

## Medication Management of Spasticity in the Traumatic Brain Injured Patient

Chad Walters, D.O.  
Medical Director  
Radical Rehab Solutions

6<sup>th</sup> Annual Northern Kentucky TBI Conference  
March 23, 2012  
www.bridgenky.org

## Overview

- **Definition of Spasticity**
- **Oral Medications**
  - Central acting
  - Peripheral acting
    - Dosage, Mechanism of Action, Side effects
- **Local treatments**
  - Botulinum toxin
  - Phenol
    - Mechanism of Action, Side effects
- **Intrathecal Baclofen**
  - Mechanism of action, side effects

## Spasticity

- **Definition**
  - Velocity dependent resistant to stretch resulting in abnormally increased tone
- **Mechanism**
  - Uninhibited spinal reflex activity leading to increase in muscle tone and deep tendon reflexes
  - Gamma Amino Butyric Acid (GABA) is most abundant CNS inhibitory NT and controls the spinal reflex activity
    - Deficient in TBI patient

## Spasticity

- **Treatments**
  - Oral Medications
    - Central Acting
    - Peripheral Acting
  - Local Medications
    - Botulinum toxin
    - Phenol neurolysis
  - Intrathecal Baclofen

## Spasticity

- **Oral Medications**
  - Central acting agents
    - Baclofen
    - Tizandine (Zanaflex)
    - Diazepam (Valium)

## Oral Medications

- **Central acting agents**
  - **Baclofen** 20-80mg daily divided twice to three times daily
    - GABA agonist which inhibits spinal reflex activity leading to decreased muscle tone
    - Side effects: weakness, lethargy, somnolence, confusion, ataxia, hallucinations, lowers threshold for seizure activity, withdrawal syndrome

## Oral Medications

- **Central acting agents**
  - **Tizanidine** 6-36mg daily divided three times per day
    - Alpha adrenergic agonist which binds to spinal cord receptors inhibiting spinal cord reflexes
    - Side effects: weakness, sedation, dizziness, dry mouth, hypotension

## Oral Medications

- **Central acting agents**
  - **Benzodiazepines**
    - **Diazepam (Valium)** 2-10mg BID to TID
    - **Clonazepam** 0.5-2mg BID to TID
  - Enhances affinity for GABA in the CNS (brain > SC)
  - Enhances pre and post synaptic inhibition at the SC
  - **Side effects:** Sedation, fatigue, habituation, impairment of motor recovery
  - Should only be used in severe cases

## Oral Medications

- **Peripheral acting agents**
  - **Dantrolene** 50-300mg daily divided BID to QID
    - Inhibits Ca release from the sarcoplasmic reticulum which is required for muscle contraction
    - Side effects: weakness, dizziness, drowsiness, hepatotoxicity

## Local Treatments

- Botulinum toxin
  - Type A and B
- Phenol

## Local Treatments

- **Botulinum toxin**
  - Chemical neurotoxin produced by *Clostridium botulinum* bacterium
  - Type A (Botox) inhibits release of acetylcholine by binding to SNAP-25 receptor on presynaptic membrane
  - Type B (Myobloc) inhibits release of acetylcholine by binding to synaptobrevin receptor on presynaptic membrane

## Local Treatments

- **Botulinum toxin**
  - Onset within 12-72 hours
  - Duration ~ 3 months
  - Best results if localization techniques used
    - EMG guidance
    - Ultrasound
    - Electrical stimulation
  - Dosage differs between Type A and B and is physician dependent

## Local Treatments

- **Phenol**
  - Chemically destroys the nerve at the neuromuscular junction
  - Non-selective
  - Causes muscle tissue destruction and atrophy

## Local Treatments

- **Phenol**
  - More challenging than botulinum toxin injections
  - Lower cost
  - Technical issues
  - Used for large muscle groups only
  - Onset: Immediate
  - Duration: 1-36 months
  - Side effects: Dysesthesias, Marked muscle pain, peripheral edema, extensive motor weakness

## Intrathecal Baclofen

- GABA agonist
  - Decreases neural activity at the spinal cord level
- Surgically implanted pump in the subcutaneous tissue in lower abdomen
- Rubber catheter that runs from pump to CSF at the spinal cord

## Intrathecal Baclofen

- **Pros:**
  - Flexibility in dosing to allow tailoring to patient's needs
  - Beneficial for UE and LE, large and small muscle groups
  - Rarely leads to weakness in unaffected muscles
- **Cons:**
  - Surgical procedure
  - Patient selection must be a careful process
  - Overdose and Withdrawal syndromes

## Intrathecal Baclofen

- **Side effects:**
  - Hypotonia
  - Somnolence
  - Nausea/vomiting
  - Dizziness
  - Urine retention
  - Constipation
  - Withdrawal
  - Overdose

## Baclofen Overdose

- **Causes**
  - Programming errors
    - Incorrect concentration used
    - Large dose increases
    - Switching from continuous to bolus dosing
  - Failure to wean oral medications with increases in pump dosage

## Baclofen Overdose

- Hypotension
- Hypotonia
  - Increased weakness from baseline
- Significant somnolence
- Respiratory depression
- Death

## Baclofen Overdose

- Treatment
  - Emergency – call 911
  - Respiratory support
  - Determine cause and reverse

## Baclofen Withdrawal

- **Causes**
  - Empty pump
  - Pump failure
    - Battery expires (5-7 years from implant)
    - Motor malfunction
  - Catheter problems
    - Kinking
    - Breakage
    - Separation from pump
    - Occlusion
    - Migration from CSF space

## Baclofen Withdrawal

- Rigidity/Clonus
- Itching without presence of a rash
- Hallucinations
- Seizures
- Fever/Malignant Hyperthermia
  - Temperatures often > 106 degrees

## Baclofen Withdrawal

- Treatment
  - IV Benzodiazepines
    - Valium 10mg
  - Cooling blankets
  - Dantrolene for malignant hyperthermia

## Summary

- Treatment of spasticity requires multidisciplinary approach including PT, OT and medications
- Selection of medications should be patient specific depending on co-morbidities and deficits
- Oral medications should be attempted prior to local or invasive treatments
- Good practice to know what medications are used for spasticity, their dosages, mechanisms of action and side effects

## References

- Braddom, et al. Physical Medicine and Rehabilitation. 3<sup>rd</sup> Edition. pp 651-662
- Zafonte, et al. Brain Injury Medicine. pp 615-651