NASCIC
SCI RESEARCH
ADVOCACY COURSE

Module 5 – SCI Biology Part II: Secondary Complications

The Autonomic Nervous System

In Module 4: SCI Biology Part I: How an SCI Causes Loss of Function, we talked about how an injury to the spinal cord that disrupts communication between the brain and the body results in a loss of sensory and motor function (the ability to feel and move).

Disruption of communication via the spinal cord can also cause loss of function of the organs throughout the body by impairing part of the nervous system called the "autonomic" nervous system.

The autonomic nervous system controls the automatic, involuntary functions of your body that you don't have to consciously control and that continue whether you are awake or asleep. For example, the autonomic nervous system controls breathing, the heart and circulatory system, digestion, body temperature, and production of sweat, tears, saliva and mucus. The autonomic nervous system also controls the involuntary parts of bladder, bowel, and sexual function, such as erections and vaginal lubrication.

Autonomic dysfunction is at the root of many (but not all) of the secondary complications that a person can experience following an SCI. Knowledge of the autonomic system is important for research advocates to understand both the causes of many secondary complications, and also the research that is being done to better understand and treat them.

Let's start with the structure of the autonomic nervous system:

- The autonomic nervous system's network of neurons and glial cells form the autonomic nervous system, located throughout the head and body.
    - Some autonomic nerves extend directly from the brain; these nerves control pupil dilation and eye focusing; production of tears, nasal mucus, and saliva; and organs in your chest and abdomen.
    - Other autonomic nerves extend from the spinal cord to control the heart, lungs, liver, pancreas, spleen, stomach and intestines, kidney, bladder, and sexual organs.
- Just like the neurons we discussed previously, neurons in the autonomic nervous system communicate information in one direction: either from the brain to the body or from the body to the brain.

- Neurons in the autonomic nervous system also communicate through the exchange of a specific set of neurotransmitters in the synapses between them, which stimulates electric signals. This was discussed in more detail in Module 4: SCI Biology Part I.

The autonomic nervous system includes two coordinated systems that work together to keep the body in balance and functioning healthily. One part is the **sympathetic** nervous system. It's counterpart is the **parasympathetic** nervous system.

The **sympathetic** nervous system responds to stress or danger and is responsible for activating the body's "fight-or-flight" response. This includes nerves that emerge from the thoracic and lumbar regions of the spinal cord and stimulates pupils to dilate, salivation, opening of the airways, and increase in heart rate, and inhibits digestion, relaxes the bladder, and reduces blood flow to sexual organs.

The **parasympathetic** nervous system is responsible for activating the body's "rest-and-digest" processes, which includes cranial nerves that begin in the lower part of the brain and brainstem, as well as sacral nerves that emerge from the spinal cord in the sacral segments of the spine, which slows heart rate and constricts airways, stimulates digestion, constricts the bladder and increases blood flow to sexual organs.

There is a continuous give and take between the **sympathetic** and **parasympathetic** nervous systems. During a fight-or-flight response, the sympathetic nervous system dominates, and the parasympathetic nervous system decreases its activity.

After the fight-or-flight response is over, the parasympathetic nervous system dominates to conserve energy and replenish resources that were consumed by the fight-or-flight response.

Overall, sympathetic activity is reduced after an SCI, which causes the parasympathetic nervous system to become dominant. This imbalance may lead to many different secondary complications that vary depending on the level and severity of the SCI, which will be discussed further in the next video – Video 3: Examples of Secondary Complications Caused by Autonomic Dysfunction.