



# Spasticity Management in Adults With Cerebral Palsy

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No disclosures

# Definition

Cerebral Palsy- a group of permanent disorders of the development of movement and posture, causing activity limitations that are attributable to disturbances that occurred in the developing fetal or infant brain.

# Introduction

- Most patients with Cerebral Palsy (CP) are living well into adulthood with lifespans approaching that of the general population.
- Aging can lead to multiple musculoskeletal and neurological problems that impair mobility and function despite CP being a static injury.



# Function

- Survey published in Developmental Medicine and Child Neurology
  - Questionnaire mailed to 363 adults with CP
  - 221 adults aged 20-58 completed
  - 77%- problems with spasticity
  - 84% lived in own homes with or without assistance
  - 24% worked full time
  - 18% full disability

# Function

- 27% never walked
- 64% walked with or without aids, 35% had decreased walking, and 9% had stopped walking
- 80% contractures
- 18% pain everyday
- 60% physically active
- 54% not limited in ability to move about the community



# Secondary Conditions

- Pain
- Fatigue
- Progressive orthopedic problems
- Decreased mobility
- Decreased independence
- Decreased fine motor control.

# Pain

- Multiple studies have shown pain in patients with CP as high as 67-82%
- Causes of pain
  - Contractures
  - Spasticity
  - Orthopedic deformities
  - Poor nutrition
  - Pressure from sitting on bony prominences
  - GI issues



# Functional Ability

- Most studies show a decrease in functional ability with aging.
  - Gait and ADLs
  - May start decline as young as age 25.
  - May stop ambulating due to pain in lower extremities which can be caused by foot deformities.

# Spasticity

- Affects up to 70% of patients with CP
- Major contributor to contractures and bony deformities.
  - Patella alta
  - Hip subluxation
    - 50% develop pain which contributes to decrease ambulation or positioning in wheel chair
  - Repetitive hyperextension can lead to spondylolysis- a stress fracture through the pars interarticularis.
  - Neuromuscular scoliosis
  - Pressure ulcers



# Goals

- Goals of treating spasticity vary
  - Pain control
  - Increased functional movement
  - Hygiene
  - Skin health
  - ADLs
- Goals should be identified before treatment begins.

# Evaluation

- Identify the clinical pattern of motor dysfunction
- Identify the patient's ability to control muscles involved in the clinical pattern
- Identify the role of muscle stiffness and contracture as it relates to functional problem.



# Spasticity

- An increase in excitability of muscle stretch reflexes, both phasic and tonic, that is present in most patients with UMN lesion.
- Excessive resistance of muscle to passive stretch- resistance increases with the velocity of stretch.

# Spastic Dystonia

- Tonic muscle activity that maintains the limb in a fixed posture in the absence of phasic stretch or voluntary effort.
- Abnormal supraspinal drive- characterized by an inability to inhibit muscle activity despite efforts to do so.
- May need EMG to determine.
- Limb also can be held in fixed position due to tissue stiffness, contracture, HO



# Muscle Stiffness and Contracture

- Physical shortening of muscle length and it is often accompanied by fixed shortening of other soft tissues such as fascia, nerves, blood vessels and skin.
- If all muscle contraction were blocked, physical shortening would still remain.

# Pharmacologic Treatment

## Dantrolene

- Effect is directly on the skeletal muscle fibers.
- Inhibits release of calcium from the sarcoplasmic reticulum
  - Calcium initiates cross-bridging of myofilaments and build up of contractile tension.
- Reduces the force of muscle contraction and can reduce tension in overactive muscles.
- Good for clonus or brief spasms.
- Can be sedating, but less so
- Hepatotoxicity- monitor liver functions

# Diazepam

- Centrally acting and highly sedating
- Increases the central inhibitory effects of GABA( gamma amino-butyric acid).
- Appears to bind to receptors located at GABA-ergic synapses and increases GABA inhibition at those sites.
- The helpful effect in muscle overactivity appears to arise from the inhibitory effect on the alpha motor neuron in the spinal cord.
- Helpful at night for spasms with tolerable sedation.



# Baclofen

- Derivative of GABA
- Appears to act as a GABA agonist inhibiting transmission at specific synapses within the spinal cord.
- Inhibitory effect on alpha motor neuron (lower motor neuron).
- Very good for SCI/MS- especially with spasms.
- Sedating side effects
- Not studied much in cerebral causes.

