of the nervous system is the neuron (Figure 44-1). The brain contains billions of individual neurons. The nervous system begins very early in embryonic development, by week 3, as the neural tube, which eventually develops into the brain and spinal cord. Each neuron is made up of a main cell body that contains the nucleus and a relatively long extension of the cell, called the axon, that may be covered with a myelin sheath. Multiple filaments, called dendrites, extend from the neuron body. Dendrites receive the nerve impulse from a preceding neuron and carry it into the cell body. Impulses are carried away from the cell body through the axon to another neuron or to cells in another tissue. This transfer of stimuli begins as an electrical impulse that travels down an axon of one neuron and becomes a chemical impulse while moving across the synapse (the space between two neurons) to the dendrite of another neuron. The transfer of impulses from the end of one neuron to the dendrites of another is enhanced by chemical neurotransmitters, which bind to specific receptor sites on the dendrites of the next neuron. If the nerve impulse is traveling to a muscle or to any other organ or tissue instead of another neuron, the chemical neurotransmitters bind to special receptors in the target tissue. Messages move throughout the entire nervous system in this manner. Impulses in the neuron are electrical, the impulses become chemical as a specific neurotransmitter is released at each synapse, and they become electrical again as they are picked up by the subsequent dendrites of another neuron or by the target tissue.
Supportive cells of the nervous system are called glial or neuroglial cells. These specialized cells perform specific functions in the nervous system; for example, Schwann cells form the myelin sheath, and astrocytes help form the blood-brain barrier. However, the glial cells do not carry on any of the functions of the nervous system. The blood-brain barrier closely regulates what substances enter the brain tissue. Oxygen, water, and glucose molecules easily pass into the brain, whereas many chemicals and drugs are prevented from moving into brain tissue. Brain inflammation can increase the ability of many drugs to cross the blood-brain barrier.

**Central Nervous System**

The brain and spinal cord together make up the CNS. The brain is encased within the skull in the cranial cavity. The spinal cord is a bundle of nervous tissue that extends inferiorly from the brainstem at the base of the brain and exits the skull at the foramen magnum. It descends for about 17 inches inside the spinal canal, which courses through the vertebrae of the backbone.

**Brain**

The brain accounts for only about 2% of a person's weight, but it consumes about 20% of the body's oxygen. The brain is divided into three main areas: the cerebrum, the cerebellum, and the brainstem (Figure 44-2). The cerebrum, the largest and uppermost section of the brain, has multiple convolutions along its surface, called gyri, which are formed by the folding in of the cerebral cortex. The gyri are separated by shallow grooves, called sulci. The gyri greatly increase the surface area of the cerebrum, which maximizes the potential of the CNS neurons in each area. The cerebrum is divided into lobes, which are named after the region of the skull under which they are located. The cerebrum is separated by a longitudinal fissure into left and right hemispheres. The right hemisphere usually controls artistic functions, such as drawing, rhythm, and picture memory. The left hemisphere controls verbal functions, such as reading, writing, speaking, and mathematical calculations. The diencephalon, located deep in the center of the cerebrum near the superior portion of the brainstem, is made up of the thalamus and the hypothalamus. The thalamus acts as a relay station between sensory neurons and the cerebral cortex. The functions of the hypothalamus include controlling the autonomic nervous system, regulating endocrine processes, and managing body temperature, sleep, and appetite to maintain homeostasis. Within the cerebrum are four spaces, called ventricles, which contain cerebrospinal fluid (CSF). CSF nourishes, lubricates, and provides some cushioning protection for the brain and the spinal cord.

The cerebellum is just inferior to the occipital lobe of the cerebrum and controls balance, equilibrium, posture, and muscle...
coordination. The brainstem controls reflexes and serves as a sensory relay station for input coming into the brain from the body. The brainstem plays a vital role in vision, hearing, respiration, heart rate, blood pressure, waking, and sleeping.

**Spinal Cord**

The spinal cord extends from the inferior portion of the brainstem to approximately the second lumbar vertebra. Thirty-one pairs of spinal nerves extend from the spinal cord through openings in the vertebrae. Starting just below the first cervical vertebra in the neck, a nerve extends from the spinal cord on each side; therefore, a pair of spinal nerves originates at each level. Each of these pairs of nerves innervates a specific organ or area of the body. The spinal cord carries messages between the spinal nerves and the brain.

**Meninges**

Because the brain and the spinal cord are critical to life, they are well protected. They both are encased in some of the thickest bones in the body; they also are surrounded by three membranes, called meninges; and they are cushioned by the CSF (Figure 44-3).

The outer layer of the meninges is called the dura mater ("hard mother"), because it is a tough membrane, similar to a very strong rubber band. The subdural space lies below the dura mater and contains small veins that have little support. Trauma to the head can cause bleeding of these tiny vessels, ultimately leading to the development of a subdural hematoma. Above the dura mater is the epidural space. The arterial supply to the meninges comes from blood vessels that line the inner aspect of the skull. If the skull is fractured, these arteries can be damaged, resulting in a collection of blood between the skull and the dura mater called an epidural hematoma.

The middle meningeal layer is the arachnoid, which was given that name because of its fine spider web appearance. Beneath the arachnoid membrane in the subarachnoid space is the cerebrospinal fluid, a clear liquid that contains glucose, protein, and chloride produced by specialized cells in the ventricles (Table 44-1). CSF circulates continuously through the ventricles and around the brain and spinal cord, carrying nutrients and removing wastes.

The innermost layer, which covers the brain and spinal cord, is the delicate pia mater ("tender mother"); it is highly vascular and the thinnest of the three layers. The pia mater provides support for the blood vessels of the brain.

**HYDROCEPHALUS**

Hydrocephalus is the abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles of the brain. It is the result either of overproduction of CSF or of failure of the fluid to drain properly. If left untreated, hydrocephalus causes gross enlargement of the skull and severe damage to brain tissue from increased intracranial pressure. The only treatment is surgery to place a shunt (tube) from a ventricle in the brain to the right atrium or to the abdominal cavity. The shunt allows the excess CSF to drain away from the brain.

**Peripheral Nervous System**

The PNS is made up of the nerves that exit the brain or spinal cord. The peripheral nerves exiting the brain directly through the cranial or from the spinal cord enter and exit the spinal canal through spaces between the vertebrae. Cranial nerves originate from the underside of the brain and relay information to and from the sensory organs and muscles of the face and neck (Table 44-2).

Spinal nerves carry information to and from the brain through the spinal cord. Sensory fibers in these nerves carry stimuli from the skin and internal organs to the CNS. Motor fibers carry
TABLE 44-1  Typical Laboratory Values for Cerebrospinal Fluid

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>PRESSURE (mm)</th>
<th>APPEARANCE</th>
<th>CELLS</th>
<th>PROTEIN (mg/dl)</th>
<th>GLUCOSE (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>10-200</td>
<td>Clear, colorless</td>
<td>0-10 lymphocytes and monocytes</td>
<td>&lt;45</td>
<td>50-80</td>
</tr>
<tr>
<td>Acute bacterial meningitis</td>
<td>200-500</td>
<td>Turbid</td>
<td>100-10,000 granulocytic neutrophils</td>
<td>50-500</td>
<td>Absent or low</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>200-500</td>
<td>Bloody</td>
<td>Red blood cells (RBCs)</td>
<td>50-1000</td>
<td>50-80</td>
</tr>
</tbody>
</table>

TABLE 44-2  Cranial Nerves and Their Functions

<table>
<thead>
<tr>
<th>CRANIAL NERVE</th>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Olfactory</td>
<td>Smell</td>
</tr>
<tr>
<td>II</td>
<td>Optic</td>
<td>Vision</td>
</tr>
<tr>
<td>III</td>
<td>Oculomotor</td>
<td>Eye movement</td>
</tr>
<tr>
<td>IV</td>
<td>Trochlear</td>
<td>Eye movement</td>
</tr>
<tr>
<td>V</td>
<td>Trigeminal</td>
<td>Muscles of chewing, General sensations from anterior half of head, including entire face and meninges</td>
</tr>
<tr>
<td>VI</td>
<td>Abducent</td>
<td>Eye movement</td>
</tr>
<tr>
<td>VII</td>
<td>Facial</td>
<td>Muscles of facial expression, Tearing, salvation, and taste</td>
</tr>
<tr>
<td>VIII</td>
<td>Vestibulocochlear</td>
<td>Hearing and equilibrium</td>
</tr>
<tr>
<td>IX</td>
<td>Glossopharyngeal</td>
<td>Swallowing and taste</td>
</tr>
<tr>
<td>X</td>
<td>Vagus</td>
<td>Parasympathetic to thorax and abdomen</td>
</tr>
<tr>
<td>XI</td>
<td>Spinal accessory</td>
<td>Shoulder and head movements</td>
</tr>
<tr>
<td>XII</td>
<td>Hypoglossal</td>
<td>Tongue movements</td>
</tr>
</tbody>
</table>

CRITICAL THINKING APPLICATION

Dr. Song mentions a patient’s nervous system function to Mai. The patient hears this conversation and asks Mai, “What does my nervous system do?” How should Mai answer this question? What resources could she use to help explain the nervous system to the patient?

