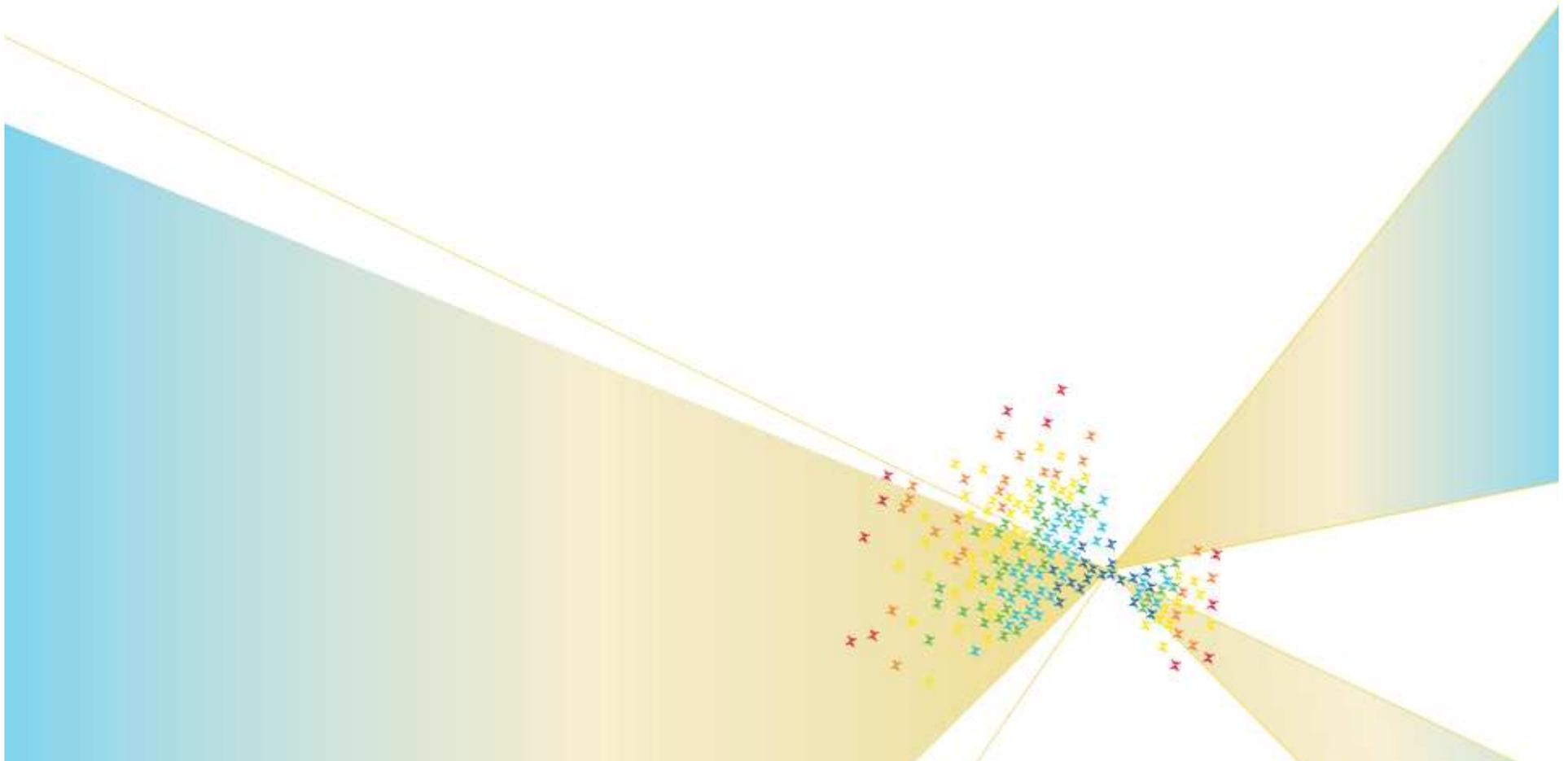
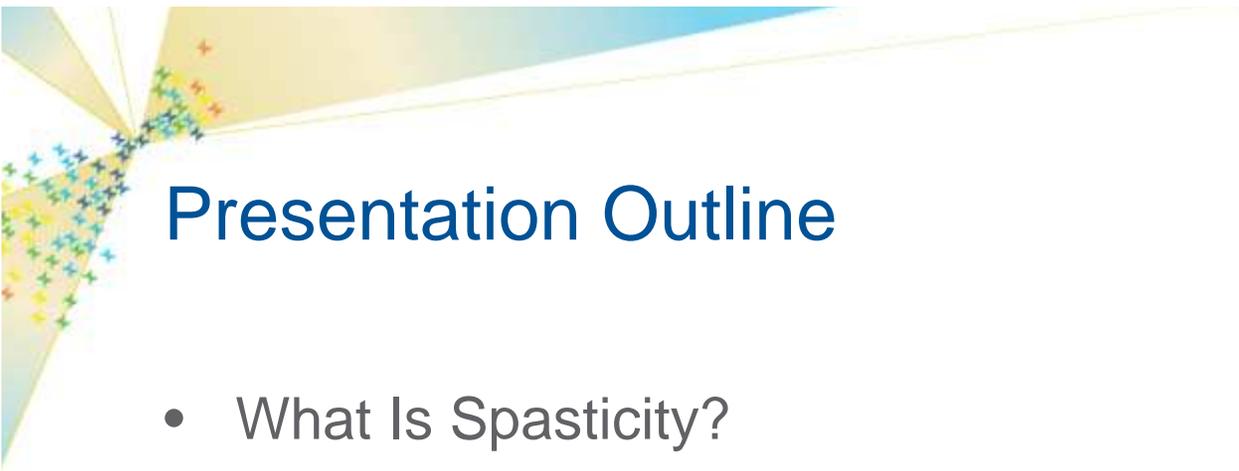


Managing Severe Spasticity





Presentation Outline

- What Is Spasticity?
- Pathophysiology of Spasticity
- Common Etiologies
- Spasticity Management Goals and Spectrum of Care
- ITB Therapy for Severe Spasticity

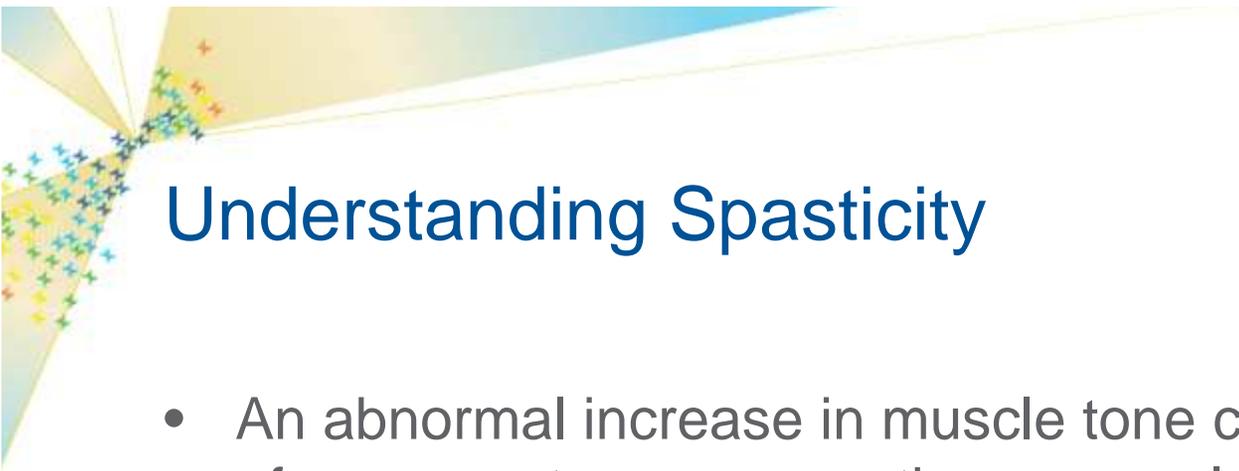


What Is Spasticity?



