

# Pediatric Spasticity

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# Disclosures

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- Nothing to disclose

# What is Spasticity

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- A motor disorder characterized by an abnormal, *velocity-dependent* increase in the tonic stretch reflexes (muscle tone) with exaggerated phasic stretch reflexes (tendon jerks, clonus) resulting from hyperexcitability of the stretch reflex.

## Compare to

- Rigidity: Resistance to stretch that is *not* velocity dependent
- Dystonia: muscle contraction resulting in twisting, turning, and posturing

# Why do we care?

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## Associated Disorders

- Cerebral Palsy
- Brain Injury (Traumatic or Acquired)
- Spinal Injury
- Stroke
- Genetic Disorders

## • Epidemiology

- Difficult to determine due to differing classifications/criteria

## • Estimate

- Cerebral Palsy
  - 8.1 million worldwide (age <5)
  - 764,000 in US (3 per 1,000 births)
- 80% of children with CP have spasticity
- Worldwide: 6,480,00 Children under 5 with spasticity
- US: 611,200

# Why do we care?

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- Contraction Formation
- Altered Bone Shape
- Joint Dislocation (primarily hip)
- Altered Limb Positions (equinus, equinovarus, etc)
- Joint Instability
- Difficult/Altered Ambulation
- Impaired Speech
- Impaired Development
- Pain
- Premature Osteoarthritis

# Upper Motor Neuron Syndrome

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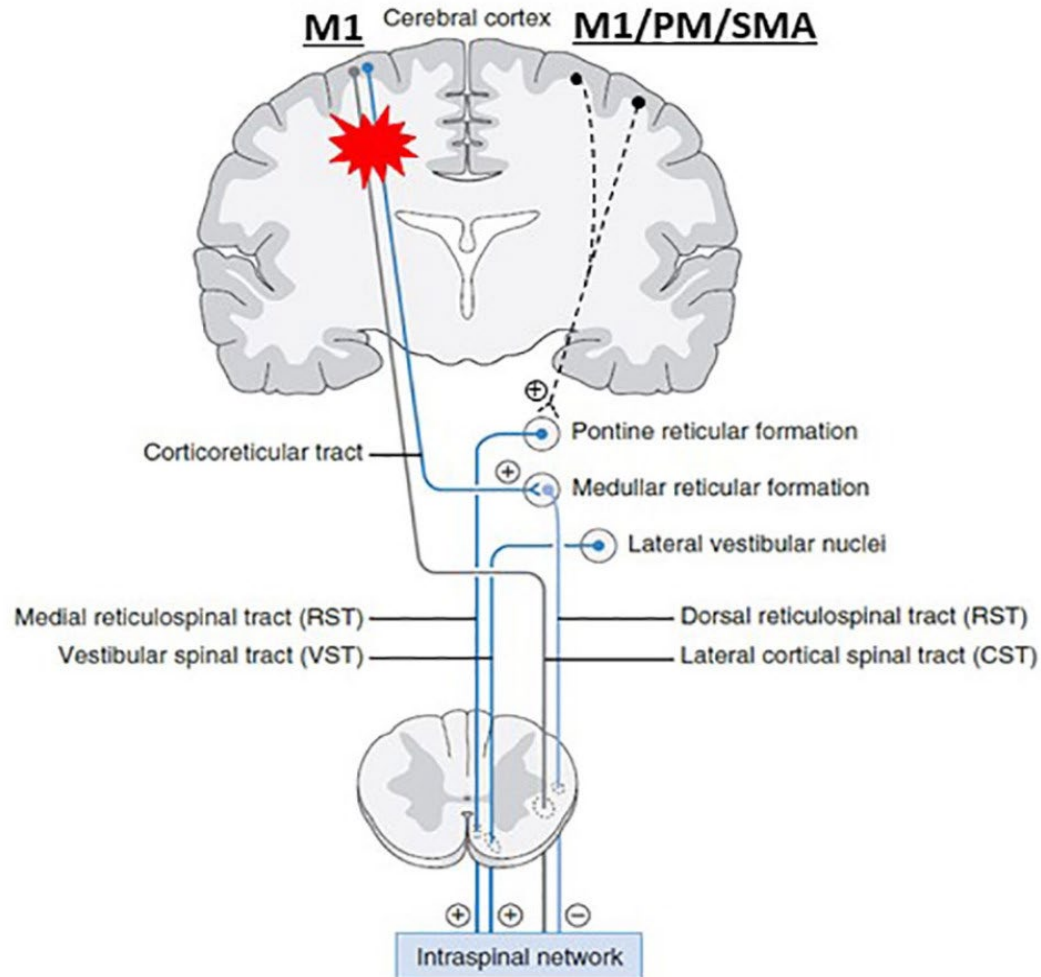
- Positive Symptoms

