Spinal Cord Injury Education Program

The Spinal Cord Injury Education Program offers patients and families information needed to adjust to changes after a spinal cord injury. There are many emotions to work through and tasks that need to be learned. The Upstate Hospital Physical Medicine and Rehabilitation team will help you cope with the challenges you experience with life changes and learn what you need to in order to keep you as healthy as possible.

General Topics to be discussed

- Anatomy and Function of the Spinal Cord and types of spinal cord injury (SCI)
- Respiratory Care
- Skin Care
- Bladder Management
- Bowel Management
- Food Diary
- Autonomic Dysreflexia
- Sexuality
- Adjustment and Depression
- Returning to Your Life
- Resources
- Syndromes
Brain and Spinal Cord

Cervical Nerves
- C1 - C3 neck muscles
- C4 Diaphragm
- C5 Deltoid (shoulder)
- C6 Wrist
- C7 Triceps
- C7 - C8 Fingers

Thoracic Nerves
- T1 Hands
- T2 - T12 Intercostal/Trunk
- T7 - L1 Abdominal

Lumbar Nerves
- L2 Hips
- L3 Quadriceps
- L4 - S1 Hamstrings/Knee
- L4 - S1 Foot

Sacral Nerves
- S2 Sexual Function
- S2 - S3 Bowel & Bladder

Coccygeal nerve
Muscle Function Grading

0 = total paralysis
1 = complete voluntary contraction
2 = active movement: full range of motion (ROM) with gravity eliminated
3 = active movement: full ROM against gravity
4 = active movement: full ROM against gravity and moderate resistance in a muscle specific position
5 = (normal) active movement: full ROM against gravity and full resistance in a functional muscle position expected from an otherwise healthy person

NT = not testable (i.e., due to immobilization, severe pain such that the patient cannot be moved, amputation of limbs, or contraction of > 50% of the normal range of motion)

Sensory Grading

0 = Normal
1 = Altered, either decreased/impaired sensation or hyperesthesia
2 = Normal

NT = Not testable

Non Key Muscle Functions (optional)

May be used to assign a motor level to differentiate AS B vs. C

ASIA Impairment Scale (AIS)

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

B = Sensory Incomplete. Sensory but no 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). ASIA Motor Function is preserved in more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved below the neurological level** and more than half of key muscle functions below the neurological level of injury (NLI) have a muscle grade less than 3 (Grade 3-2).

D = Motor Incomplete. Motor function is preserved below the neurological level** and at least half (but not more than 1/3) of key muscle functions below the NLI have a muscle grade of 3.

E = Normal. Full sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had no motor deficits, nor the ASIS grade in E. Someone without an intact SCI does not receive an AIS grade.

** For an individual to receive a grade of C or D, i.e., motor incomplete status, they must have either (1) voluntary or spontaneous contraction or (2) sensory sparing with sparing of motor function more than three levels below the motor level for the sides of the body. The International Standards for the two above are the same, non key muscles function more than 3 levels below the motor level to be used in determining motor incomplete status (NLI minus 3).

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI:

1. Determine sensory levels for right and left sides.
   The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.
   Defined by the lowest key muscle function that has a grade of at least 3 (pin prick testing, providing that key muscle function is represented by segments above that level and judged to be valid and graded as a 3).

3. Determine the neurological level of injury (NLI)
   The NLI refers to the most caudal segment of the cord with intact sensation and antigravity (2) or motor muscle tone strength, provided that there is normal (grade 5) sensory and motor function distally in at least 1 of the 2 limbs.

4. Determine whether the injury is Complete or Incomplete. Interpretation of its meaning is as follows:
   Complete: No voluntary or contraction. NLI all S4-5 sensory score = 0 and deep pressure = 0, therefore no ASIS = Complete.
   Incomplete: Motor incoordination or other remaining function is present.

