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Nervous System

Terminology

**Agraphia**—Inability to convert one’s thoughts into writing.

**Alexia**—The inability to understand written words.

**Analgesia**—Without sensitivity to pain.

**Aneurysm**—An abnormal widening or ballooning of a portion of an artery due to weakness in the wall of the blood vessel.

**Aphasia**—Inability to communicate through speech, writing, or signs due to an injury or disease in certain areas of the brain.

**Apraxia**—Inability to perform coordinated movements or use objects properly.

**Ataxia**—Without muscular coordination.

**Bradykinesia**—Abnormally slow movement.

**Burr hole**—A hole drilled into the skull using a special drill.

**Cephalgia**—Pain in the head, headache.

**Coma**—A deep sleep where a person cannot be aroused and does not respond to external stimuli.

**Craniotomy**—A surgical incision in the skull.

**Demyelination**—A degenerative process that erodes away the myelin sheath that normally protects nerve fibers.

**Gait**—The way a person walks.

**Hemiparesis**—Slight or partial paralysis of one half of the body.

**Hyperkinesia**—Excessive muscular movement and physical activity.

**Kinesiology**—The study of muscle movement.

**Neuralgia**—Pain that follows the path of a nerve.

**Neuritis**—Inflammation of a nerve.

**Paraplegia**—Paralysis of the lower extremities and trunk, usually associated with spinal cord injuries.

**Paresthesia**—A sensation of numbness or tingling.

**Quadriplegia**—Paralysis of all four extremities and the trunk resulting from an injury to the cervical vertebrae in the spinal cord.

**Sciatica**—Inflammation of the sciatic nerve causing numbness or weakness in the lower back that radiates down the back of the leg.

**Syncope**—Temporary loss of consciousness and posture, also known as fainting.

**Thrombosis**—Formation of a blood clot inside a vessel.

Introduction

The nervous system acts as a control center for the entire body. It directs every body system and controls all movement, sensation, thought, and emotion. It receives messages from the external environment, processes them and then makes a decision on how to best respond. Signals are then sent to other parts of the body and the response is carried out. This all happens in a very short amount of time. The nervous system consists of the central nervous system, which includes the brain and spinal cord, and the peripheral nervous system, which includes the nerve fibers that branch out of the central nervous system, sending messages from the brain to the rest of the body. These are electrochemical signals called impulses.

The nervous system works with the endocrine system to maintain homeostasis. Together they can regulate and maintain certain aspects of the body’s internal environment. For instance, the nervous system regulates the heart rate and the endocrine system produces
epinephrine (adrenaline). These two systems work together, receiving signals from each other that affect the function of the other.

The nervous system is made up of two different types of cells, neurons, and neuroglias. The neuron has a cell body, dendrites, and an axon. The cell body has a nucleus that contains mostly genetic material. Dendrites are the branches that extend out from the cell body. The surface of the dendrites is where the chemical messages are received from other neurons. The longest axon in the human body extends from the bottom of the spine to the big toe, with an average length of approximately three feet. Typically neurons have one axon, which is responsible for carrying the impulses away from the cell body. In the central nervous system (CNS), bundles of axons and dendrites are called tracts; in the peripheral nervous system (PNS) they are nerves.

The neuroglias are cells that support and protect neurons. There are primarily four types of glial cells in the central nervous system: astrocytes, oligodendrocytes, microglia, and ependymal cells. The peripheral nervous system has connective tissue cells that work in the same way, but they are called Schwann cells.

The astrocytes provide physical support to neurons and assist in cleaning up debris in the brain. They have a star-shaped appearance. Astrocytes provide neurons with some of the chemicals required for the proper functioning. They also participate in providing nourishment to the neurons.

Microglia protect the brain from invading microorganisms by engulfing particles or debris (a process called phagocytosis), and digesting them. These are the smallest glial cells. Ependymal cells assist in the production of cerebrospinal fluid. It provides a thin epithelial membrane lining the ventricular system of the brain and spinal cord.

Schwann cells work very much the same way as neuroglias, except they support the peripheral nervous system. The same fatty material called myelin insulates the axons to provide conduction.

