

SPASTICITY

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**National
Multiple Sclerosis
Society**

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Spasticity is one of the most common symptoms of multiple sclerosis (MS). It can be defined as an involuntary increase in muscle tone which may be affected by the speed of the muscle contracting. It is seen in upper motor neuron disorders and occurs most frequently in muscles of the upper and lower extremities. MS-related spasticity is usually the result of increased co-contraction of muscles during movement. Increased stiffness, or tone, can lead to decreased range of motion of major joints and result in shortening of connective tissue around the joints. This, in turn, can result in contractures. Fortunately, this common symptom responds to a variety of therapeutic approaches.

Clinical Signs and Symptoms

Clinical indications of spasticity are highly variable and may include:

- Decreased range of motion
- Difficulty relaxing muscles once a movement has ceased
- Impaired voluntary control of muscles
- Sensation of muscle tightness
- Pain
- Difficulty initiating movements
- Flexion or extension synergy patterns
- Clonus, a repetitive rhythmic beating movement of a foot or wrist
- An increase in deep tendon reflexes

These clinical signs and symptoms may be aggravated by fatigue, stress, urinary tract infections, constipation, infections of other origins, progression of the disease, and pain. Additionally, spasticity may lead to increased fatigue due to the extra energy expended to overcome tone during voluntary movements involved in activities of daily living. A [study](#) of 701 patients with MS found that spasticity has a significant direct effect upon quality of life.

Assessment

Screening for spasticity involves assessing range of motion of upper and lower extremities, degree or severity of spasticity, and the ability to carry out activities of daily living. This includes examination of mobility, transfers, self-care, assistive devices/braces, strength, balance and activities of daily living. Recent changes in spasticity should signal a need for additional assessment. Aggravating factors such

as local or systemic infections or noxious stimuli need to be identified. Noxious stimuli that can contribute to the severity of spasticity may include pain, pressure sores, ingrown toenails, and bladder or bowel distention. Removal of the noxious stimuli will often lead to significant reductions in tone. The Modified Ashworth Scale (Table 1) is used to grade spasticity. This scale measures the presence of velocity-dependent resistance on a 0 to 4 scale, with zero representing normal muscle tone, and four representing a limb that is fixed in flexion or extension.

A thorough assessment includes consideration of function in addition to increased tone, since some spasticity can be beneficial. Totally eliminating spasticity is not always a goal; some individuals with muscle weakness use their tone to stand and transfer. Consideration of how much spasticity is actually beneficial is important when determining pharmacologic treatment, and medications should be titrated accordingly.

Management

Long-term rehabilitation for MS-related spasticity is essential and should be initiated as early as possible. It is critical to identify the underlying causes and components of the spasticity so that appropriate treatment can be provided to maximize the patient's physical abilities and comfort.

The most effective management approach involves the use of a multidisciplinary team including the physician, nurse, and occupational and physical therapists.

Spasticity usually requires both pharmacological and non-pharmacological interventions (Figure 1). Significant changes in spasticity may signal the need to review the patient's medications. Adjustment in dosages or addition of other anti-spasticity medications may successfully reduce tone. Oral medications are often effective, especially in the early stages of the disease. Baclofen administered intrathecally (Intrathecal Baclofen) through an implanted pump, can be an excellent option when large doses of oral medications are required to manage tone or when side effects of oral medication outweigh these benefits. For those individuals managed with intrathecal baclofen, the healthcare team needs to be familiar with the management of baclofen pumps. These systems can have mechanical failures, or the medicine-distributing catheters can become dislodged or plugged, resulting in loss of delivery of baclofen to the patient.

Botulinum toxin (Botox) and phenol injections into specific target areas can be effective adjuncts to oral medications. In exceptionally difficult cases, surgical intervention may be necessary, including tenotomy, neurectomy and rhizotomy. Periodic monitoring is needed to assess effectiveness of medications and therapeutic interventions of spasticity.

