

# Spasticity Management for Patients with Spinal Cord Injury

## Overview of Spasticity

Spasticity is the involuntary contraction of one or more muscles causing muscle spasms. While a spasm is a single episode of involuntary muscle contraction – spasticity is a collective term that describes recurrent spasms.

Spasticity in the muscles below the level of the injury is common after a spinal cord injury (SCI) and is caused by damage to portions of the central nervous system. For patients living with SCI, spasticity can impact nearly every aspect of their life. It can negatively impact their mobility and cause pain. Conversely, some spasticity can also be beneficial with activities such as transferring, standing, walking, or sitting. For these reasons it is important to understand what spasticity is, how to assess it, and options for how to best manage it.

Spasticity is not only seen in patients with SCI but is also common in patients with ALS, Cerebral Palsy, and Parkinson's Disease, as well as other neurological conditions. Spasticity can vary from mild muscle stiffness to severe uncontrolled movements. It can be seen and experienced as: increased muscle tone, muscle spasms, stiff joints (in trunk and/or limbs), rapid muscle contractions, exaggerated deep tendon reflexes, and even scissoring (involuntary crossing of the legs).

Spasticity can and should be managed if it is negatively impacting the patient.

## Purpose of this Resource

The purpose of this resource is to provide front line health care providers with guidance on how to identify, assess, and help patients to best manage their spasticity.

## Key Messages

1. Spasticity can occur in any part of the body that is below the level of the SCI (e.g., legs, trunk and/or arms). Spasticity presents in different ways and can range from mild to severe.
2. There is a potential risk of injury or other complications secondary to spasticity.
3. Spasticity can be beneficial. Sometimes spasticity can assist people with mobility and other activities.
4. Spasticity can and should be treated if it is causing pain, puts the patient at risk of injury or interferes with activities of daily living, or is impacting the patient's quality of life in negative ways.
5. Pharmacological management is the first recommended treatment for management of spasticity.
6. If spasticity suddenly becomes worse or the pattern changes, it may be a warning sign that something else is wrong in the body.
7. Patients with lived experience are often the experts in their own care. It is important to ask the patient if they know what triggers their spasticity, and what improves or aggravates it.

### Glossary

**Functional electrical stimulation (FES)** is a “technique that uses electrical current to cause a muscle to contract” where, “the current is then slowly increased until it’s strong enough to make the muscle contract. This level (the smallest current needed to make the muscle contract) will be used for the treatment. It’s important that you actively try to do functional tasks during FES (e.g., grasping and releasing an object).”

**Hypertonia** is a muscle at rest that has so much spasticity that it is rigid. The muscle resists movement due to the excessive amount of spasm (tone). At times, hypertonia is so strong that the muscle cannot be manually stretched due to co-contraction of both flexor and extensor groups of muscles.

**Neuromuscular Electrical Stimulation (NMES)** is a type of treatment that delivers low voltage electrical stimulation to nerves to stimulate muscle contraction. It is often used after injury or surgery to re-train muscles to function.

**Spasm** is a single episode of involuntary muscle contraction. After spinal cord injury or brain injury, these are a result of injury to a specific section of the nervous system called the upper motor neurons. These are often pattern (position) generated and present with typical muscle contraction synergies.

**Spasticity (tone)** is an involuntary contraction of one or more muscles. Spasticity is a collective term that describes recurrent spasms.

**Spinal cord stimulators** are implanted devices that send a low level of electrical current directly into the spine to help relieve pain.

**Transcutaneous Electrical Nerve Stimulation (TENS)** is a type of therapy that moves a low-voltage electrical current through pads on the skin as a pain management strategy.

### Background

Spasticity can occur in any muscle group below the level of SCI. It occurs because SCI leads to a loss of descending cortico-spinal pathways which control movement and changes in motor neuron activation. Stimuli below the level of the injury, such as movement, stretching or skin irritation, can result in involuntary muscle contraction. Spasticity may look very different from patient to patient and can begin weeks to months after their initial injury. It is most commonly seen with SCI at or above the 12th thoracic vertebrae but can be seen with injuries below this level.

It is estimated that 53% to 78% of all individuals with chronic SCI experience spasticity, and approximately 41% of individuals with spasticity list it as one of the major medical obstacles to community and workplace re-integration.

### Complications and Benefits of Spasticity

Spasticity can impact both persons living with SCI and their care providers. Spasticity can prevent patients from doing their daily activities and cause them to avoid certain tasks. The uncontrolled movements can cause pain, which may or may not be felt by the patient. In

patients with SCI at the 6th thoracic vertebrae level and above, the pain can lead to autonomic dysreflexia (AD), which is a life-threatening condition due to a rapid rise in blood pressure. Spasticity can also contribute to skin breakdown. If positioning due to spasticity is limited, there is potential for pressure injuries as well as moisture being trapped leading to moisture associated skin damage. Uncontrolled or unpredictable movements from spasticity may also unintentionally cause injury to care providers.

