

Spasticity in Transverse Myelitis

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Transverse myelitis (TM) changes the lives of children and adults in many ways. Major motor problems include weakness, increased muscle tone or spasticity, decreased mobility in joints, and fatigue. Muscle spasms and contractures can be painful.

Spasticity is defined as a heightened response to stretch that is velocity dependent. This means that muscle tone increases with movements and usually decreases during sleep. The doctor or therapist evaluates for spasticity through observing the muscle tone during passive movement according to a number of different grading scales. Spasticity is caused by an injury along the spinal cord tract that starts in the brain's motor cortex called the upper motor neuron. The cell body sits in the outer surface of the brain in the area responsible for voluntary movement. The tract comes down through the brain and crosses to the opposite side of the spinal cord then makes a connection to the lower motor neuron. This nerve cell is in the spinal cord and sends a long process out all the way to the muscles of the arms, trunk, and legs. When there has been an injury to the upper motor neuron or its long tract, it results in the inability of the nervous system to produce movement in a relaxed or normal state. When the person tries to move or is passively moved, the tone increases in a specific pattern that limits voluntary movement.

There are other associated signs of upper motor neuron damage. One problem is called **clonus**, in which alternating contractions of opposing muscle groups appear to cause a reverberating circuit and rhythmic contraction of a joint. This occurs most commonly at

the ankle when the calf muscles are stretched quickly. The neurologist checks for this by tapping the Achilles tendon with a reflex hammer and watching the response. Clonus can be sustained, and can be uncomfortable and embarrassing. Another associated problem is called the **Babinski** response. This is checked for by scratching the bottom of the foot with a sharp object, such as a key and watching the response of the toes. The great toe (big toe) moves up toward the face, if the reflex is abnormal and the other toes may fan out. This can make wearing shoes less comfortable and cause breakdown of the skin, if the reflex is set off while standing or walking. Spasticity scores can be generated to determine whether a patient is responding to a treatment. One of the most common is called the Ashworth score. It ranges from a score of 0 which is no spasticity up to 4 which is limb rigidity in flexion or extension. This scoring system has been modified, and there are other scales which can detect smaller changes. Spasticity may be helpful to some people for standing and weight bearing. If the spasticity is reduced too much, the patient may not be strong enough to stand for transfers or walking. If spasticity is too high, the patient may not be able to move the arms or legs for function. In the legs, it can make it difficult to move one leg at a time as in walking, and can cause a scissor-like problem where one leg moves forward too close to the midline and is obstructed by the opposite weight bearing leg.

In addition, spasticity that is present most of the time usually leads to limitation of joint movement or contractures. These contractures can become permanent, making daily activities more difficult and less comfortable. An example is that common flexion contractures that limit complete straightening of the hips and knees make lying flat in bed impossi-

ble. Turns during the night can be only backlying or sidelying, increasing the risk of skin breakdown (decubitus ulcers). When attempting to stand and walk, hip and knee flexion contractures cause one to expend more energy in weight bearing because it requires constant muscle activity, rather than allowing resting on ligaments. This contributes to muscle fatigue. Another common problem is contracture of the Achilles' tendon causing one to bear weight only on the toes and ball of the foot. This reduces the surface area of weight bearing and decreases stability of the base of support, and again contributes to falls and fatigue. Contractures in the adductor muscles (the muscles that bring the knees closer together) can make dressing and personal hygiene more difficult, resulting in loss of independence. Contractures make orthotics (braces) more difficult to use, resulting in a vicious cycle with progressive loss of range of motion.

Some things can increase spasticity. These include, but are not limited to, bladder infection or distention, bowel distention, ingrown toenails or other painful skin irritants, and deep venous thromboses (blood clots). Excitement and stress can also increase spasticity.

Treatment of spasticity is multifaceted. Range of motion can be maintained through physical therapy or a home stretching program. Strengthening the muscles opposite the spastic muscle groups helps balance the tone and joint positions. The use of orthotics to maintain the desired joint positions is very important, as no one can perform stretching and strengthening exercises throughout the day and night, especially when fatigued. Finally, having specific functional goals, such as maintaining ambulation (walking), wheelchair or driving positioning, transfers, and ability to turn at night prevent some of the dependence caused by TM.