- Spasticity
- Hyperreflexia
- Clonus
- Persistent/re-appearing of primitive reflexes
- Rigidity
- Spastic Dystonia
- Athetosis
- Increased Cutaneous Reflexes
- Loss of Autonomic Control

- Negative Symptoms

- Muscle Weakness
- Paralysis/paresis
- Voluntary Movement Loss
- Coordination Loss
- Decreased Dexterity
- Atrophy
- Fatigue

# Spasticity- Pathology



- Involved Brain Structures
  - Supplementary motor area
  - Pre-motor area
  - Cortico-reticular fiber tracts
  - Frontal Cortex and Anterior Limb of the Internal Capsule
  - Spinal Cord

# Measurement/Evaluation

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- Modified Tardieu Scale

- Joint ROM
  - R1: angle of initial “catch”
  - R2: angle of final range of joint
- Velocity of movement
  - V1: slow
  - V2: speed of gravity falling
  - V3: joint moved as fast as possible
- Grading
  - 0: NO resistance
  - 5: joints immovable

- Modified Ashworth Score

- 1: "catch" and release
- 1+ "catch" and increased tone in remainder of ROM
- 2: increased muscle tone through majority of ROM, but easily moved
- 3: considerable increase in muscle tone, difficult passive movement
- 4: rigid in flexion or extension



# Spasticity/Tone Treatment

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- Non-Medical Treatment
  - Stretching, ROM
  - Splinting/Casting to maintain stretch
  - Cryotherapy/Heat Therapy
- Avoidance of aggravating Factors
  - Pain
  - Infections (UTI)
  - Other Noxious Stimuli

# Orthosis – Upper Extremity

Restrictive Garment



Elbow Contracture Prevention Orthosis



Wrist-Hand Orthosis



# Orthosis- Spinal

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# Lower Extremity Orthosis – Hip and Bone