Ariel F.
Receiving Medtronic
ITB Therapy since 2007





Understanding Spasticity

- An abnormal increase in muscle tone caused by injury of upper motor neuron pathways regulating muscles
- May be caused by injury or disease of the central nervous system (brain or spinal cord)
- A velocity-dependent increased resistance to passive stretch
- Characterized by exaggerated tendon jerks
- May be accompanied by hyperexcitability of the stretch reflex

Limitations Associated with Severe Spasticity

- Functional Impairments
 - Pain, fatigue, sleep difficulties, joint contractures, bowel and bladder dysfunction
- Activity and Participation
 - Difficulty with positioning, walking, mobilizing a wheelchair, transferring to and from bed, toilet, or car
 - Difficulty with ADLs
 - Reduced intimacy, vocational disability, and social isolation



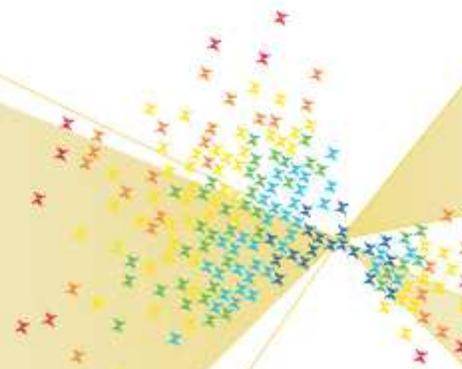
Spasticity Management in Multiple Sclerosis. Evidence-Based Management Strategies for spasticity Treatment in Multiple Sclerosis Clinical Practice Guidelines. Multiple Sclerosis Council for Clinical Practice Guidelines. 2005.



Pathophysiology of Spasticity



Ali G.
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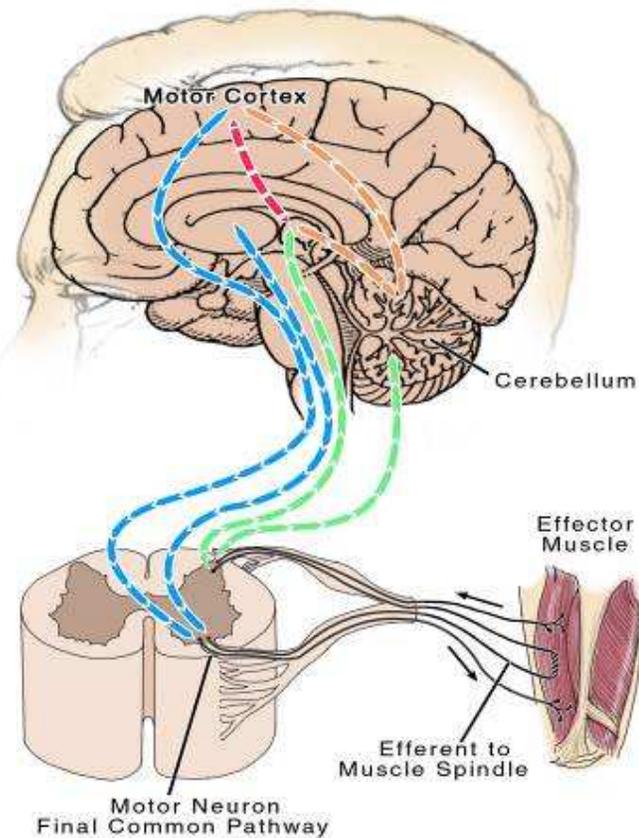


What Causes Spasticity?

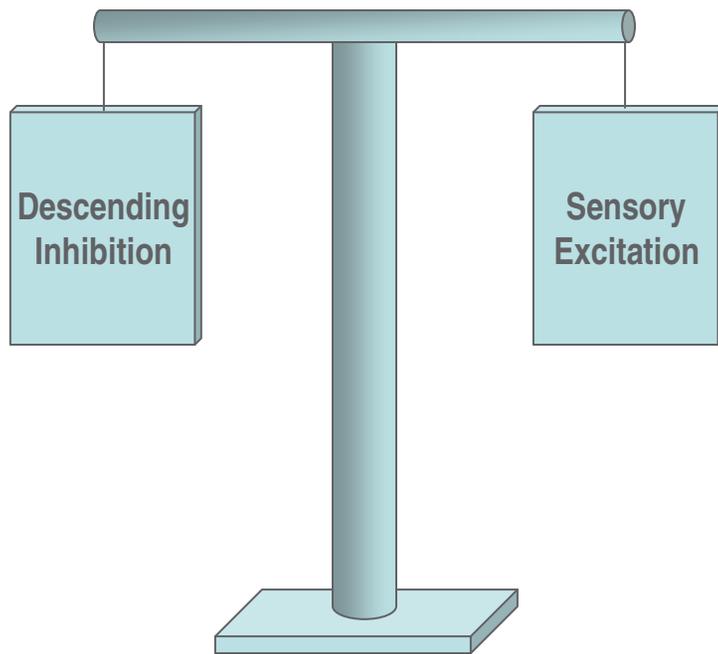
Theory

- Imbalance between descending excitatory and inhibitory impulse to the alpha motor neuron:
 - Spasticity of cerebral origin results from lack of descending inhibitory input from subcortical nuclei in the brain
 - Spasticity of spinal origin results from interruption of descending tracts that inhibit or modulate alpha and gamma motor neurons

