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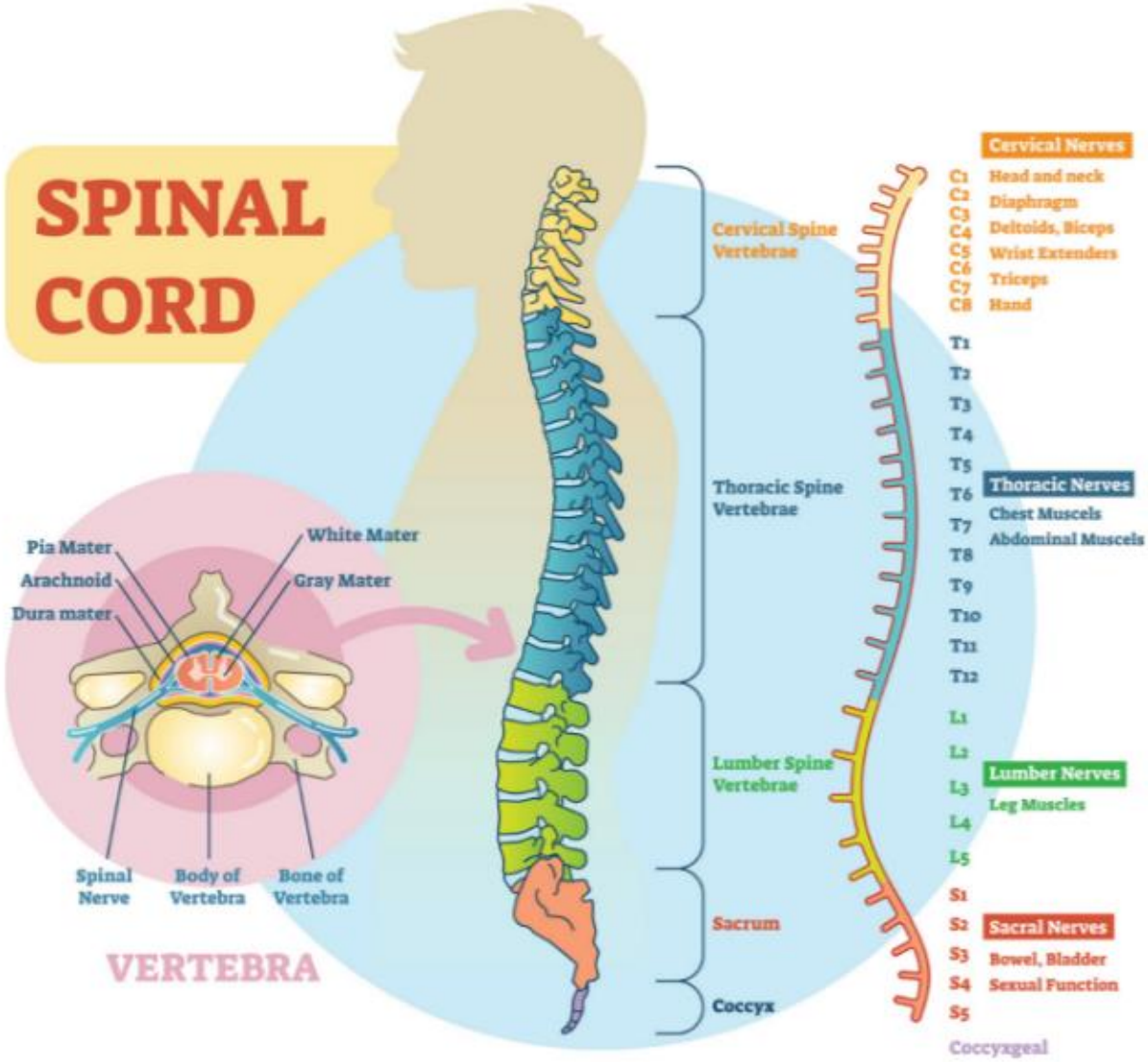
Understanding Spinal Cord Injury: Brief Tutorial



Forming the central nervous system, the brain and the spinal cord work together to control the body's sensory, motor and autonomic functions. When the spinal cord is injured, the exchange of information between the brain and other parts of the body is disrupted. Trauma or illness can damage the nerves within the boney protection of the spinal canal, causing the spinal cord to be bruised, stretched, crushed or occasionally severed resulting in a loss of function below the level of injury.