In some cases, spasticity may be beneficial and can help patients with activities such as transfers, standing, walking, and even sitting. Spasms can improve venous return and decrease the risk of deep vein thrombosis. Spasticity can also reduce fracture risk and protect against muscle atrophy and help maintain muscle mass.

Spasticity that is beneficial may not need to be treated. However, if spasticity is limiting a person from being able to live and enjoy their lives or creating a risk for them; management becomes vital.

### Common Spasticity Triggers (Stimuli)

Stimuli that trigger or cause spasticity vary greatly and can include things like dehydration, constipation, unmanaged pain, uncomfortable positioning, illness, or being too hot or cold. Spasticity triggers can vary from patient to patient. An increase in frequency or severity of spasticity may be an indicator of an underlying medical issue, such as an infection.

The following table is a list of spasticity triggers and common causes. It is not an exhaustive list, and it does not address recommended actions for the trigger. It also does not include spasticity that is caused if a patient is withdrawing from a medication, forgets to take a medication, is NPO, or has autonomic dysreflexia.

Table 1: Triggers and Common Causes of Spasticity

Triggers	Common Causes
Bladder	Full bladder Dehydrated and an empty bladder Kidney infection Urinary tract infection Urinary tract calculi
GI/Bowel	Constipation Hemorrhoids Gallstones Diverticulitis Appendicitis Abscess

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Skin	Pressure Injury Maceration or skin irritation Tight clothing, binders, wraps, or shoes Ingrown toenails Osteomyelitis (bone infection)
Pain or sensory stimulation	Neuropathic pain Nociceptive pain Musculoskeletal pain Visceral pain
Pregnancy	Physical and hormonal changes Enlarging uterus Joint laxity Postpartum
Positioning	Awkward or uncomfortable positioning Ill-fitting orthotics, braces, casts, or splints Wheelchair issues
Temperature	Too hot Too cold
Emotions	Anxiety Stress Mental Stress Excitement
Physical or neurological change	Syringomyelia Tethered cord syndrome Fracture Heterotopic ossification Compression neuropathy Disease Progression Menstruation
Systemic Illness	Deep Vein Thrombosis Systemic Infection Any illness that would normally cause pain or discomfort

(Cabahug et al., 2020)

### Assessment

It is important to assess where the spasticity is, the amount of spasticity, changes to spasticity or how it is impacting the patient.

#### 1) Patient History

Ask the patient about their history of spasticity.

- When did the spasms start?
- Do spasms affect breathing?
- Are spasms causing pain?
- What impact does spasms have on their activities of daily living and / or participation in rehabilitation therapies?
- Have they noticed a pattern in their spasms? Are there certain triggers?
- Are spasms worse at certain times of the day or with certain activities?
- When do spasms peak in terms of severity?
- Have they tried any previous interventions for spasticity?
- Do they self-medicate with alcohol, marijuana, or non-prescription drugs?

#### 2) Physical Assessment

- Assess the location of the spasms.
- Assess limbs for signs of contractures.
  - Are contractures symmetrical between sides?
- Assess limb position at rest.
- Assess posture during activity.

If spasticity or muscle spasms suddenly become worse than usual or the pattern of the spasticity changes, it may be a warning sign that there is something else going on in the body such as an infection.

### Assessment Tools

Tools to assess spasticity are available but tend to miss certain important aspects of the assessment, and may only be useful in certain settings. Globally, there is no specific assessment tool that nursing, physiotherapy or occupational therapy use to evaluate spasticity.

An initial detailed assessment of spasticity is commonly done by physiatrists, to help determine appropriate treatment plans to support optimal management of spasticity and determine if an intervention is making a measurable change.

There are four common assessment tools used to measure spasticity.

1. The **Modified Ashworth Scale** measures resistance to limb movement in a clinical setting in a five-point scale, however, cannot differentiate between the neural and non-neural components in increased tone.
2. The **Modified Tardieu Scale** is better able to quantify muscle spasticity and assesses the response of the muscle to stretch that is applied at specific velocities.
3. The **Spastic Paraplegia Rating Scale** is a 13-item scale designed to rate functional impairment in spastic paraplegia and is suitable for outpatient settings.
4. The **Penn Spasm Frequency Scale** is a self-report measure that assesses an individual's perception of spasticity frequency and severity. It self-rates spasm frequency on a scale of 0-4 and spasm severity from 1-3. If the participant selects 0 in the first part of the assessment, the second part is not performed.

