

Objectives

- Discuss etiology, presentation, and consequences of undertreated spasticity.
- Explain the role of therapy in the examination and treatment of spasticity.
- Improve understanding of multidisciplinary nature of spasticity management including preferred treatment combinations for mild, moderate, and severe spasticity as well as focal versus generalized spasticity.
- Discuss current evidence related to contemporary spasticity management strategies.

Spasticity

- Spasticity is defined as “a velocity-dependent response of muscle to passive stretching”
- Modified Ashworth Scale and Modified Tardieu Scale are most frequently used in clinical practice and research, and although their inter-rater and intra-rater reliability have been questioned, research showed higher reliability in certain muscles tested and improved reliability with tester training
- UMN lesion disturbs the balance of supraspinal inhibitory and excitatory input causing hyperexcitable stretch reflexes

Upper motor neuron syndrome

Positive signs

- Spasticity
- Clonus
- Increased deep tendon reflexes

Negative signs

- Loss of selective motor control
- Weakness/decreased motor control
- Loss of dexterity
- Modified Ashworth Scale (MAS)

Modified Ashworth Score

- 0-4 range
- Reliability depends on training
- Used extensively in literature
- Tests passively- no patient effort needed
- Tests passively- limited understanding of how movement will impact spasticity
- Can be used on any muscle group- can track improvement or worsening of spasticity

Tardieu Scale

- Limbs moved at 3 different velocities and joint angles measured at each
- R1= angle of muscle reaction
- R2= angle of full PROM
- R2-R1= dynamic tone
- 0= no resistance through passive movement
- 1=slight resistance throughout passive movement
- 2=clear catch at a precise angle, followed by release
- 3=fatigable clonus at a precise angle, followed by release
- 4=unfatigable clonus (>10 sec) with no release
- 5=joint is immovable

Spasticity Characteristics

- Focal vs. Multifocal/Regional vs. Generalized
- Mild/Moderate/Severe
- Clinical conundrum: We examine spasticity passively but we also see its effects when individuals try to move and function

Spasticity, it's complicated

- Increased resistance to passive stretch can be:
- Neural
- Non-neural- contractile tissue changes seen in longer term cases (and don't forget about H.O.)
- Influenced by patient position, activity level, medical issues, cognition, many factors
- Who is affected?

TBI

- Stroke
- Cerebral Palsy
- Multiple Sclerosis- Just 5 years after diagnosis, spasticity was a problem in 75% of patients with MS and after 10 years over 80% of patients reported spasticity. Of those patients, 50% rated the problem as **moderate to severe** (Kister et al 2013, n>25,000 patients)
- Prevalence of spasticity in MS has been estimated in the literature at 41-69% but ranging as high as 81%

Stroke- most likely to exhibit problematic spasticity include:

- Moderate to severe paresis
- Hemorrhagic stroke
- Sensory deficits
- Low Barthel Index score
- Lesion location and size may play a role- thalamus, basal ganglia, MCA territory

How does spasticity affect the person- using the ICF model for clinical decision making

Un/Undertreated spasticity: consequences

- Loss of PROM
- Loss of active muscle action via reciprocal inhibition
- Pain
- Poor positioning in bed, chair and standing/amb
- Skin breakdown
- Increased caregiver burden

PT and OT Spasticity Management starts with a detailed examination of:

- Muscle tone
- Range of motion- active and passive
- Strength/motor control
- Postural stability
- Positioning
- Activities of daily living
- Functional mobility
- Participation
- Patient and/or caregiver perception and goals

Standardized Tests and Measures

ANPT Core Outcome Measure

- Berg Balance Scale
- Functional Gait Assessment
- Activities-Specific Balance Confidence Scale
- 10 Meter Walk Test
- 6 Minute Walk Test
- 5 Times Sit to Stand Test
- Limitations of these measures and some alternative suggestions

Functional Mobility and Balance

Impact of Spasticity on Positioning and Recovery

Assessment= Critical Thinking

- How does the patient's spasticity fit into their overall impairment profile? For example is the spasticity leading to a loss of P/AROM?
- Are there any red or yellow flags to consider?
- How does spasticity impact their function?
- How does spasticity impact their participation?
- What contributions do personal and environmental factors make to the overall patient presentation?