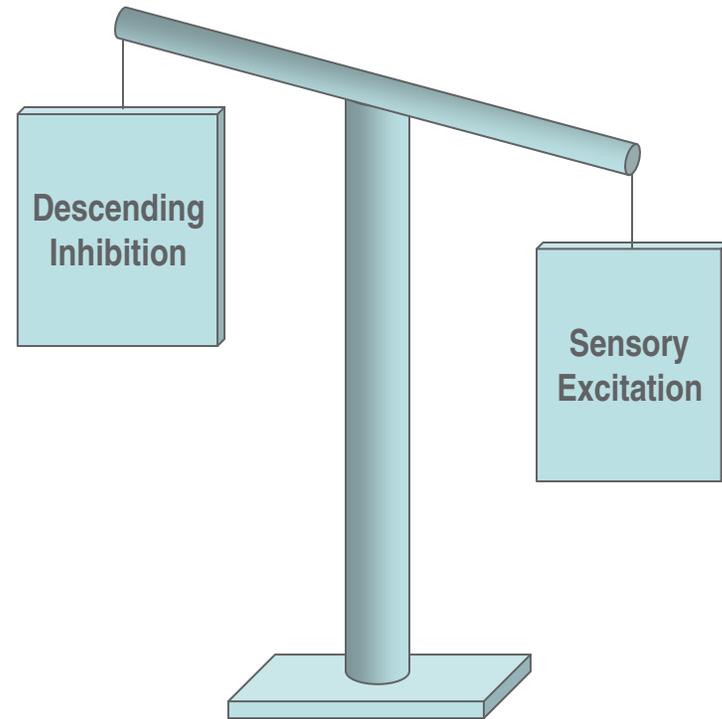
Sensory and Stretch Receptors



Inhibitory Input vs. Loss of Inhibitory Input



Normal Muscle Tone



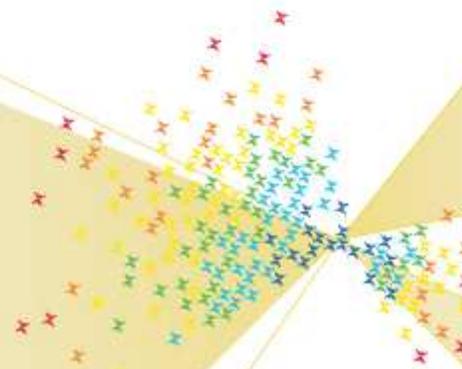
Loss of Descending Inhibitory Input

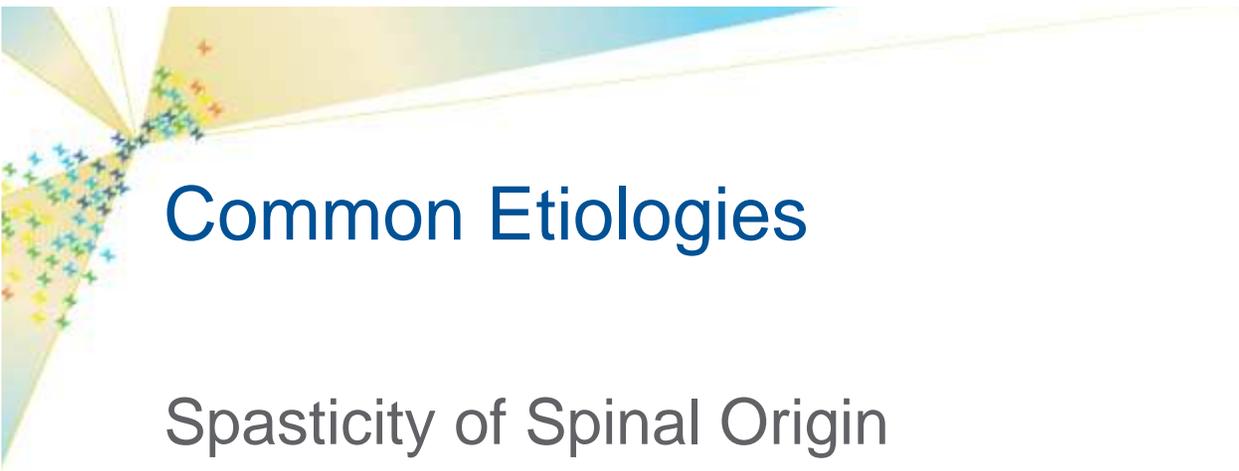


Common Etiologies



Andrina M.
Receiving Medtronic
ITB Therapy since 2007





Common Etiologies

Spasticity of Spinal Origin

- Spinal Cord Injury
- Multiple Sclerosis

Spasticity of Cerebral Origin

- Stroke
- Brain Injury
- Cerebral Palsy



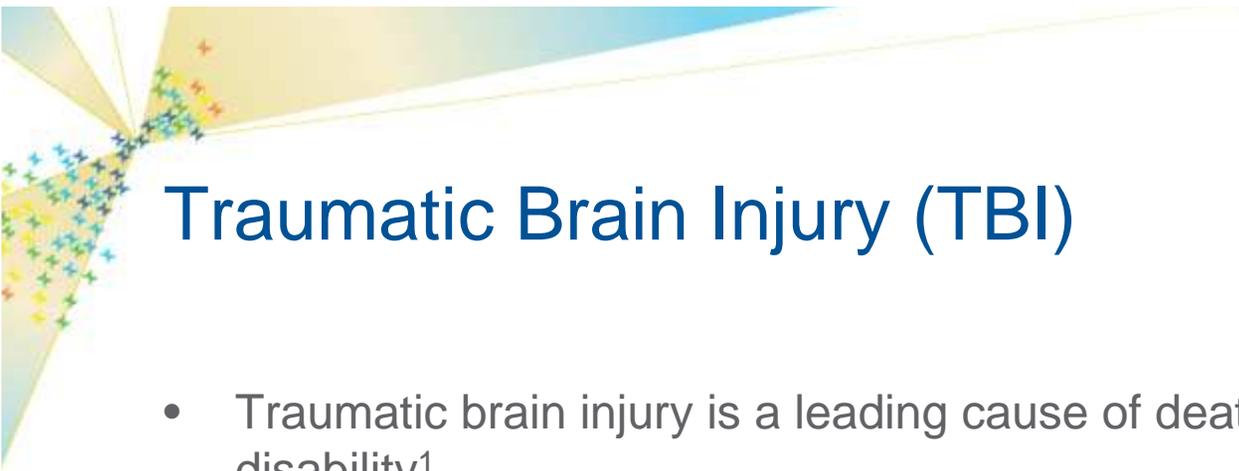


Spinal Cord Injury (SCI)

- There are approximately 12,000 new cases of SCI per year, but recent data is limited¹
 - Since 2000, the majority of injuries have resulted in incomplete tetraplegia (30.1%) and complete paraplegia (25.6%)
- Anson and Shepherd (1996) reported the following statistics on 348 patients post-SCI:²
 - 62% are living with spasticity that does not interfere with functioning
 - 12% are living with severe spasticity that interferes with activities of daily living
- Spasticity management does not interfere with spinal cord injury medical management

1. <http://www.fscip.org/fact.htm>. Accessed June 21, 2010.

