The Basics of Spasticity Assessment and Management

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Spasticity

- Diagnosis
- Pathophysiology
- Assessment and evaluation
- Management (Pharmacological)

Diagnosis

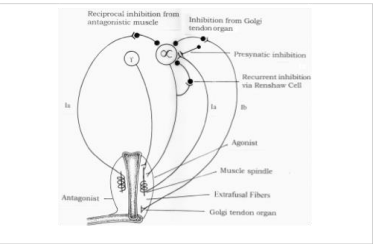
Definition

- Motor disorder characterised by a velocity dependent increase in the tonic stretch reflexes (muscle tone) with exaggerated tendon jerks, resulting from hyperexcitability of stretch reflexes as one component of the upper motor neuron syndrome *(Lance 1980)*

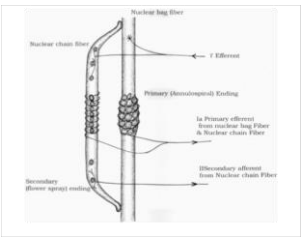
Physiology of Motor Unit

- Motor control system uses a feedback loop
- Coordination of agonist and antagonist muscles
- Integrates information on muscle length, velocity, muscle tension and joint position
- Combination of monosynaptic reflexes and polysynaptic reflexes (spinal and supraspinal)

Physiology of Motor Unit



Muscle spindle



Pathophysiology

Pathophysiology

- Spinal mechanisms - Changes in the functioning of spinal neurons and motor subsystems
- Supraspinal and suprasegmental mechanisms

Upper Motor Neuron Syndrome Etiology

- Spinal reflexes (stretch, nociceptive, cutaneous)
1. Stretch reflexes
2. Clonus
3. Flexor reflex afferent
4. Babinski
- Efferent drives – Not dependent on afferent feedback
1. Spastic dystonia
2. Associated reaction
- Disorders of voluntary movement
1. Co-contraction

Upper Motor Neuron Syndrome

Positive signs
- Phasic and tonic stretch reflexes
- Co-contraction
- Spastic dystonia
- Associated reactions
- Released flexor reflexes
- Increased muscle stiffness (rheologic changes)

Negative signs
- Weakness
- Impaired dexterity
- Impaired coordination
- Fatiguability
- Slowed movements

Associated Reactions

Common neurological conditions

- Stroke
- Traumatic brain injury
- Spinal cord injury
- Multiple sclerosis
- Neurodegenerative diseases
- Cerebral palsy

Epidemiology

- Post stroke : 17 – 46 % at 1 year post stroke *(Lundstrom et al 2008, Watkins et al 2002)*
- Post spinal cord injury : 53 - 78% *(Walter et al 2002, Maynard et al 1990)*
- Multiple sclerosis : 85% *(Rizzo et al 2004)*
- Traumatic brain injury : 25 – 34% *(Wedekind et al 2005)*
- Cerebral palsy : 85% *(Yeargin-Allsop et 2008)*

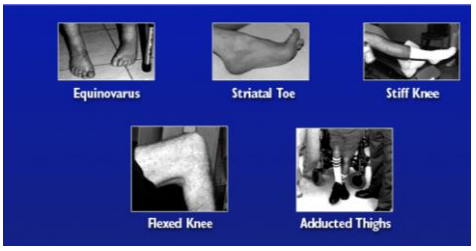
Assessment & Evaluation

Assessment & Evaluation

- Assess the amount of spasticity
- Determine the functional limitation it creates
- Develop a management plan for the individual patient

Presentation

- Focal
- Multifocal (Several joints affected in the same limb)
- Regional (Spastic diplegia)
- Generalised (Diffuse muscle overactivity)



Outcome Measures

- **Modified Ashworth Scale**
- Spasm frequency
- Hygiene scale
- Pain
- Functional mobility (eg. Gait speed , endurance)
- **Barthel Index**
- **Goal assessment scale**

