HOLD ME, THRILL ME, STICK ME, CHILL ME: APPROACHES TO SPASTICITY MANAGEMENT

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DISCLOSURES

None

OVERVIEW

- Spasticity Defined
- Spasticity Measured
- “Hold Me”
- “Thrill Me”
- “Stick Me”
- “Chill Me”
- Case presentation

SPASTICITY…SO WHAT IS IT??

SPASTICITY AS DEFINED BY EXPERT FOLKS…

- 1980, Lance and colleagues defined spasticity at consensus symposium:
  - "a motor disorder characterized by a **velocity-dependent increase in tonic stretch reflexes** with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex as one component of the *upper motor neuron syndrome*"
- 2005, Pandyan and colleagues clarified the sensorimotor issues:
  - "**disordered sensorimotor control**, resulting from and upper motor neuron lesion, presenting as intermittent or sustained *involuntary activation* of muscles."
- 2021, Li and colleagues expounded more:
  - "manifested as **velocity- and muscle length-dependent increase in resistance** to externally imposed muscle stretch. It results from hyperexcitable descending excitatory brainstem pathways and from the resultant exaggerated stretch reflex responses. Other related motor impairments, including abnormal synergies, inappropriate muscle activation, and anomalous muscle coactivation, coexist with spasticity and share similar patho-physiological origins."

KEY DEFINING CLINICAL POINTS ON SPASTICITY

A component of the Upper Motor Neuron Syndrome

It is a sequela of another disease process

ETIOLOGIES OF SPASTICITY

- Stroke
- Cerebral Palsy
- TBI
- ABI
- Multiple Sclerosis
- Traumatic and non-traumatic spinal cord injuries/non traumatic myelopathies
- ALS
- Primary lateral sclerosis

TAKE THE GOOD WITH THE BAD

The Bad

- Negatively impair function
- Interfere with positioning/hygeine
- Pain and discomfort
- Increase caregiver burden

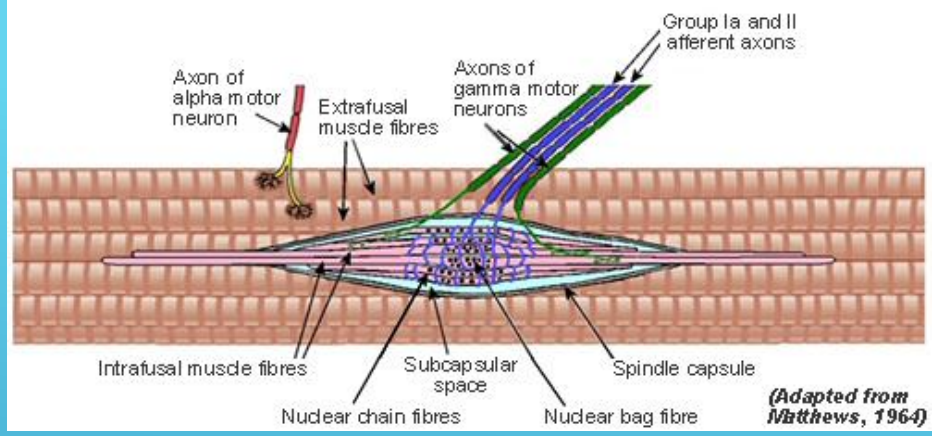
The Good

- May facilitate gait, positioning and transfers
- Achieve developmental milestones in children (CP)