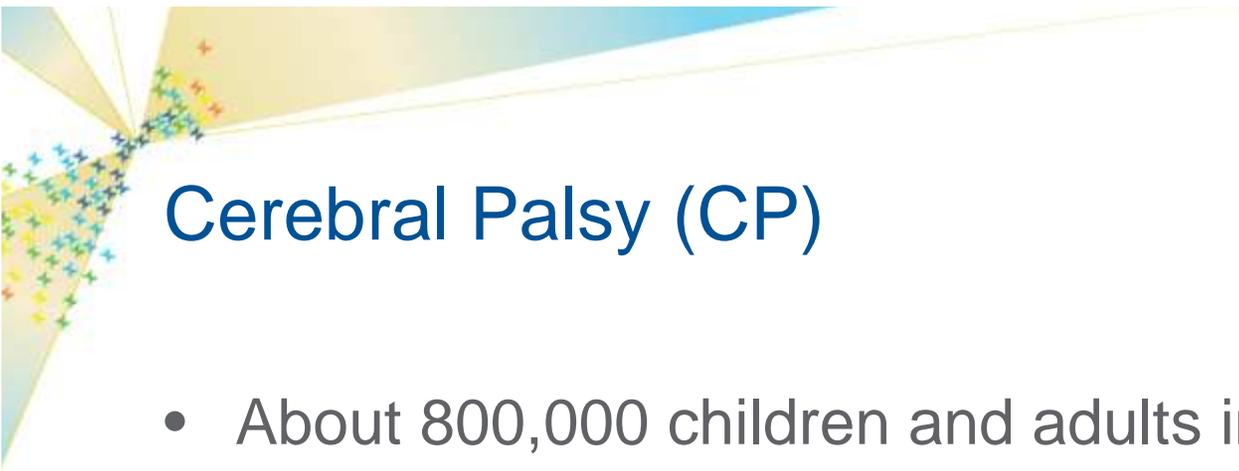
2. Anson CA, Shepherd C. Incidence of secondary complications in spinal cord injury. *Int J Rehabil Res.* 1996;19:55-66



Traumatic Brain Injury (TBI)

- Traumatic brain injury is a leading cause of death and life-long disability¹
- An estimated 1.7 million TBI-related deaths, hospitalizations, and emergency department visits occur each year²
- 17% of those living with TBI not affecting the mid-brain (and pons) experience spasticity³
- For those with injuries affecting the mid-brain, spasticity is seen in greater than half (53%) of the population³
- Spasticity management does not interfere with brain injury medical management

1. Thurman DJ, Alverson C, Dunn K, Guerrero J, Sniezek J. Traumatic brain injury in the United States: a public health perspective. *J Head Trauma Rehabil.* 1999;14:602-615.
2. Langlois JA, Rutland-Brown W, Thomas KE. Traumatic brain injury in the United States: emergency department visits, hospitalizations, and deaths. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2006.
3. Wedekind C, Lippert-Gruner M. Long-term outcome in severe traumatic brain injury is significantly influenced by brainstem involvement. *Brain Inj.* 2005;19:681-684.



Cerebral Palsy (CP)

- About 800,000 children and adults in the United States have CP¹
- Each year, approximately 10,000 babies born in the U.S. will develop CP¹
- Spasticity management does not interfere with cerebral palsy medical management

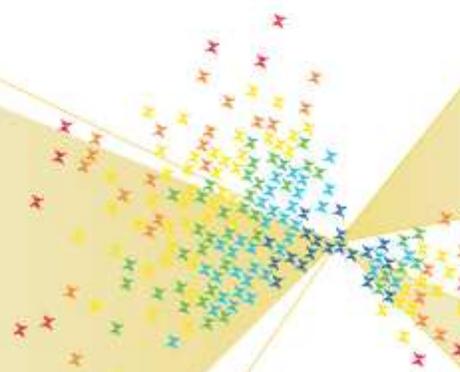
1. http://www.ninds.nih.gov/disorders/cerebral_palsy/detail_cerebral_palsy.htm. Accessed June 21, 2010.

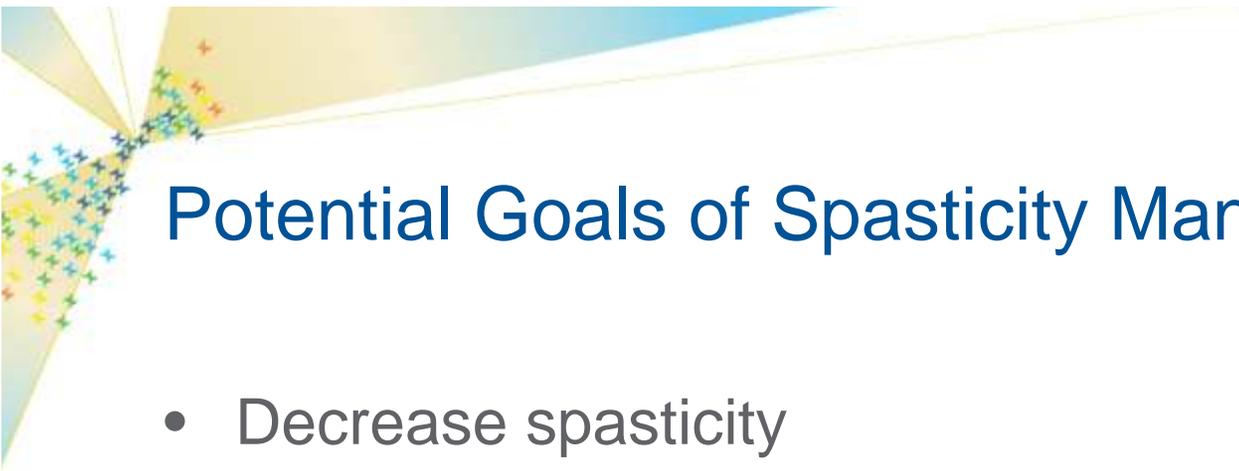


Spasticity Management Goals and Spectrum of Care



Clyde M.
Receiving Medtronic
ITB Therapy since 2004



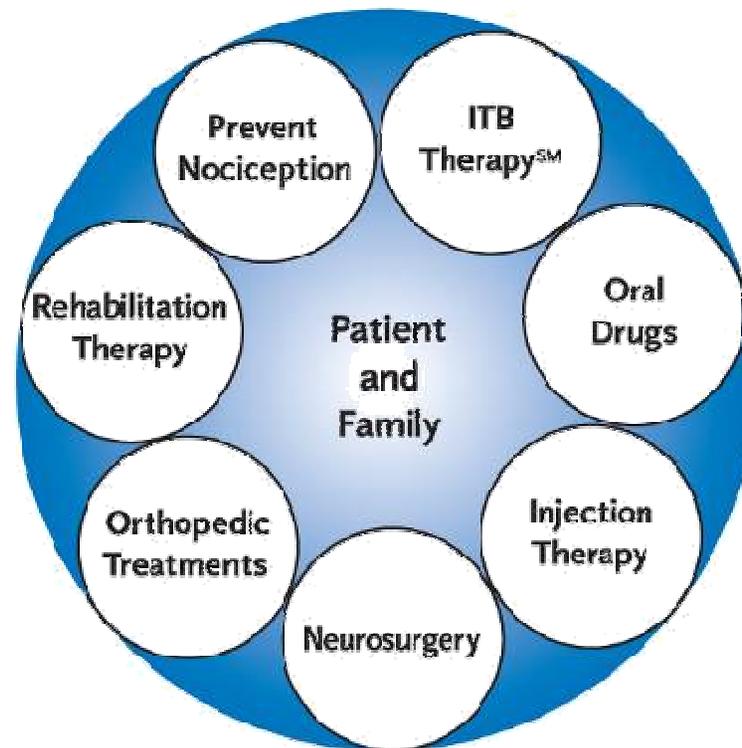


Potential Goals of Spasticity Management

- Decrease spasticity
- Improve functional ability and independence
- Decrease pain associated with spasticity
- Prevent or decrease incidence of contractures
- Improve ambulation
- Facilitate hygiene
- Ease rehabilitation procedures
- Save caregivers' time

Severe Spasticity Spectrum of Care

Common Treatment Options
Offered at Spasticity Management Centers





ITB Therapy for Severe Spasticity



Jason F.
Receiving Medtronic
ITB Therapy since 1991



What Is ITB Therapy?