Spasticity Management: Assessment

- Understanding of how spasticity affects the patients mobility, gait, positioning, sleep, ADLs, pain levels and quality of life
- Timeline of when spasticity began or started to worsen to rule out other factors (ie. infection, fracture, drug noncompliance)
- Determine what is amenable to treatment and when referrals are needed
- What has been tried so far? Successful or not? Was the patient ready for that intervention (ie. casting)?
- Medical stability, cognition, and patient/family must always be considered

Spasticity Management

- Focal Spasticity- can PT and OT alone be effective if only one muscle group is involved?
- Cochrane Review (2010) Robust evidence that stretching alone does not prevent or reverse contractures
- Generalized Spasticity- don't be a hero
- Make a plan as a team- but be ready to change it

Principles of therapy management

- Guide to Physical Therapist Practice 3.0
- Procedural Interventions
- Communication/Collaboration/Documentation
- Patient/Client/Caregiver Education
- This needs to be 24/7/365 (no evidence to support)

Therapy Based Treatment Options

- Alignment
- Stretching- short duration
- Stretching- long duration such as standing frame
- Splinting/casting- long duration stretch
- Modalities- NMES, diathermy, etc
- Strengthen the agonist
- Early AFOS
- Positioning- bed and w/c
- Task specific training
- Long term clinic follow up- marathon not a sprint

When to throw the flag.....

- Losing or not increasing PROM
- Unable to tolerate splints, casts or bracing
- Increased pain
- Unable to participate in active treatment
- Positioning and basic nursing care is impacted

Medical Management: Oral Medications

- Oral medications- baclofen, diazepam, dantrolene and tinzandine
- THC:CBD spray- appears to decrease spasticity as an add-on in MS with good tolerance (Markova et al., 2019)
- Despite widespread use, the effectiveness of oral anti-spasticity agents such is not supported by strong evidence in some populations
- Medications have numerous side effects including fatigue, dizziness, weakness

Medical Management: Phenol Blocks

- Diluted alcohol used to denervate the muscle leading to a decrease in spasticity via weakening
- Cheaper but harder to do
- Effect is seen immediately and lasts 6-9 months
- Can lead to pain syndromes if injected too close to sensory branch of the nerve
- Some risk of compartment syndrome
- May lose effectiveness if scarring develops
- Can be very effective in large ms groups ie. hip adductor spasticity

Medical Management: Botox injections

- Toxin inhibits the release of acetylcholine at the neuromuscular junction
- Works by weakening
- Easier to do but expensive
- Better effect seen in smaller muscles
- Takes effect in 3-5 days and lasts 3-4 months
- No permanent effect on muscle or nerve, but can develop antibodies to the drug
- Carries a black box warning in CP

Botox evidence to consider

- Improvement in MAS, AROM and PROM as well as improved brace tolerance in people with TBI (Pierson et al., 1996)
- Early study in LE spasticity RCT Botox A vs placebo in 120 people with stroke showed significant improvement in MAS, but non significant improvement in gait speed and gait pattern (Kaji et al., 2010)
- Several studies have shown no significant improvement in gait kinematics and deviations when spasticity has been reduced

Medical Management: ITB

Intrathecal Baclofen Pump (ITB)

- Intrathecal dose is 1/100th of the oral dose due to site of action therefore causes less side effects
- Refills done every 2-3 months depending on dose and dose adjusted via external telemetry
- Major risks: infection, meningitis, pump malfunction leading to baclofen withdrawal which can be life-threatening
- Numerous studies have proven that ITB decreases spasticity- better studies on function and QOL are needed.
- ITB is reversible

Medical Management: Surgery

Neurosurgery

- Selective Dorsal Rhizotomy- studies show long term improvements in tone, mobility and ADLs in children with CP- especially those with GMFCS I and II.
- No large data sets in adults.
- Neurectomy- successful in CP, stroke, TBI

Orthopedic surgery- ms or tendon lengthening/transfer/release

- Most common equinovarus foot deformity
- Pros and cons and interdisciplinary approach
- Effect on gait

Real life-What do patients care about?

Upper Limb International Spasticity (ULIS-III) study (Turner-Stokes et al., 2021) N=1004 from 14 countries, diagnosis- stroke

Goal attainment scale priorities for patients were:

- Pain
- Reducing unwanted movements
- Improving passive function (range of motion)
- Improving active function
- Only a few chose improving mobility

Spasticity reduction ≠ Function

- Reducing spasticity has many fine objectives but does not always lead to functional gains
- Use of Botox early in stroke recovery yielded improvement in PROM of the upper limb, less reliance on splinting but no significant difference in performance on Action Research Arm Test in acute stroke survivors in RCT (Lindsay et al., 2020)
- Why is there not a linear relationship?

The Power of Collaboration- A Way to Approach This

- IF treating the spasticity alone does not always lead to functional improvement

AND

- IF working on functional mobility is difficult due to the presence of problematic spasticity

THEN

- We address both in an interdisciplinary manner
- We work together and reassess together
- We know when to refer and when to treat alone

Decision Making

- What is function? How is it measured?
- Outcomes
- Reexamination is Critical
- What impairments have changed or not changed?
- Has the patient improved functionally or not? Why?
- Have “non-functional” areas improved?
- What is the patient and/or caregiver’s perception of the success of the treatment?
- Do changes in status necessitate changes to: positioning, w/c set up, assistive devices, exercise programs, etc.