Central Nervous System

The central nervous system is highly complex in structure and function, and requires a great deal of protection. The brain is encased in the cranium or skull, and the vertebrae of the spine protect the spinal cord. In addition to these bony types of protection, there is also connective tissue membranes (meninges) and cerebrospinal fluid that aide in the protection of these organs. The meninges are three layers of protective membranes that surround the brain and spinal cord and will be discussed in detail later in this chapter. The cerebrospinal fluid contains proteins, glucose, urea, salts, and some white blood cells. It provides nutrition to the Central Nervous System (CNS).

Brain

The brain is the primary controller of the body. It regulates all the major activities of the body such as perception, cognition, attention, emotion, memory, and action. Estimates indicate that the brain is made of 50–100 billion nerve cells. It is suspended in cerebrospinal fluid that is continuous with the spinal cord, and is protected by the skull. There are three main parts of the brain. They are the cerebrum, cerebellum, and brainstem.

Cerebrum

The cerebrum is the largest part of the brain. It is divided into four sections or "lobes," and controls higher
brain function such as thought and action. The four lobes are the frontal, the parietal, the occipital, and the temporal. Each area has its own specific function:

- Frontal lobe—reasoning, planning, emotions, smell, judgment, and problem solving
- Parietal lobe—movement, orientation, response to stimuli, recognition
- Occipital lobe—vision and reading
- Temporal lobe—perception, memory, speech, some hearing, fear

There is a deep furrow that divides the cerebrum in two halves, known as the right and left hemispheres. The two look very much the same, but studies have shown that they function differently. The right hemisphere controls the left side of the body, can analyze non-verbal information, and communicates emotion. The left hemisphere controls the right side of the body, and helps to produce and understand language. The corpus callosum is a bundle of axons connecting the two hemispheres. Nerve cells make up the gray surface of the cerebrum, and white nerve fibers carry signals between the nerve cells and other parts of the brain and body.

**Cerebellum**

The cerebellum, the small brain, controls the coordination of voluntary motor movement, balance, posture, and muscle tone. It is located just above the brain stem in the back of the brain. It is the second largest part of the brain.

**Brain Stem**

The brain stem contains vital control centers and is located in the posterior part of the brain. For such a small structure, it is vital to the function of the brain as it serves as a conduit for the nerve connections of the motor and sensory systems to pass through to get to the rest of the body. There are three major structures of the brain stem to include the midbrain, pons, and medulla oblongata. The midbrain consists of two bundles of nerve tracts called cerebral peduncles, and controls visual and auditory reflexes. The pons lies between the midbrain and the medulla oblongata and forms part of the anterior wall of the fourth ventricle, and controls facial expressions and eye movement. The medulla oblongata joins the spinal cord at the level of the foramen magnum, which is an opening in the occipital portion of the skull. The medulla oblongata controls the regulation of the heart rate as well as the breathing rate.

The thalamus sits on top of the brainstem, near the center of the brain, positioned to send nerve fibers out to the cerebral cortex in all directions. It is the largest structure in the diencephalon, which is the part of the brain that is situated between the midbrain and the forebrain. The thalamus’ main functions include sensation, motor signals, and regulation of consciousness, sleep, and alertness.

The hypothalamus is a small cone-shaped structure located just below the thalamus in the brainstem. It connects the nervous and the endocrine system to help regulate homeostasis. It also contains regulatory areas for thirst, hunger, body temperature, water balance, and blood pressure.

**Spinal Cord**

The spinal cord begins at the occipital bone mid-posterior of the brain and extends down to the space between the first and second lumbar vertebrae; it does not extend the entire length of the vertebral column. At approximately the lumbar region of the spine the spinal cord ends, separating and continuing through the vertebral canal as spinal nerves. This collection of nerves resembles a horse’s tail and is so named the cauda equina. A clear fluid, called cerebrospinal fluid (CSF), serves as protection to the nerve tissues of the spinal cord from the vertebrae. The spinal cord functions primarily as a transmitter of neural signals from the brain to the rest of the body, but also contains neural circuits that can independently control various reflexes and central pattern generators.
The spinal nerves that branch out from the spinal cord to the other parts of the body are called lower motor neurons (LMNs). These spinal nerves exit and enter at different levels of the vertebrae to communicate with specific areas of the body. The sensory portions of the LMN carry messages about sensation from the skin and other body parts to the brain.