- A treatment for individuals with severe spasticity due to:
 - Stroke
 - Multiple Sclerosis
 - Brain Injury
 - Spinal Cord Injury
 - Cerebral Palsy
- Can be used with or in place of orally administered antispastic medications
- Nondestructive, adjustable, and reversible therapy (by pump explantation)
- For patients who experience severe spasticity of cerebral origin (must be at least 1 year post trauma in cases of traumatic brain injury)
- A treatment for the management of severe spasticity for patients who have had ineffective results or intolerable side effects from oral baclofen (for severe spasticity of spinal origin)



How ITB Therapy Works

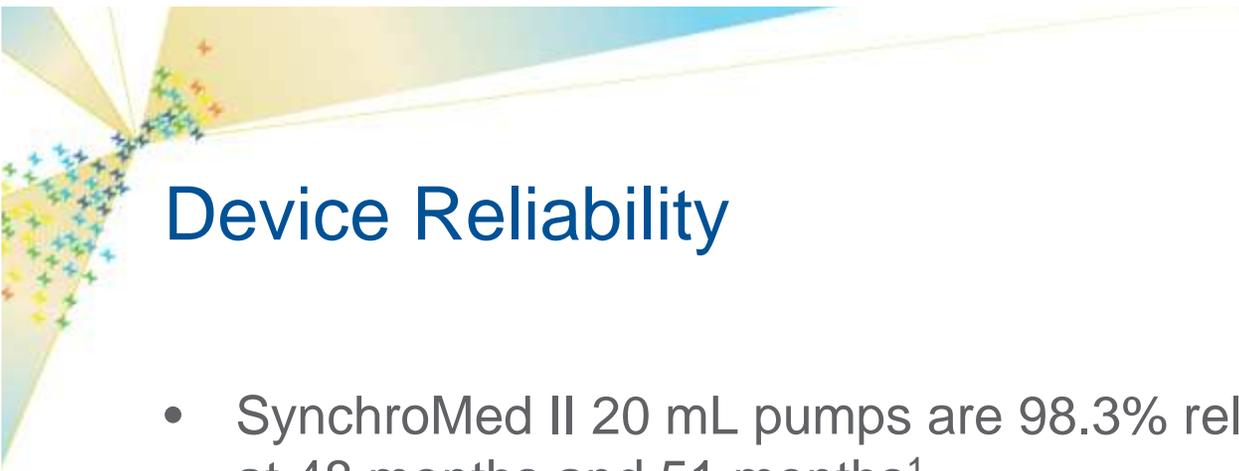
- Uses an implantable, programmable SynchroMed[®] II pump to deliver precise amounts of Lioresal[®] Intrathecal (baclofen injection) directly to the site of action at the spinal cord via the cerebrospinal fluid
- Because ITB Therapy delivers baclofen directly to the spinal cord, a fraction of the oral medication dose may be needed



The SynchroMed II Infusion System

- Consists of two fully implantable components
 - SynchroMed II pump
 - Intraspinal catheter
- Uses a clinician programmer to deliver precise and customized therapy to patients
- Can deliver medication at either a constant rate or a variable rate



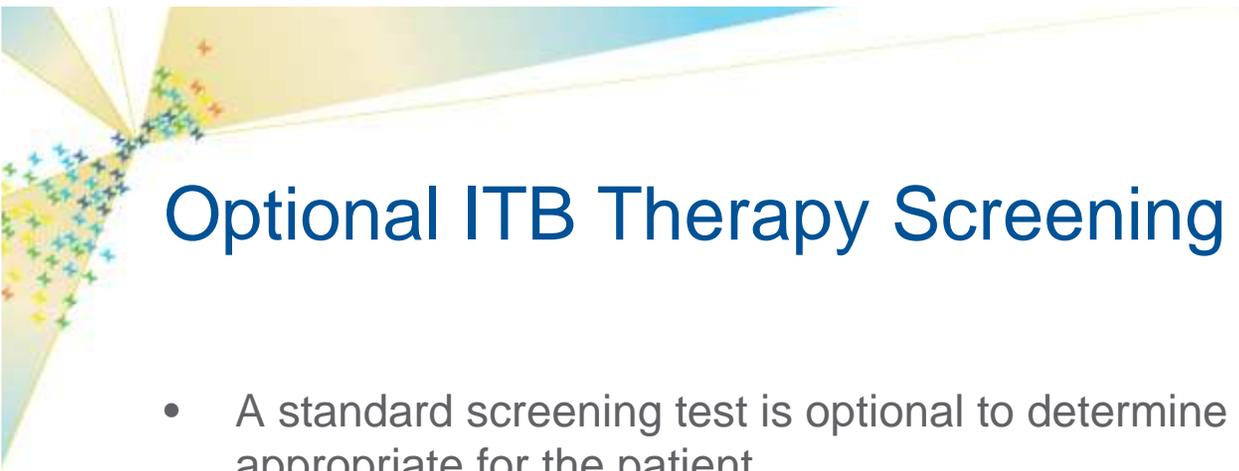


Device Reliability

- SynchroMed II 20 mL pumps are 98.3% reliable* (event-free) at 48 months and 51 months¹
- SynchroMed II 40 mL pumps are 99.2% reliable* (event-free) at 48 months and 51 months¹

**Reliability is the probability a pump remains event-free through the time interval. Events are defined as any change that prevented delivery of the therapy to the intended location, required surgical intervention to correct, and were related to a problem with the pump.*

1. Medtronic Product Performance Report.
http://professional.medtronic.com/performance09/downloads/NeuroPain_PPRinfusion_FY10_200903263aEN.pdf. Accessed June 22, 2010.



Optional ITB Therapy Screening Test

- A standard screening test is optional to determine if ITB Therapy is appropriate for the patient
- The screening test allows the patient to try the therapy before committing to the implant
- An intrathecally administered test dose of baclofen injection is given via a lumbar puncture
 - In a single study, 97% of patients with spasticity of spinal origin demonstrated a positive response to the screening test¹
 - In a single study, 86% of patients with spasticity of cerebral origin demonstrated a positive response to the screening test²
- Possible adverse events include hypotonia, somnolence, nausea, vomiting, headaches, and dizziness.
- A screening test is contraindicated in the presence of active infection and in patients who demonstrate hypersensitivity to oral baclofen.