DISEASES AND DISORDERS OF THE CENTRAL NERVOUS SYSTEM

Because the CNS and PNS are so complex, diseases and conditions that affect them can produce a wide range of signs and symptoms. Causes include trauma, infection, congenital anomalies, degeneration, tumors, and vascular disorders (Table 44-3). The medical assistant needs to listen carefully when a patient describes his or her neurologic symptoms. Many different types of symptoms can indicate a serious condition of the nervous system.

Cerebrovascular Disease

Cerebrovascular disease (CVD) is the third leading cause of death and the most frequent cause of crippling disease in the United States. Generally, CVD is related to arteriosclerosis or atherosclerosis of the cerebral arteries, but it also can be caused by untreated or uncontrolled hypertension, thrombi, or emboli. Arteriosclerosis causes progressive loss of elasticity of the arterial wall and is seen in elderly individuals with CVD. Atherosclerosis, the deposit of fatty plaque on the inside of the arterial wall, can involve any of the major arteries supplying the brain or any of their branches. Sudden narrowing, or occlusion, may occur when an artery becomes blocked by a thrombus or an embolus.

CVD usually is diagnosed through cerebral arterial angiography, in which a radiopaque dye is injected into the suspect vessel and a radiograph is immediately taken. Other confirming tests include magnetic resonance imaging (MRI), computed tomography (CT), and electroencephalography (EEG).

SYMPTOMS THAT SUGGEST POSSIBLE NEOLOGIC PROBLEMS

- Recurrent headache
- Periodic memory loss
- Change in sleeping patterns
- Frequently dropping items
- Difficulty with particular speech patterns
- Numbness in a specific body area
- Visual disturbances or abrupt changes in vision
- Loss of consciousness
- Confusion or disorientation as to date, time, and place
Transient Ischemic Attacks

Transient ischemic attacks (TIAs), also called ministrokes, occur when the blood supply to a particular part of the brain is inadequate for a limited time, usually seconds to minutes. TIAs occur when brain tissue becomes ischemic for a short time, causing the same symptoms as a stroke. Because the cause of the ischemia is limited, the symptoms dissipate quickly. Symptoms can include numbness or weakness in the face, arm, or leg or on one side of the body; confusion or difficulty talking or understanding speech; vision abnormalities, including diplopia; difficulty walking; and vertigo or loss of balance and coordination.

These episodes may occur in the days, weeks, or months before a stroke. Patients and their families should understand that any stroke-like symptom should be taken seriously. Individuals experiencing TIAs should be seen within an hour of the onset of symptoms so that they can be evaluated carefully and treated to prevent a possible stroke. Individuals with atrial fibrillation (an irregular rapid firing of electrical activity in the atria of the heart) may be prescribed anticoagulants (e.g., heparin or warfarin [Coumadin]), or they may be put on daily low-dose aspirin or clopidogrel (Plavix), because these individuals are at increased risk of emboli formation. TIAs are important warning signs that the patient is at serious risk of having a debilitating stroke. When TIAs occur, it is time for preventive treatment and patient education, including altering and/or treating such factors as hypertension, smoking, heart disease, diabetes, carotid artery disease (carotid artery occlusion with atherosclerotic plaques), and alcohol abuse.

Cerebrovascular Accident

A cerebrovascular accident (CVA) is the most important clinical manifestation of CVD. A CVA, commonly referred to as a stroke, occurs when a vessel in the brain either ruptures or occludes and the tissue on the other side of the damaged vessel becomes oxygen deprived. Cerebral artery ruptures are caused by uncontrolled hypertension or hemorrhaging of a weakened section of an artery in the brain. As a result of the rupture, the surrounding brain tissue fills with blood, damaging and possibly destroying the affected tissue. An occlusion occurs when an embolus or thrombus becomes wedged in an artery and obstructs the flow of blood to an area of the brain (Figure 44-5).

The patient's subsequent symptoms depend on the location of the arterial occlusion or rupture. Some of the more common symptoms include slurred speech; unexplained confusion; sudden, severe headache; difficulty swallowing; vertigo; diplopia; loss of consciousness; personality change; loss of bowel or bladder control; and paralysis on one side of the body.

Treatment of a stroke requires immediate emergency transport to the hospital. The initial emphasis is on minimizing the long-term disabilities often seen with strokes by providing immediate treatment to salvage as much brain tissue as possible. Thrombolytic drugs to dissolve the clot and anticoagulants may be given if the cause of the stroke was a thrombus or an embolus. However, thrombolytic medication can effectively treat resulting ischemia.
<table>
<thead>
<tr>
<th>DISEASE</th>
<th>SIGNS AND SYMPTOMS</th>
<th>DIAGNOSTIC PROCEDURES</th>
<th>LABORATORY TESTS</th>
<th>TREATMENT AND MEDICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alzheimer's disease</td>
<td>Short-term memory loss; progressive, irreversible confusion and disorientation</td>
<td>History</td>
<td>None specific; ordered to rule out other causes of dementia</td>
<td>Supportive care, tacrine (Cognex), donepezil (Aricept)</td>
</tr>
<tr>
<td>Brain tumor</td>
<td>Depend on location; generally caused by increased ICP</td>
<td>History, neurologic examination, imaging studies</td>
<td>None</td>
<td>Estrogen, surgery, radiation, chemotherapy</td>
</tr>
<tr>
<td>CVA</td>
<td>Depend on severity; speech difficulties, hemiplegia, confusion, loss of muscle coordination</td>
<td>History, neurologic examination, CT, MRI</td>
<td>Lumbar puncture</td>
<td>Thrombolytics, antiinflammatories, anticoagulants, hyperbaric oxygen, rehabilitation, supportive care</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>Increased ICP, cerebral edema</td>
<td>History, neurologic examination, CT, MRI</td>
<td>Lumbar puncture</td>
<td>Antivirals, supportive care</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>Grand mal: tonic-clonic muscle contractions</td>
<td>History, neurologic examination, CT, MRI, EEG</td>
<td>Blood work</td>
<td>Anticonvulsants</td>
</tr>
<tr>
<td></td>
<td>Petit mal: momentary absence, stare, amnesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed head injury caused by trauma</td>
<td>Depend on location and severity of injury; headache, increased ICP</td>
<td>History, neurologic examination, CT, MRI</td>
<td>Lumbar puncture</td>
<td>Diuretics; reduce ICP</td>
</tr>
<tr>
<td>Meningitis</td>
<td>Headache, nuchal rigidity</td>
<td>History, neurologic examination, Kernig's and Brudzinski's signs</td>
<td>Lumbar puncture</td>
<td>Antibiotics, anticonvulsants, antiinflammatories</td>
</tr>
<tr>
<td>Migraine</td>
<td>Unilateral throbbing sensation, nausea, vomiting, blurred vision</td>
<td>History, neurologic examination</td>
<td>Tests to rule out organic causes of headaches</td>
<td>Vasodilators, vasoconstrictors</td>
</tr>
<tr>
<td>Multiple sclerosis</td>
<td>Problems with vision, sensation, motor function</td>
<td>History, neurologic examination, MRI</td>
<td>None</td>
<td>Interferon, corticosteroids, antispasmodics, antidepressants</td>
</tr>
<tr>
<td>Parkinson's disease</td>
<td>Resting tremor, shuffling gait, masklike face</td>
<td>History, neurologic examination</td>
<td>None</td>
<td>Anticholinergics, dopamine agonists</td>
</tr>
</tbody>
</table>

CT, Computed tomography; CVA, cerebrovascular accident; EEG, electroencephalography; ICP, intracranial pressure; MRI, magnetic resonance imaging.

Only if it is given within the first 3 to 6 hours after the ischemia began. If cerebral edema is present, the patient is treated with corticosteroids and diuretics to reverse the swelling. Hyperbaric oxygen also can be used to increase oxygenation of the brain. An important part of the subsequent recovery is extensive treatment in a stroke rehabilitation program that includes physical, occupational, and speech therapies.

**TYPES, CAUSES, AND RISKS OF CEREBROVASCULAR ACCIDENTS**

*Thrombotic stroke:* A blood clot (thrombus) forms in a cerebral artery and blocks distal blood flow.

*Embolic stroke:* A blood clot from somewhere else in the body (e.g., the lower leg) or a piece of plaque (typically from the carotid arteries) breaks away and flows through the bloodstream to the brain; the embolus eventually blocks a cerebral artery, causing distal ischemia.

*Cerebral hemorrhage:* An artery in the brain ruptures, possibly because of untreated or uncontrolled hypertension or a congenital aneurysm.

Any of the following factors can increase the risk of a stroke:
- Hypertension
- Diabetes (increases the risk by two to three times)
- Hypercholesterolemia
- Cigarette smoking (increases the risk by 50%)
- Obesity
- Family history of stroke
- Endocarditis (may promote thrombus formation)
- Arteriosclerosis and atherosclerosis
- Heart disease (e.g., atrial fibrillation, which increases the risk by five times)
- Sleep apnea
- Sickle cell anemia
- Cocaine abuse

Individuals with three or more of the following five health conditions are twice as likely to have a cerebrovascular accident: obesity, low high-density lipoprotein (HDL) cholesterol levels, high triglyceride levels, blood pressure of 130/85 mm Hg or higher, and diabetes and/or prediabetes (fasting blood sugar between 100 and 125).
Migraine Headache

More than 28 million Americans suffer from migraine headaches, and the condition affects three times more women than men. Migraine headaches are paroxysmal attacks of headaches that can be completely incapacitating and frequently are associated with other symptoms, such as nausea, vomiting, visual disturbances, and throbbing pain on one side of the head. The manifestations of migraine headaches differ from one individual to another. The patient may experience a sensory warning sign (an aura) before the onset of the headache. An aura often consists of some form of visual disturbance, such as dark lines or spots within the visual field or a flash of light.