The meninges are membranes covering the brain and spinal cord. They are made up of three connective tissue layers, which all together are called meninges. The pia mater is a very delicate membrane that sits the closest to the central nervous system and adheres to the surface of the brain and spinal cord. The arachnoid mater is the middle membrane of the meninges, and derives its name from its spider web-like appearance. The dura mater is a thick and durable membrane that sits closest to the skull. The dura mater surrounds and supports the large venous channels that carry blood from the brain toward the heart.

Peripheral Nervous System
The peripheral nervous system accounts for all the neural tissue and expands out from the brain and spinal cord. It works to connect the central nervous system to the limbs and organs, and is divided into the somatic nervous system and the autonomic nervous system. The somatic nervous system is responsible for controlling voluntary movements of the body, and acting in response to the external environment. There are two types of neurons that carry impulses to and away from the central nervous system so the body can act accordingly. The motor neurons are efferent neurons that relay nerve impulses toward the central nervous system. The sensory neurons are afferent neurons that relay nerve impulses toward the central nervous system.

There are 12 pairs of cranial nerves originating from the brain stem, and located in the cranium. The function of each of these nerves is:

- Olfactory (cranial nerve I)—smell
- Optic (cranial nerve II)—vision
- Oculomotor (cranial nerve III)—eyelid and eyeball movement, pupil dilation
- Trochlear (cranial nerve IV)—turns eye downward and laterally
- Trigeminal (cranial nerve V)—chewing, face, mouth, touch, pain
- Abducens (cranial nerve VI)—turns eye laterally
• Facial (cranial nerve VII)—facial expressions, secretion of tears and saliva, taste
• Auditory (vestibulocochlear) (cranial nerve VIII)—hearing, equilibrium
• Glossopharyngeal (cranial nerve IX)—taste, senses carotid blood pressure
• Vagus (cranial nerve X)—senses aortic blood pressure, slows heart rate, stimulates digestive organs, taste
• Spinal accessory (cranial nerve XI)—controls trapezius and sternocleidomastoid, controls swallowing movements
• Hypoglossal (cranial nerve XII)—controls tongue movements

The spinal cord can be divided into segments according to the nerve roots that branch off of it. The nerve roots run through the bony canal, and at each level a pair of nerve roots exits from the spine. There are 31 pairs of spinal nerves:

• 8 pairs of cervical nerves
• 12 pairs of thoracic nerves
• 5 pairs of lumbar nerves
• 5 pairs of sacral nerves
• 1 pair of coccygeal nerves

The spinal nerves run through gaps between adjacent vertebrae and enter the back and the front of the spinal cord as spinal nerve roots.

A nerve plexus is an intricate network of intersecting nerves that are combined into sets of spinal nerves to form one large grouped nerve to serve the same area of the body. They are named based on the area they serve:

• The cervical plexus serves the head, neck, and shoulders.
• The brachial plexus serves the chest, shoulders, arms, and hands.
• The lumbar plexus serves the back, abdomen, groin, thighs, knees, and calves.
• The sacral plexus serves the pelvis buttocks, genitals, thighs, calves, and feet.
• The solar plexus serves the internal organs.
• The coccygeal plexus serves the coccyx.

The autonomic system splits into three divisions, known as the sympathetic, parasympathetic, and enteric. The sympathetic nervous system responds to external danger by increasing the heart rate and blood pressure, among other physiological changes. It is also responsible for the sense of excitement that is felt due to an increased amount of adrenaline in the body, also known as the
“flight or fight” response. The parasympathetic nervous system works much in the opposite way. It is at work during restful times and relaxes the body causing the constriction of the pupils, slow heart rate, dilation of blood vessels, and stimulation of the digestive and genitourinary systems. The enteric nervous system regulates all aspects of the digestive system from the esophagus to the colon.

The process by which an electrical or chemical signal is passed from one cell to another is called synapse. They allow neurons to pass the signals to individual target cells through a plasma membrane that comes into close contact with the signal passing neuron. Both the presynaptic and postsynaptic membranes contain extensive arrays of molecular cells that link them together and carry out the process.

Peripheral nervous system tissue regeneration—or neuroregeneration—occurs often. Injury to the PNS signals the migration of phagocytes, Schwann cells, and macrophages to clear away damaged tissue. However, injuries to the central nervous system are not followed by extensive regeneration. The environment in the CNS, especially following trauma, counteracts the repair of myelin and neurons, which can lead to loss of function.