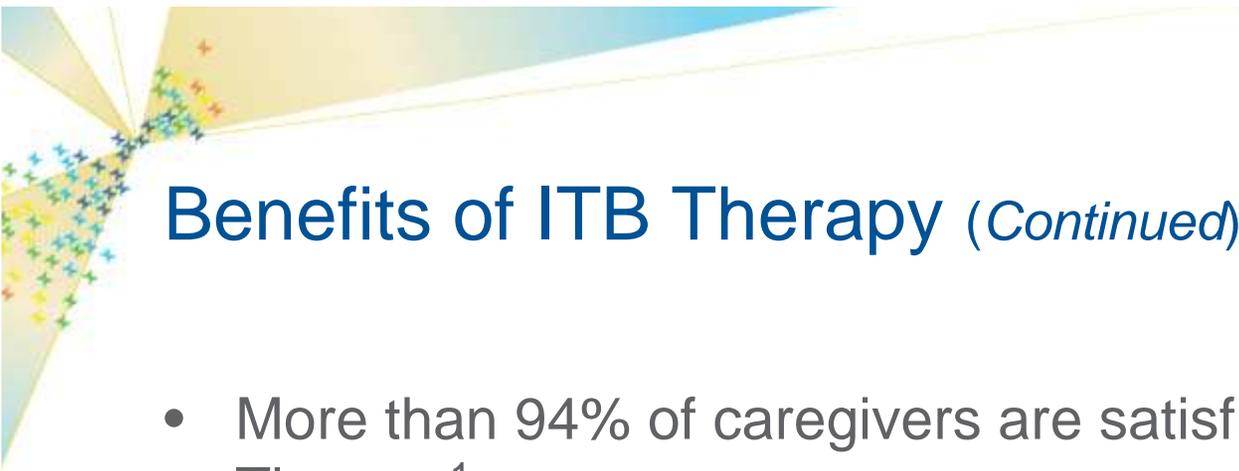
1. Penn RD. Intrathecal baclofen for spasticity of spinal origin: seven years experience. *J Neurosurg.* 1992;77:236-240.
2. Gilmartin R, Bruce D, Storrs BB, et al. Intrathecal baclofen for management of spastic cerebral palsy: multicenter trial. *J Child Neurol.* 2000;15:71-77.



Benefits of ITB Therapy

- Reduced spasticity¹⁻⁹ and spasms^{2,3,8,9}
- Increased independence allowing people to better perform activities of daily living including feeding or dressing themselves, sitting more comfortably, or transferring more easily¹⁰⁻¹³

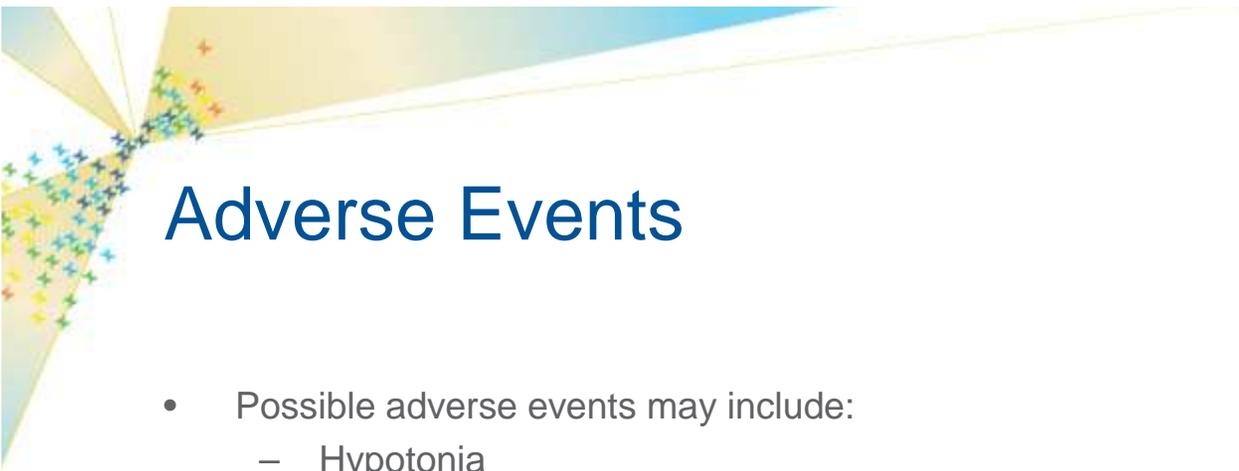
1. Albright AL, Gilmartin R, Swift D, Krach LE, Ivanhoe CB, McLaughlin JF. Long-term intrathecal baclofen therapy for severe spasticity of cerebral origin. *J Neurosurg.* 2003;98(2):291-295
2. Becker R, Alberti O, Bauer BL. Continuous intrathecal baclofen infusion in severe spasticity after traumatic or hypoxic brain injury. *J Neurol.* 1997;244(3):160-166.
3. Coffey RJ, Cahill D, Steers W. Intrathecal baclofen for intractable spasticity of spinal origin: results of a long-term multicenter study. *J Neurosurg.* 1993;78(6):226-232.
4. Francisco GC, Boake C. Improvement in walking speed in poststroke spastic hemiplegia after intrathecal baclofen therapy : a preliminary study. *Arch Phys Med Rehabil.* 2003;84(8):1194-1199.
5. Ivanhoe CB, Francisco GE, McGuire JR, Subramanian T, Grissom SP. Intrathecal baclofen management of poststroke spastic hypertonia: implications for function and quality of life. *Arch Phys Med Rehabil.* 2006;87(11):1509-1515.
6. Meythaler JM, Guin-Renfroe S, Brunner RC, Hadley MN. Intrathecal baclofen for spastic hypertonia from stroke. *Stroke.* 2001;32(9):2099-2109
7. Meythaler JM, Guin-Renfroe S, Law C, Grabb P, Hadley MN. Continuously infused intrathecal baclofen over 12 months for spastic hypertonia in adolescents and adults with cerebral palsy. *Arch Phys Med Rehabil.* 2001;82(2):155-161.
8. Ordia JI, Fischer E, Adamski E, Chagnon KG, Spatz EL. Continuous intrathecal baclofen infusion by a programmable pump in 131 consecutive patients with severe spasticity of spinal origin. *Neuromod.* 2002;5(1):16-24.
9. Penn RD. Intrathecal baclofen for spasticity of spinal origin: seven years of experience. *Neurosurg.* 1992;77(2):236-240.
10. Krach LE, Nettleton A, Klempka B. Satisfaction of individuals treated long-term with continuous infusion of intrathecal baclofen by implanted programmable pump. *Pediatr Rehabil.* 2006 Jul-Sep;9(3):210-218.
11. Azouvi P, Mane M, Thiebaut JB, Denys P, Remy-Neris O, Bussel B. Intrathecal baclofen administration for control of severe spinal spasticity: functional improvement and long term follow up. *Arch Phys Med Rehabil.* 1996;77(1):35-39.
12. Gooch JL, Oberg WA, Grams B, et al. Care provider assessment of intrathecal baclofen in children. *Dev Med Child Neurol.* 2004 Aug; 46(8):548-552.
13. Guillame D, Van Havenbergh A, Vloeberghs M, Vidal J, Roeste G. A clinical study of intrathecal baclofen using a programmable pump for intractable spasticity. *Arch Phys Med Rehabil.* 2005;86:2615-2171.