Medical science has not yet discovered the underlying cause of migraines. However, some researchers believe they may be caused by a combination of a problem with the trigeminal nerve and an imbalance of chemicals in the brain, especially the neurotransmitter serotonin; this causes cerebral blood vessels to become dilated and inflamed, resulting in the acute onset of a terrible headache. Individuals who suffer from migraine headaches report a number of different triggers, including changes in estrogen levels; certain foods, such as alcohol, chocolate, aspartame, caffeine, and monosodium glutamate (MSG); elevated stress levels; bright lights, sun glare, and certain smells; altered sleep patterns; and changes in the weather, especially with changing altitude levels and barometric pressures. The diagnosis usually is established from a complete medical history. EEG, a
CT scan, or an MRI study can be performed as part of the diagnostic process to rule out other causes of the headaches.

Drugs used to treat migraines include nonsteroidal antiinflammatory drugs (NSAIDs) or triptans, such as sumatriptan (Imitrex), rizatriptan (Maxalt), or zolmitriptan (Zomig), which mimic the effects of serotonin, causing vascular constriction (these drugs must be taken at the onset of the headache to be effective). Other medications recommended for the prevention of migraines include beta blockers and antidepressants. Antiseizure medications, such as topiramate (Topamax) and gabapentin (Neurontin), may be effective in reducing the frequency and severity of the headaches. Other treatments include biofeedback techniques and elimination diets to avoid migraine triggers.

**Dementia and Alzheimer's Disease**

The term dementia describes a group of symptoms caused by altered brain function. Dementia symptoms may include short-term memory loss; disorientation about person, time, and place; neglect of personal hygiene, nutrition, and safety; personality changes; and inability to follow simple directions. Dementia can be caused by multiple conditions. Some can be reversed, such as nutrition disorders or disorientation caused by a minor head injury. Others are irreversible, such as multi-infarct (vascular) dementia and Alzheimer's disease.

Multi-infarct dementia is caused by a series of small strokes that interfere with the brain's blood supply, resulting in multiple areas of tissue necrosis. The location of the infarcts determines the degree of disability and the dementia symptoms that might occur. Symptoms of an acute onset of dementia typically are caused by this type of dementia. People with multi-infarct dementia are likely to show signs of improvement or remain stable for long periods and then quickly develop new symptoms if more strokes occur. Untreated or uncontrolled hypertension usually is the cause of this type of dementia.

Alzheimer's disease is the most common form of dementia among older people today. It is a devastating, chronic, progressive, and degenerative disease that begins in the parts of the brain that control thought, memory, and language. The patient exhibits slow, increasing loss of recent memory; loss of recognition of people, places, and events; confusion and disorientation; and physical deterioration that leads to death. The cause remains unknown, and there is no known cure. Treatment is supportive care only. (Alzheimer's disease is addressed in more detail in Chapter 48.)

**CRITICAL THINKING APPLICATION 44-3**

Mr. Jackson, a 75-year-old patient with Alzheimer's disease, is coming in for his first visit. He does not respond to verbal commands and is unable to answer direct questions. How can Mai get him into the examination room and into a patient gown while preserving his dignity?

**Epilepsy and Seizure Disorders**

Epilepsy is a chronic brain disorder associated with abnormal electrical impulses generated by some of the neurons in the brain. These errant impulses cause seizures (Figure 44-6). A seizure is characterized by abnormalities in levels of consciousness, sensory disturbances, and impaired motor function. A diagnosis of a seizure disorder is made if the individual has two or more seizures. Children may have a single seizure associated with a high fever (i.e., febrile seizure), but that alone does not mean that the child has a seizure disorder. However, most individuals with the disorder have an onset of seizures during childhood, although many children grow out of the problem as they get older. In many cases the cause is never identified; some known causes include brain tumors, CNS infections, anoxia, CVA, and traumatic head injury.

Seizures are classified as either partial or generalized, based on how much of the brain is involved in the abnormal electrical activity. Partial seizures result from abnormal electrical activity in just one part of the brain, whereas generalized seizures involve most or all of the brain. Seizure classifications are divided into more specific categories. Simple partial seizures originate in a small, localized area of the brain, do not cause loss of consciousness, and are identified by a routine action, such as shaking of an arm or a leg or altered speech. Complex partial seizures also begin in a small area of the brain but cause staring and repeated movements, such as hand rubbing, lip smacking, and swallowing, as well as postseizure confusion or amnesia. Generalized seizures include petit mal seizures, which are brief episodes characterized by staring, subtle body movement, and brief lapses of awareness.

Probably the best-known seizure disorder is the generalized tonic-clonic form that causes grand mal seizures, with loss of consciousness, tonic (stiffening) muscle contractions, followed by clonic (twitching, jerking) muscle contractions of the limbs, clenched teeth, and/or loss of bowel or bladder control. After the shaking subsides, the individual may fall asleep or appear confused for a few minutes. The patient may experience an aura, usually a sensory warning such as a specific smell or taste, before a grand mal seizure occurs.

Diagnosis depends on an accurate seizure history, EEG, and CT or MRI scans. Seizures cannot be cured but usually can be controlled effectively by pharmaceutical treatment; however, finding the most effective medication at the right dose can be complex. Some individuals with epilepsy require more than one drug or have to try multiple medications until the most effective one is found. Antiseizure (anticonvulsant) medications include phenytoin (Dilantin), carbamazepine (Tegretol), valproic acid (Depakene), gabapentin (Neurontin), phenobarbital, clonazepam (Klonopin), and lamotrigine (Lamictal). It is very important that patients know never to stop taking their seizure medication without the physician's supervision, because this may trigger more frequent and severe seizure episodes.

**WHAT IS ELECTROENCEPHALOGRAPHY?**

Electroencephalography (EEG) is used to record the brain wave activity of a patient suspected of having a seizure disorder or to determine the effectiveness of pharmaceutical treatment to control the brain's abnormal electrical activity. The particular pattern of brainwave activity helps diagnose the seizure disorder type. Electroencephalograms are also used to help localize
Central Nervous System Infections

Encephalitis

Most cases of encephalitis are viral in origin and are transmitted to humans from mosquitoes and ticks or are caused by other infections, such as herpes infections. In a mild case symptoms can include headaches, muscle aches, malaise, and general flulike symptoms. In more severe cases, the symptoms can include fever, delirium, convulsions, coma, and even death.

A quiet, nonstimulating environment is necessary to prevent triggering of seizure activity, to relieve headache, and to promote rest. A patient with cerebral inflammation from encephalitis may suffer from confusion, disorientation, and other behavioral changes. These symptoms are part of the disease and usually disappear when the condition improves.

Patient management treats the symptoms and is aimed at controlling fever and seizure activity, as well as constant monitor-
ing of respiratory and urinary functions. In patients with severe CNS damage, recovery usually is prolonged, and physical therapy is necessary to overcome the neurologic and musculoskeletal complications. If encephalitis is caused by the herpes simplex or varicella zoster virus, treatment includes the use of acyclovir (Zovirax) or ganciclovir (Cytovene).

**Meningitis**

Meningitis is an infection and inflammation of the meninges and CSF of the brain and spinal cord that can be caused by viruses, bacteria, or fungi. Meningitis is transmitted from an infected individual through coughing, sneezing, kissing, or sharing personal items, such as eating utensils or a toothbrush. Viral meningitis usually is mild and has flulike symptoms that typically resolve in 10 days or earlier. Fungal meningitis is seen in patients with immune deficiencies, such as acquired immunodeficiency syndrome (AIDS), and can be life-threatening. Acute bacterial meningitis can occur as a complication of an earlier infection of the ears, sinuses, or lungs, or it can be transmitted from an infected person.

Bacterial meningitis can be quite serious; symptoms can include a high fever, severe headache, stiff neck, photophobia, confusion, seizures, and positive Brudzinski’s and Kernig’s signs. A lumbar puncture is done, and the diagnosis is confirmed if the CSF is cloudy and has large numbers of white blood cells and bacteria. Culturing the CSF usually identifies the causative organism so that the patient can be treated with the appropriate intravenous antibiotics. The patient also is treated with analgesics and medications to reduce cerebral edema. Despite treatment, meningitis can be fatal or can cause long-term neurologic damage in some patients.

**TESTING FOR BRUDZINSKI’S AND KERNIG’S SIGNS**

**Brudzinski’s Sign**

The patient is placed in the supine position. The head is passively flexed toward the chest. Brudzinski’s sign is seen if the patient spontaneously flexes the arm, hip, and knee in response to the neck flexion.

