TBI Inform

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Spastic Hypertonia following Traumatic Brain Injury

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What is Spastic Hypertonia?

Spastic hypertonia (SH) is a term that doctors use to provide a more complete description of spasticity and various conditions of extreme muscle tension. Spastic hypertonia refers to uncontrollable "jerking" movement (muscle spasms), stiffening or straightening out of muscles (rigidities), shock-like contractions of all or part of a muscle or group of muscles (myoclonus), and abnormal tone in the muscles or involuntary sustained muscle contraction (dystonia).

Movement & Reflex Centers

The body moves in response to messages sent by way of the nerves from the brain to the muscles located throughout your body. Reflex centers located in the brain and spinal cord process these messages. For example, when you pick up a cup of water, a message from your brain tells your hand to move and pick up the cup. As you touch the cup, the nerves in your hand send a message back to the brain signaling that you have touched the cup. The brain sends a message back to certain muscles to pick up the cup. In addition, the brainstem and spinal cord modify these unconscious messages to help you coordinate and refine each movement. These messages help you adjust your grasp and balance the cup so you do not spill the water.

Other movements are in response to sensations such as temperature, texture, pressure or pain. Movement may be the result of protective reflexes. For example, when you touch a hot cup you quickly jerk your hand away from the heat. The nerves from your hand send messages through the spinal cord to your brain, which identifies the sensation. A message is then sent back to your hand, telling it to move away from the heat. There is also a message that controls the muscle movement, so the arm stops at a certain point.

Another example of reflex movement is called crossed reflex. For example, if you step on a sharp object you automatically lift your foot. Another message tells the muscles in the opposite leg to react so that leg can support all your weight. Movement often occurs without ever having to think about the separate actions or movements.

Understanding Muscle Tone

Many different mechanical and chemical factors affect how your muscles move. Muscle tone is most important. Muscles with too much or too little tone cannot function at their best. Muscles lacking tone are flaccid or soft and cannot offer resistance when stretched. A muscle with high tone is rigid or hypertonic. This makes it difficult for a person to perform normal tasks (walking, picking up objects, dressing). For example, muscle tone must change for you to pick up a cup. The muscles must be able to contract to grasp the cup and then relax at the proper time to let go of the cup.

After a Traumatic Brain Injury

Spastic Hypertonia often occurs after a traumatic brain injury (TBI) as a result of damage to the brain stem, cerebellum or mid-brain. The damage affects the reflex centers in the brain, interrupting the flow of messages along various nerve pathways. This disruption of signals can cause changes in muscle tone, movement, sensation and reflex. The location of the brain injury can affect which areas of the body are affected and what the specific motor deficit may be. For example, the changes in movement may involve only one side of the body.

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The reflex centers in the brain are more complex than those in the spinal cord. This can make the treatment of spastic hypertonia in individuals with TBI more difficult to treat than in persons with spinal injuries or diseases.

Shortly after a brain injury, individuals often go through a period of increased muscle tone where their body posture becomes very rigid. A common position is elbows held rigidly at their sides, wrists and fingers bent and fists clenched. The legs are usually extended at the hips and knees with ankles and toes flexed. When the elbows are bent it is referred to as decorticate posture. If the elbows are extended it is called decerebrate posture.

As the patient recovers, nerve signals that control motor functions may change. Some signals may not reach the reflex centers of the brain. In other cases, the brain may send too many signals, and the muscles cannot respond properly. As motor movement begins to return, the movement is usually unconscious and reactive rather than planned and purposeful. There may be spasms or other large uncontrolled movements. During the first six months, there will be changes in patterns and movements as the individual recovers. Muscle tone can develop and change dramatically over the first year following injury.

Treatment

Proper positioning is the primary treatment goal for an individual with TBI who has abnormal posturing caused by spastic hypertonia. The individual needs to be properly positioned when laying and sitting. Therapists often work on preventing contractures or further tightening of the muscles that may develop due to abnormally high tone and improper positioning of the limbs. 85% of individuals with TBI who require inpatient rehabilitation develop contractures from spastic hypertonia. There is also concern that abnormal posture can lead to pressure sores, a decrease in blood flow to the extremities or a decrease in blood pressure.