- **Key: How do we "use it"**

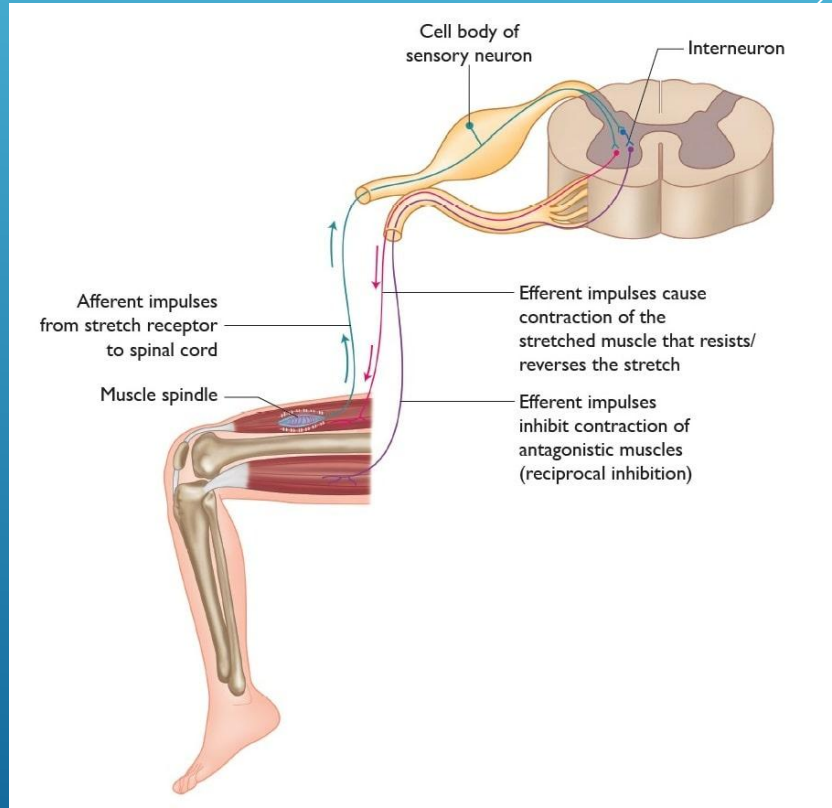
PATHOPHYSIOLOGY

- Loss of descending inhibition
- Disrupted balance excitatory and inhibitory supraspinal control
  - Hyperexcitable reflexes
- Unopposed medial cortico-reticulo-spinal tract excitability from unaffected CNS may cause "maladaptice neuroplasticity"
  - Interneurons
- Several cellular players involved.



https://ehealth.kcl.ac.uk/tel/muscle-spindle/01-muscle-spindle-basics.html

https://stretchcoach.com/articles/myotatic-stretch-reflex/?srsltid=AfmBOop0Oa8aRIYbnztsN1H5VNfkeWgQM8QvMzMEsWoqZgxy5TtbX_HX



https://speciality.medicaldialogues.in/ultrasound-a-better-tool-than-x-ray-for-diagnosing-long-bone-fracture-study

https://www.handsurgeryresource.net/spasticity-upper-extremity

POSSIBLE BAD OUTCOMES OF SPASTICITY NOT ADDRESSED

https://bestwoundpractice.com/trochanteric-pressure-sore-in-patient-with-advanced-ms/

Modified Ashworth scale

Grade	Description
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion (ROM) when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone passive, passive movement difficult
4	Affected part(s) rigid in flexion or extension

Instagram|@Physioscare|t.me/physioscare

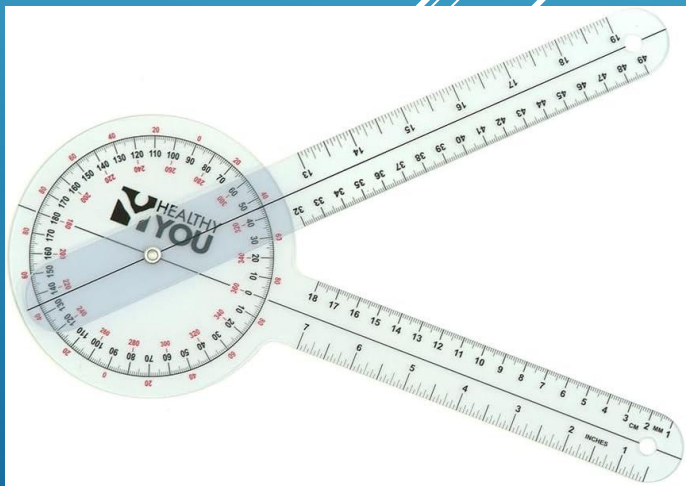
https://www.threads.com/@physioscare/post/DCRWNNAyYvl

Table 3
Tardieu scale

Velocities	
V1	As slow as possible, slower than the natural drop of the limb segment under gravity
V2	Speed of limb segment falling under gravity
V3	As fast as possible, faster than the rate of the natural drop of the limb segment under gravity
Scoring	
0	No resistance throughout the course of the passive movement
1	Slight resistance throughout the course of passive movement, no clear catch at a precise angle
2	Clear catch at a precise angle, interrupting the passive movement, followed by release
3	Fatigable clonus with less than 10 s when maintaining the pressure and appearing at the precise angle
4	Unfatigable clonus with more than 10 s when maintaining the pressure and appearing at a precise angle
5	Joint is immovable

https://www.semanticscholar.org/paper/Spasticity-management-in-multiple-sclerosis.-Hughes-Howard/b89d9ac856c0b950f62e9ed3c5ae3b5232abe295

MEASURING SPASTICITY



https://www.amazon.com/Healthy-You-Goniometer-360-Degree/dp/B07RHW1YVH

OK, SO WE HAVE THIS SPASTICITY THING, NOW WHAT?

