

Spasticity

by Sue Kushner, MS, PT and Kathi Brandfass, MS, PT

Spasticity is one of the most common symptoms of multiple sclerosis (MS). It can be defined as a velocity-dependent increase in muscle tone, which is usually associated with hyperactive deep tendon reflexes. 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:

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

These clinical signs and symptoms may be aggravated by fatigue, stress, urinary tract infections, infections of other origins, 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.

ASSESSMENT

Screening for spasticity involves assessing range of motion of upper and lower extremities, and the ability to carry out activities of daily living. This includes examination of mobility, transfers, self-care, assistive devices/braces, strength, and balance. 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, decubitus ulcers, 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.

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. 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.

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-pharmacologic interventions (Figure 1). 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. 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.

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 Extensors															
Elbow Flexors															
Elbow Extensors															
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 Treatment of Spasticity

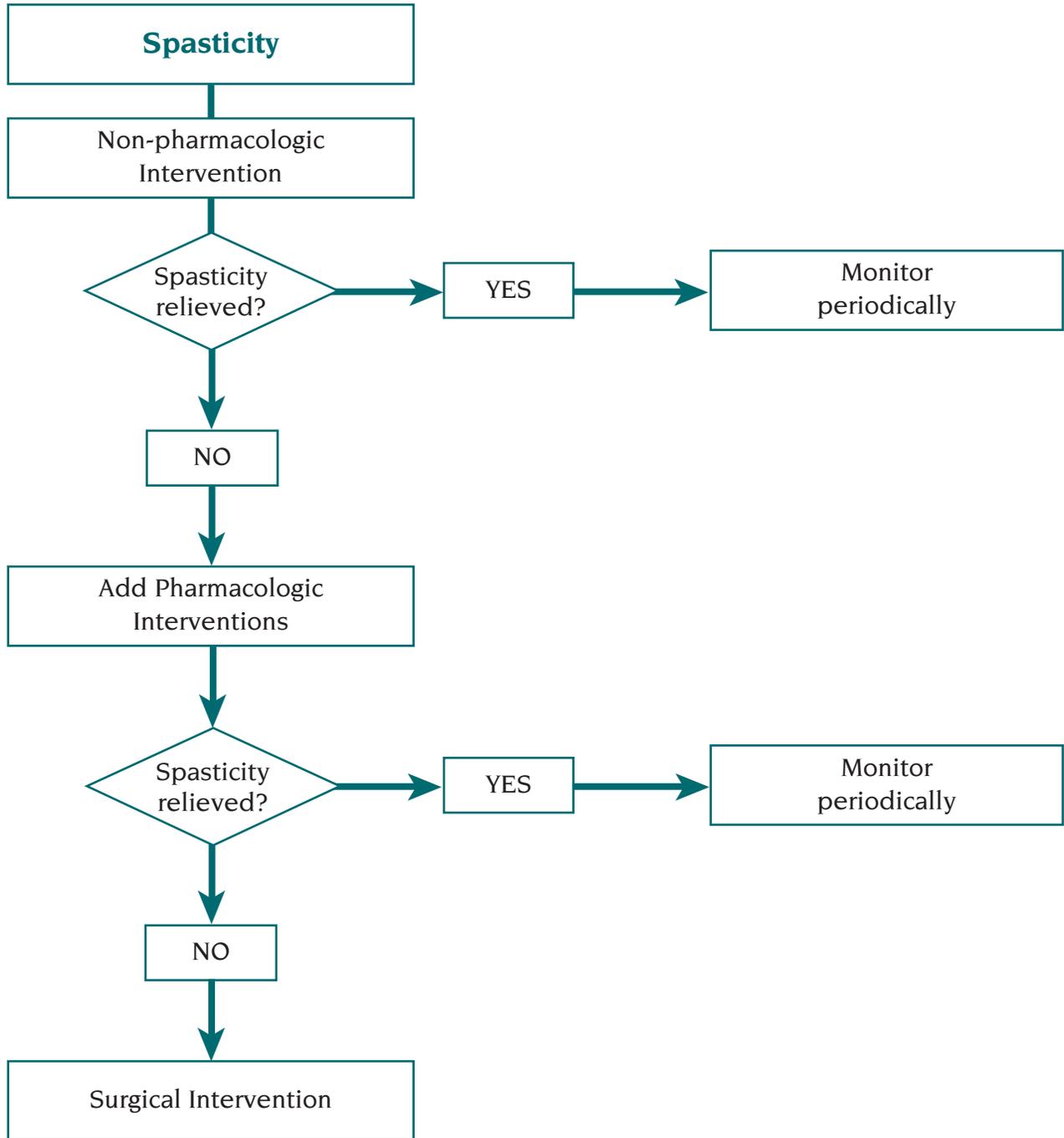
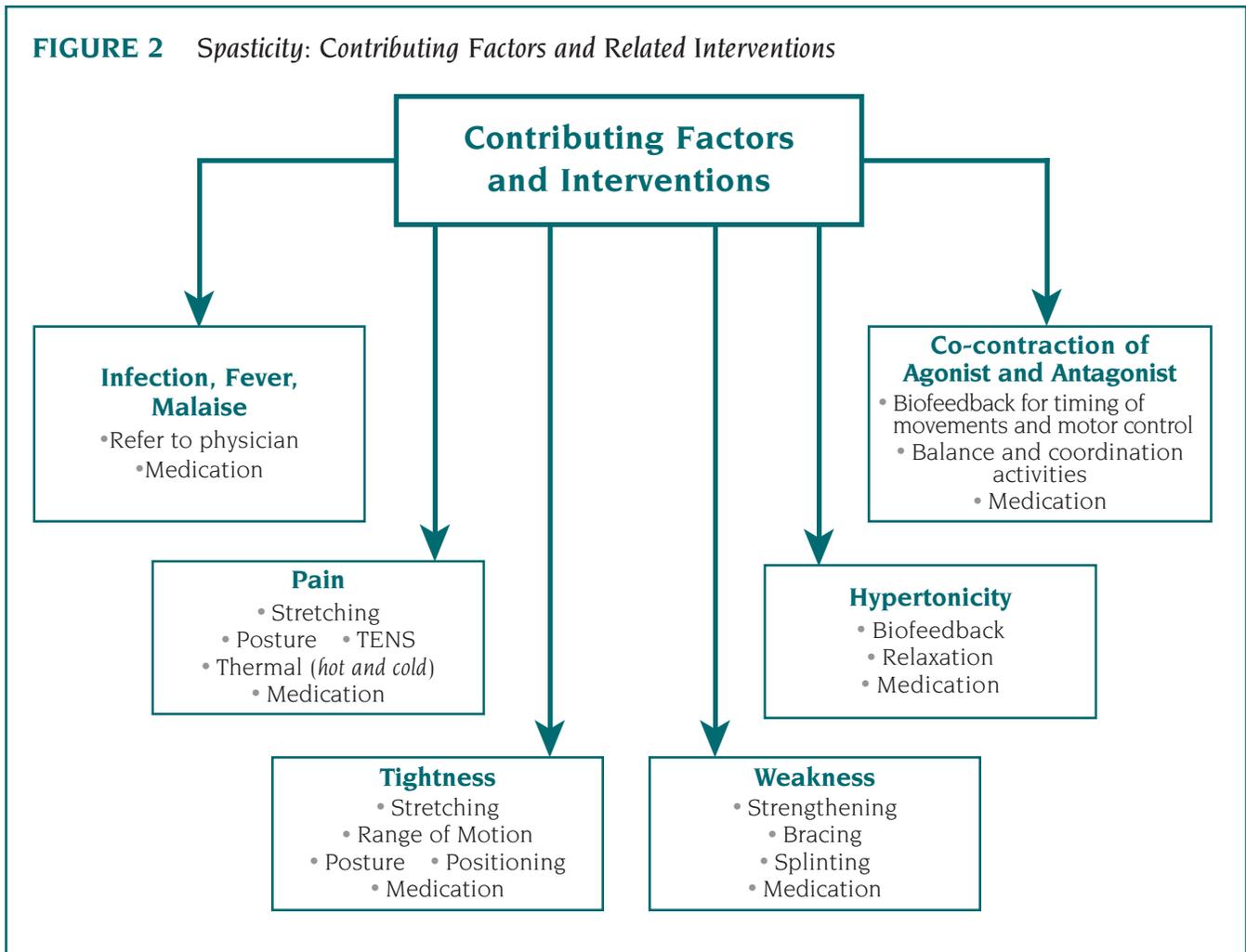


