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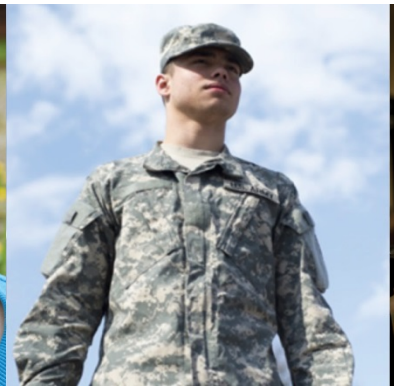


Spasticity
Evaluation & Management

Kenneth Ngo, MD
Medical Director, NeuroRestorative Florida

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NeuroRestorative's COVID-19 Response

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We are committed to protecting the health and safety of the individuals we serve, our staff, and the community. Our services are considered essential, and we are taking precautions to minimize disruption to services and keep those in our care and our team members safe. In some programs, that has meant innovating our service delivery model through Interactive Telehealth Services. We provide Interactive Telehealth Services throughout the country as an alternative to in-person services. Through Interactive Telehealth Services, we deliver the same high-quality supports as we would in-person, but in an interactive, virtual format that is HIPAA compliant and recognized by most healthcare plans and carriers.

You can learn more about our COVID-19 prevention and response plan at our Update Center by visiting **neurorestorative.com**.

Objectives

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- Define spasticity and recognize the importance of spasticity
- Familiarize with the different modalities used to treat spasticity
- Familiarize with the spectrum of treatment options for managing spasticity

Define Spasticity

- Velocity-dependent resistance to movement/stretching of a muscle group across a joint
  - Hyperexcitability of the stretch reflex
  - Component of upper motor neuron syndrome

Pathophysiology of Spasticity

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- Spasticity develops when an imbalance occurs in the excitatory and inhibitory inputs to the alpha motor neurons.
- Upper motor neuron syndrome
- Present in various degrees in patients with: stroke, brain injury, multiple sclerosis, spinal cord injury, cerebral palsy

May Coexist with the Following Conditions

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- **Rigidity** - Involuntary, bidirectional, non-velocity-dependent resistance to movement
- **Clonus** - Self-sustaining, oscillating movements secondary to hypertonicity
- **Dystonia** - Involuntary, sustained contractions resulting in twisting, abnormal postures
- **Athetoid movement** - Involuntary, irregular, confluent writhing movements
- **Chorea** - Involuntary, abrupt, rapid, irregular and unsustained movements
- **Ballisms** - Involuntary flinging movements of the limbs or body
- **Tremor** - Involuntary, rhythmic, repetitive oscillations that are not self-sustaining

Common Methods to Quantify Spasticity

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- Ashworth/modified Ashworth Scale
- Tardieu Scale
- Penn Spasm Frequency Score
- Others:
  - Visual Analog Scale
  - Pendulum Test
  - H-Reflex & F-wave measurements
  - Dynamic multichannel EMG

Ashworth Scale/Modified

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0 No increase in tone

1 Slight increase in tone giving a catch and release or minimal resistance at end range

1+ Slight increase in tone with a catch followed by resistance through remainder (less than half)

2 More marked increase in tone through most of ROM, but easily moved

3 Considerable increase in tone – passive movement difficult

4 Limb rigid in flexion or extension

Complications of Spasticity

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- Limit Recovery
- Interference with activities of daily living
- Painful spasms/acquired peripheral neuropathy
- Interfere with hygiene
- Disfigurement
- Impede ambulation
- Lead to contractures, joint subluxations/dislocations, fractures/malunion may occur
- Increased risk of heterotopic ossification
- Skin breakdown
- Impair respiratory function
- Sleep disturbance

Benefits of Spasticity

- Assist with standing, transfers (stand-pivot), and ambulation
- Carry or hold objects
- Maintain muscle tone
- Support circulatory function
- Minimize deep venous thrombosis
- Decrease risk of osteoporosis
- Diagnostic – sign of noxious stimuli

Recap So Far

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- Define spasticity
- Other conditions co-exist with spasticity
- How to assess spasticity
- Complications & benefits of spasticity
- Do we really need to treat spasticity?
- What are patient's & family's goals of treatment?