INITIAL APPROACH

- Must have a valid diagnosis!
- In depth H&P with a focus on:
  - Current function and preserved neurologic
  - Care giver burden
  - Functional goals (are they in therapy?)
  - Pain, positioning and sleep
  - What's already been done
- **Remember, you are not "curing" spasticity, you are managing…so sometimes, you are just leaving it alone!!!**

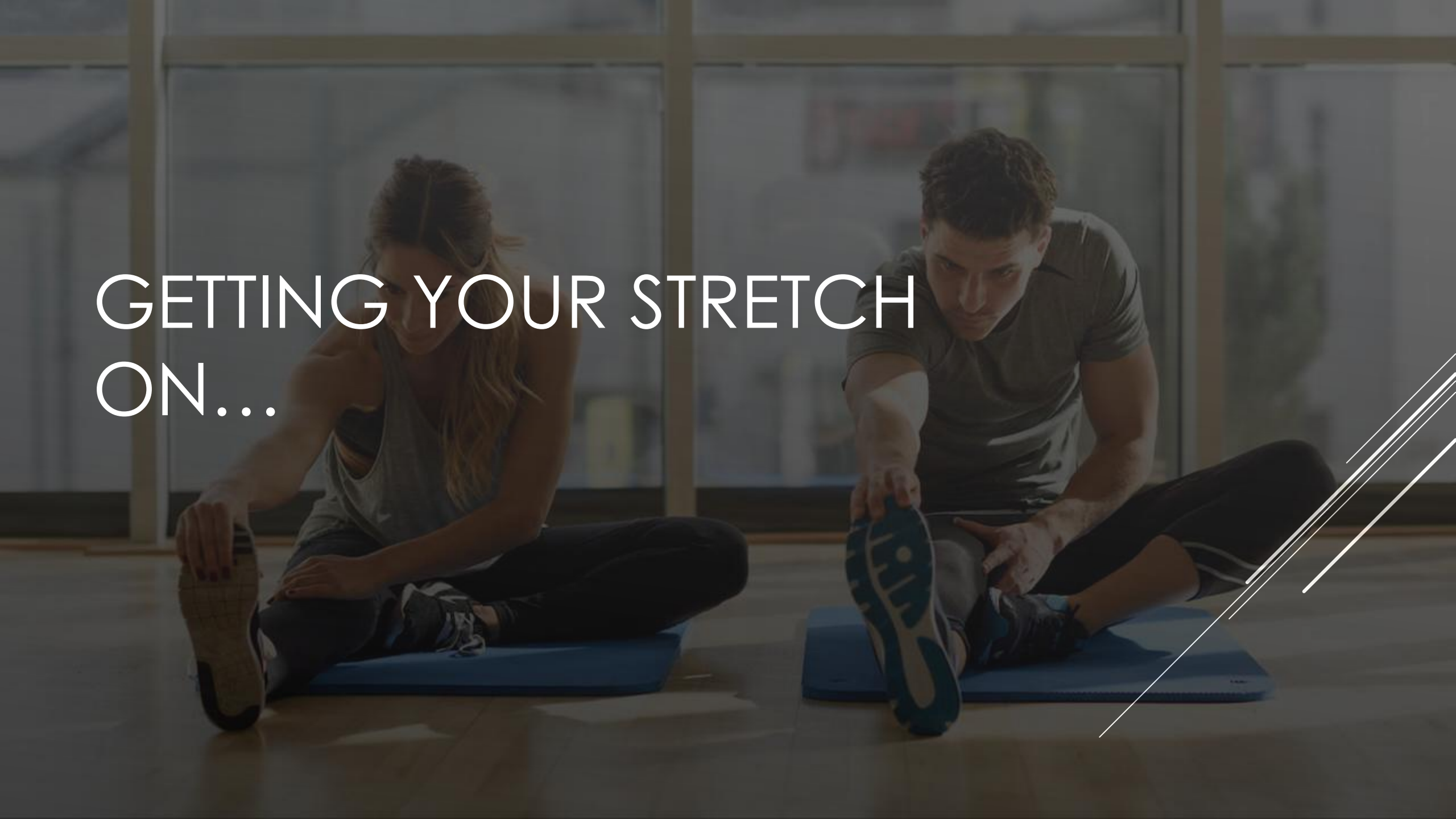
BRIEF ASIDE…

“HOLD ME”

STRETCHING AND BRACING

- First line treatment and adjuvant at all times
  - Cheap and available
  - Engages self management
- Optimize ROM
  - Includes finding position of ease and less stress on body
- Positioning!!!