SWASH



Twister Cables  
With AFOs



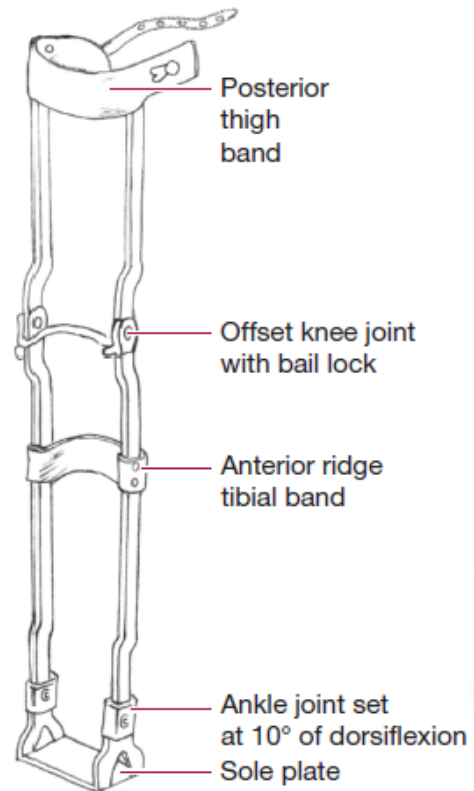
Tibia Counter Rotator



# Lower Extremity Orthosis – Hip Knee Ankle



Hip-Knee-Ankle-Foot

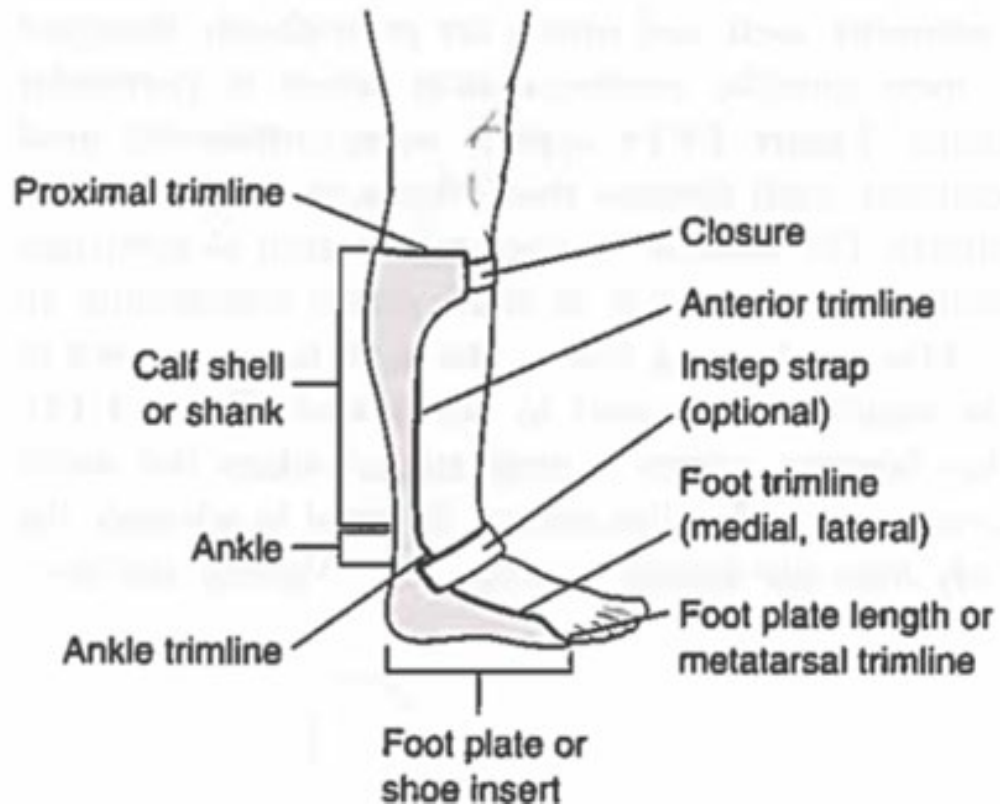


Knee-Ankle-Foot



Knee Immobilizers

# Orthosis – Ankle Foot Orthosis



Solid AFOs