Spasticity Treatment

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- Do we need to treat?
- If so, identify factors that may induce spasticity:
  - Infections: UTI, pneumonia, cellulitis
  - Bowel impaction
  - Bladder distension
  - Kidney stone
  - Deep venous thrombosis
  - Ingrown toenails
  - Changes in temperature
  - Psychological factors
  - Diet, medications
  - Disease progression

Therapeutic Interventions & Physical Modalities

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- Sustained stretching
- Massage
- Vibration
- Heat modalities
- Cryotherapy
- Functional electrical stimulation/biofeedback
- Strengthening of antagonistic muscle groups
- Hippotherapy
- Hydrotherapy

Orthotics/Positioning

- Serial or inhibitive casting of the elbows, wrists, fingers, knees, ankles
- Splinting/orthotics
  - Upper and lower extremities, soft or hard, custom or prefabricated
  - An orthosis may help to hold a limb in a functional position, reduce pain, and prevent deformity
- Positioning to reduce synergy patterns
  - For example: wheelchair seating and bed positioning

Pharmacologic/Surgical Treatment

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- GABA system:
  - Baclofen, benzodiazepines
- Monoamines:
  - Tizanidine, clonidine
- Ion Flux:
  - dantrolene, gabapentin
- Others:
  - Cannabinoids

- Injectables
  - Botulinum toxins
  - Phenol, alcohol
  - Lidocaine
- Surgery
  - tenotomy, tendon transfer, osteotomy
  - Selective dorsal rhizotomy
  - Myelotomy, cordectomy

Common Pharmacologic Treatment

- Baclofen
  - Very effective
  - Sedation limitation
- Tizanidine
  - Effective
  - Hypotension, sedation
- Dantrolene
  - 3rd line agent
  - Weakness, dizziness, drowsiness
  - Hepatotoxicity
- Lidocaine/bupivicaine block
  - Differentiate spasticity vs. contracture
  - Followed by serial casting
- Phenol/alcohol neurolysis
  - Effects last for >6 months
  - No graded effects (profound weakness)

Botulinum Toxins

- Botox, Xeomin, Myobloc, Dysport
- Weakens a muscle (normal or spastic muscle)
- Efficacy depends on:
  - Clinician experience
  - Dosage, volume, dilution
  - Injection technique
  - Injection sites
  - Timing of injection
  - Muscle size
  - Severity of spasticity
  - Presence of contracture

- Adverse Effects
  - Excessive weakness
  - Dysphagia
  - Dry mouth
  - Antibody-mediated resistance
  - Not recommended in patients who are pregnant, lactating, or have neuromuscular junction disorders

Intrathecal Baclofen Pump

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- Key is patient selection, reliable support/follow-up, mutual specific goals
- Implantable pump placed under the skin, in the abdomen, outside abdominal cavity
- A catheter is attached to the pump, then tunneled into the intrathecal space
- Test dose prior to ITB pump implantation
- Pump reservoir is refilled every 1-6 months via injection into a refill port; an office procedure
- Batteries need replacement approximately every 7 years
- Patients as small as 25 lb (11.5 kg) have successfully undergone implantation
- Procedure is reversible

Intrathecal Baclofen Pump

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- Clinical efficacy seen at the level of the tip of the catheter placed and below (usually at thoracic level)
  - Generally work best for lower extremities
- Minimize cognitive side effects as compared to oral baclofen
- Various programmable modes of medication delivery
  - Continuous mode, flexible dosing, bolus
- MRI compatible (up to 3T MRI)
- Low maintenance (taking meds on time, frequent dosing of meds)
- Common side effects
  - Nausea/vomiting, sedation, dizziness
- Potential complication
  - Procedural errors, pump/catheter complications
  - Abrupt baclofen withdrawal is a medical emergency!

Summary

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- Define spasticity & associated conditions
- Benefits & potential complications of spasticity
- Therapeutic interventions & physical modalities
- Pharmacologic treatments of spasticity
  - Oral medications, injectable, implantable
- Botulinum toxins
- Intrathecal baclofen therapy