GETTING YOUR STRETCH ON…



STRETCHING STUDIES

- Bovend'Eerdt et al. in 2008: stretching improved outcomes for persons with spasticity in 6 of 10 class 1 studies
- Odeen et al 1981: best effect stretching at least 1 minute up to 30 minutes
- Prescription specify intensity and degree of desired stretch, duration, repetitions and approach

ORTHOTICS

- Tis what you can use when the sun goes down

- Dynamic or static
- Can be protective – ie, offload heel when supine

https://dynasplint.com/product/wrist-forearm/

https://www.dme-direct.com/wheaton-pediatric-afo-ankle-foot-orthosis?srsltid=AfmBOooWu8ZBRTFSXgBjjTvTqAkeQ1qA191e2ax8M4HyiTlPX8x8GqiE

https://nimmed.com/multipodus-boot-size-l.html

ORTHOTIC STUDIES

- Literature on effectiveness of orthotics as isolated intervention for spasticity management limited
  - Some studies found no changes to bracing alone
  - Orthotics + chemodenervation shown more efficacy

“THRILL ME”

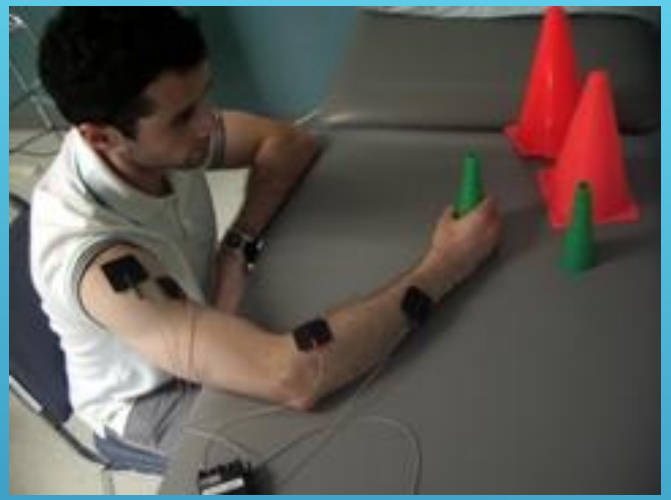

THUNDERSTRUCK

NEUROMUSCULAR ELECTRICAL STIMULATION VS. FUNCTIONAL ELECTRICAL STIMULATION

- NMES: Application of electrical impulses to cause muscle contraction
- FES: A type of NMES that uses electrical stimulation to assist with a specific, functional activity

A CLOSER LOOK…

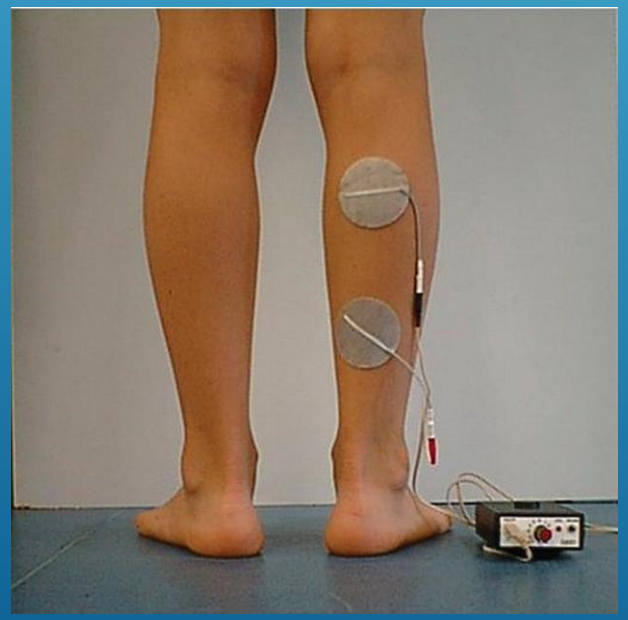
- Bekhet et al 2019 review on NMES/FES and spasticity in SCI
  - Reduced spasticity as measured by MAS 45-60%
  - Increased ROM
  - Some results last for > 24 hours (most 1-6 hours)
  - But – parameters of NMES/FES highly variable
  - SCI only in this study
    - Other studies done with CVA and TBI demonstrate efficacy



https://strokengine.ca/en/interventions/functional-electrical-stimulation-upper-extremity/

https://www.cambridge.org/core/books/abs/textbook-of-neural-repair-and-rehabilitation/functional-electrical-stimulation-in-neurorehabilitation/AAC2E2AD7E6B2E1892CF543F26D136E6

https://www.sportingwheelies.org.au/new-fes-functional-electrical-stimulation-cycle-has-arrived/



https://adc.bmj.com/content/97/4/364

PRACTICAL NMES/FES

Benefits

- Non-pharmacologic
- Efficacy
- Co-management of tone and adding functional tasks and gains