Benefits of ITB Therapy (*Continued*)

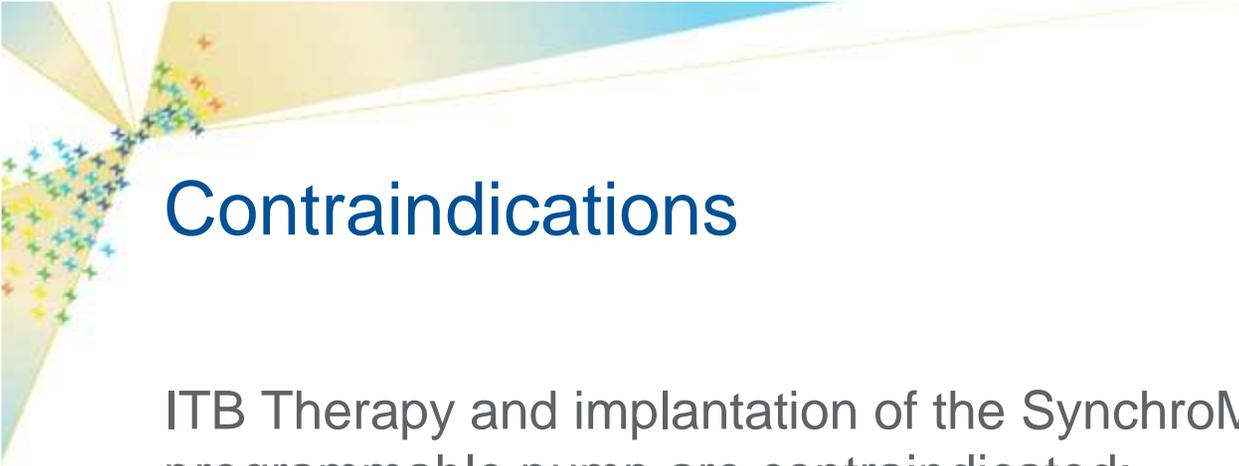
- More than 94% of caregivers are satisfied with ITB Therapy¹
- 82% of subjects/caregivers indicated they would repeat the decision to receive the treatment²

1. Campbell WM, Ferrel A, McLaughlin JF, et al. Long-term safety and efficacy of continuous intrathecal baclofen. *Dev Med Child Neurol.* 2002;44(10):660-665.
2. Krach LE, Nettleton A, Klempka B. Satisfaction of individuals treated long-term with continuous infusion of intrathecal baclofen by implanted programmable pump. *Pediatr Rehabil.* 2006 Jul-Sep;9(3):210-218.



Adverse Events

- Possible adverse events may include:
 - Hypotonia
 - Somnolence
 - Nausea
 - Vomiting
 - Headaches
 - Convulsion
 - Dizziness
 - Paresthesia
- Overdose and withdrawal, although rare, have been identified and in extreme cases may be life threatening
- Possible device complications may include:
 - Catheter or pump moving within the body or eroding through the skin
 - Catheter leak, tear, kink, or dislodgement, resulting in underdose or no baclofen infusion
 - Pump failure may cause overdose or underdose of intrathecal baclofen



Contraindications

ITB Therapy and implantation of the SynchroMed programmable pump are contraindicated:

- In the presence of infection or spinal anomalies
- When the pump cannot be implanted 2.5 cm or less from the surface of the skin
- In patients whose body size is not sufficient to accept the pump bulk and weigh
- In patients with hypersensitivity to baclofen

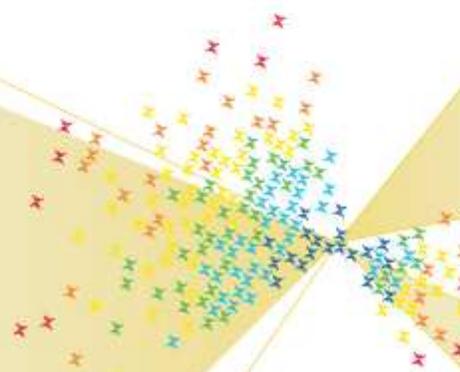
Safety and effectiveness in pediatric patients below the age of 4 have not been established.



Patient Care Pathway and Referral Process

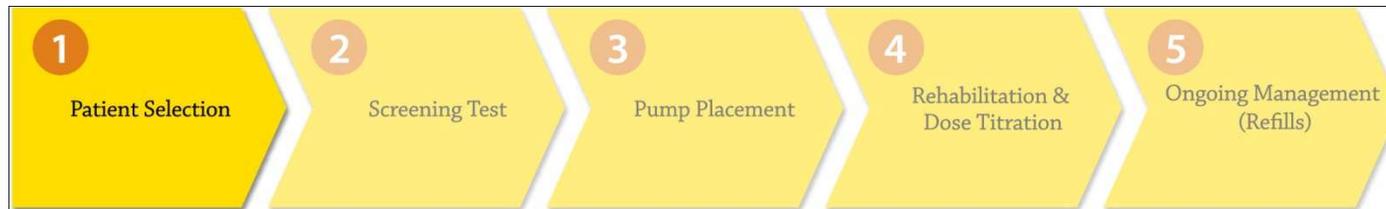


Cindy H.
Receiving Medtronic
ITB Therapy since 1996



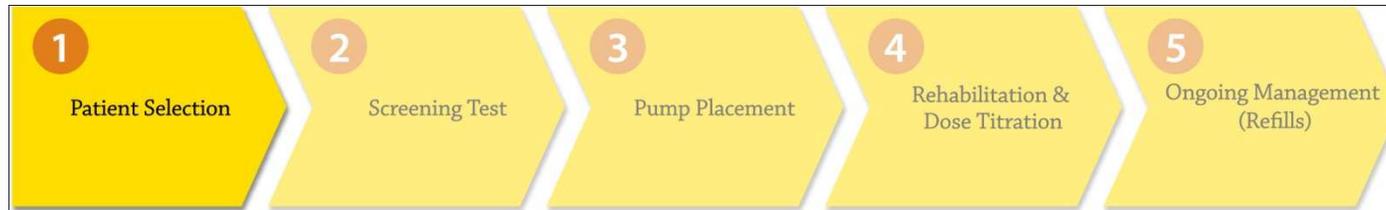


ITB Therapy Patient Care Pathway



1. **Patient Selection**—Essential to therapeutic success
2. **Optional Screening Test**—Trial dose of Lioresal[®] Intrathecal (baclofen injection) via lumbar injection
3. **Pump Placement**—If screening test yields positive results, a Medtronic SynchroMed[®] II Drug Infusion System is implanted
4. **Rehabilitation and Titration**—Dose titration, which may be accompanied by inpatient and/or outpatient rehabilitation
5. **Management**—Outpatient follow-up for pump refill of Lioresal Intrathecal