Diseases and Disorders

**Epilepsy**

Epilepsy is a brain disorder in which clusters of nerve cells, or neurons, in the brain send abnormal signals to the body. In epilepsy, the normal pattern of neuronal activity becomes disturbed, causing strange sensations, emotions, and behavior or sometimes convulsions, muscle spasms, and loss of consciousness. Many things can cause epilepsy, and basically anything that disturbs the normal pattern of neuron activity, such as illness, brain injury, or abnormal brain development, can lead to seizures. It is very important to remember that having a seizure does not necessarily mean that a person has epilepsy. In general, a person who has had two or more seizures is considered to have epilepsy. Sometimes seizures can be related to temporary conditions such as drug use, withdrawal from certain drugs, a high fever, or abnormal levels of sodium or glucose in the blood. In these cases the person would not be considered as having epilepsy. Children may be born with a defect in the structure of their brain, or they may suffer a head injury or infection that causes epilepsy. Severe head injury is the most common known cause in young adults. In middle age, strokes, tumors, and injuries are more frequent. In people over 65, stroke is the most common known cause, followed by degenerative conditions such as Alzheimer’s disease.

The ICD-10-CM code range for epilepsy (seizures) is G40.001–G40.919

To code for epilepsy in ICD-10-CM, the following is necessary:

- **Type of epilepsy**
- **Intractable or not intractable**
- **With or without status epilepticus**

| Localization-related (focal)(partial) idiopathic epilepsy and epileptic syndromes with seizures of localized onset, not intractable, with status epilepticus | G40.001 |
| Localization-related (focal)(partial) idiopathic epilepsy and epileptic syndromes with seizures of localized onset, not intractable, without status epilepticus | G40.009 |
| Localization-related (focal)(partial) idiopathic epilepsy and epileptic syndromes with seizures of localized onset, intractable, with status epilepticus | G40.011 |
| Localization-related (focal)(partial) idiopathic epilepsy and epileptic syndromes with seizures of localized onset, intractable, without status epilepticus | G40.019 |
| Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with simple partial seizures, not intractable, with status epilepticus | G40.101 |
| Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with simple partial seizures, not intractable, without status epilepticus | G40.109 |
Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with simple partial seizures, intractable, with status epilepticus  
G40.111

Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with simple partial seizures, intractable, without status epilepticus  
G40.119

Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with complex partial seizures, not intractable, with status epilepticus  
G40.201

Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with complex partial seizures, not intractable, without status epilepticus  
G40.209

Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with complex partial seizures, intractable, with status epilepticus  
G40.211

Localization-related (focal)(partial) symptomatic epilepsy and epileptic syndromes with complex partial seizures, intractable, without status epilepticus  
G40.219

In the above table, the need for the type and status of the epilepsy, as well as if it is intractable or not intractable is shown. The guidelines in ICD-10-CM state “the following terms are to be considered equivalent to intractable: pharmacoresistant (pharmacologically resistant), treatment resistant, refractory (medically) and poorly controlled”.

**Migraines**

A migraine headache is a form of vascular headache. Migraine headaches are caused by vasodilatation (enlargement of blood vessels) that prompts the release of chemicals from nerve fibers coiled around the large arteries of the brain. The chemicals cause inflammation, pain, and further enlargement of the artery, which intensifies the pain.

A migraine is a very severe, often debilitating type of headache, causing nausea, vomiting, and sensitivity to light and sound, and can last anywhere from a few hours to a few days. There is often an aura, which can begin within 30 minutes of the onset of the migraine. Sometimes the aura resides with the onset of the migraine and sometimes it may continue. Symptoms of the aura can include blind spots, flashing lights, weakness, or ringing in the ears. Severe symptoms may even include hallucinations.

Migraines are classified according to the symptoms they produce, with the most common types being migraines with or without aura. In adolescents, boys are affected more frequently than girls; however, in adulthood, symptoms in women exceed the number of symptoms reported by men.

The ICD-10-CM code range for migraines is G43.001–G43.919.