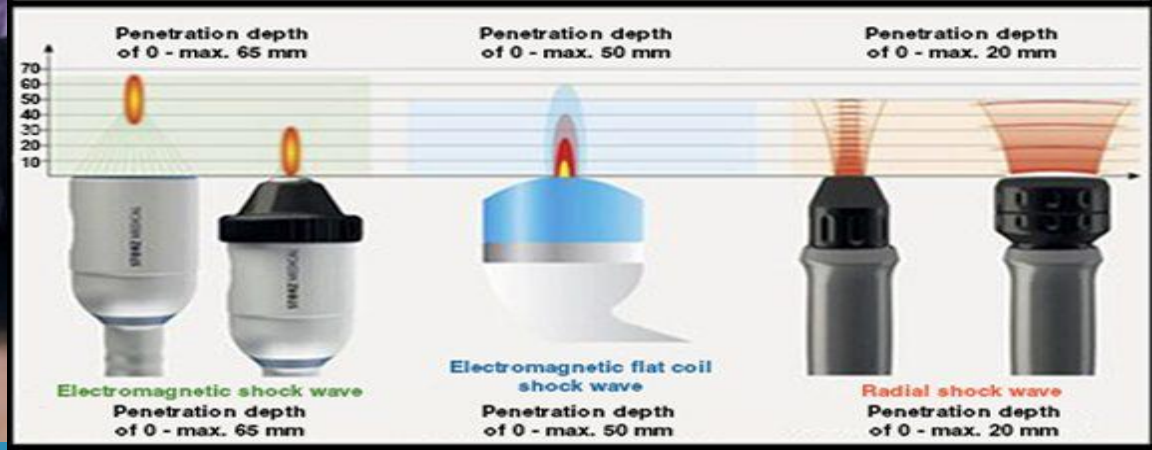
Drawbacks

- **Labor intensive to set up**
- Need skilled clinicians
- Depends on intact peripheral nerves
- Contraindicated in pregnancy, implanted cardiac device, malignancy

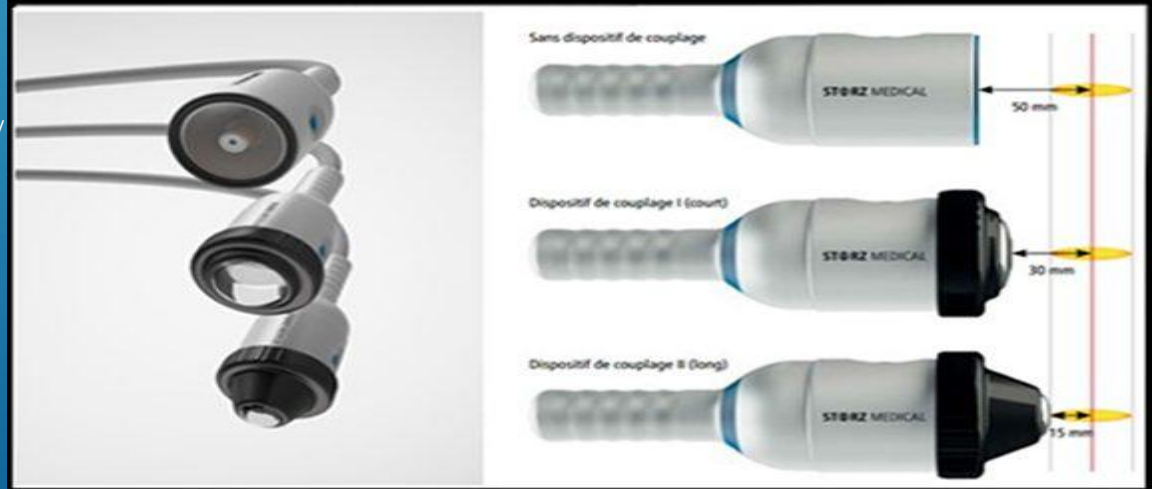
EXTRACORPOREAL SHOCK WAVE THERAPY

- Non-invasive intervention that uses high-energy sound waves to stimulate healing in musculoskeletal tissues
- Sequence of single sound pulses that create pressure disturbance with a high pressure peak and brief duration that spreads rapidly in 3 dimensions
  - Categorized as focused extracorporeal shock wave (fESW) or radial extracorporeal shock wave (rESW)

https://www.footandanklecentersofsj.com/blog/what-is-shockwave-therapy-and-how-does-it-work-on-foot-pain



https://nydnrehab.com/treatment-methods/shockwave/



FOCUSED VS. RADIAL ESWT

SO WHAT HAVE THE STUDIES SHOWN?