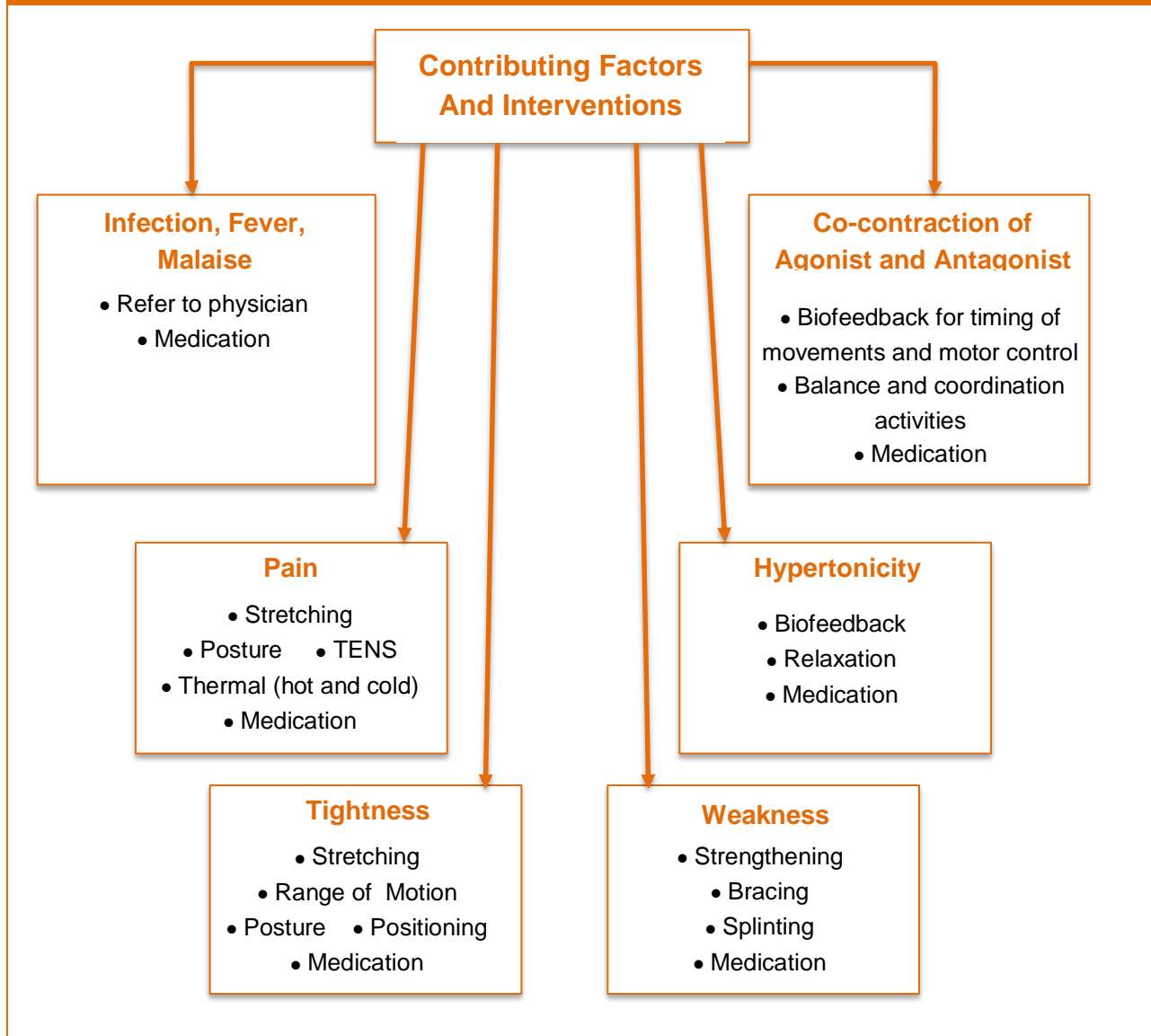
TABLE 1: Modified Ashworth Scale for Physical Therapy—Spasticity Evaluation

Date/Time															
	R	L	R	L	R	L	R	L	R	L	R	L	R	L	
Shoulder Flexors															
Shoulder Extensions															
Elbow Flexors															
Elbow Extensions															
Wrist Flexors															
Wrist Extensors															
Hip Flexors															
Hip Extensors															
Hip Abductors															
Hip Adductors															
Knee Flexors															
Knee Extensors															
Ankle Dorsiflexors															
Ankle Plantarflexors															
Average for UE															
Average for LE															
Date/Comments															

Modified Ashworth Scale for Grading Spasticity

Grade	Description
0	No Increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension

FIGURE 1 Spasticity: Contributing Factors and Related Interventions



Interventions

Treatment of spasticity will vary from patient to patient, based on the wide spectrum of factors presented. Specific interventions are determined after performance abilities and limitations are clearly identified (Figure 1).