**Kernig’s Sign**

With the patient in a supine position, the physician flexes both one hip and the ipsilateral knee to 90 degrees and then attempts to straighten the leg completely by straightening the knee. Kernig’s sign is seen if pain prevents straightening of the leg or if the patient involuntarily flexes the contralateral knee and hip.

**Brain and Spinal Cord Injuries**

Traumatic brain injuries are caused by a blow or jolt to the head. They may be limited to a particular section of the brain or may result in generalized neurologic damage. Injuries can range from a mild concussion to severe injury, coma, and death. A minor concussion usually has no long-term side effects; however, a moderate to severe brain injury can result in headaches, amnesia, confusion, personality changes, and seizures. Spinal cord injuries usually result from severe, accidental trauma to the back or neck. These injuries are most common in the 16- to 30-year-old age group and are associated with automobile and sports accidents. The higher the damage to the spinal cord, the more serious the injury is.

Fortunately, CNS injuries can be prevented with the proper use of child car seats, adult safety belts, and helmets in childhood sports and activities and by reducing the frequency of drinking and driving. Several types of brain injuries can occur, depending on the type and amount of force with which the head is struck.

**SIGNS OF A CONCUSSION**

Signs that occur seconds to minutes after a head injury include:

- Possible loss of consciousness
- Difficulty focusing, with slowed responses
- Slurred speech
- Nausea and vomiting
- Headache
- Blurred vision
- Confusion and disorientation or amnesia

The patient should be seen immediately if he or she reports any of the following signs and symptoms days or weeks after a head injury:

- Persistent headache
- Vertigo (dizziness)
- Inability to concentrate
- Repeated problems with memory
- Nausea or vomiting (especially if vomiting is projectile)
- Unusual anger, irritability, anxiety, or depression
- Sleep disorders
- Seizures

**Cerebral Concussion and Contusion**

Concussion is the mildest and the most common type of brain injury. Trauma from an impact or a sudden change in motion can cause a concussion with loss of consciousness, which may last seconds to several minutes and may be followed by a period of disorientation that lasts up to 24 hours (Figure 44-8). A single concussion may disrupt the normal electrical activity in the brain, but the brain usually is not injured permanently. However, research has shown that the damage from multiple concussions may be cumulative, and neurologists recommend that children should be removed from all sporting activities if they have experienced three concussions.

A more serious injury to the brain can cause the formation of a contusion, or bruised area, usually because of a skull fracture. Symptoms can include headache, nausea, vomiting, vision disturbances, and sensitivity to light. Talking with the patient may reveal reduced levels of concentration, irritability, or periods of amnesia. The patient’s initial assessment may include an evaluation of consciousness according to the parameters of the Glasgow Coma Scale (Table 44-4).
Open and Closed Head Injuries
In a closed head injury, a brain injury occurs but the skull is not fractured. A more serious brain injury can occur with an open head injury, because the skull is fractured or displaced. A serious head injury can cause life-threatening damage to the intracerebral structures. Subarachnoid hemorrhage may occur when the delicate meningeal blood vessels are ruptured, resulting in the collection of blood in the subarachnoid space. This causes a rapid increase in intracranial pressure, which may give rise to sudden, severe headache; nausea and severe projectile vomiting; motor disturbances; visual disturbances; and seizures. In addition to trauma, other predisposing factors that can cause subarachnoid hemorrhage include hypertension, a family history of the condition, and congenital malformations of cranial blood vessels. Treatment is designed to reduce the intracranial pressure, sometimes surgically.

A subdural hematoma develops when blood collects in the space between the dura mater and the arachnoid layers of the meninges, usually as a result of head trauma that has caused slow bleeding from ruptured blood vessels in the meningeal layers. Symptoms of increased intracranial pressure occur over a several days as the hematoma increases in size. Signs and symptoms build over time and include headache, motor disturbances, speech abnormalities, nausea and vomiting, seizures, and a decreased level of consciousness. Treatment requires surgery to stop the bleeding and reduce the pressure inside the skull. People age 75 or older are at greatest risk of developing a subdural hematoma after a minor fall or cranial impact.

Shaken Baby Syndrome
Shaken baby syndrome is the most common reason for serious head injury in infants. It is caused by violently shaking the infant back and forth, forcing the brain against opposite ends of the skull. Shaking is so dangerous for babies because of their small size in comparison to their relatively large head size, as well as their undeveloped neck muscles. The typical presentation is a child approximately 6 months old who is brought to the clinic or emergency department because of difficulty breathing or marked lethargy. Usually little or no external bruising or trauma is seen. Physical findings on examination or autopsy include a subdural hematoma and retinal hemorrhages. The history given by the caregiver usually indicates that the baby “fell” from the sofa, coffee table, or bed or was “dropped.” Approximately one fourth of these infants die of their injuries.

Spinal Cord Injuries
If a traumatic accident completely transects the spinal cord, all CNS stimulation to nerves distal to the injury stops, resulting in paralysis of the areas below the injury. Paralysis because of cord transection is grouped into one of two categories (Figure 44-9). In paraplegia, transection occurs below the midpoint of the spinal cord, causing paralysis of both legs, loss of function below the level of injury, including loss of bladder and bowel control, and

![Figure 44-8: Skull with concussions and contusions. (Modified from Frazier MS, Drzymkowski JN: Essentials of human diseases and conditions, ed 4, St Louis, 2009, Saunders.)

**TABLE 44-4: Glasgow Coma Scale**

<table>
<thead>
<tr>
<th>SCORE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye opening</td>
<td>No response</td>
<td>To pain</td>
<td>To voice</td>
<td>Spontaneously</td>
<td></td>
</tr>
<tr>
<td>Best motor response (movement of arms and legs)</td>
<td>No response</td>
<td>Extension to pain</td>
<td>Flexion to pain</td>
<td>Localizes to pain</td>
<td>Follows commands</td>
</tr>
<tr>
<td>Best verbal response</td>
<td>No response</td>
<td>Incomprehensible sounds</td>
<td>Inappropriate words</td>
<td>Disoriented and conversations</td>
<td>Oriented and conversations</td>
</tr>
</tbody>
</table>

Scoring: 13 to 15, Mild head injury; 9 to 12, moderate head injury; 3 to 8, severe head injury.
sexual dysfunction in males. In *quadruplegia*, transection occurs in the upper thoracic or cervical region of the spinal cord, causing paralysis of all four limbs, respiratory difficulty, and loss of function to all muscles below the injury points. *Hemiplegia* is unrelated to spinal cord injury and occurs when a CVA, a vascular injury such as a ruptured aneurysm, or a tumor occurs on one side of the brain, resulting in paralysis on the opposite side of the body.

No surgery or treatment can restore a transected cord, although much research currently is underway in this area. If the spinal cord is injured but not completely transected, the degree of paralysis depends on the degree of injury. Such patients usually respond well to physical therapy, and their ability to restore motor function is good, although they may always have some functional limitations.

### Additional Central Nervous System Pathologies

**Parkinson's Disease**

Parkinson's disease (PD) is a chronic, progressive, debilitating disease that affects about 1 in 100 adults over age 60; more than 60,000 new cases occur annually in the United States. PD affects men more frequently than women. The four primary symptoms of PD are tremors of the hands, arms, legs, jaw, and face; rigidity of the limbs and trunk; bradykinesia, or slowness of movement; and postural instability with impaired balance and coordination. The typical presentation of PD includes a unilateral, pill-rolling tremor; a high-pitched, monotone voice; difficulty swallowing; a masklike facial expression; and bowed head and forward-bent posture. Tremors and rigidity increase in severity over time. Currently there are no laboratory tests specific for PD; therefore the diagnosis is based on a comprehensive medical history and neurological examination.

Parkinson's disease is caused by a deficiency of the neurotransmitter dopamine in the brain. The disease has no cure, but various medications are prescribed for symptomatic relief, including carbidopa-levodopa (Sinemet), which converts into dopamine in the brain. Dopamine agonists, which mimic the effects of dopamine, are also prescribed and include pramipexole (Mirapex) and ropinirole (Requip). Although the initial response to medical treatment can show dramatic relief of symptoms, over time the body's response to Parkinson medications declines. Surgical destruction of the most affected area of the brain may produce some relief of symptoms. Another treatment option is deep brain stimulation (DBS), in which electrodes are implanted in the brain and connected to a small electrical device that is externally programmed to help control the tremors and gait problems associated with the disease.

### Tumors

The symptoms of a brain tumor depend on the type and location of the mass, but generally the initial symptoms are headaches, vomiting, dizziness, diplopia, and alterations in muscle strength and coordination. Changes in personality and mental function, seizures, progressive paralysis, loss of speech, and sensory disorders appear as the tumor enlarges.

CNS tumors can be diagnosed by means of CT, MRI, EEG, or lumbar puncture. Ophthalmoscopic examination may reveal papilledema. Accurate diagnosis of a brain tumor includes determining its precise location in the brain and whether it is benign or malignant. Approximately half of all brain tumors are metastatic growths from other primary cancer sites in the body. Lung cancer, breast cancer, and melanoma frequently spread to the brain by metastasis. Regardless of whether the mass is benign or malignant, as brain tumors grow, they cause serious problems and complications for the patient because of the limited space inside the skull. Treatment of brain tumors can include surgery, chemotherapy, and radiation in any combination.