- ESWT used in CVA patients for pain, limb spasticity and plantar fasciitis
- Liu and Zhang in July 2025 completed Cochrane review:
  - ESWT improved spasticity, pain, motor function after CVA
  - Significant improvement ROM in LE
  - Treatment most effective with frequency less than 8 and pressure less than 2 bar
  - Released/radial ESWT associated with better outcomes
- Lee et al 2014 completed review in TBI
  - MAS improved immediately and 4 weeks after ESWT
  - Fewer patient and no clarity of type and protocols

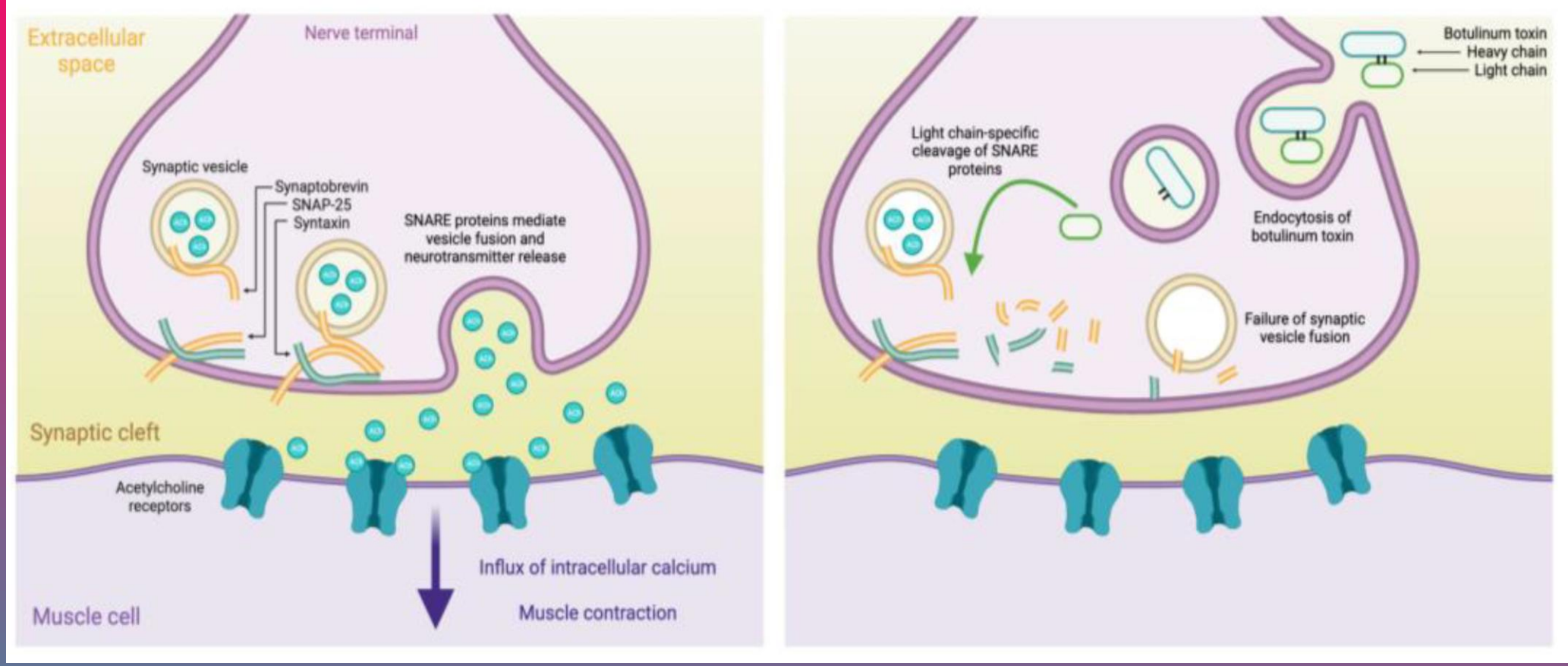
ADDITIONAL ESWT THOUGHTS…

- Side effects include pain, redness, swelling and bruising at treatment sites.
- Several review studies did not go into side effects in UMN patient population
  - In high cervical SCI, would there be a trigger for autonomic dysreflexia
- Application time lines (ie – immediately post injury vs. chronic) not clear at this time
- BUT, all the literature is very promising