Non-pharmacologic Interventions

Non-pharmacologic interventions are an essential component of spasticity management. This [paper](#) provides an objective view of non-pharmacological treatments in the effective management of spasticity.

- Stretching and range of motion exercises: Following a thorough musculoskeletal exam, can treat connective tissue tightness. *Posture* may be a focus for improved body alignment and decreased musculoskeletal problems. However, this may include evaluation and adjustment of a wheelchair seating system. *Gait and assistive devices* may need to be further evaluated. A manual muscle test may assist in determining whether or not upper extremity strength can compensate for spasticity. However, this test is not always valid, since spasticity can interfere with the results.
- Timing exercises: Problems with co-contractions can be treated with *timing exercises* and by focusing on *motor control*. Relaxation techniques, yoga and tai chi may also be beneficial. Biofeedback may help with reducing the activity of muscle groups that should be relaxing during certain movements.
- Strengthening: Reducing spasticity and strengthening weak muscle groups may be options to help with co-contraction problems. Strengthening may help with weak muscles or muscle groups and may be alleviated to some extent with *strengthening exercises* specific to those muscles identified as being weak. General conditioning can also help to strengthen weak and deconditioned muscle groups and increase endurance and cardiovascular conditioning. Strengthening can be achieved in a variety of ways, using free weights, machines, Theraband, Swiss Balls, or aquatic exercises. Strength training can also assist with the timing of movements, depending on the strength or weakness of the agonist/antagonist muscles. Precaution must be taken to avoid fatiguing muscles or the patient with excessive training. Exercise should be done in a cool environment as overheating can contribute to weakness and fatigue. Energy conservation techniques should be addressed to minimize fatigue and maximize function.
- Balance and coordination exercises: Energy expenditure and diminished fluidity of movement can be addressed by *balance and coordination exercises*. Swiss ball and pool exercises are very effective for balance and coordination, as are yoga and tai chi.
- Pain management: [Pain](#) can be associated with modifiable risk factors and may be alleviated or reduced by *stretching, transcutaneous electrical nerve*

stimulation(TENS), or thermal modalities such as cooling. Assistive devices, splints and braces may also decrease pain. Ergonomic and environmental factors should be evaluated for patients' vocational and avocational activities as these may be contributing to increased pain

Medical Marijuana

The American Academy of Neurology (AAN), an association of neurologists and neuroscientists dedicated to promoting high-quality care for people with nervous system disorders, released a [summary of evidence-based guideline on complementary and alternative medicine in MS](#) in 2014. The guideline was created by a panel of medical experts who evaluated all published research studies. Among studies of several forms of cannabis and its derivatives evaluated by the panel, evidence suggests:

- Oral cannabis extract and synthetic THC (tetrahydrocannabinol—a major active component of cannabis) are probably effective for reducing patient-reported symptoms of spasticity and pain, but not MS-related tremor or spasticity measurable by tests administered by the physician.
- A [study](#) on Sativex oral spray (GW Pharmaceuticals, not available in US) concluded that Sativex can be a useful and safe option for patients with MS with moderate to severe spasticity resistant to common antispastic drugs.
- [Cannabis and MS -The Way Forward](#) describes the multiple issues and research opportunities needed to further the advance of knowledge in potential cannabis treatment.
- 5481 participants responded to a 2017 [survey](#) regarding marijuana treatment in MS issues. A majority of respondents favor legalization and report high interest in the use of marijuana for treatment of MS symptoms.
- A large 2016 Italian [study](#) found that Oromucosal Spray showed good effectiveness and tolerability in the management of patients with resistant MS spasticity.