To code a migraine in ICD-10-CM, the following information is necessary:
- Type of migraine
- If aura is present or not
- Intractable or not intractable
- With or without status migrainosus (lasting more than 72 hours)

| Migraine without aura, not intractable, with status migrainosus | G43.001 |
| Migraine without aura, not intractable, without status migrainosus | G43.009 |
| Migraine without aura, intractable, with status migrainosus | G43.011 |
| Migraine without aura, intractable, without status migrainosus | G43.019 |
| Migraine with aura, not intractable, with status migrainosus | G43.101 |
| Migraine with aura, not intractable, without status migrainosus | G43.109 |
Nervous System

Migraine with aura, intractable, with status migrainosus  G43.111
Migraine with aura, intractable, without status migrainosus  G43.119
Abdominal migraine, not intractable  G43.D0
Abdominal migraine, intractable  G43.D1

In the above table, the need for the type and status of the migraine, as well as if it is intractable or not intractable is shown. The guidelines in ICD-10-CM state “the following terms are to be considered equivalent to intractable: pharmacoresistant (pharmacologically resistant), treatment resistant, refractory (medically) and poorly controlled”.

Cerebrovascular Disease

A cerebrovascular accident (CVA), or stroke, occurs when the brain does not receive enough oxygen to function properly. There are two types of cerebrovascular accidents: ischemic, which occurs when the blood flow to the brain is restricted due to a blockage, and hemorrhagic, which occurs when there is bleeding in or around the brain. Sometimes the arteries can build up with plaque (atherosclerosis) and cause blood clots to form. If the blood clot or a piece of the plaque breaks loose, it can get lodged in an artery of the brain, decreasing or stopping the amount of blood and oxygen flowing to the brain. A cerebral hemorrhage (bleeding in the brain), as from an aneurysm (a widening and weakening) of a blood vessel in the brain, also causes stroke.

The extent of damage caused by a stroke depends greatly on the type and area of the brain that was affected, and how much time passed between the onset and treatment. The most common effect of a stroke is paralysis of one side of the body with partial or complete loss of voluntary movement or sensation in the leg or arm. Additional residual effects may include problems with speech and weak facial muscles that may cause drooling. If the base of the brain is involved, very commonly balance, vision, swallowing, and breathing can be affected. These problems may develop initially or may take hours, and even occasionally, in rare cases, over several days.

The ICD-10-CM code range for cerebrovascular diseases is I60.–I69.

To code for cerebrovascular diseases, the following information is necessary:

- Type of cerebrovascular disease
- Site

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of right vertebral arteries</td>
<td>I63.211</td>
</tr>
<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of left vertebral arteries</td>
<td>I63.212</td>
</tr>
<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral arteries</td>
<td>I63.219</td>
</tr>
<tr>
<td>Cerebral infarction due to embolism of right anterior cerebral artery</td>
<td>I63.421</td>
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<tr>
<td>Cerebral infarction due to embolism of left anterior cerebral artery</td>
<td>I63.422</td>
</tr>
<tr>
<td>Cerebral infarction due to embolism of unspecified anterior cerebral artery</td>
<td>I63.429</td>
</tr>
<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of right posterior cerebral artery</td>
<td>I63.531</td>
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<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of left posterior cerebral artery</td>
<td>I63.532</td>
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<tr>
<td>Cerebral infarction due to unspecified occlusion or stenosis of unspecified posterior cerebral artery</td>
<td>I63.539</td>
</tr>
</tbody>
</table>

In the above table the need for the type of cerebrovascular disease as well as the site of the occlusion is shown.
In the cerebrovascular disease in the tabular section of ICD-10-CM, the guidelines state:

“Use additional code to identify presence of:”
- alcohol abuse and dependence (F10.-)
- exposure to environmental tobacco smoke (Z77.22)
- history of tobacco use (Z87.891)
- hypertension (I10–I15)
- occupational exposure to environmental tobacco smoke (Z57.31)
- tobacco dependence (F17.-)
- tobacco use (Z72.0)

Cerebral Palsy and Other Paralytic Syndromes

Cerebral palsy happens when the areas of the brain that control movement and posture do not develop correctly or get damaged. It is a group of disorders involving the brain and nervous system functions such as movement, learning, hearing, seeing, and thinking. Early signs of cerebral palsy usually appear before 3 years of age. Babies with cerebral palsy are often slow to reach developmental milestones. Some babies are born with cerebral palsy; others develop it after they are born.