“STICK ME”

https://dranmolchugh.com/botox-injection-price-vs-quality-what-matters-more/

BOTOX!!!!!!!!!!!!!!!!!



https://www.mdpi.com/2072-6651/16/2/96

MECHANISM OF ACTION BOTULINUM TOXIN

- Can use it first line in focal spasticity management
  - 3 months after injury general recommendation
- Each formulation with own dosing
- FOCALIZED TREATMENTS!!!!!!
- Studies have demonstrated improvements in MAS and pain
  - Have not shown direct improvement in function
- In conjunction with other interventions

BOTOX THE GAME CHANGER

ASPIRE

- 2 year multicenter, prospective, observational registry of patients receiving onabotulinumtoxinA (Botox) for lower limb spasticity
  - Ongoing results being published
  - Clinician and patient satisfaction and extreme satisfaction
- Recent data ASPIRE published April PM&R 2026 by Wissel et al.
  - Pain reduction from baseline was observed across all treatments and persisted
    - Majority patients reviewed spasticity post stroke

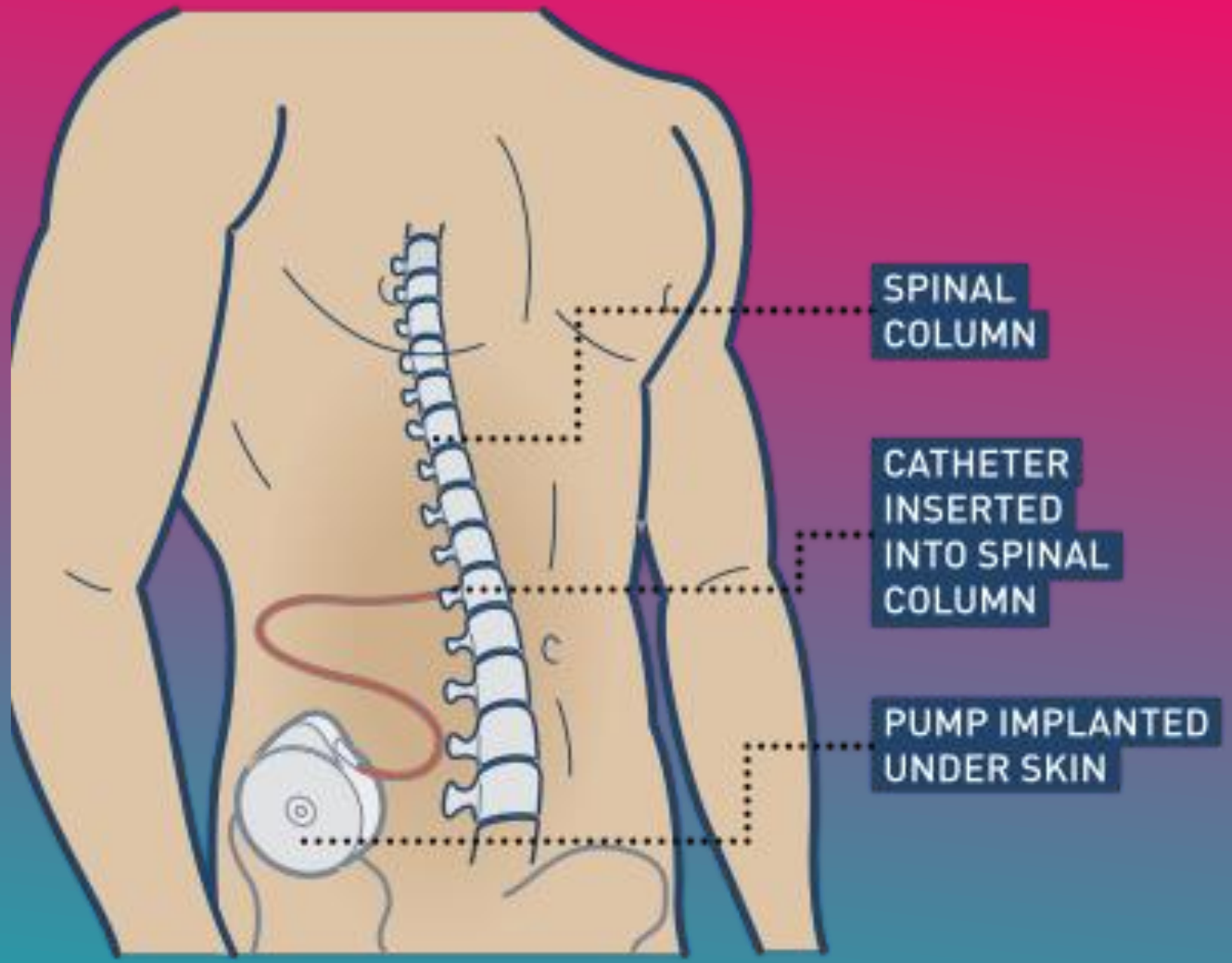
MORE ON BOTULINUM…

- Effects are not permanent, last usually 3 months
- Most common side effects are injection site pain, myalgia, weakness, erythema.
  - Systemic toxicity case reports rare, early usage of botulinum
  - Need to remind folks – will make you "weaker"
- May lose efficacy over time
- Strongly recommend therapies in conjunction with new botulium toxin interventions
  - This helps with the functional gains!