Spastic hypertonia in not necessarily a medical problem unless the extreme muscle tone interferes with normal range of motion or regular daily activities. For example, stiffened muscles or contracted muscles may keep individuals from doing their own self-care routines such as dressing or grooming. In some cases it also makes it difficult for the caregiver to assist with basic tasks.

Possible Advantages of Spastic Hypertonia

1. Maintains muscle tone and mass.
2. Reduces bone loss and decreases the risk for osteoporosis.
3. Increases metabolic requirements such as promoting blood circulation and improving breathing.
4. Helps in performance of daily self-care routines such as assisting in pressure reliefs to prevent pressure sores.
5. Helps in performance of daily functions such as picking up items, transferring or walking with braces.
6. Warns when there is a problem in areas where the body has no feeling.

Possible Disadvantages of Spastic Hypertonia

1. Limits range of motion.
2. Causes pain due to stress put on joints and muscles.
3. Interferes with daily functions from dressing and eating to driving, walking and participating in other activities.
4. Interferes with other activities such as sexual activity, sleeping, changing position, sitting or transferring.
5. Affects posture and ability to sit comfortably, maintain balance or change positions.
6. Causes rubbing and friction to the skin and increases the risk for pressure sores.
7. Adds to the cost of medications and attendant care.

Quality of Life

The goal of all treatment for SH is to improve quality of life (QOL). However, many individuals do not know when treatment is necessary. It may be hard to decide if SH is having more of a positive or negative impact on your QOL. You can ask yourself the following questions to help decide whether or not treatment is right for you or the person you are caring for.

- Does spastic hypertonia limit your independence by keeping you from doing things for yourself and participating in activities?
- Do you need more personal assistance because of your spastic hypertonia?
- Do you lose sleep because of your spastic hypertonia?
- Does your spastic hypertonia you at risk for other medical problems such as a pressure sore?

If you decide that treatment for spastic hypertonia may improve your QOL, you should talk with a doctor who is familiar with individuals with TBI. Some treatment options can be dangerous and even life threatening if not properly monitored by a doctor. Other important factors to consider in deciding on treatment include:

- What is the cause (etiology) of your spastic hypertonia?
- Do you have a support network if you need help in taking your medication or applying a splint or brace?
- Do you need transportation to and from the doctor to get treatment and follow-up examinations?
- Do you have other current medical problems such as a lack of balance, numerous infections, high/low blood pressure, or depression?
- Do you live in an area where you can get treatment?
- What treatments are covered by medical insurance or will you have to pay for your treatment?

Treatment Options

The doctor must first determine which nerve pathways are damaged before selecting the type of treatment. This can vary from patient to patient, making SH more difficult to treat.

Rehabilitation

Daily Range of Motion exercises and regular stretching can promote relaxation of rigid or spastic muscles. All stretching and exercises should be prescribed by a physical therapist. One helpful treatment in reducing SH for some persons is the use of standing devices or standing frames. These can counteract the tendency of muscles to flex after prolonged sitting.

Medications

Medications are the most widely used option for treating SH. Some medications are taken by mouth (oral) or by feeding tube (enteral feeding). Your doctor may first prescribe oral medications because they are usually effective for individuals with TBI.

- ***Benzodiazepines*** [Diazepam (Valium®), Clonazepam (Klonopin® or Rivotril®)] act on the central nervous system and result in a decrease of overactive muscles and fewer painful spasms. These drugs are sedative/hypnotics and are used mainly for nighttime spasms and sleep disturbances. Common side effects are dizziness, drowsiness, impaired memory and attention, and loss of strength. These medications can be addictive for some individuals, so a sudden stop in use may cause symptoms of withdrawal. This is not the first drug of choice in a new head injury because of cognitive side effects that can slow recovery.

- ***Baclofen (***Lioresal®) is another medication that works through the central nervous system. It helps to improve passive range of motion and reduces muscle spasms, pain and tightness. Daily functioning and activities of daily living may not improve with baclofen use. Some individuals reported side effects such as

dizziness, drowsiness, weakness, fatigue, nausea, urinary retention or incontinence, bowel constipation or incontinence and sexual dysfunction.

- ***Dantrolene sodium*** (Dantrium®) is a medication that works differently than benzodiazepines and baclofen. It acts at the muscle, rather than on the central nervous system, where it interferes with muscle contraction. Dantrolene improves passive movement, decreases muscle tone and reduces muscle spasms, tightness and pain. Its use has been limited in individuals with TBI because it is not selective for spastic muscles. Dantrolene can cause generalized weakness to all muscles, including the respiratory muscles. This drug is metabolized in the liver and requires a blood test to monitor liver enzymes. The most common side effects are dizziness, drowsiness, diarrhea, fatigue and weakness.