On their own, these tools do not adequately describe the extent or impact of the patient's spasticity. If used, they should be combined with the above assessment questions for a more comprehensive assessment.

### Management

As previously mentioned, not all spasticity is negative or harmful. However, if spasticity is causing pain, interfering with everyday life, or is impacting the patient's quality of life in negative ways, management becomes vital. The goal of treatment is to keep spasticity from interfering with activities or causing health problems, not to eliminate it. For patients with lived experience, ask what strategies they use to help manage the length and/or severity of their spasms.

During a spasm, protect any affected extremity from striking sharp or hard objects.

Physiatrists and the AHS Spasticity clinics have expertise in spasticity management. When there are issues managing the patient's spasticity, physiatry or a specialty spasticity clinic should be consulted. The patient should be connected with their regular physiatrist or care provider on discharge.

### Pharmacological Management

Pharmacological management is the first recommended treatment for management of spasticity, however many of these medications have side effects such as drowsiness, weakness, and hypotension. They can also affect organ function; therefore periodic bloodwork may be ordered. Use of medications should be balanced to cause minimal side effects, while achieving the desired outcome.

The most commonly prescribed medications to treat spasticity are Baclofen, Tizanidine, and Dantrolene.

- **Baclofen** is a skeletal muscle relaxant. Baclofen is widely used as the first line of pharmacological treatment and is considered the most effective medication for managing spasticity in patients with SCI, despite its unwanted side effects (e.g. drowsiness, nausea, vomiting, headache, etc.). It works by inhibiting the synaptic reflexes at the spinal cord level. Baclofen is used orally but also via an intrathecal pump on a continuous basis. When given intrathecally (e.g., Intrathecal Baclofen given through a catheter in the subarachnoid space), there may be fewer side effects and greater reduction of pain and spasticity than when given orally. Sudden discontinuation of baclofen can result in withdrawal symptoms such as seizures, confusion, hallucinations and rebound muscle overactivity, therefore weaning is suggested.
- **Tizanidine** is Alpha-2 adrenergic agonist works by increasing the presynaptic inhibition which will decrease the use of spinal motor neurons.
- **Dantrolene** is a direct-acting skeletal muscle relaxant and acts directly on the skeletal muscles by reducing the calcium concentration that activates the acute catabolic processes. This drug may cause liver damage so does require additional monitoring.

Other medication / drug classes used to manage spasticity include:

- **Benzodiazepines** (e.g., Diazepam, Clonazepam) enhance the activity of GABA, which slows the central nervous system.
- **Anticonvulsants** (e.g., Gabapentin, Pregabalin)- work to prevent pain by preventing excitatory neurotransmitter release, reducing pain signals sent from the brain down the spinal cord.
- **Botox** (botulinum toxin) - injected into spastic muscles and prevent acetylcholine from being released in the synaptic cleft, which reduces tone or contraction in the muscles that are causing tightness or spasm.
- **Local Anesthetic** (e.g., Bupivacaine)- works to block the generation and conduction of nerve impulses to prevent pain transmission.
- **Topical Anesthetic** (e.g., Phenol) (less common)- degenerates the large and small nerve fibers in the nerve roots to prevent nerve transmission.

### Non-Pharmacological Management

Non-pharmacological methods may be useful in conjunction with pharmacological management to reduce spasticity and include:

- **Physiotherapy/Occupational Therapy**  
Consult physiotherapy (PT) and/or occupational therapy (OT) to assist with spasticity management including the use of padded straps, splints, wheelchair options, and prescribed exercise and stretching routines to help control spasticity.
- **Exercise and stretching**  
It is important to use stretching to maintain range of motion, perhaps desensitize stretch reflex and reduce the risk of contracture, which can then become an impediment to function and/or seating.

- Daily passive stretching assists in reducing muscle tone and maintaining joint mobility.
- PT or OT creates the stretching plan, which may be carried out by family, caregivers, therapy assistants, nurses, or others. Therapist or caregiver guided muscle stretching is helpful in the management of spasticity.
- Daily or weekly strengthening programs
- **Splinting, Casting, Bracing**

These options should be used to break spasticity patterns or reduce the severity of presentation through positioning in lying or sitting.

  - PT/OT may recommend and/or prescribe splinting, casting, or bracing.
  - OT may fabricate splints.
  - PT/OT will evaluate the *safe* use of bracing/splinting to maintain position and or range of motion.
  - Caution needs to be taken with bracing in spasticity as can potentially lead to pressure injuries.
- **Stimulation Techniques**

Stimulation techniques use a low intensity electric current to disrupt the pain signal with the intention of providing relief from spasticity.