Pharmacologic Interventions

Pharmacologic interventions include the following:

- Oral *baclofen* is often used as a first line drug for management of spasticity. Many patients get good to excellent reduction in tone with this medication. It is started at a low dose and slowly titrated up to minimize sedation and to identify the lowest effective dose. Patients and family members become adept at making minor dose adjustments to control changes in tone that occur secondary to infection, stress, and other causes previously discussed. Patients may experience fatigue or weakness as a side effect. *Tizanidine* (Zanaflex), which can also be sedating, is an effective anti-spasticity medication that may be used alone or in combination with baclofen. *Dantrolene sodium* (Dantrium), which works at the muscle level and may cause liver toxicity, may also be considered.
- Implantation of a *pump to deliver baclofen intrathecally* is very effective for patients who do not respond well to oral medication or cannot tolerate the side effects at the required dosage level. It is also an option for individuals wanting to avoid ongoing nerve injections. Very small amounts of baclofen are required for symptom relief, avoiding the side effects of systemic administration.
Intrathecal baclofen is administered through a surgically implanted pump under the skin of the abdomen with a catheter that delivers the medication into the spinal fluid. The pump, which has a battery that typically lasts from 5 to 7 years, can be programmed with computer that communicates with the pump via a wand placed over the skin, thus allowing the dosage of baclofen to be adjusted easily.
The pump needs to be refilled by a trained healthcare professional every 1 to 6 months. Refills are done by inserting a needle through the skin into the refill pot on the pump.
Possible problems with the pump include pump failure, infection, and lead displacement.
- *OnabotulinumtoxinA* (BOTOX) is a powerful neurotoxin that temporarily blocks connections between the nerves and the muscles, resulting in short-term relaxation of the targeted muscle. Botox is administered by injection and is approved by the FDA to treat *upper limb* spasticity in adults, to

relieve increased muscle tone in elbow-flexors (biceps), wrist flexors, and finger flexors.

- Other oral drugs used off label include *diazepam* (Valium), which is very sedating at therapeutic levels, and may be habit-forming; *clonazepam* (Klonopin), which is a benzodiazepine used in multiple sclerosis primarily for the treatment of tremor, pain, and spasticity; and *gabapentin* (Neurontin), an anti-epileptic medication that has had some success in management of spasticity.
- For more severe spasticity, *phenol nerve blocks* are often effective for up to six months and are especially useful for conditions such as severe adductor spasm.

Summary of pharmacologic interventions:

- Baclofen (oral or intrathecal)
- Tizanidine
- OnabotulinumtoxinA
- Diazepam
- Dantrolene sodium
- Clonazepam
- Gabapentin
- Phenol

Surgical Procedures for Intractable Spasticity

Availability of the baclofen pump has greatly reduced the need for invasive surgeries. In rare instances intractable spasticity will necessitate ablative irreversible procedures such as:

- Tenotomy
- Neurectomy
- Rhizotomy

Summary

[Research](#) indicates that treatment of spasticity related to multiple sclerosis is most effective when there is a multidisciplinary approach to patient care. The

patient's abilities and limitations need to be considered in the management plan, as each person's tone and disease progression are unique. In some cases, a single intervention will be effective, but more often a combination of non-pharmacologic and pharmacologic strategies will be needed. These interventions need to be monitored as the course of the MS changes and modifications need to be made accordingly. All healthcare members should be consulted on an ongoing basis. In rare cases of intractable spasticity, ablative surgical procedures may be required.

Additional Resources

The [National MS Society](#) offers information and interactive programming on a wide variety of topics (e.g., disease-modifying therapies, symptom management, research), as well as access to local resources and events.

Resources for Patients

[Controlling Spasticity in MS](#)

[Spasticity in MS Webinar](#)

Recommended Reading

- Holland NJ, Halper J (eds.). *Multiple Sclerosis: A Self-Care Guide to Wellness* (2nd ed.). New York: Demos Medical Publishing, 2005.
- Kalb R (ed.). *Multiple Sclerosis: The Questions You Have; The Answers You Need* (5th ed.). New York: Demos Medical Publishing, 2012.
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- Schapiro RT. *Managing the Symptoms of Multiple Sclerosis* (6th ed.). New York: Demos Medical Publishing, 2014