In some people with cerebral palsy, parts of the brain are injured due to unknown causes of low levels of oxygen in the area. There is no cure for cerebral palsy, but treatment can improve the lives of those who have it. Treatment includes medicines; braces; and physical, occupational and speech therapy.

Other Paralytic Disorders

Hemiplegia refers to complete paralysis of one entire side of the body, including arm, leg, and trunk. It may be congenital or acquired for an illness or injury. Strokes are the most common cause in elderly individuals. When children are affected, it is most commonly a congenital disorder and a specific cause cannot be found.

Paraplegia refers to paralysis of the lower extremities. If only one limb is affected it is known as monoplegia. The condition is most often a result of a traumatic injury, but can also be congenital, such as in spina bifida. If all the limbs are affected by partial or total paralysis it is called quadriplegia. It is possible that people with quadriplegia are able to move their arms, but do not have control over hand movements.

The ICD-10-CM code range for cerebral palsy and other paralytic syndromes is G80–G83.

To code cerebral palsy and other paralytic syndromes, the following information is necessary:
- Type of paralytic syndrome
- Laterality
- Dominant or nondominant side affected, as necessary

<table>
<thead>
<tr>
<th>Paralytic Syndrome</th>
<th>Code</th>
</tr>
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<tbody>
<tr>
<td>Spastic quadriplegic cerebral palsy</td>
<td>G80.0</td>
</tr>
<tr>
<td>Spastic diplegic cerebral palsy</td>
<td>G80.1</td>
</tr>
<tr>
<td>Spastic hemiplegic cerebral palsy</td>
<td>G80.2</td>
</tr>
<tr>
<td>Athetoid cerebral palsy</td>
<td>G80.3</td>
</tr>
<tr>
<td>Atactic cerebral palsy</td>
<td>G80.4</td>
</tr>
<tr>
<td>Flaccid hemiplegia affecting unspecified side</td>
<td>G81.00</td>
</tr>
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<td>Flaccid hemiplegia affecting right dominant side</td>
<td>G81.01</td>
</tr>
<tr>
<td>Flaccid hemiplegia affecting left dominant side</td>
<td>G81.02</td>
</tr>
<tr>
<td>Flaccid hemiplegia affecting right nondominant side</td>
<td>G81.03</td>
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<td>Flaccid hemiplegia affecting left nondominant side</td>
<td>G81.04</td>
</tr>
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<td>Quadriplegia, unspecified</td>
<td>G82.50</td>
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<tr>
<td>Quadriplegia, C1-C4 complete</td>
<td>G82.51</td>
</tr>
<tr>
<td>Quadriplegia, C1-C4 incomplete</td>
<td>G82.52</td>
</tr>
<tr>
<td>Quadriplegia, C5-C7 complete</td>
<td>G82.53</td>
</tr>
<tr>
<td>Quadriplegia, C5-C7 incomplete</td>
<td>G82.54</td>
</tr>
</tbody>
</table>

In the above table the need for the type of paralytic condition as well as laterality and whether the dominant or nondominant side of the body is affected is shown.

According to the ICD-10-CM guidelines, assignment of whether the dominant or nondominant side is affected should be guided by documentation in the medical record. Should this information not be available in the record, and the classification system does not include a default, the default should be dominant. For ambidextrous patients, the default should also be dominant.

**Coma**

A coma is a state of deep sleep in which a patient in unable to wake, respond to normally painful stimuli, light or sound, and does not initiate voluntary actions. Comas may result from various conditions including trauma, bleeding and/or swelling affecting the brain, inadequate amounts of oxygen and abnormal levels of glucose, as well as various poisons can also directly injure the brain to cause a coma. In the case of trauma, the brain may swell (edema) and there is no place for the fluid to go causing the brain to become compressed by being pushed up against the skull. If the swelling continues without the fluid being released it can result in conditions that affect blood pressure and breathing. Comas can also be intentionally induced to reduce blood pressure in a patient with an injury to the brain in an attempt to keep swelling to a minimum and allow time for healing. A medically induced coma may be reversed at any time to allow the patient to become conscious whenever the physician feels they are ready and the risk of additional swelling has passed.