### CRITICAL THINKING APPLICATION 44-5

A 34-year-old man has just found out that he has a brain tumor, and Mai is to schedule him for surgery next week. Before he leaves the office, he says he wants to talk to Mai privately. They go into an examination room, and he says, “Tell me the truth; this is cancer, and I’m going to die, right?” How should Mai respond to this frightened patient?

### DISEASES OF THE PERIPHERAL NERVOUS SYSTEM

**Multiple Sclerosis**

The axon of a nerve cell in the PNS is covered with a myelin sheath to protect and insulate electrical stimulation as it is passed to the terminal end of the neuron. Multiple sclerosis (MS) is an autoimmune reaction that causes progressive inflammation and deterioration (demyelination) of the myelin sheath, leaving nerve fibers uncovered and resulting in a scattering of the nervous message as it passes down the axon. Early symptoms may include
numbness, paresthesia, diplopia, ataxia, and bladder control problems. As the disease progresses, patients experience increased spasticity, vertigo, depression, gait problems, joint pain, fatigue, and varying degrees of paralysis. It most commonly begins in women in their early 30s. The cause remains unknown; however, it is more common in Northern climates, and it may be associated with a viral infection. MS frequently is diagnosed by the exacerbation and remission of neurologic symptoms characteristic of the condition. Patients cycle through remission and relapse, and an ever-increasing degree of dysfunction occurs after each episode. An MRI study may show plaques on nerve fibers where the myelin sheaths have been destroyed and areas of sclerosis from scar tissue at the inflammation sites.

MS has no cure; therefore treatment focuses on alleviating symptoms and delaying the progression of the disease. Medications used to treat the disease include corticosteroids during periods of exacerbation, interferon (Betaseron, Avonex) to reduce the frequency and severity of relapses, and additional medications to treat fatigue, pain, spasticity, and bladder control problems. Some patients live an essentially normal life with only occasional attacks, whereas others experience rapidly progressive incapacitation.

Amyotrophic Lateral Sclerosis

Amyotrophic lateral sclerosis (ALS), or Lou Gehrig's disease, is a rapidly progressive, ultimately fatal neurologic disease that destroys the motor neurons responsible for voluntary muscle control. Without stimulation from motor neurons, muscles cannot function and gradually weaken and atrophy. ALS usually begins with small, local, involuntary muscle contractions in the forearms and hands. As the disease progresses, the patient has difficulty with speech, chewing, swallowing, and breathing. In most cases the disease does not affect a person's personality, intelligence, or memory, nor does it affect the ability to see, smell, taste, hear, or recognize touch. The first drug treatment for the disease, recently approved by the U. S. Food and Drug Administration (FDA), is riluzole (Rilutek), which reduces damage to motor neurons and prolongs survival, especially in patients with difficulty swallowing. Other treatments, which are palliative, include attempts to keep the individual as comfortable as possible and to help with pain, depression, sleep disturbances, and constipation. Death from failure of the respiratory muscles usually occurs within 3 to 5 years after the onset of symptoms. The cause is unknown, but the disease most commonly occurs in males over age 50.

Bell's Palsy

Bell's palsy is a temporary facial paralysis. It results from inflammation and edema of the seventh cranial nerve, which in turn are caused by a viral infection (e.g., herpes simplex or Epstein-Barr virus). The condition occurs suddenly, and symptoms reach their peak within 48 hours. The disorder usually subsides spontaneously over several weeks to months. Symptoms range in severity from mild weakness to complete paralysis on the affected side, depending on the degree of nervous involvement. The patient can experience facial twitching, eyelid drooping, excessive tearing of the affected eye, and drooping of the mouth with drooling of saliva. The patient is unable to close the eye on the affected side completely and may have taste disturbances. The antiviral drug acyclovir may be prescribed, as well as prednisone to reduce the inflammation and control edema. The physician recommends an eye patch to protect the exposed eye, especially at night, to prevent corneal abrasions.

Peripheral Neuropathy

Peripheral neuropathy is not a disease in itself, but rather a condition of peripheral nerve dysfunction that can have more than 100 different known causes. It can be cryptogenic, or idiopathic, which means that the underlying cause cannot be identified. Conditions that can cause peripheral neuropathy include diabetes mellitus, human immunodeficiency virus (HIV) infection, nutritional deficiencies, and neurologic side effects of some medications. Symptoms usually affect the legs and arms and can include muscular weakness and pain or sensory disturbances such as burning, numbness, and tingling.

Symptoms can vary widely from person to person in both number and severity. Patients often feel extremely frustrated when they try to explain to the physician the abnormal sensations they are experiencing. Peripheral neuropathies can result from damage or injury to any portion of the neuron. Treatment of peripheral neuropathy is most effective when the causative condition is diagnosed and then treated successfully. Encouraging a healthy lifestyle, including weight control, exercise, a nutritious diet, and limiting or avoiding alcohol, helps control the physical and emotional effects of peripheral neuropathy.

Carpal Tunnel Syndrome

Carpal tunnel syndrome (CTS) results from compression of the median nerve as it passes through the carpal bones of the wrist. The carpal tunnel, which is about the size of the thumb, is an open area between the wrist bones that contains the flexor tendons of the forearm and the median nerve, which runs from the forearm to the hand. Compression of these structures within the carpal tunnel can occur spontaneously but more commonly is the result of repetitive movements. CTS is the most common repetitive strain injury (RSI). A frequently reported cause is daily use of the computer keyboard for prolonged periods. The symptoms of median nerve compression are pain, weakness, and numbness in the hand and wrist that radiates up the arm, and paresthesia of the radial-palmar region of the hand. As symptoms worsen, the individual may have reduced grip strength, which makes forming a fist, grasping small objects, or performing other fine motor tasks difficult.

Treatment includes taking breaks from repetitive hand or wrist activities, wearing a wrist support, taking NSAIDs, applying ice, and undergoing physical therapy. If these treatments do not resolve the problem, surgery may be required to relieve the pressure on the median nerve.

MENTAL HEALTH

Each year more than 44 million Americans are affected by a diagnosable mental condition that adversely affects their work, their relationships with family and friends, and their activities of
daily living. Mental health disorders can be caused by a number of factors, alone or in combination, including changes in brain chemicals, hereditary makeup, psychological disposition, and life experiences. Emotional and physical symptoms can occur for no apparent reason and can be quite persistent. Emotional symptoms may include panic, apprehension, fear, anxiety, nightmares, withdrawal, flashbacks, and ritualized repetitive behaviors, such as constant hand washing. Possible physical symptoms include tachycardia, shortness of breath, sleep disturbances, gastrointestinal upset, muscular tension, and cold, clammy hands. Patients often do not associate these symptoms with a mental health disorder and therefore do not get the appropriate diagnosis and treatment.

Depressive Disorders

About 10% of adults in America experience depression each year. About twice as many women as men are affected by the disorder. Depression interferes with daily activities and causes pain and suffering not only to those who have the disorder, but also to those who care about them. Although multiple medications and psychosocial therapies are available to treat and manage depression, most individuals do not seek treatment. Depressive disorders affect the way a person thinks, feels, eats, and sleeps. People with depression cannot “snap out of it” and without treatment may experience symptoms that persist for weeks, months, or years.

Depressive disorders can be categorized as major depressive disorders, dysthymic disorders, and bipolar disorders. Individuals with major depression show a combination of symptoms that interfere with their ability to work, study, sleep, eat, and enjoy activities they once considered pleasurable. Dysthymic disorders are a less severe type of depression in which patients experience long-term, chronic symptoms that are not incapacitating but that affect their level of performance and daily emotions. Many people with dysthymia also experience major depression at some time in their lives. Individuals with bipolar disorders, also called mood disorders or manic-depression, cycle through a wide range of moods from extreme highs (mania) to extreme lows (depression). When in the depression cycle, they may show any or all of the symptoms of a depressive disorder. When cycling through mania, they may make decisions or act in a way that can be both embarrassing and dangerous. Manic individuals are extremely energetic and rarely sleep. If left untreated, the disorder can progress to a psychotic state.

Patients must understand that antidepressant medications take a minimum of 3 to 4 weeks for the full therapeutic effects of the drug to occur. Once they start to feel better, many individuals are tempted to stop taking the medication. It is important to continue treatment for a minimum of 4 to 9 months to prevent a recurrence of the depression. The patient should never stop taking antidepressant medication suddenly or without the direction of a physician. Individuals with bipolar disorders or chronic major depression may need maintenance therapy indefinitely. Treatment for depression typically begins with a selective serotonin reuptake inhibitor (SSRI), because these medications have limited side effects. SSRIs include fluoxetine (Prozac), paroxetine (Paxil), sertraline (Zoloft), and citalopram (Celexa). If the patient does not experience relief of symptoms, the physician may order an older group of drugs called tricyclic antidepressants (TCAs), which inhibit the reabsorption of serotonin and norepinephrine.

Recently, concern has arisen about the association of suicidal thoughts with antidepressant medications in children and adults in the first few weeks of treatment and also when dosages are altered. The FDA has warned physicians to monitor patients closely when starting antidepressant therapy and to provide patient and family education on the importance of reporting to the physician any changes in symptoms.

