PedsCases Podcast Scripts

This is a text version of a podcast from Pedscases.com on "**Pediatric Rehabilitation Part 3: Assessment and Management of Spasticity.**" These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

Pediatric Rehabilitation Part 3: Assessment and Management of Spasticity

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Introduction

Hello, and welcome to PedsCases podcasts. My name is Andy Le and I am a medical student at the University of Alberta. This podcast was developed in conjunction with Dr. Matthew Prowse, the Program Director of the Division of Physical Medicine and Rehabilitation at the University of Alberta. Today, we will be discussing the assessment and management of spasticity in pediatric patients.

After listening to this podcast, the learner will be able to:

1. Understand the difference between spasticity and rigidity
2. Recognize complications of spasticity
3. Conduct a basic assessment of spasticity
4. List reasons for worsening spasticity
5. Recognize treatment methods for spasticity
6. Understand the importance of goal setting in the treatment of spasticity

Case

Let's return to our previous case, where we met Jeremy, an 11 year old boy with cerebral palsy, specifically spastic diplegia. Due to the spasticity in his legs, his lower

extremities are weak, but he is still able to walk, though requires forearm crutches for assistance for longer distances. So what is spasticity? How will spasticity affect Jeremy, how can we assess the severity of his spasticity, and how can we manage it?

What is Spasticity?

Although spasticity may not be commonplace in the general pediatric population, it is likely that you will come across patients affected by spasticity. This is most frequently caused by cerebral palsy or CP. CP is the most common cause of physical disability in childhood (affecting roughly 1 in 300 children) and is typically associated with spasticity. Other diagnoses such as acquired brain injury and spinal cord injury are less common but are also likely to be associated with spasticity. In this podcast, we will go over the basics of assessment and management of spasticity

To begin, let's start with some background information.
Muscle tone is the state of muscle tension inside a muscle or a group of muscles while it is at rest. Spasticity is defined by the American Academy of Neurology as "a velocity-dependent increase in muscle tone, with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex". Depending on how quickly you move the joint you will feel different resistance to movement. Often, you can initially freely move the joint, until reaching a spastic "catch", which requires increased force until it releases and you can freely move the limb again. It differs from rigidity, which is an increase in muscle tone that is independent of velocity. An example of rigidity is "lead pipe rigidity". Lead is soft metal which can be slowly bent when you apply force - no matter how fast or slow you try to bend the pipe it will bend with the same resistance.

Spasticity is one of the positive symptoms of the upper motor neuron syndrome. Other symptoms that may be seen with the upper motor neuron syndrome include hyperreflexia, upgoing plantar reflexes (AKA a upgoing Babinski's reflex), a positive Hoffman's reflex, weakness that often originates from underlying spasticity and is therefore described as spastic weakness, and clonus. Not all of these symptoms will necessarily be present simultaneously.

There are various different causes of spasticity, all relating to either local or diffuse upper motor neuron injury – examples include brain injury or stroke, spinal cord injury, or metabolic encephalopathies. Cerebral palsy is an umbrella term for a group of non-progressive but changing motor impairment syndromes that occur secondarily to brain injury early in development. Spastic diplegia is the most common type of cerebral palsy. The pathophysiology of spasticity is quite complicated and involves the interplay of various sensory and motor neural circuits, but ultimately can be simplified as a decrease in inhibition of the motor stretch reflex. This results in a lower threshold for activation of reflexive muscle contractions that occur due to changes in length or stretching of muscle fibers and therefore hyperexcitability of the stretch reflex.

Assessment of Spasticity

There are a few different methods of assessing spasticity, though the most commonly used is the Modified Ashworth Scale. It is a 6-point scale from 0-4. That sounds confusing, but the Ashworth Scale includes 6 categories: 0, 1, 1+, 2, 3, and 4.