Modified Ashworth Scale

- Ease and speed of use
- Measures resistance to passive movement
- Does not distinguish neural from non-neural components of increased tone

Score	Ashworth (Ashworth 1964)	Modified Ashworth (Bohannon and Smith 1987)
0	No increase in tone	No increase in tone
1	Slight increase in tone giving a catch when the limb is moved in flexion/ extension	Slight increase in tone giving a catch, release and minimal resistance at the end of range of motion (ROM) when the limb is moved in flexion/extension
1+		Slight increase in tone giving a catch, release and minimal resistance throughout the remainder (less than half) of ROM
2	More marked increase in tone, but the limb is easily moved through its full ROM	More marked increased in tone through most of the ROM, but limb is easily moved
3	Considerable increase in tone – passive movement difficult and ROM decreased	Considerable increase in tone – passive movement difficult
4	Limb rigid in flexion and extension	Limb rigid in flexion and extension

Outcome Measures

- Spasms – Spasm frequency scale
- Perineal hygiene
- Pain – Visual Analogue Scale / Numerical Rating Scale

Barthel Index

- **FEEDING**

0 = unable
5 = needs help cutting, spreading butter, etc., or requires modified diet
10 = independent

- **BATHING**

0 = dependent
5 = independent (or in shower)

- **GROOMING**

0 = needs to help with personal care
5 = independent face/hair/teeth/shaving (implements provided)

- **DRESSING**

0 = dependent
5 = needs help but can do about half unaided
10 = independent (including buttons, zips, laces, etc.)

- **BOWELS**

0 = incontinent (or needs to be given enemas) 5 = occasional accident
10 = continent

- **BLADDER**

0 = incontinent, or catheterized and unable to manage alone
5 = occasional accident
10 = continent

- **TOILET USE**

0 = dependent
5 = needs some help, but can do something alone 10 = independent (on and off, dressing, wiping)

- **TRANSFERS (BED TO CHAIR AND BACK)**

0 = unable, no sitting balance
5 = major help (one or two people, physical), can sit
10 = minor help (verbal or physical)
15 = independent

- **MOBILITY (ON LEVEL SURFACES)**

0 = immobile or < 50 yards
5 = wheelchair independent, including corners, > 50 yards
10 = walks with help of one person (verbal or physical) > 50 yards
15 = independent (but may use any aid; for example, stick) > 50 yards

- **STAIRS**

0 = unable
5 = needs help (verbal, physical, carrying aid) 10 = independent

- **TOTAL SCORE =** _____

Goal Attainment Scale

- Patients set their own goals in spasticity treatment together with healthcare team
- 0 : Outcome as expected
- + 1 to + 2 : Outcome better than expected
- - 1 to – 2 : Outcome worse than expected
- It is criterion referenced
- Makes it responsive to minimally clinically significant changes

Functional mobility

- 6 minute walk test – Measures endurance
- 10 m walk test – Gait speed
- Berg Balance

Management

Synergistic Model of Management

- Removal of noxious stimuli
- Physical measures
- Oral medications
- Neurolytic blockade
- Intrathecal baclofen
- Surgery

Management

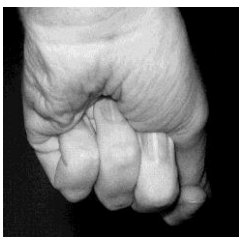
- The first step in the management of spasticity is to identify the key aims and realistic goals of therapy.
- Understanding the underlying pathology and possible prognosis is helpful in planning these goals .
- Identification and management of any trigger or aggravating factors
- Initial assessment should exclude any co -morbidity that may worsen spasticity such as pressure sores, chronic pain, infection (commonly urinary tract infection), constipation etc.
- Instigation of an effective and realistic physical therapy programme including attention to posture and positioning should also be noted.