Specialists that can help patients man-

age their spasticity include physical and occupational therapists, orthotists (bracemakers), neurologists and physiatrists, and the wheelchair vendors.

Finally, when these measures are not enough, medications can be used. The most commonly used medication is **baclofen**. This medication is available as a tablet or liquid. It is thought that it reduces the release of excitatory neurotransmitters (chemical messengers). Doses are gradually increased to monitor for side effects, such as somnolence (sleepiness), nausea, paresthesias (abnormal sensations), and even seizures when suddenly withdrawn. Rarely, the liver can be harmed by this medication.

Another medication with similar effects is **diazepam**. It is available as oral tablets, liquid, or rectal gel forms. This class of medicines reduces anxiety, but can also cause sedation. Dependence can develop with this medication, requiring higher doses over time.

Dantrolene works directly on muscles by preventing the release of calcium ions, in turn reducing muscle contraction. It is available as 25 mg tablets, but also as a powder for solution. Some people take very large doses, but there is potential for liver toxicity and requires monitoring blood work.

Tizanidine works by a different mechanism, increasing the inhibitory pathways in the spinal cord. It is available as 4 mg tablets taken every 6-8 hours. It affects the autonomic (automatic) nervous system functions and can reduce blood pressure, cause dry mouth, somnolence, weakness, and can even increase muscle spasms and tone so must be monitored. There are reports of abnormal liver functions, so blood work may be suggested by your doctor.

Other medicines are thought to reduce spasticity, though their main purpose

is for other diseases. Examples include **gabapentin**, **amantadine**, and **4-aminopyridine**.

Botulinum toxin is an extremely potent neuromuscular blocker. In its natural form, it is highly toxic. It has been developed as an agent to decrease muscle contraction in dystonia and spasticity by direct injection into the affected muscle groups. The maximum effects are apparent within a few days after the injection. These effects typically wear off after a few months. Children and some adults require sedation for this procedure, and it is most accurate if performed in conjunction with an electromyogram to be sure the injection is into muscle rather than other tissues. While very costly, combining this therapy with rehabilitation maximizes the beneficial effects. Serial casting is used after injection to gradually regain lost range of motion, and ongoing therapy and stretching are important to prevent the loss of motion.

Other treatments of interest include electrical stimulation of peripheral nerves and muscles through the skin, or even through epidural electrodes (around the spinal cord). These are less well accepted. Some therapists use vibration, cold applications, topical anesthetics to reduce tone and some believe that acupuncture is helpful. These are much less studied and difficult to incorporate into a daily routine.

One surgical option is the placement of a baclofen pump under the skin of the abdomen. This is connected to a catheter. The system delivers the medication to the space around the spinal cord, and avoids the central nervous system side effects of the oral form. It requires regular replacement of the medication through a needle. There are rare complications including infection and scar formation. The placement requires anesthesia and the surgery and device are

expensive. A test dose is given by injection of baclofen through a spinal needle, with doctor and therapist observing for improvement in muscle tone. Complications of the operation include spinal fluid collections, constipation, headache and spinal fluid leak. There can be kinking of the catheter, and the pump may malfunction if cold.

Another surgical option is called selective posterior rhizotomy. In this operation, the nerve roots bringing sensory information into the spinal cord are exposed and selectively and permanently cut. This reduces the muscle tone in the muscle supplied at that spinal cord root level. It requires anesthesia, and can result in bladder dysfunction and sensory problems.

Patients with spasticity frequently develop osteoporosis, and need to be sure to take in an adequate amount of calcium and vitamin D. Weight bearing is thought to improve bone health, even when support is needed for standing. Physical therapists can do periodic assessment to try to prevent long term problems, such as excessive wear and tear on shoulders from wheeling.

Although spasticity is a big problem in TM, there are a lot of avenues to reduce spasticity and complications. Not all treatments work in every individual, requiring trials and reassessment. Despite their availability, it is up to the individual person to be sure they are receiving these treatments that often increase function and independence. Be your own advocate!