# Intrathecal Baclofen

- Used to treat spasticity and dystonia
- Becoming very common
- Fewer side effects like sedation, but are risks.
- Most of the studies are with children with CP, not many with adults.
- Muscle tone consistently reduced, but variable functional outcomes

# Intrathecal Baclofen

- Less sedating
- Much smaller doses are used and delivered directly into the subarachnoid space.
- Has to be adjusted and refilled frequently.
- Overdose or withdrawal can be life threatening.
- Technical problems
- Family must be compliant.



# Intrathecal Baclofen

- Overdose
  - Respiratory depression/coma
- Withdrawal
  - Increased spasticity, itching, hallucinations, seizures, death

# Intrathecal Baclofen

- Study from The University of Pittsburgh
  - Intrathecal pumps were placed in 40 patients with either spastic quadriplegia or diplegia
  - At the time of implantation orthopedic surgery was planned in 28 patients.
  - 18 of those patients did not need surgery after the pump was placed.
  - The authors concluded that IBI for treatment of spastic CP reduces the need for subsequent orthopedic surgery for the effects of lower-extremity spasticity. In patients with spastic CP and lower-extremity contractures, spasticity should be treated before orthopedic procedures are performed.

# Tizanidine

Acts at alpha 2 adrenergic receptor sites both spinally and supraspinally

Reduces muscle response to passive stretch in both the spinal and cerebral forms of muscle overactivity.

Side effects- hypotension, sedation, fatigue, dry mouth, hepatotoxicity

Good for co-contraction



# Botulinum Neurotoxin (BoNT)

- Focal action without significant side effects
- Injected directly into the affected muscle groups
- EMG guidance
- Causes reversible, dose dependent muscle relaxation by blocking acetylcholine at the neuromuscular junction.
- Can use BoNT A or B
- Benefits 3-7 days after injection
- Duration is about 3 months
- Adverse effects- excessive weakness, pain at injection site, headache, fatigue, flu-like symptoms

# Selective Dorsal Rhizotomy

- The dorsal spinal roots transmit sensation from the muscle to the spinal cord.
- Surgeon identifies the rootlets causing spasticity by EMG during surgery and selectively cuts them.
- This reduces messages from the muscle resulting in better balance of activities in nerve cells in the spinal cord, reducing spasticity.

# Selective Dorsal Rhizotomy

- Requirements
  - Adult with spastic diplegia who can ambulate independently without assistive device
  - Spasticity limits energy, walking speed, flexibility and balance
  - Not mixed with dystonia
  - Good strength in trunk, hips and legs
  - Motivation to attend PT and do home exercises
  - Healthy BMI
  - No significant medical problems



# Selective dorsal rhizotomy

- Study from the British Journal of Neurosurgery
- 30 teenagers and young adults underwent selective posterior lumbosacral rhizotomy
  - All had satisfactory long term tone reduction
  - 21 had improvements in sitting and 17 in standing
  - 25/26 with spastic diplegia had improvements with walking
  - 5 had dysaesthetic sensations in lower extremities
  - No patients had incontinence

# Surgery

- If deformity is severe, may warrant early surgery to prevent a fixed contracture
- Releasing a contracted limb may allow improved ADLs even if the limb itself does not improve.

# References

- 1. Aisen, M., et al. (2011) Cerebral palsy: clinical care and neurologic rehabilitation. *The Lancet Neurology*. Volume 10, Issue 9.
- 2. Albright, A. et al. (1995) Spastic Cerebral Palsy. *Practical Therapeutics*. Volume 4, Issue 1
- 3. Andersson, C. et al. (2001) A survey describing problems, needs and resources. *Developmental Medicine and Child Neurology*. Volume 43, Issue 2.
- 4. Gerszten, P. (1998) Intrathecal baclofen infusion and subsequent orthopedic surgery in patients with spastic cerebral palsy. *Journal of Neurosurgery*. Volume 88.
- 5. Krach, L. (2009) Intrathecal baclofen use in adults with cerebral palsy. *Developmental Medicine and Child Neurology*. Volume 4, Issue 1.
- 6. Noonan, K., et al. (2004) Hip function in Adults with severe cerebral palsy. *Journal of Bone and Joint Surgery*. December.
- 7. Peter, J., et al. (1994) Selective Posterior lumbosacral rhizotomy in teenagers and young adults with spastic cerebral palsy. *British Journal of Neurosurgery*. Volume 8, Issue 2.
- 8. Simpson, D. et al. (2008) Botulinum neurotoxins for the treatment of spasticity. *Neurology*. Volume 70.
- 9. Tosi, L. (2009) Adults with cerebral palsy: a workshop to define the challenges of treating and preventing secondary musculoskeletal and neuromuscular complications in this rapidly growing population. *Developmental Medicine and Child Neurology*. Volume 51. Supplement.