Step 1: Patient Selection



- Appropriate patient selection is essential to therapeutic success
- Consider ITB Therapy for patients who:
 - Have severe spasticity of cerebral or spinal origin¹
 - Demonstrate positive response to a single bolus dose of Lioresal[®] Intrathecal (baclofen injection) during the screening test¹
 - Are refractory to oral baclofen or experienced intolerable side effects at effective doses¹ (spasticity of spinal origin)
 - Have experienced traumatic brain injury at least 1 year prior to being considered for long-term ITB Therapy¹
 - Have sufficient body mass to support the bulk and weight of the pump²

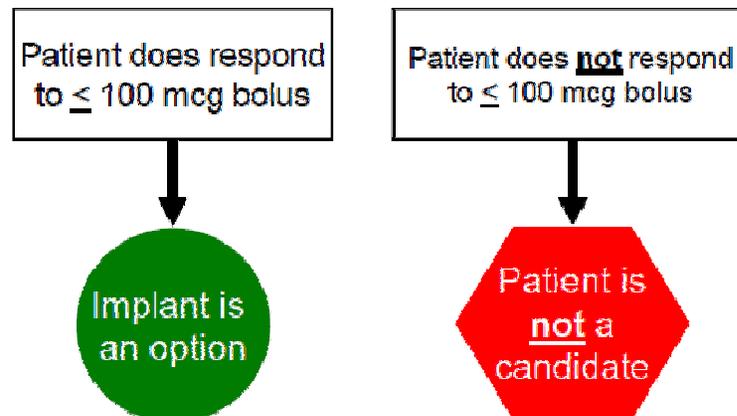
1. Lioresal Intrathecal package insert

2. Medtronic information for prescribers for SynchroMed pump

Step 2: Optional Screening Test



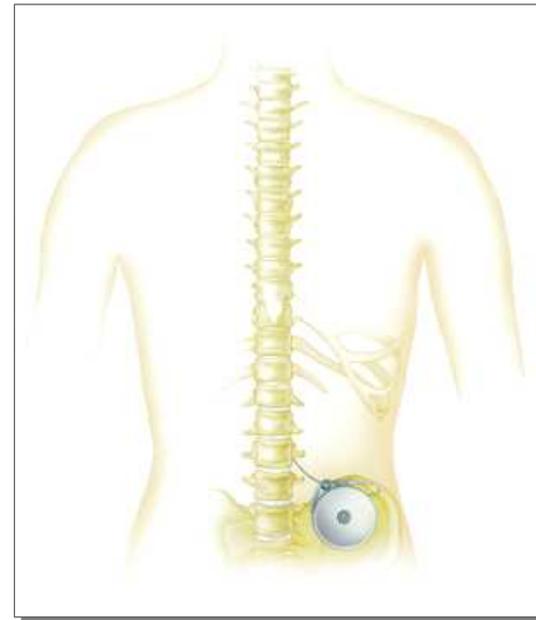
- To determine if a patient is appropriate for ITB Therapy, they first receive an intrathecally administered test dose of baclofen injection via lumbar puncture
- The bolus is large enough (50-100 mcg) to significantly reduce spasticity in appropriate patients
- Patients who do not respond to the bolus are not considered candidates for ITB Therapy

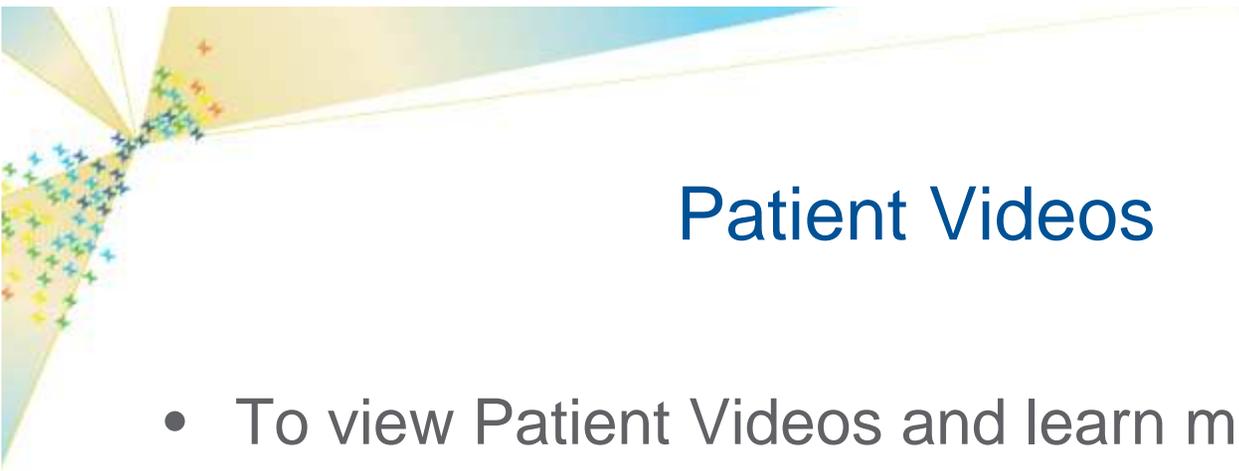


Step 3: Pump Placement



- The catheter is inserted into the lumbar region and advanced to the T10-12 region. It can also be advanced higher for an increased effect on the upper extremities.
- An abdominal incision is made for the pump
- The catheter is connected to the pump
- The entire pump and catheter system is placed subcutaneously
- An initial dose is programmed based on the patient's response during the screening test
- Surgical complications are possible and include infection, headache, spinal fluid leak, meningitis, and paralysis





Patient Videos

- To view Patient Videos and learn more about the Baclofen pump please visit the Medtronic Website at:

<http://professional.medtronic.com/pt/neuro/itb/edu/Pre-implant-patient-education-resources/index.htm#tabs-4>

Click frame to play



Medtronic Resources



- **www.Professional.Medtronic.com**
A resource for health care professionals interested in learning more about ITB Therapy
- **www.Medtronic.com**
General information on Medtronic for patients and clinicians (or call 866-669-3649)
- **www.ReleaseYourPotential.com**
A resource for spasticity patients
- **www.Spasticity.com**
A resource for patients considering or currently receiving ITB Therapy
- **Coverage and Authorization Services: 800-292-2903**
For information or questions on reimbursement for Medtronic Neurological therapies.
Available Monday-Friday, 7:00 am–6:00 pm Central Time
- **24-hour Technical Services Hotline: 800-707-0933**
- **Customer Service: 800-328-0810**
- **Patient Services: 800-510-6735**
Available Monday-Friday, 8:00 am–5:00 pm Central Time
- **ITB Therapy Ambassador Program: 800-503-4110**
Available Monday-Friday, 7:00 am–6:00 pm Central Time