5. Assign ASIA Impairment Scale (AIS) Grade:

   Is injury Complete?
   Yes, ASIS-A and can record 3/5 (sensations or reflexes on one side with some preservation)
   No

   Is injury Motor Complete? (No voluntary or contraction) Yes, ASIS-B
   No

   Motor Function score
   [0] Motor level
   [B] Motor level
   [C] Motor level
   [D] Motor level
   [E] Motor level
   [F] Motor level
   [G] Motor level
   [H] Motor level
   [I] Motor level
   [J] Motor level
   [K] Motor level
   [L] Motor level
   [M] Motor level
   [N] Motor level
   [O] Motor level
   [P] Motor level
   [Q] Motor level
   [R] Motor level
   [S] Motor level
   [T] Motor level
   [U] Motor level
   [V] Motor level
   [W] Motor level
   [X] Motor level
   [Y] Motor level
   [Z] Motor level

   Is sensory and motor function in normal in all segments, ASIS-E

   Motor ASIS-E is used in the follow-up testing when an individual with a documented SCI has recovered normal function. If initial testing did not identify any deficits, then the individual is neurologically intact. The ASIA Impairment Scale does not apply.
What is the spinal cord and what does it do?
The spinal cord is part of your nervous system and is the largest nerve in your body. The nerve fibers in the spinal cord send messages back and forth between your brain and different parts of your body. These messages tell your body to move and feel sensations such as heat, cold, and pain. The spinal cord controls body functions that are involuntary that the body does without thinking. Examples are blood pressure, body temperature and sweating.

Spinal Cord Facts

- The spinal cord is protected by a layer of bones called vertebrae.
- The vertebrae are stacked on top of each other and make up the spinal column.
- The spinal cord runs through the middle of the vertebrae.
- The spinal cord is about 18 inches long and extends from the base of the brain to about the waist.
- Nerves exit between the vertebrae and reach out to all parts of the body.

Spinal Column Parts

- The spinal column is divided into 4 sections.
- The top section is the cervical area and it has 8 cervical nerves and 7 cervical vertebrae.
- The next section is the thoracic area and it includes the chest area and has 12 thoracic vertebrae.
- The lumbar section is known as the lower back. The lumbar section has 5 lumbar vertebrae.
- The last section is the sacral section and has 5 sacral vertebrae. These vertebrae or bones are actually fused (connected together) into one bone.
Spinal Cord Injuries

The spinal cord can be damaged from an injury or disease. With most spinal cord injuries, the backbone (vertebrae) pinches the spinal cord causing it to swell or bruise. The spinal cord and/or nerve fibers may tear. When the spinal cord is injured, the nerves above the injury function normally. The nerves below the injury can’t send messages like they used to so body functions are affected.

The level of spinal cord injury (SCI) is determined by the lowest area on the spinal cord where there is a change in sensation or movement.

- Quadriplegia or tetraplegia is the term used when the injury at any level between C1 (cervical) to T1 (thoracic). There can be a loss of feeling and or movement in the head, neck, shoulder, arms and/or upper chest.
- Paraplegia is the term used when there is a decrease in feeling or movement in the lower parts of the body. Paraplegia, injury between T2 (thoracic) to S5 (sacral), may affect the chest, stomach, hips, legs and feet.

Complete Spinal Cord Injury (See Module 1 b Complete Spinal Cord Injury Functional Goals)

A complete injury is the term used when there is no movement or sensation in the S4 or S5 (sacral) or anal area. If there is movement or sensation in these areas, the injury is considered incomplete.

Incomplete Spinal Cord Injury—discuss expected recovery for your level with your care providers. Per ASIA scale rating:

B. There is sensation but no motor function below the neurological level and includes S4-S5 (sacral).

C. There is motor function below the neurological level and more than half of the muscles below this level have a muscle grade less than 3. There is sensation below the neurological level and includes sacral 4 and 5.

D. There is motor function below the neurological level or half of the key muscles below the neurological level have a muscle grade of 3 or more. There is sensory function below the neurological level and include sacral 4 and 5.

What happens right after a spinal cord injury?

- Sometimes the injury only bruises the spinal cord or causes swelling.
- As the swelling goes down, the nerves may start working once again.
- Some people have involuntary movements such as twitching or shaking, which are called spasms.
- Spasms occur when the nerve sends the wrong message and causes the muscle to move. Often individuals can’t control these movements.