Articulated AFOs

# Orthosis – Lower Extremity

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**SupraMalleolar Orthosis**



**University of California- Berkeley  
Laboratories Orthosis (UCBL)**

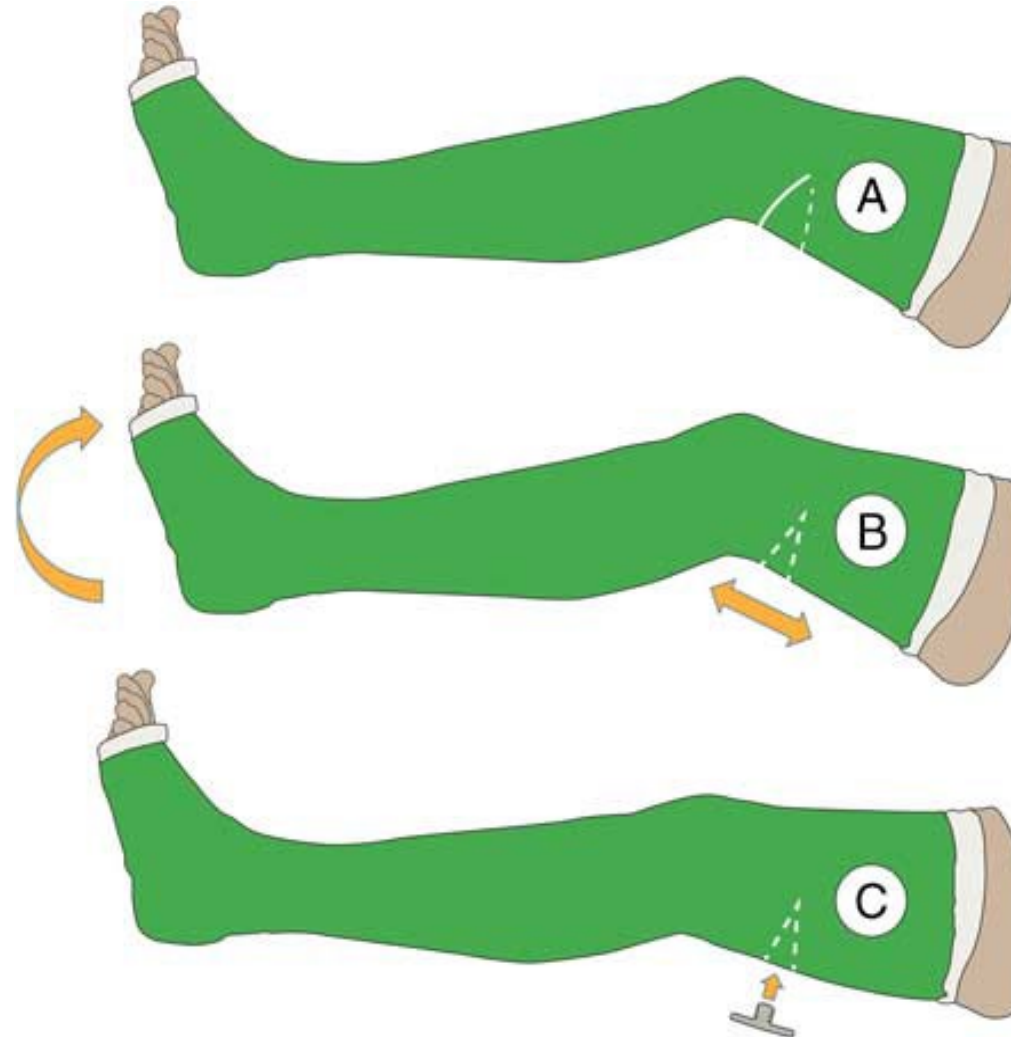
# Instructions on wearing articulated AFOs

