An Interdisciplinary Program for the Management of Spasticity

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Objectives

• Review of Spasticity
  – Impairments resulting from spasticity
• Medical Management of Spasticity
• Non-Invasive Management
• Surgical Management
What is Spasticity?

• A muscle control disorder that is characterized by tight or stiff muscles and an inability to control those muscles

• Caused by an imbalance of signals from the central nervous system (brain and spinal cord) to the muscles

• It is common in individuals with cerebral palsy, traumatic brain injury, stroke, multiple sclerosis and spinal cord injury
What are the symptoms of spasticity?

- Increased muscle tone
- Overactive reflexes
- Involuntary movements, which may include spasms and clonus
- Decreased functional abilities and delayed motor development
- Difficulty with care and hygiene
- Abnormal Posture
- Contractures
- Bone and joint Deformities
- Pain
Spasticity Facts and Statistics

• 75% of patients with physical disability following severe traumatic brain injury will develop spasticity requiring specific treatment.

• It is not always harmful.

• Patients with a combination of weakness and spasticity may rely on the increased tone to maintain their posture and aid standing or walking.

• Not all individuals with spasticity will require treatment however spasticity requires assessment over a lifetime as it can change and progress.
Interventions for Managing and Treating Skeletal Muscle Spasticity

• Medical Management Techniques
  – Baclofen, Clonidine, Dantrolene sodium, Tinazidine, Botulinum Toxin A, Phenol Injections, Surgical Tendon Release

• Non-Invasive Management
  – Casting, Splinting, Stretching, Strengthening, Transcutaneous Electric Nerve Stimulation, Bobath treatment, Weight Bearing Gait Training, Seating
Fig 2 Management strategy for adults with spasticity. Note: It is not uncommon to have a mixed pattern of spasticity and interventions are almost always combined, eg physical management programs and systemic medication.
Medical Management Techniques

• Medical Management techniques are considered any techniques which either involve pharmaceutical management or an invasive procedure.

• These techniques are administered and controlled by a medical physician.
Oral Medications

- **Baclofen** (GABA b receptor): Most studied in SCI and MS.
  - GABA b receptor is what produces baclofen’s range of therapeutic properties
  - Drug is absorbed after oral administration and widely distributed throughout the body.
  - Half life of Baclofen is 2-4 hours and therefore is administered frequently throughout the day
  - Strong side effect profile: sedation, dizziness, weakness
Oral Medications

- **Tizanidine** (Zanaflex) alpha 2 adrenergic agonist, preventing release of excitatory neurotransmitters

  - Side effects: drowsiness, dry mouth, weakness, hypotension, elevated LFT’s (5%), psychosis

- **Clonidine** (transdermal patch) alpha 2 adrenergic agonist, preventing release of excitatory neurotransmitters

  - Side effects: drowsiness, nausea, weakness, paresthesia, hepatotoxicity (1-2%)

- **Dantrolene** (blocks release of Ca+ from the sarcoplasmic reticulum, decreasing ms contraction) peripherally acting

  - Side effects: drowsiness, nausea, weakness, paresthesia, hepatotoxicity (1-2%)
Oral Medications

• Benzodiazepines
  – Diazepam acts by facilitating the postsynaptic action of ammabutyric acid
    • Side effects include sedation, ataxia, and fatigue
  – Clonazepam
    • Side effects are weakness, hypertension, ataxia, dyscoordination, sedation, depression and memory impairment
Motor Point Blocks

• Motor Point

  Where the motor nerve enters the muscle

• Motor Point Block

  Interruption of neural impulses by anesthesia or destruction of the nerve at the motor point
Botulinim Toxin (Botox)

- Derived from Clostridium Botulinim. Seven types (A-G)
  - Botulinim toxin A: Botox, Dysport
    - Cost of Botox: $541. per 100u

- Inhibits release of acetylcholine into the neuromuscular junction (NMJ), decreasing muscle contraction

- Generally lasts 3-4 months

- Benefit over oral medications: can be used focally to reduce spasticity, not causing the systemic side effects that oral medications do. WAY MORE EFFECTIVE

- Administered using EMG-guidance in order to better locate the NMJ and for needle location. Another method is ultrasound guided.
Phenol Nerve Blocks