Symptoms of Depression

According to the National Institute of Mental Health (NIMH), the severity of depressive symptoms varies among individuals and also with each episode. A discussion of the following symptoms can be found at www.nimh.nih.gov.

- Persistent sad, anxious, or “empty” feeling
- Feelings of hopelessness and pessimism
- Feelings of guilt, worthlessness, and helplessness
- Loss of interest or pleasure in hobbies and activities that once were enjoyed, including sex
- Decreased energy and complaints of fatigue
- Difficulty concentrating, remembering, and making decisions
- Insomnia, early morning awakening, or oversleeping
- Either anorexia and weight loss or overeating and weight gain
- Thoughts of death or suicide, with possible suicide attempts
- Restlessness, irritability
- Persistent physical complaints that do not respond to treatment, such as headaches, gastrointestinal disturbances, or chronic pain

Anxiety Disorders

Anxiety disorders affect approximately 19 million American adults. The primary symptoms are an overwhelming, irrational feeling of anxiety and fear. Anxiety disorders include panic disorder, obsessive-compulsive disorder (OCD), post-traumatic stress disorder, and phobias. Individuals with panic disorder report feelings of terror that strike unexpectedly and are accompanied by nausea, chest pain, palpitations, diaphoresis, weakness, vertigo, syncope, and a fear of impending doom or loss of control. People with OCD experience anxious thoughts or images (obsessions) that they cannot control, so they resort to performing specific rituals (compulsions) to try to prevent or dispel the obsession. For example, an individual may be obsessed with germs or dirt, so he or she repeatedly washes the hands; or an individual may have to check repeatedly to make sure a door is locked because of fear that it will be left open. Performing the ritual does not bring pleasure, only temporary relief of the anxiety caused by the obsession, which will grow if the compulsion is not performed.

Post-traumatic stress disorder can occur after a patient is a part of or witnesses some terrifying, horrendous, or violent physical or emotional event, such as assault, battery, rape, war, natural disasters, acts of terrorism, and serious accidents during which
many people are killed or injured. The person who survives the ordeal often has flashbacks; feelings of panic, fear, or guilt; constant replaying of the event in his or her mind; or deep feelings of emotional numbness. Severe depression and inability to function normally in daily activities also may be present.

A phobia is an intense, irrational fear of something that poses little or no actual danger. It may include such things as fear of heights, escalators, tunnels, and water. Although the individual may realize that the fear is unreasonable, just the thought of facing the feared object or situation causes a panic attack or severe anxiety. The two types of treatment for anxiety disorders are anti-anxiety medication, such as alprazolam (Xanax) or buspirone (BuSpar), and specific types of psychotherapy.

**Schizophrenia**

Schizophrenia is a chronic, severe, disabling brain disorder with symptoms that include hallucinations and delusions; difficulty speaking and expressing emotions; and cognitive deficits, such as problems with concentration and memory loss. Schizophrenia cannot be cured, but psychotic episodes can be reduced significantly by long-term, consistent pharmaceutical treatment. However, relapses are not unusual, because most individuals with schizophrenia stop taking their antipsychotic medication periodically because they feel better, they do not believe they need the medication, or they do not think that taking it regularly is important. In addition, the earliest antipsychotic medications, such as chlorpromazine (Thorazine) and haloperidol (Haldol), caused disturbing side effects, including rigidity, persistent muscle spasms, tremors, and restlessness. Newer drugs, which have limited side effects, include risperidone (Risperdal) and olanzapine (Zyprexa).

**SUICIDE FACTS FROM THE NATIONAL INSTITUTE OF MENTAL HEALTH**

- More than 90% of individuals who commit suicide have a diagnosable mental disorder, typically depression, or are substance abusers.
- The highest suicide rate in the United States is seen in Caucasian men over age 85.
- Suicide is the third leading cause of death in children ages 10 to 19 and in young adults ages 20 to 24.
- Although women attempt suicide two to three times more often than men, four times as many men are successful.
- Risk factors vary with age, gender, and ethnic group. They include serious depressive disorders; reduced levels of serotonin (a neurotransmitter); a prior suicide attempt; family violence, including physical or sexual abuse; and exposure to the suicidal behavior of others, including family members and peers.

**THE MEDICAL ASSISTANT'S ROLE IN THE NEUROLOGIC EXAMINATION**

As with other physical examinations, a careful history provides the physician with valuable clues in diagnosing neurologic conditions. Such clues may include a record of seizures, syncope, diplopia, incontinence, or any of the previously mentioned subjective symptoms. The patient's general health often complicates a neurologic diagnosis.

The purposes of a neurologic examination are to determine whether a nervous system malfunction is present, to discover its location (or locations), and to identify the type and extent of the malfunction. During the examination, the physician may determine the effect of the symptoms on the patient's emotional status, intellectual performance, cognitive ability, and general behavior (Procedure 44-1). The patient's grooming and mannerisms are carefully observed, as is his or her ability to communicate effectively, including the appropriate use of speech, language, and writing skills. The medical assistant should listen carefully for difficulty putting words together, slurred speech, and whether conversation makes sense. If you notice inappropriate changes in the patient, note them on the patient's record for the physician's attention and evaluation.

The physical examination of the neurologic system includes evaluation of the cranial nerves. You can assist by helping the patient assume the proper position necessary for each test and by having the instruments the physician needs readily for use. For example, cranial nerve I (the olfactory nerve) is tested by determining the patient's ability to identify familiar odors such as coffee, tobacco, or cloves. Cranial nerve V (the trigeminal nerve) is checked by having the patient differentiate between warm and cold objects held against the right and left cheeks.

Peripheral nerve function is evaluated by examining the motor system, including muscular strength, gait, and movements. The diameters of the upper arms and the calves of the legs may be measured and compared to diagnose muscle atrophy. Motor functioning can be assessed through Romberg's test, in which the patient is asked to stand with the feet together, arms horizontal to the body, and eyes closed. The sensory system is examined by noting the patient's ability to perceive superficial sensations, such as a wisp of cotton brushed on the skin, a light pinprick, or heat and cold touching certain areas. Several deep tendon reflexes (DTRs), such as the patellar and Achilles reflexes, are tested (Figure 44-10). Babinski's reflex is tested by stroking the lateral aspect of the sole of the foot with a dull instrument (e.g., the handle of a reflex hammer or a tongue blade). In a positive Babinski's sign, the great toe dorsiflexes while the other toes fan out. This may indicate a possible stroke or brain lesion. Other diagnostic tests may include a skull radiograph, carotid arteriogram, EEG, and MRI and CT studies.

**DIAGNOSTIC TESTING**

Several diagnostic tests are used to help the physician accurately diagnose conditions and diseases of the neurologic system. The most common diagnostic procedures are the lumbar puncture and various radiographic studies (Table 44-5).

**Electroencephalography**

EEG is the recording of changes in electrical impulses in various areas of the brain by means of electrodes placed on the scalp. Every individual has a unique EEG pattern. In a healthy brain, most of the recorded waves are the occipital alpha waves coming from the back of the head. Irregular slow waves are called delta
PROCEDURE 44-1

Assist the Physician with Patient Care: Assist with the Neurologic Examination

**GOAL:** To assist the physician in performing a neurologic examination of the patient.

**EQUIPMENT and SUPPLIES**

- Patient gown
- Drape
- Otoscope
- Ophthalmoscope
- Percussion hammer
- Disposable pinwheel
- Penlight
- Tuning fork
- Cotton ball
- Tongue depressor
- Small vials of warm and cold liquids prepared according to the physician's instructions
- Small vials of sweet and salty liquids prepared according to the physician's instructions
- Small vials containing substances with distinct odors (e.g., instant coffee, cinnamon, vanilla) prepared according to the physician's instructions
- Patient's record

**PROCEDURAL STEPS**

1. Assemble and prepare the equipment and supplies needed for the neurologic examination and prepare the room.
2. Sanitize your hands and follow Standard Precautions.
   **PURPOSE:** To ensure infection control.
3. Identify the patient and briefly explain the procedure.
   **PURPOSE:** Explanations gain the patient's cooperation and ease apprehension.
4. Instruct the patient to disrobe as needed for the examination and to put on a gown with the opening in the back.
5. During the examination, be prepared to assist the patient in changing positions as necessary. Have the necessary examination instruments ready for the physician at the appropriate time during the examination. Record all results from the examination as indicated by the physician.
   **PURPOSE:** To facilitate a thorough, accurate neurologic examination.
6. A neurologic examination proceeds as follows but can be modified according to the physician's preference:
   - Mental status examination
   - Proprioception and cerebellar function
   - Cranial nerve assessment
   - Sensory nerve function
   - Reflexes
7. Record all procedures in the patient's medical record.
   **PURPOSE:** A procedure is not complete until it has been documented accurately in the patient's medical record.

waves, which normally are found in people deeply asleep and in infants and young children. A delta wave pattern is abnormal in an awake adult. Rhythmic slow waves, called theta waves, show a decrease in brain activity. Electrical silence (flatline EEG) indicates no evidence of brain activity and is one of the criteria used to determine brain death. EEG is valuable for diagnosing epilepsy, brain tumors, and other brain conditions (Procedure 44-2).