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- Wear Socks at ALL times
  - Minimize skin-to-brace contact
- Socks should be straight, without wrinkles
- Always wear shoes/slippers
  - Billie Shoes, Sketchers, New Balance
  - Extra-Wide!
- Do not take to school until wearing 6-8 hours daily
- Wear schedule: Every day that ends in “Y”
- Do NOT take to the beach
- Wear Schedule Titration
  - Day 1: 30 min
  - Day 2: 60 min
  - Day 3: 90 minutes
  - Day 4: 2 hours
  - Day 5: 3 hours
  - Etc
- Monitor for signs of skin breakdown
- Immediately stop wearing if
  - Erythema >20 minutes
  - Blisters
  - Wounds
- Orthotist can make adjustments for fit



# Serial Casting



Cast placed and a wedge cut out to form a hinge  
2 weeks post casting leg gently extended to tolerance (patient awake)

Plastic wedge placed into cut to apply stretch

Wedge gradually replaced with larger sizes to gradually increase knee extension

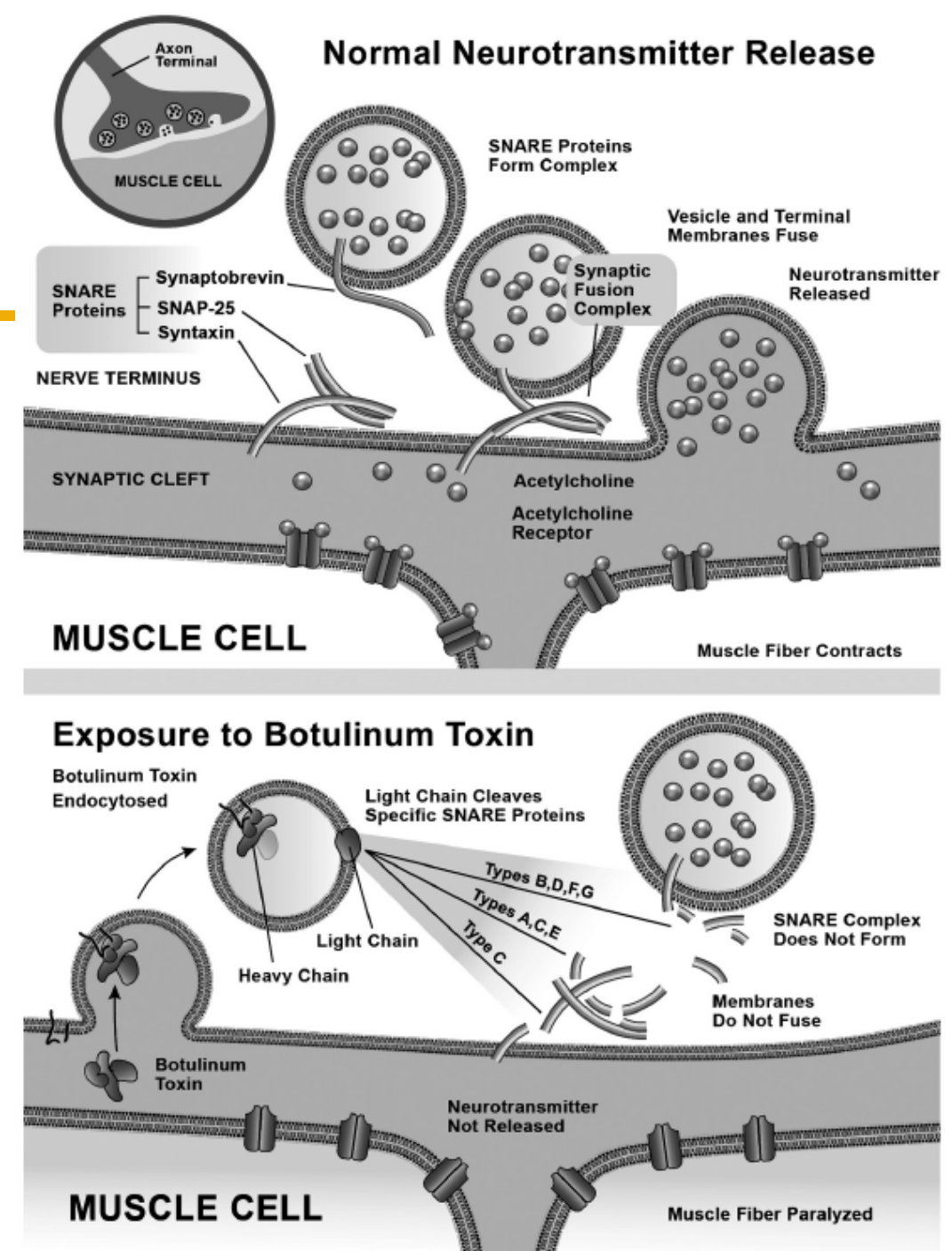
# Spasticity/Tone Treatment

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- Oral Medication Generalized Spasticity
  - Baclofen
    - Oral
    - Intrathecal
      - Allows much lower dosages
  - Diazepam
  - Tizanidine
  - Dantrolene
    - Acts on muscle directly
    - Avoids sedation effects
- Specific Muscle Groups
  - BoNTA (Botox)
  - Denervation
    - Chemical
    - Cryo
- Orthopedic Surgery
  - Tendon lengthening
  - Osteotomies
- Selective Dorsal Rhizotomy

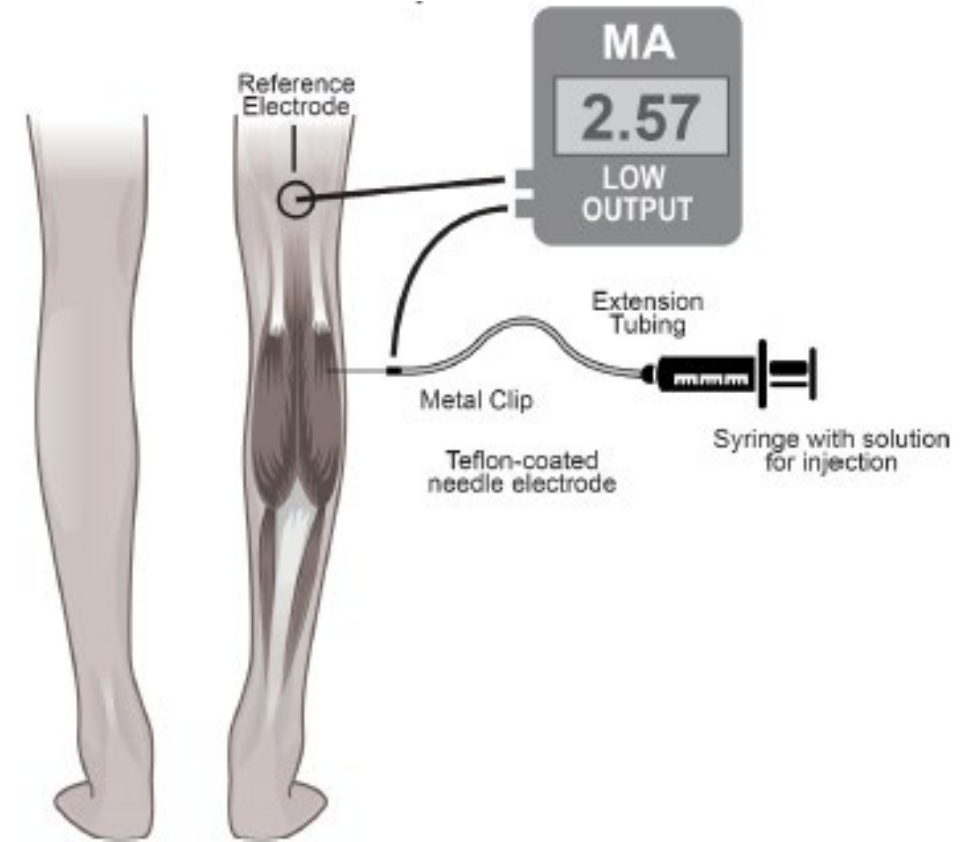
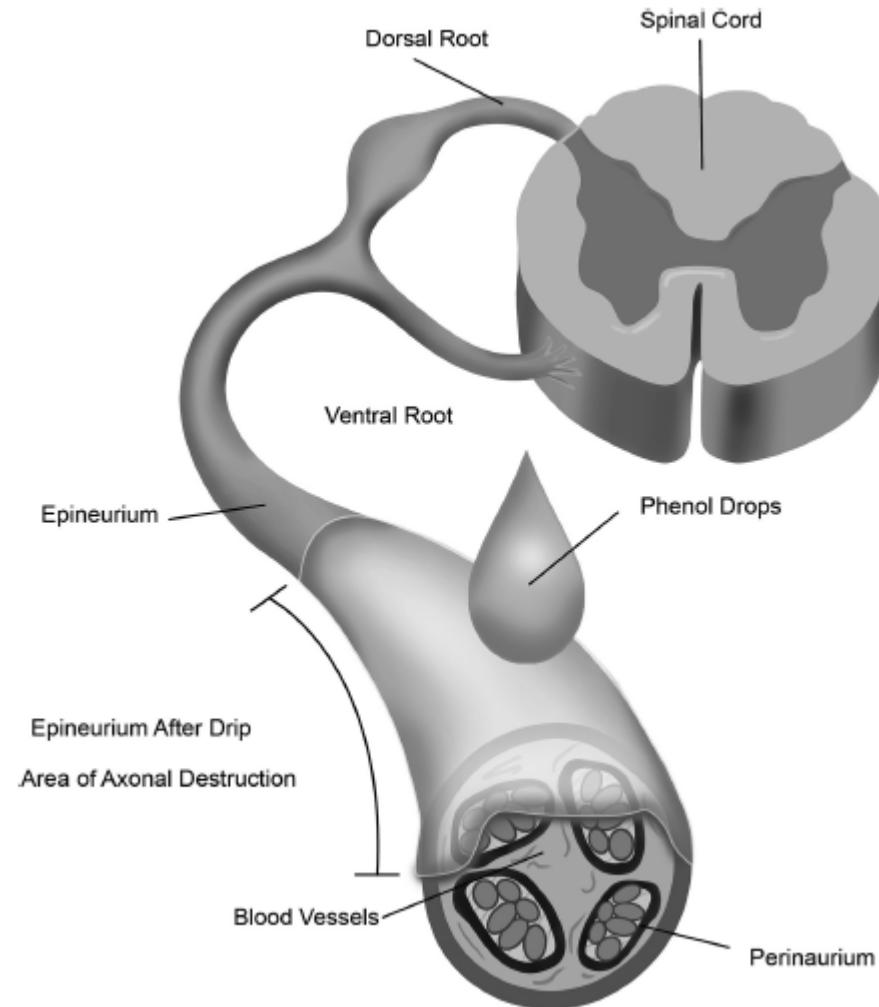
# Botulism Injections