- A score of 0 indicates normal tone and no spasticity.
- A score of 1 indicates a spastic catch and release near the end of range of motion (ROM) so most of the ROM is normal.
- A score of 1+ indicates a spastic catch followed by minimal resistance for less than half of the ROM.
- A score of 2 indicates increased tone throughout more than half of the ROM, but the affected part can still be easily moved.
- A score of 3 is a marked increase in tone through the full ROM with difficulty moving the affected part
- Finally, 4 indicates rigidity of the affected part in flexion or extension.

As you can see, the Modified Ashworth Scale is dependent on the subjective assessment of the clinician using this tool, but it has been shown to have good inter-rater agreement and reliability. It is especially helpful for tracking the improvement or worsening of a patient's spasticity. It is important to get lots of practice assessing spasticity to get a feel for what each Modified Ashworth score feels like.

Complications

Before discussing treatment methods, it is important to understand the long-term complications of spasticity. Spasticity itself is a troubling symptom that impairs range of motion, strength or coordination in affected muscles and joints. Overtime spasticity can lead to long-term complications, some of which include contractures, skin breakdown, pain, and joint dislocations. Contractures occur when muscles and tendons become stiff from chronic spasticity to the point where there is permanent shortening of the muscles. Joint dislocations can occur from contractures or if there is enough tension in muscles to disrupt the alignment of a joint. Skin breakdown can occur due to repeated spastic movements that may cause repetitive physical abrasive damage or in weight dependent areas due to pressure from prolonged immobility resulting from spastic weakness. Pain can occur from uncontrollable spasms in muscles. These complications can reduce the quality of life and function of patients.

Management

Management of spasticity is focused on improving function, managing or preventing complications, or a combination of these. Treating spasticity requires a multidisciplinary approach including medications, physiotherapy, occupational therapy, and in some cases, surgery.

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It is important to be aware that even though spasticity can cause many issues that can be improved or prevented through treatment, there is no guarantee that reducing spasticity will necessarily result in benefit. In fact, reducing spasticity may unmask underlying weakness or other impairments that were not previously appreciated. For example, a patient may have been relying on spasticity in the extensor muscles in their legs for transfers. The spasticity can hold the legs straight in an extended position and provide support when weight-bearing. Taking away this spasticity might unmask weakness in the quadriceps and could actually decrease the patient's ability to perform standing transfers. In addition many treatments of spasticity can cause weakness as a side effect. Knowing that treatment has the potential for causing functional deterioration, it is imperative that a patient's care is individualized to their situation. Appropriate goals should be set that address the patient's functional requirements and desires, taking both complications and possible benefits of spasticity into account. Therefore, as with any rehabilitation intervention, realistic and attainable goal setting is crucial to the management of spasticity and should be guided by functional goals.

Before treating a patient's spasticity, it is also important to recognize comorbid factors that worsen spasticity and treat these first. Examples include urinary tract infections, pressure sores or ulcers, stool impaction, pain, restrictive clothing, or ingrown toenails. Pain can be from spasticity, but can also be due to associated joint subluxation, fractures or skin breakdown. After assessing for these comorbidities and treating them appropriately, you can begin therapies for spasticity.

In general, there are non-pharmacologic, pharmacologic, and surgical methods for the management of spasticity. It is important to incorporate non-pharmacologic management into a patient's care before jumping to medications, as these often have good effect with fewer side effects and complications. Passive stretching is recommended for all patients with spasticity. This can initially be facilitated by a health care provider (eg: OT, PT), with the goal that this would be transitioned to a home based program for the patient or caregiver to perform. Strengthening of spastic muscles has also been shown in some populations to reduce spasticity and should be considered whenever possible as strength on its own is often a major determinant of function.
Various other methods such as massage, acupuncture, tendon pressure, vibration, bandaging, and so forth have been shown to have some benefit in managing spasticity.

The pharmacologic methods can be divided into oral, injectable, and intrathecal. One of the most common oral medication used in the treatment of spasticity is baclofen. It mimics the effects of GABA and results in central inhibition of the stretch reflex. The main side effect associated with baclofen is sedation, but it is often tolerated well.