FIGURE 2 Spasticity: Contributing Factors and Related Interventions



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 2).

Non-pharmacologic Interventions

Possible non-pharmacologic interventions are as follows:

- ◆ **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. 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. This test is not always valid, since spasticity can interfere with the results.

- ◆ **Problems with co-contractions** can be treated with *timing exercises* and by focusing on *motor control*. One goal is to minimize fatigue through energy conservation techniques and adequate fluid intake. *Yoga, Tai Chi* and *biofeedback* may be appropriate relaxation interventions. *Aquatic exercises* may also be helpful.
- ◆ **Weakness** 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 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** may be alleviated or reduced by *stretching, transcutaneous electrical nerve stimulation (TENS)*, or *thermal modalities* such as cooling. Ergonomic and environmental factors should be evaluated for patients' vocational and avocational activities as these may be contributing to increased pain.

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.
- ◆ 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. More recently, *botulinum toxin* (Botox) injections have been used successfully for small muscle groups.
- ◆ Implantation of a *pump to deliver baclofen intrathecally* may be helpful 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. Problems with the pump include pump failure, infection, and lead displacement.

Summary of pharmacologic interventions:

- ◆ Baclofen (oral or intrathecal)
- ◆ Tizanidine
- ◆ Diazepam
- ◆ Dantrolene sodium
- ◆ Clonazepam
- ◆ Gabapentin
- ◆ Phenol
- ◆ Botulinum toxin

Surgical Procedures for Intractable Spasticity

In rare instances intractable spasticity will necessitate ablative irreversible procedures such as:

- ◆ Tenotomy
- ◆ Neurectomy
- ◆ Rhizotomy

SUMMARY

The treatment of spasticity related to multiple sclerosis is most effective when there is a multi-disciplinary 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 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. In rare cases of intractable spasticity, ablative surgical procedures may be required.

ADDITIONAL READINGS

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Contributors: Dan Scott, MD, Nancy Holland, EdD, RN and Deborah Hertz, MPH

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