- Interacts with the SNARE protein complex
- Prevent neurotransmitter release by preventing vesicle interaction with neuronal membrane and thus exocytosis

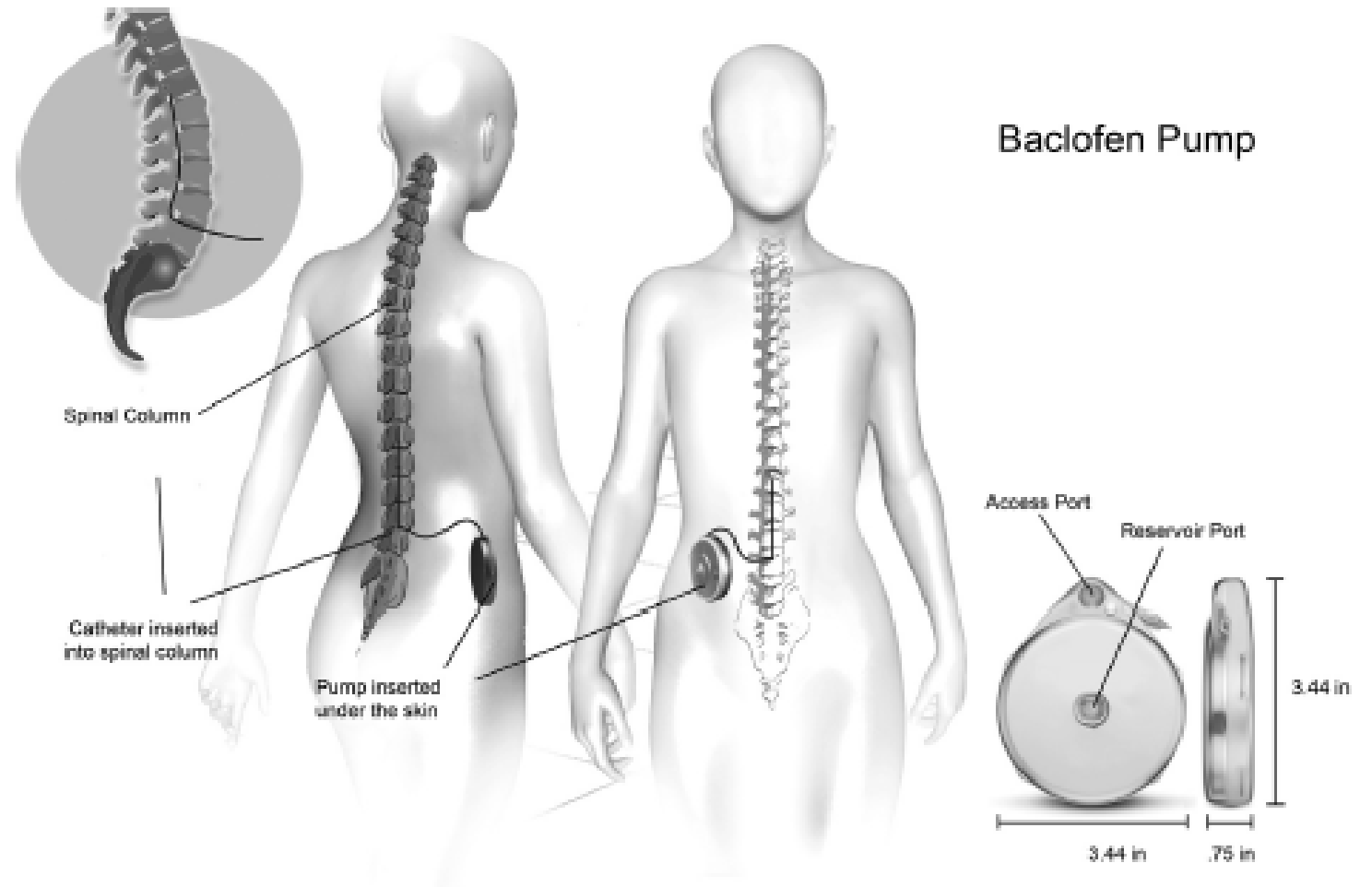


# Neurolysis

- Phenol
- Ethanol
- Cryogenic

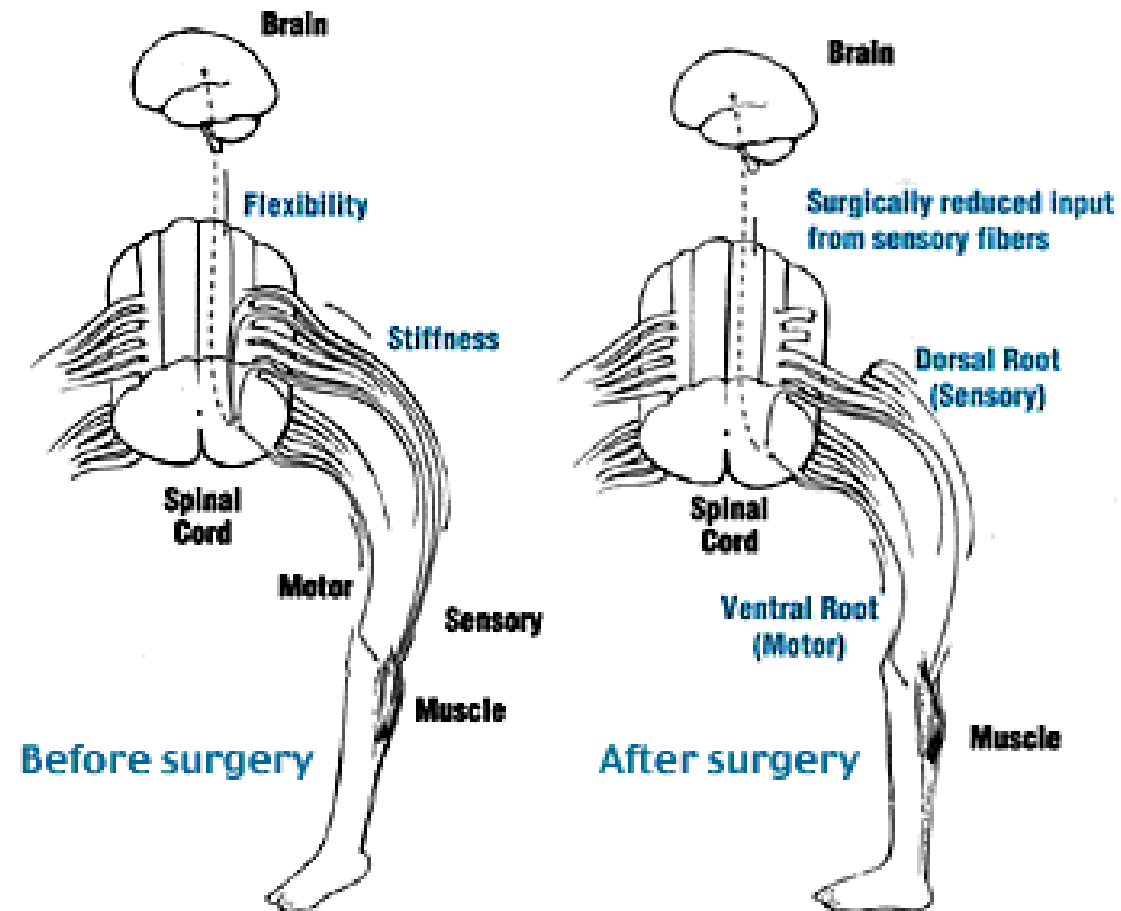