Other common oral pharmacologic medications include tizanidine, dantrolene sodium, and gabapentin. These all have different mechanisms of action and side effect profiles and need to be considered on an individual basis.

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The main form of injectable treatment is botulinum toxin therapy. Botulinum toxin, or "BoTox" is a potent neuromuscular blocking agent and works by preventing the presynaptic release of acetylcholine. Injectable therapies are appealing due to their local effect, potential reduction of contractures and pain, and their ability to be used in conjunction with oral pharmacologic and non-pharmacologic therapies. Botulinum toxin has a typical duration of action of 2-3 months. However, in some patients the effects of Botox last longer than 3 months, so the frequency of treatment should be determined by the individual's clinical response.

In patients with severe spasticity not sufficiently managed with less invasive treatments, intrathecal baclofen can be considered as an option. This requires the insertion of a pump that continuously releases baclofen into the intrathecal space around the spinal cord. This is often reserved for patients with severe spasticity primarily affecting the lower limbs.

Surgical management of spasticity is the last line option. Orthopedic surgeons often conduct procedures to manage the complications of spasticity, whereas neurosurgeons typically conduct procedures that try to decrease spasticity. Examples of orthopedic procedures include contracture release, tendon lengthening, and muscle to tendon transfer. Selective dorsal rhizotomy is a neurosurgery procedure that is seen more commonly in pediatric patients than adults. This procedure involves selectively sectioning dorsal rootlets carrying the sensory afferent signals for the stretch reflex arc. The reduced sensory input results in less hyperactive reflex responses and less spasticity.

Case

Let's return to our case. From your exam, you determined that Jeremy has spasticity in his arm flexors, knee extensors, ankle plantarflexors, and hip adductors. On assessment of his knee extensor and hip adductor tone, you notice there is increased tone throughout the entire ROM and his legs are difficult to move; you therefore assign a Modified Ashworth Score of 3. When assessing his plantarflexors, there is increased tone throughout the entire ROM but his feet are still easy to move, – you therefore assign a Modified Ashworth Score of 2. In his upper extremities, you determine a subtle catch and release when assessing his arm flexors and assign a Modified Ashworth Score of 1. You examine his skin and do not notice any areas of breakdown and Jeremy denies any pain that may be worsening his spasticity. You explain what spasticity is to Jeremy and discuss the goals for management – the spasticity in his hip adductors is making it difficult for toileting and peri-care, however you worry that treating the spasticity in his knee extensors might cause weakness that results in increased functional impairments; therefore you suggest treating the spasticity in his hip adductors to hopefully prevent complications and provide functional improvement. Since the spasticity to be addressed is relatively focal in nature, you feel botulinum toxin injections are the most appropriate choice of therapy and Jeremy agrees to this intervention. You are aware that evidence shows that these injections work best as an augmentative

measure to other therapies. You show him some stretching and strengthening exercises, while also encouraging him to work with a physiotherapist. A treatment of injected Botulinum toxin to his hip adductors is trialed with good effect, though by 3 months, the effects begin to diminish and Jeremy has to come back for repeat treatment.

Conclusion:

This brings us to the end of this PedsCases podcast on the assessment and management of spasticity. Before we leave, let's review some take-home points:

1. Spasticty is a velocity-dependent increase in muscle tone and a component of the upper motor neuron syndrome.
2. The Modified Ashworth Scale can be used to assess and monitor progression of spasticity.
3. There are many causes for worsening spasticity, so these should be investigated and treated first.
4. Treatment of spasticity involves non-pharmacologic and pharmacologic methods, ultimately aimed at improving functional outcomes and preventing complications of chronic spasticity.

Thank you for listening!

References:

Randall Braddom. (2010). Physical Medicine and Rehabilitation 4th Edition. Philadelphia, PA. Saunders Publishing.

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