The Glasgow Coma Scale is the most widely used scoring system used to quantify the level consciousness of a patient in a coma. There are three separate components that are measured on the scale: eye, verbal, and motor responses. The components are assessed separately as well as their sum. The lowest possible GCS sum is 3 and the highest possible sum is 15. The scoring system is shown below:

**Best eye response (E)**
1. Eyes do not open
2. Eyes open in response to pain
3. Eyes open in response to verbal stimuli
4. Eyes open spontaneously

**Best verbal response (V)**
1. No verbal response
2. Incomprehensible sounds
3. Inappropriate words are mumbled
4. Confused
5. Oriented

**Best motor response (M)**
1. No response
2. Extension to pain
3. Abnormal flexion to pain
4. Flexion/withdrawal to pain
5. Purposeful movement in response to pain
6. Obey commands

Each component may be documented separately; however, the assessment of each of these three components should be performed during the same encounter. The overall sum indicates the patient’s level of disability:
- Score of 13–15 indicates mild disability
- Score of 9–12 indicates moderate disability
- Score of 3–8 indicates severe disability
- Score of less than 3 indicates vegetative state

Each separate component of the Glasgow Coma Scale is represented by a code in ICD-10-CM. A note in
the tabular section states “these codes are intended primarily for trauma registry and research use but may be utilized by all users of the classification who wish to collect this information.” In order to code Glasgow Coma Scale assessments in ICD-10-CM the following is necessary:

- The score for each component
- When the assessment was performed

<table>
<thead>
<tr>
<th>Unspecified coma</th>
<th>R40.20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coma scale, eyes open, never</td>
<td>R40.211-</td>
</tr>
<tr>
<td>Coma scale, eyes open, to pain</td>
<td>R40.212-</td>
</tr>
<tr>
<td>Coma scale, eyes open, to sound</td>
<td>R40.213-</td>
</tr>
<tr>
<td>Coma scale, eyes open, spontaneously</td>
<td>R40.214-</td>
</tr>
<tr>
<td>Coma scale, best verbal response, none</td>
<td>R40.221-</td>
</tr>
<tr>
<td>Coma scale, best verbal response, incomprehensible words</td>
<td>R40.222-</td>
</tr>
<tr>
<td>Coma scale, best verbal response, inappropriate words</td>
<td>R40.223-</td>
</tr>
<tr>
<td>Coma scale, best verbal response, confused conversation</td>
<td>R40.224-</td>
</tr>
<tr>
<td>Coma scale, best verbal response, oriented</td>
<td>R40.225-</td>
</tr>
<tr>
<td>Coma scale, best motor response, none</td>
<td>R40.231-</td>
</tr>
<tr>
<td>Coma scale, best motor response, extension</td>
<td>R40.232-</td>
</tr>
<tr>
<td>Coma scale, best motor response, abnormal</td>
<td>R40.233-</td>
</tr>
<tr>
<td>Coma scale, best motor response, flexion withdrawal</td>
<td>R40.234-</td>
</tr>
<tr>
<td>Coma scale, best motor response, localizes pain</td>
<td>R40.235-</td>
</tr>
</tbody>
</table>

Coma scale, best motor response, obeys commands | R40.236-|
Glasgow coma scale score 13-15 | R40.241|
Glasgow coma scale score 9-12 | R40.242|
Glasgow coma scale score 3-8 | R40.243|
Other coma, without documented Glasgow coma scale score, or with partial score reported | R40.244|

The ICD-10-CM guideline stated, “These codes, one from each subcategory, are needed to complete the scale.”

Codes R40.211–R40.236 require the use of a 7th character extension. The ICD-10-CM manual instructs the user to:

- Code first any associated:
  - Coma in fracture of skull (S02-)
  - Coma in intracranial injury (S06-)

The seventh character extension provides detail on when the GCS assessment was made:

- 0 = unspecified time
- 1 = in the field [EMT or ambulance]
- 2 = at arrival to emergency department
- 3 = at hospital admission
- 4 = 24 hours or more after hospital admission

Per the ICD-10-CM guidelines, “The 7th character should match for all three codes.”

Sources

- Comprehensive Medical Terminology (Fourth Edition) by Betty Davis Jones.
- Stedman’s Medical Dictionary, 28th edition
- Bates’ Pocket Guide to Physical Examination and History Taking, Third Edition (Lynn S. Bickley-Lippincott)