# Baclofen Pump Placement



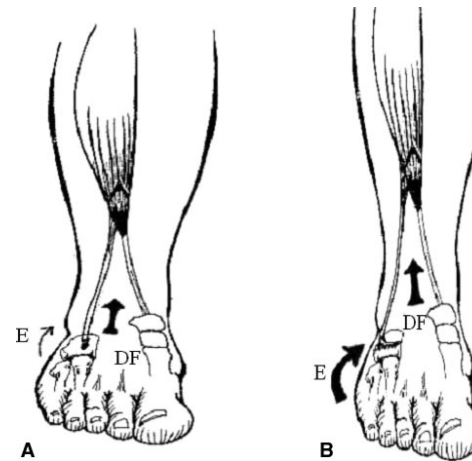
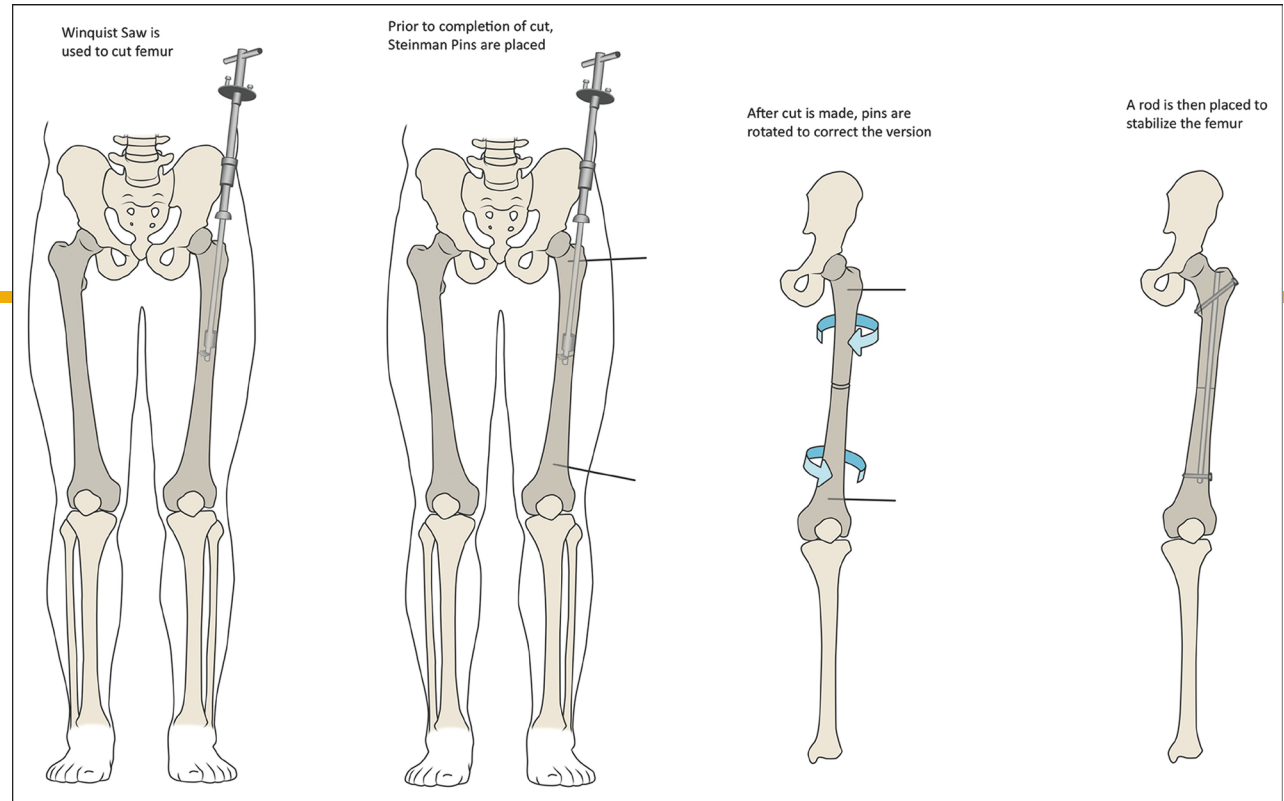
# Selective Dorsal Rhizotomy

- Lessen sensory component to tone



# Surgeries

- Osteotomies
- Acetabuloplasty
- Tendon Release
- Tendon Rerouting



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# THANK YOU!