  - Transcutaneous Electrical Nerve Stimulation (TENS)
  - Neuromuscular Electrical Stimulation (NMES)
  - Functional Electrical Stimulation (FES)
  - Spinal cord stimulators

\*Note: in some patients, stimulation may make pain worse.
- **Calming techniques**

Calming techniques can be used to shift the focus away from the pain and offer a form of distraction that can help with spasticity management.

  - Breathing strategies
  - Meditation
  - Yoga (may need to be modified)
  - Mindfulness
  - Guided imagery
  - Relaxation Audio Tracks
  - Progressive Muscle Relaxation
- **Psychological Supports**

Patients may benefit from a variety of psychological supports, depending on their stage of recovery from their initial injury.

  - Spiritual Care
  - Indigenous Cultural Helpers
  - Social Work
  - Psychology
  - Mental health supports
- **Complementary and Alternative Medicine**

Patients and their families may choose to participate in adjunct or complementary and alternative medicine therapies, based on their individual beliefs and preferences. These are considered as supportive therapies and should not be used as an alternative to the evidence-based spasticity management therapies above. The Most Responsible Health Care Provider (e.g., Physician) should be made aware of any alternative medications the



patient is taking as complementary / alternative therapy, as they may interact with their prescribed medication management. Examples of complementary and alternative medicine therapies include, but are not limited to:

- Acupressure
- Acupuncture (from trained professionals)
- Ayurvedic Medicine
- Massage Therapy
- Reiki
- Traditional Chinese Medicine

\*Note: The services mentioned above are largely offered by practitioners who are external to AHS. Due to factors such as legislation, professional regulations, liability, and privacy considerations, external providers may not be able to deliver these services while a patient is receiving care at an AHS facility. As no current provincial policy is in place pertaining to external providers, if a patient or their family requests the involvement of external providers while in the hospital, please:

- ensure that the most responsible healthcare provider overseeing the patient's care is informed,
- inform your charge nurse and/or unit manager and,
- consult Health Profession Strategy and Practice (HPSP) Professional Practice Consultation Service (PPCS) by emailing, [practice.consultation@ahs.ca](mailto:practice.consultation@ahs.ca)
- consult AHS Legal Clinical at [legal.clinical@ahs.ca](mailto:legal.clinical@ahs.ca)

### Patient Education

Provide education to the patient and their care provider(s) in the early phase of learning to manage their SCI. However, remember that patients and their families will likely feel overwhelmed in the early stages of recovery and rehabilitation, so information may need to be given in small increments and repeated several times.

There are several online resources available including: [LivingWithSCI.ca](http://LivingWithSCI.ca); [the Christopher and Dana Reeve Foundation](http://the.Christopher.and.Dana.Reeve.Foundation); and [MyHealth.Alberta.ca](http://MyHealth.Alberta.ca).

The [MyHealth.Alberta.ca](http://MyHealth.Alberta.ca) education resources can be accessed in Connect Care, linked in the Discharge Navigator under Education and attachments. Some topics that may be beneficial for spasticity management are:

- [Exercise](#)
- [Breathing strategies](#)
- [Meditation](#)
- [Yoga](#) (may need to be modified)
- [Mindfulness](#)
- [Guided imagery](#)
- [Relaxation Audio Tracks](#)
- [Progressive Muscle Relaxation](#)
- [Complementary and Alternative Medicine](#)
- [Functional electrical stimulation](#)
- [Transcutaneous Electrical Nerve Stimulation \(TENS\)](#)

### Documentation

When documenting about spasticity, it is important to include the following:

- The patient's baseline level of spasticity to identify the risk of early complications
- Frequency and severity of spasticity
- If there is pain with the spasticity
- Does spasticity interfere with seating or pressure distribution?
- Is the spasticity disturbing to the patient?
- Concerns related to transfers or safety due to the spasticity (if spasticity is helpful during transfers or how it may interfere)
- The time of day the spasticity is better or worse.
- Precipitating and relieving factors

### Specialty Spasticity Clinics

There are two specialty spasticity clinics located within the province in Calgary and Edmonton Zones:

- Calgary [Spasticity Clinic](#) at the Foothills Medical Centre
- Edmonton [Adult Spasticity Clinic](#) at the Glenrose Rehabilitation Hospital

These clinics should be contacted, or consulted, to assist with patients whose spasticity is not well controlled / managed.

The patient should be connected with their regular physiatrist or care provider on discharge. Physiatrists and the AHS Spasticity clinics have expertise in spasticity management.

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