### Lumbar Puncture

If the physician suspects that an infection or inflammation of the CNS is present, a lumbar puncture (spinal tap) is ordered to collect a CSF sample for culture, for analysis of glucose and protein, or to detect increased intracranial pressure or an area of intracranial bleeding (Figure 44-11). The patient is placed on the left side in the fetal position; using sterile technique, the physician injects the lumbar puncture site with a local anesthetic, and the puncture is performed by inserting a special needle into the subarachnoid space, usually between the L4 and L5 vertebrae. The pressure within the subarachnoid space is recorded, and a sample of CSF is collected for laboratory analysis.

After the procedure, the patient must remain flat in bed for approximately 8 hours to reduce the chances of developing a spinal headache. Medical practices usually have a specially equipped room where this procedure is performed. If you are working in such an office, you may be responsible both for assisting with the procedure and for monitoring the patient after the procedure until he or she is sent home. Watch for side effects such as severe headaches, visual disturbances, and pain. You also will have particular office protocols to follow regarding the frequency of vital signs, liquid intake, urine output, and visitors. Lumbar punctures usually are performed in hospitals, outpatient clinics, or surgical centers (Procedure 44-3). On discharge, patients should be told to notify the physician immediately if they experience any numbness and tingling of the legs; drainage of blood or liquid from the injection site; inability to urinate; or a persistent headache.

### CRITICAL THINKING APPLICATION 44-6

Dr. Song wants to perform a lumbar puncture on a 10-year-old girl who he suspects has bacterial meningitis. Her mother agreed to the procedure, but while Mai is preparing the girl, the mother changes her mind. She is afraid that inserting a needle into her daughter's spine will paralyze the girl. What should Mai do in this situation?

### CLOSING COMMENTS

### Patient Education

The nervous system is the major communication and control system in the human body. It influences and regulates all mental...
activity, including thought, learning, and memory. It is responsible for maintaining homeostasis (constant internal environmental conditions that are compatible with life) among the body’s systems. Through its many receptors, the nervous system constantly monitors what is going on inside the body and in the environment outside the body.

When the nervous system becomes damaged or diseased, signs and symptoms can appear in every other body system. Motor activity can become erratic, or activity level can decline to the point that the person becomes unable to communicate or function normally.

Your main responsibilities as a medical assistant in neurology are to observe, listen, and report any changes in patients. Even signs and symptoms that may seem rather slight can give the physician the one clue needed to put the puzzle together and arrive at a correct diagnosis before proceeding to the appropriate treatment. It is crucial that medical assistants working in a neurology practice recognize the importance and significance of a
TABLE 44-5 Diagnostic Tests for the Nervous System

<table>
<thead>
<tr>
<th>TEST</th>
<th>PROCEDURE AND PATIENT PREPARATION</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arteriography</td>
<td>Patient usually is given a sedative. Then, after injection of a local anesthetic, a catheter is threaded into an artery toward the head. A contrast medium is injected, and video fluoroscopic studies are recorded. The patient must remain still during the procedure, which may last up to 1 hr.</td>
<td>To visualize the vertebral and carotid arteries, cerebral arterial circulation, leaking vessels, aneurysms, and occluded vessels</td>
</tr>
<tr>
<td>CT scan</td>
<td>Patient's head is strapped into a foam block to prevent movement, and patient lies on a moveable table. The table moves into the CT machine, which converts an x-ray study into a visual image of multiple transverse sections of the test structure. Procedure can last up to 1 hr, and the patient must remain still the entire time.</td>
<td>To visualize multiple, serial, radiographic sections of a structure, differentiating between bone and soft tissues</td>
</tr>
<tr>
<td>EEG</td>
<td>Patient relaxes comfortably on a recliner or bed. Electrodes are attached to the head. The examiner may ask the patient questions, give the patient various forms of visual or auditory stimulation, or have the patient sleep.</td>
<td>To record electrical activity of the brain to determine cerebral function or origin of seizure activity, diagnose sleep disorders, or determine lack of brain function</td>
</tr>
<tr>
<td>Lumbar puncture</td>
<td>With the patient in a side-lying fetal position, a local anesthetic is injected. A needle then is inserted into the subarachnoid space between the third and fourth lumbar vertebrae. Patient must remain very still during the procedure, which normally takes 5-20 min.</td>
<td>To determine CSF pressure, obtain CSF specimens for testing, reduce intracranial pressure, and inject contrast medium for radiographic studies</td>
</tr>
<tr>
<td>MRI</td>
<td>Patient should not have any metal in the body. Patient lies down on a moveable table, and the head is strapped into a foam block to prevent movement. The table moves into the MRI machine, which converts the cells' electromagnetic energy into a visual image. Patient must remain still during the procedure, which lasts up to 1 hr.</td>
<td>As with CT, to visualize multiple, serial, radiographic sections of a structure; shows images of the brain, spinal cord, and surrounding vascular and soft tissue</td>
</tr>
<tr>
<td>PET scan</td>
<td>Radioactive isotope is injected into the patient, and the brain is scanned to locate areas of isotope concentration. Patient must remain still during the procedure, which lasts up to 2 hr.</td>
<td>A radionuclide study that can identify areas of increased metabolic activity, vascular abnormalities, and space-occupying lesions</td>
</tr>
<tr>
<td>X-ray studies</td>
<td>Patient's head is placed in a specific position in front of the x-ray film; patient must remain still for about 1 min while x-ray is taken.</td>
<td>Bone studies to identify fractures and other bone pathologies</td>
</tr>
</tbody>
</table>

CT, Computed tomography; EEG, electroencephalography; CSF, cerebrospinal fluid; MRI, magnetic resonance imaging; PET, positron emission tomography.

variety of symptoms. For example, severe headache accompanied by vomiting may indicate a serious intracranial problem that requires immediate attention. The medical assistant in a neurology practice must remain alert to these types of situations at all times, because neurologic emergencies can develop quite rapidly.

Legal and Ethical Issues

In neurology you will be faced with a variety of behaviors and personality changes that frequently are a part of neurologic conditions. Often a patient is not aware of these changes and may appear as though nothing is wrong. You must treat this patient with the same dignity and respect as you would all other patients, despite how the patient may treat you. Some patients are concerned that loved ones have turned against them and are treating them in an abusive manner. A patient's family may be experiencing severe emotional stress in coping with the patient's behavior. You must remember the medical assistant's code of ethics and the need for total confidentiality. Whatever is discussed in the examination room cannot be repeated to other staff members in the

FIGURE 44-11 A lumbar puncture.
**PROCEDURE 44-2**

**Assist the Physician with Patient Care: Prepare the Patient for an Electroencephalogram**

**GOAL:** To prepare a patient physically and psychologically so that an accurate, useful EEG can be obtained.

**EQUIPMENT and SUPPLIES:** Patient Record

**PROCEDURAL STEPS**

1. Greet the patient and introduce yourself. Explain that you will go over what is going to happen step by step to ensure the best results.
2. Explain the purpose of the EEG, how the procedure is performed, and what is expected of the patient during the test.
3. Tell the patient that the electrodes pick up tiny electrical signals from the body and that there is no danger of electrical shock.
4. Explain that the test is painless, because the electrodes are attached to the scalp with paste.
5. If this is a sleep EEG, suggest that the patient stay up later than usual the night before the test so that it will be easier to fall asleep.
6. Go over the physical preparation, including the diet to be followed for the 48 hours before the test. This usually includes no stimulants (e.g., coffee, chocolate, or sodas) and no skipping meals.

**PURPOSE:** Meal skipping may cause hypoglycemia, which alters brain function.

7. Explain that a baseline EEG will be taken at the beginning of the test, and during this time the patient will be asked to avoid all movement, even eye and tongue movement.

**PURPOSE:** These activities can be very disruptive to the brain wave tracing.

8. If a stimulation examination is ordered, explain that the patient will be asked to view flickering lights to stimulate the brain. The EEG will measure the brain's response to this stimulation.

9. Ask the patient whether he or she has any questions. If so, answer the questions so that the patient understands the procedure clearly.

**PURPOSE:** Patients are more likely to cooperate if they understand the process, so that they are not unduly apprehensive before and during the test.


**NOTE:** Advanced training is required to perform an EEG.

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**PROCEDURE 44-3**

**Assist the Physician with Patient Care: Prepare the Patient for and Assist with a Lumbar Puncture**

**GOAL:** To prepare a patient physically and mentally for a lumbar puncture so that a specimen of CSF can be obtained for testing.

**EQUIPMENT and SUPPLIES**

- Patient gown
- Drape
- Local anesthetic
- Sterile, disposable lumbar puncture kit
- Instrument stand
- Sterile gloves
- Permanent marker to label tubes
- Laboratory requisitions as needed
- Biohazard laboratory transport bag
- Patient's record

**PROCEDURAL STEPS**

1. Assemble the materials needed, and prepare the room. Prepare the equipment and supplies needed for the lumbar puncture.
2. Sanitize your hands and follow Standard Precautions.

**PURPOSE:** To ensure infection control.

3. Identify the patient and introduce yourself. Explain that you will go over what will happen step by step to ensure the best results.