Management

- It is also important to remember that not every "tight" muscle is spastic. The clinically detectable increase in muscle tone may be due to spasticity, rigidity or a fixed muscle contracture.
- The key to successful spasticity management is education of the patient and carers with both verbal and written information.
- This allows them to understand, appreciate and be fully involved in the management plan.
- All patients with spasticity should be followed up by a coordinated multidisciplinary team, which allows more timely intervention and close monitor of the progress.
- This helps to deliver a more consistent approach to the individual over time.

Indications for treatment

- Pain
- Skin breakdown
- Impairment of function – balance , gait speed, transfers, fine motor control and dexterity, sleep , perineal hygiene, sexual function
- Reduce caregiver burden eg. For dressing, hygiene, positioning
- Poor posture while lying in bed / sitting in wheelchair
- Risk of contractures



Treating noxious stimuli

- Skin breakdown, pressure sores, ingrown toenail
- Urinary tract infection, urine retention, detrusor overactivity
- Constipation
- Fracture
- DVT
- Adhesive capsulitis, contractures
- Tight fitting clothes
- Therapy interventions, uncomfortable orthotics

Pharmacological Options

- GABA A agonists – Diazepam, Clonazepam
- GABA B agonists - Baclofen
- Alpha receptor agonists – Tizanidine
- Dantrolene
- Gabapentin

Diazepam

- Acts on spinal cord and brainstem
- Suppresses afferent sensory impulses from muscle and skin receptors
- Facilitates post synaptic effects of $GABA_A$
- Inhibits excitatory influences of descending post synaptic reflexes
- Dose : 5- 20 mg tds
- Side effects : Sedation, amnesia , mental confusion, ataxia, hypotension, risk of addiction

Clonazepam

- Stimulation of $GABA_A$ receptors
- Useful for nocturnal spasms
- Avoid abrupt withdrawal
- Start off with 0.25 – 0.5 mg on (Can go up to 2 gm on)
- Side effects : Drowsiness, reduced attention

Baclofen

- Preferentially binds to $GABA_B$ receptors in spinal cord
- Presynaptic inhibition of $GABA_B$ receptors
- Also has analgesic effect
- Start at 5 mg tds and gradually titrate up over 2-3 weeks
- Dose about 5 - 20 mg tds - qds

Baclofen – Side Effects

- Fatigue
- Dizziness
- Constipation
- Mental confusion / drowsiness
- Respiratory depression
- Hypotension
- Serious – Baclofen withdrawal syndrome (eg. Seizures, hallucinations, high fever, rebound muscle spasticity, rhabdomyolysis)

Tizanidine

- Central alpha 2 adrenoceptor agonist
- Suppresses release of excitatory aminoacids in spinal cord
- Also central action – modulates facilitatory function of descending ceruleospinal pathways
- Useful when muscle pain in predominant feature
- Start with 2 mg OD and gradually increase every 3 days
- Dose of 4 -36 mg /day
- Side effects : Sedation, mild hypotension, weak hepatotoxicity

Dantrolene

- Acts directly on muscle contractile unit
- Inhibits release of calcium from sarcoplasmic reticulum
- Affects fast twitch fibres more than slow twitch (postural muscles)
- May be useful for spasms
- Can start at 25 mg bd and increase gradually to qds
- Dose of 25 - 100 mg qds (max 400 mg /day)
- Side effects : Hepatotoxicity (transaminitis, hepatitis), mild sedation, nausea, vomiting

Gabapentin

- Structurally similar to GABA
- Increases CNS levels of GABA
- Appears to act on the high affinity binding site in brain membrane (subunits of voltage sensitive calcium channels)
- Useful for spasms or when pain present
- Dose : 2400 – 3600 mg /day
- Side effects : Giddiness, ataxia, somnolence, tremor

Oral medications

- Large doses produce non selective systemic effect
- Generalised decrease in muscle tone may increase functional disability
- Value of oral medications diminishes with prolonged use
- Tolerance can develop after a few months and incremental doses needed to maintain clinical response
- Dose dependent adverse affects

Thank You

Any questions ?