• In high concentrations, phenol works to denature proteins, resulting in neurolysis

• Benefit over Botulinum toxin is that it lasts much longer, and it’s far cheaper

• Reinervation does occur, but it is incomplete

• Side effects: post-injection dysethesia, and if injected into vessels, CNS depression, tremors, convulsions
Phenol Nerve Blocks

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Duration of effect</td>
<td>Dysaesthesia- sensory nerve</td>
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<tr>
<td>Can be more effective</td>
<td>Technically demanding</td>
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<tr>
<td>Single injection site</td>
<td>Less titratable- all or none</td>
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<tr>
<td>Inexpensive</td>
<td>Infrequently indicated during motor recovery</td>
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<tr>
<td>Immediate onset (seconds)</td>
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<td></td>
<td><strong>Bupivicaine</strong></td>
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<tr>
<td>Lasts</td>
<td>Lasts 1-3 hours</td>
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<tr>
<td>Onset</td>
<td>Onset 1-15 minutes</td>
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<tr>
<td>Do not cast within</td>
<td>Avoid aggressive stretching for 24 hours</td>
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<tr>
<td>24 hours</td>
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<tr>
<td>Temporary</td>
<td>Causes nerve lysis</td>
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<td>used as assessment</td>
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<tr>
<td>tool</td>
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<td></td>
<td>MD must be very accurate because it is so caustic</td>
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Baclofen Pump

- This piece of equipment is a programmable pump which holds and stores a set amount of baclofen. The baclofen is released via a flexible silicone catheter. The whole device is programmable for rate and dosage.
How does it work?

• GABA b Agonist (inhibitory neurotransmitter)

• Most likely inhibits release of Ca+ into the presynaptic terminal, impeding release of excitatory neurotransmitters

• With lumbar tip concentration, there is a 4:1 lower extremity: upper extremity effect

• Therapeutic dose is 1/100 of oral baclofen
Benefits and Risks of Baclofen Pumps

• Benefits
  – Delivered directly to the site thereby requiring a lower dosage
  – Decreased systemic effects including sedation and drowsiness

• Risks
  – Infection (5% of people)
  – Equipment Failure
  – Rare cases: rhabdomyolysis, multiple organ-system failure and death
Surgical Tendon Release

• Muscles can be de-innervated, and tendons and muscles can be released, lengthened or transferred

• Surgical releases can be performed at the shoulder, elbow, forearm, hands and legs

• Types of surgery available
  – Tendon transfers
  – Contracture release
  – Split tendons with osteotomy and arthrodesis
Illustration of Split Anterior Tibialis Tendon Transfer
Non-Invasive Management

• Physical and Occupational Therapy
  – Serial Casting
  – Splinting
  – Range of Motion
  – Other Modalities
    • Electric Stimulation
    • Vibration
    • Hot/cold
Goals of Non Invasive Management

- Preventing deformities and the breakdown of skin
- Inhibiting tone
- Maintaining the length of muscle fibers
- Elongating shortened tissues, thereby prolonging proper positioning
- Optimizing position
- Increasing or maintaining range of motion
- Decreasing pain
Physical and Occupational Therapy

• Breaking compensation habits
• Uncover motor control
• Utilize new function
• Establish sensory level
• Establish visual deficits
• Find motivating tasks
Before you cast or splint

- Establish if there is a baseline contracture
- Establish if there is a flexible end feel
- Confirm patient, staff and family compliance
- Establish other spasticity treatments if needed
Casting

• Serial casting is a technique where the limb is gradually stretched in order to provide relaxation to the muscle.

• This is thought to increase the range of motion and prevent or improve a developing contracture.
Splinting

• This intervention provides a prolonged stretch to a muscle and aims to improve muscle length, correct and prevent contractures in order to maximize function.

• Dynamic vs. Static splints
Range of Motion

• Principal Goals of Range of Motion and Stretching
  – Maintain muscle and soft tissue length across joints
  – Facilitate care giving involvement
  – Facilitate active control of any residual movements to allow for active participation in tasks
Other Modalities

• Electrical Stimulation
• Ultrasound
• Vibration
• Hot/cold
Questions
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