

Module 5 – SCI Biology Part II: Secondary Complications

Other Secondary Complications

Secondary complications can also be a consequence of loss of motion or sensation, or because of other ways an SCI affects daily life. We will talk about how many of these serious complications affect quality of life or mortality in Module 11: SCI 101 for Researchers.

Now we will highlight a few examples to explore how loss of sensation or motor function following an SCI can result in biological changes that may lead to secondary complications.

One category of secondary complications is related to changes to body composition, such as bone loss, muscle atrophy, and obesity, which are caused or exacerbated by disuse of parts of the body where motor function is lost or impaired.

Bone Density Loss (Osteopenia & Osteoporosis)

Bone density loss is common in people who are not able to do weight-bearing activities. When functioning properly, our bones are maintained by a continuous cycle of removing old bone tissue and replacing it with new growth.

Weight-bearing activities cause muscles and tendons to exert pressure on our bones, which stimulates the growth part of the cycle. When weight-bearing activities aren't possible or aren't sufficient, there is less pressure on the bones, which means less stimulation and less growth. However, the removal of old tissue continues, so the overall result is bone loss.

About 80% of individuals with chronic spinal cord injury have either osteopenia or osteoporosis. Osteopenia is the thinning of bone mass, which is not considered severe but is a serious risk factor for the development of osteoporosis.

Bone mineral density (BMD) is used to determine if a patient has osteopenia or osteoporosis. A patient's BMD is given a T-score, which compares a patient's BMD to the average score for a healthy 30-year-old of the same sex and race.

With SCI it is likely that there are additional factors at play, because bone loss after an SCI occurs at greater rates than in other situations where weight-bearing activity is reduced, such as people on extended bed rest.

Accelerated bone loss for individuals living with SCI is not yet fully understood by researchers, but possible reasons include:

- Changes in hormone production due to an SCI.

- Disruption of signaling between the brain and the body that may be needed to maintain bone mass.
- Side effects of medications that are commonly used by people with SCI, such as blood thinners or treatments for seizures.

Bone loss creates weaker and more brittle bones which contribute to a higher risk of fractures.

Muscle Atrophy

Muscle atrophy is another change in body composition caused by lack of movement, that can lead to changes in metabolism.

Muscle influences metabolism throughout the body; for instance, skeletal muscles are the primary site for storing and using glucose and also store amino acids, which are the raw materials our bodies use to make proteins.

Atrophy, or loss of muscle mass, can result in slower metabolism and increased fat storage, and can lead to metabolic disorders. Loss of skeletal muscle also makes energy and protein less available throughout the rest of the body, which can slow recovery from illness or injury.

Lack of physical activity and a reduced rate of metabolism can contribute to a third change in body composition after an SCI, the development of obesity.

Overall, changes in body composition after SCI are associated with higher rates of glucose intolerance and insulin resistance (which are related to diabetes); elevated lipids in the blood (like cholesterol); and cardiovascular disease.

Chronic Pain

Another category of secondary complications includes several types of chronic pain; of the three main types, one is caused by damage to the nervous system, but the other two are not.

We will talk about how people with SCI experience neuropathic pain, a frequently severe form of chronic pain caused by abnormal signaling of nerves that were damaged in the injury, in Module 11: SCI 101 for Researchers.

A second type of chronic pain that is common after SCI but is not a direct result of the SCI itself is musculoskeletal pain. Musculoskeletal pain is caused by problems in the muscles, joints, or bones.

It can be caused by injury, arthritis, or overuse, often from transfers, pressure relief maneuvers, using a manual wheelchair, or repetitive use of a joystick or similar controller device. In people with SCI, musculoskeletal pain from overuse is difficult to treat because the most effective remedy is rest, often for weeks at a time, which severely limits the activities someone with an SCI can participate in.

The other type of pain that is common after SCI but is not directly caused by damage to the spinal cord is visceral pain, or pain that comes from the internal organs.

Visceral pain can be caused by inflammation, pressure, or injury to internal organs. After SCI, many of the secondary complications that result from autonomic dysfunction may lead to visceral pain, such as:

- Abdominal pain from constipation.
- Pain from a bladder or urinary tract infection.
- A kidney stone.

Visceral pain, in turn, can trigger neuropathic pain.

In the next video, we'll review what you've learned in this module; but don't forget, there are many more examples than we've covered here. For additional examples, plus first-hand accounts of how secondary complications affect the daily life of a person living with SCI, visit [Module 11: SCI 101 for Researchers](#).