Levels of Injury as Related to Function

The spinal cord is organized into segments noted by their position along the thirty-three vertebrae of the backbone. Nerves from each segment connect to specific regions of the body.

Q: What do the levels of injury mean for function?

In general, the higher in the spinal column an injury occurs, the more function a person will lose. The segments in the neck or cervical region (C1 through C8) control signals to the neck, arms, hands, and the diaphragm. Injuries to this area result in tetraplegia which is sometimes also called quadriplegia. Injury to the nerves in the thoracic (upper back) region (T1 through T12) impacts control of the torso and some parts of the hands. Segments injured in the lumbar (mid-back region just below the ribs) region (L1 through L5) leads to paralysis of hips and legs (see diagram above). Sacral nerve injury affects bowel, bladder and sexual function.

Q: Can you explain complete vs incomplete spinal cord injuries?

Individuals who have a spinal cord injury classified as complete have no sensory or motor function in the lowest spinal cord segments of S4-5. This means messages are not carried through the length of the spinal cord. Some random segments may be working or partially working but a message cannot reach all the way through the cord. In contrast, those individuals with incomplete injuries have some messages that travel from/to the brain through to/from the end of the spinal cord at S4-5.
Complete or incomplete injury terminology is often confused with complete or incomplete severing of the cord, but this is not true. Complete or incomplete injury classification is an assessment of message signaling from/to the brain through to/from the end of the spinal cord.

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments S4-5 by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. (This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3.

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

Q: What does ASIA classification mean?

The ASIA (American Spinal Injury Association) Impairment Scale (AIS) as part of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), is the most common SCI outcome assessment tool. During an ISNCSCI exam, the physician looks at a variety of determinants such as strength of key muscles of the upper and lower extremities, and light touch, sharp and dull sensations at key sensory points all over the body. Ideally given within 72 hours of the initial injury, the test is used to define and describe the level and extent of a spinal cord injury to help determine future recovery and rehabilitation needs.

Q: What is the difference between paraplegia, quadriplegia and tetraplegia?

Quadriplegia or tetraplegia refer to a spinal cord injury within the cervical section (C1 through C8) resulting in total or partial paralysis in both legs and arms. Many doctors now use the term tetraplegia to denote this injury, but individuals often continue to use quadriplegia. Paraplegia results from injuries to the thoracic (T1 through T12) and lumbar (L1 through L5) regions. People with paraplegia are able to use their arms and hands but can experience a range of paralysis in the trunk and legs. Injury to the sacral section of the spinal cord results in bowel, bladder and sexual function. There are also injuries within the spinal cord that lead to Spinal Cord Syndromes. The most common syndromes are:

Anterior Cord Syndrome, where the artery in the spinal cord is damaged by lost

blood flow resulting in loss of function, pain and temperature sensation and hypotension. Proprioception (perception or awareness of the position and movement of the body) and vibration sensation remain intact.

Brown-Sequard Syndrome is an injury to half of an inside segment of the spinal cord. The result of this injury is loss of function with preserved proprioception on one side of the body and on the other side of the body, loss of pain and temperature sensation.

Central Cord Syndrome is a result of some diseases or trauma to the neck or cervical spinal cord. This clinically presents as an incomplete injury with greater weakness in the upper than in the lower limbs.

Conus Medularis and Cauda Equina Syndromes occur in the nerves just outside of the end of the spinal cord which are peripheral nerves.

Q: Will my injury level and type of injury change over time?

After the initial swelling of the spinal cord decreases, most people show some functional improvement. The sooner muscles start working again, the better the chances are of additional recovery. Some improvement often means more improvement is possible. Generally, the longer there is no improvement, the lower the odds it will start to happen on its own., However, a person may recover some function 18 months or even years after the injury including those with complete (AIS A) tetraplegia. As neurological recovery occurs, some individuals may have their initial assessment reclassified.

Q: Are all SCIs the same? Does everyone with same level of injury have the same function?

Every SCI is different. Although there are general impairment guidelines outlined in the American Spinal Injury Association (ASIA) Impairment Scale (see above), everyone may have different sensory and motor impairments based on the injury location, severity, duration since injury, and other circumstances. At the same level of injury, there may be variations in the level of orthopedic, functional, and neurological damage.

Sources: American Spinal Injury Association (ASIA)

Need to talk to someone?
Our Information Specialists are available to answer your questions.
Call toll-free 1-800-539-7309 Mon-Fri, 9am-5pm ET.
Or schedule a call or ask a question online.

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