4. Have the patient void just before the procedure.

**PURPOSE:** To improve the patient's comfort during the procedure.

5. Give the patient a hospital gown and have him or her put it on with the opening in the back.

6. Place the patient in a left side-lying fetal position for the lumbar puncture.

**PURPOSE:** To give the physician the easiest access to the lumbar region.

7. Support the patient's head with a pillow as necessary and provide a pillow for between the knees if needed.

**PURPOSE:** To make the patient as comfortable as possible for the procedure.

8. Perform a sterile skin preparation of the lumbar region in the usual manner.

**PURPOSE:** To prevent bacterial infection at the puncture site.

9. Place the sterile disposable lumbar puncture kit on an instrument stand and open it, establishing a sterile field. Drape a sterile fenestrated drape over the lumbar region so that only the L3-L4 region of the lower spine is exposed.

**PURPOSE:** To isolate the area of the procedure in a sterile field.
10. When the physician is ready to perform the lumbar puncture, hold the vial of local anesthetic for the physician.

**PURPOSE:** To maintain sterile technique and expedite the procedure.

11. Reassure the patient and help him or her hold still during injection of the local anesthetic and insertion of the spinal needle.

**PURPOSE:** To facilitate accurate insertion of the spinal needle.

12. Using the permanent marker, label the specimens #1, #2, and #3 in the order in which they are collected. This is a crucial step in the procedure.

**PURPOSE:** Different tests are done on different tubes. The accuracy of these tests depends on the tube on which they are performed.

13. Complete the laboratory requisition form and prepare the CSF specimens for transport to the laboratory.

**PURPOSE:** To ensure that all the necessary tests are ordered correctly.

14. Clean the area by disposing of sharps, biohazard materials, and regular waste in the normal manner.

15. Monitor the patient and give liquids as directed by the physician.


**PURPOSE:** A procedure is not complete until it has been documented accurately in the patient's medical record.

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**HIPAA Applications**

Although patients typically have the right to obtain a copy of their confidential health information, under the privacy regulations of the Health Insurance Portability and Accountability Act (HIPAA), access to psychotherapy notes is limited. HIPAA describes psychotherapy notes as the documentation completed by a mental health professional that describes and analyzes the conversations with a patient during counseling sessions. These notes are not supposed to be stored in the patient's general chart and should not be released to third-party payers. Disclosure of psychotherapy notes requires specific patient permission before any documentation can be released to an insurance provider. Under federal law, the therapist must decide whether to release the notes to the patient, and if the therapist decides not to release the information, the patient cannot appeal this decision. However, the final authority rests with individual state laws. If a state law is stricter than the federal mandate or gives the patient greater access to psychotherapy notes, state law takes precedence over federal law.

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**SUMMARY OF SCENARIO**

Mai has excelled in her new position as clinical assistant and patient educator. With Dr. Song's approval, she has developed a series of patient information sheets that explain the functions of the nervous system, the symptoms to watch for after a head injury, the kinds and causes of headaches, and infections of the nervous system. Patients often ask for information sheets for other family members and for their friends and neighbors. She also developed a set of information sheets to explain typical neurologic diagnostic tests and how best to prepare for them. Although the patient receives a copy of the information sheet, Mai still talks with each patient to make sure he or she understands exactly what will happen in the test and to answer all questions completely. Mai feels a great deal of personal satisfaction from working with patients and helping them understand their diagnosis and treatment protocols.

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**SUMMARY OF LEARNING OBJECTIVES**

1. Define, spell, and pronounce the terms listed in the vocabulary. Spelling and pronouncing medical terms correctly bolster the medical assistant's credibility. Knowing the definitions of these terms promotes confidence in communication with patients and coworkers.

2. Apply critical thinking skills in performing the patient assessment and patient care.

   Completing the Critical Thinking Application exercises throughout the chapter can help the student medical assistant become more adept at critical analysis of real-life situations.

3. Summarize the anatomy and physiology of the nervous system.

   The main function of the nervous system is to control body functions so that homeostasis can be maintained. It does this by receiving messages in the CNS from the PNS, then sending a response to the appropriate location in the body, again via the PNS. The neuron is the functional cell of the nervous system, and neural glial cells support and protect neurons throughout the system. The brain is made up of the cerebrum, cerebellum, and brainstem. The CNS is well protected, first by the skull, and then by the dura mater, arachnoid mater, and pia mater meninges.

4. Differentiate between the central and peripheral nervous systems. The nervous system is made up of two parts: the CNS, which includes the brain and spinal cord, and the PNS, which includes all the nerves outside the CNS.

5. Identify the typical symptoms associated with neurologic disorders.
Symptoms of potentially serious neurologic conditions include headache, nausea and vomiting, change in vision, altered level of consciousness, memory loss, sleep disorders, confusion or disorientation, and problems with mobility.

6. **Distinguish among common nervous system diseases and conditions.**
   Table 44-3 summarizes the most common diseases and conditions of the nervous system.

7. **Describe the pathology of cerebrovascular diseases.**
   CVD may be caused by atherosclerosis, hypertention, thrombi, emboli, or aneurysms. A TIA is a temporary limitation of function as a result of short-term ischemia. A CVA occurs when the blood supply to a particular part of the brain is cut off by an embolus, a thrombus, or an aneurysm that bursts. Migraine headaches are associated with a disturbance in the blood supply to the brain.

8. **Identify the various types of epilepsy.**
   Seizures are classified as either partial or generalized, based on how much of the brain is involved in the abnormal electrical activity. Partial seizures result from abnormal electrical activity in just one part of the brain, whereas generalized seizures involve most or all of the brain. Generalized seizures include petit mal seizures, which are brief episodes characterized by staring, subtle body movements, and brief lapses of awareness. Probably the best-known seizure disorder is the generalized tonic-clonic disorder that causes grand mal seizures.

9. **Compare and contrast encephalitis and meningitis.**
   Encephalitis is a viral infection of the brain that can cause serious CNS symptoms. Meningitis may be caused by viruses, bacteria, or fungi. Bacterial meningitis is most serious. Viral meningitis usually resolves without treatment or incident.

10. **Explain the dynamics of head and spinal cord injuries.**
    Traumatic brain injuries can range from a mild concussion to severe injury, coma, and death. A minor concussion usually causes no long-term side effects; however, a moderate to severe brain injury can result in headaches, amnesia, confusion, personality changes, and seizures. The higher the damage to the spinal cord, the more serious the injury. Head injuries can be either open or closed, with possible serious intracerebral damage and potential complications within the meningeal layers. Shaken baby syndrome is caused by violently shaking an infant back and forth, forcing the brain against opposite ends of the skull.

11. **Summarize the neurologic diseases that affect mobility.**
    PD is a chronic, progressive, debilitating neurologic disease that is caused by lack of the neurotransmitter dopamine. MS causes progressive inflammation and demyelination of the axon, resulting in a scattering of the nervous message as it passes down the axon. ALS is a rapidly progressive, ultimately fatal neurologic disease that destroys the motor neurons responsible for voluntary muscle control. Bell’s palsy causes temporary facial paralysis because of damage or trauma to cranial nerve VII. Peripheral neuropathies can result from damage or injury to any part of the neuron and typically are caused by other systemic diseases, such as diabetes. CTS results from compression of the median nerve as it passes through the carpal bones of the wrist.

12. **Differentiate among common mental health disorders.**
    Depressive disorders affect the way a person thinks, feels, eats, and sleeps. People with depression cannot “snap out of it” and without treatment may suffer from symptoms that last weeks, months, or years. Types of depressive disorders include major depression, dysthymia, and bipolar disorders. Anxiety disorders cause an overwhelming, irrational feeling of anxiety and fear; these include panic disorder, OCD, post-traumatic stress disorder, and phobias. Risk factors for suicide include serious depressive disorders; reduced serotonin levels; a prior suicide attempt; family violence; and exposure to the suicidal behavior of others. Schizophrenia is a chronic, severe, and disabling brain disorder with symptoms that include hallucinations and delusions; difficulty speaking and expressing emotions; and cognitive deficits.

13. **Analyze the medical assistant’s role in the neurologic examination.**
    When assisting in neurology, the medical assistant must be particularly careful to recognize signs and symptoms, which frequently are quite subtle but yet can be extremely significant in helping to assess and diagnose the neurologic patient accurately (see Procedure 44-1).

14. **Explain the common diagnostic procedures for the nervous system.**
    Diagnostic tests for the neurologic system are summarized in Table 44-5. They include arteriograms, CT, MRI, and PET scans, EEG, lumbar puncture, and various x-ray studies.

15. **Outline the steps needed to prepare a patient for an electroencephalogram (EEG).**
    Procedure 44-2 outlines the steps for preparing a patient for an EEG.

16. **Describe the steps for preparing a patient for and assisting with a lumbar puncture.**
    Procedure 44-3 describes the procedural steps for preparing a patient for and assisting with a lumbar puncture.

**CONNECTIONS**

- **Study Guide Connection:** Go to the Chapter 44 Study Guide. Read and complete the activities.

- **Evolve Connection:** Go to the Chapter 44 link at evolve.elsevier.com/kain to complete the Chapter Review and Chapter Quiz. Peruse other resources listed for this chapter to increase your knowledge of Assisting in Neurology and Mental Health.