- Tizanidine (Zanaflex®) is a medication that reduces SH by acting on the central nervous system. It does not reduce the strength of muscles as much as other types of oral or transdermal medications (skin patch). It is a short acting drug and should be taken during daily activities when the relief of SH is most important. Some individuals may experience side effects such as sedation, dizziness, and low blood pressure.

There are other oral medications that are currently being studied to determine their effectiveness on spastic hypertonia. A medical doctor experienced in working with individuals with TBI will be able to help you with this.

Motor Point Blocks

Chemodenervation is the use of chemicals injected directly into the muscle to interrupt the flow of nerve impulses to the spastic muscles. Some of these chemicals include Botulinum Toxin Type A (BOTOX® and Dysport®), Botulinum Toxin B (Myobloc®), and Phenol and Alcohol. They work by reducing muscle contractions and allowing a more normal position or function of the involved limb.

The advantage to using these drugs is that they only work for several weeks. If you do not like the side effects, you can stop treatment with no permanent effect on motor nerve communication. The disadvantage is that the overall effect is temporary and localized muscle weakening will clear up. Each chemical has advantages and disadvantages, so you should talk to your doctor about any possible risks or side effects of the treatment.

Intrathecal

Intrathecal medication is a fast growing treatment option. First, an Intrathecal Pump (IP) is surgically implanted into the abdomen. The difference between the IP and other surgical options is that the IP surgery is reversible. Second, the IP has a reservoir of medicine (usually the same baclofen used as an oral medication). The medicine is pumped through a small tube directly to the fluid surrounding the spinal cord.

Advantages of the Intrathecal Pump

- Medicine is sent directly to the nerve cells where it is needed.
- Medicine dosage can be adjusted as needed.
- Much less medication is needed than if it were taken orally, which reduces side effects, especially sedation.
- Reservoir is easily refilled by injection when needed.
- Surgery is reversible.

Disadvantages of the Intrathecal Pump

- Requires surgery to implant the pump.
- Expensive.
- Tubing can become disconnected or kinked.
- Risks include infection, baclofen overdose, pump dysfunction, and developing symptoms of withdrawal.

Surgical

Before surgery can be successful, the muscle tone must first be controlled or reduced. Otherwise the

contracture is bound to return despite splinting and positioning. Individuals who choose surgery as an option should also understand that most of these procedures are nonreversible.

Orthopedic surgery is done to correct or counterbalance the effects of SH through various procedures to muscles, tendons or bones. Four common types of these orthopedic surgeries are:

1. **Contracture release** either partially or completely cuts a tendon to release a contracture of the tendon or muscle. A contracture is an abnormal joint posture due to persistent muscle shortening. When muscles are not stretched regularly, the tendons shorten and tighten, which limits the muscle's full range of motion.
2. **Tendon transfer** moves the attachment point of a spastic muscle. This means that the muscle can no longer pull the joint into a deformed position.
3. **Osteotomy** is removing a small wedge from a bone to allow it to be repositioned or reshaped.
4. **Arthrodesis** is the fusing together of bones that normally move independently.

Dorsal root rhizotomy is a surgical treatment rarely used for individuals with TBI. The procedure interrupts the reflex arcs or sensory inputs to the spinal cord when the nerve roots are cut, burned or chemically injured. This is also an irreversible procedure. For example, once a nerve is cut, there is no procedure to restore the nerve function.

Evaluating Treatment

You should keep in close contact with your doctor and continue to reevaluate your current quality of life (QOL). Your doctor may know of new treatment options that may improve your QOL. When evaluating your treatment, ask yourself;

- Am I more or less independent in my daily activities since I began treatment?
- Do I have problems with concentration or memory?
- Do I have more or less pain than I did before treatment?

You may decide that your current treatment is not improving your QOL. You may want to consider another treatment option, or you may also decide that no treatment is the right option for you.

Conclusion

Spastic Hypertonia is common for individuals with TBI. However, not all individuals choose treatment. If you decide that treatment for SH might improve your quality of life, it is up to you and your doctor to choose the treatment option that is best for you.

About the Author

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