- Intrathecal baclofen pump therapy
  - Bypass systemic delivery via oral dosing to limit side effects and optimize efficiacy
  - Effective for **chronic** spasticity of SCI, MS, BI, CP, CVA
  - Generally considered a later/last resort
  - Complete a baclofen pump trial

PUMP IT!!!!

amazon.com/Reebok-Mens-Pump-Omni-Sneaker/dp/B0BK34N76M



PUMP SET UP

https://spinalcordinjuryzone.com/news/53871/baclofen-pumps-are-safe-effective-and-highly-satisfactory-to-patients-19-year-study-reports

HOW DO THE PUMPS DO?

- Effective for global and regional spasticity management in adults and children
- More effective than oral baclofen in reducing spasm frequency
- Used in conjunction with several other interventions***
- Risk of pump infection, pump failure
- PATIENTS MUST BE RELIABLE!!!!

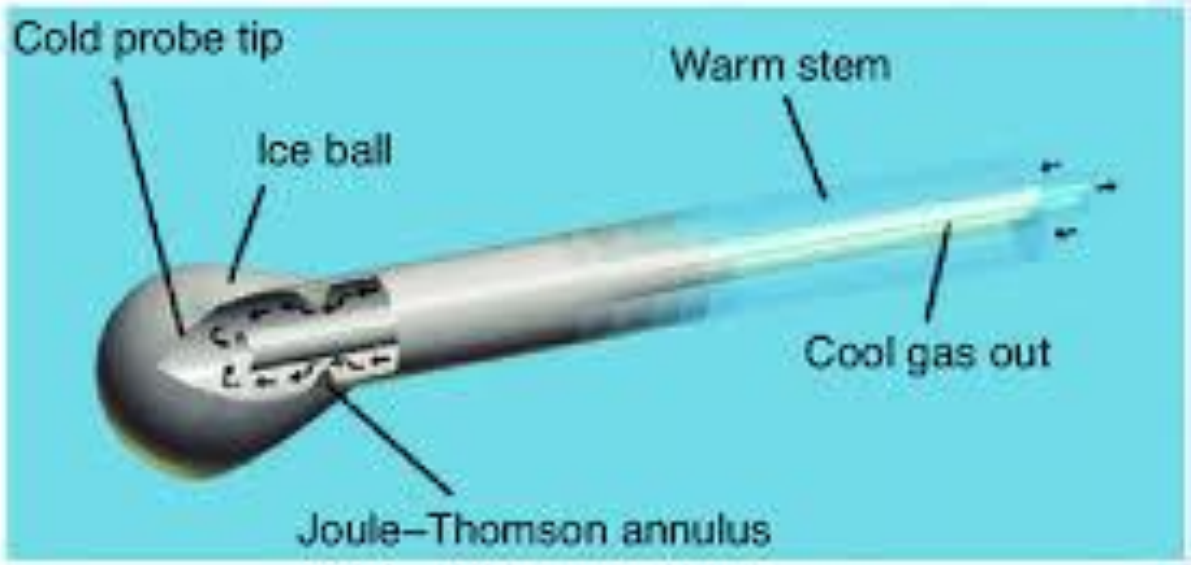
- Phenol 3-6% or ethyl alcohol 40-50% are the injectable OG's (since 1960s)
- Generally applied to motor nerves/branches to minimize sensory nerve denaturation and painful dysesthesias
  - Musculocutaneous nerve, obturator nerve, motor branch sciatic nerve to medial hamstring, radial nerve to brachioradialis
- Use Estim guidance to localize motor nerve
- Most frequently used in patients with CP
- Requires highly trained practitioner, often under sedation

LET'S TAKE A MOMENT FOR ALCOHOL…

“CHILL ME”

WHAT IS CRYONEUROLYSIS

- Use of cold temperatures to cause reversable, second degree nerve injury that can treat nerve pain
- Recently trialed for spasticity
  - Ultrasound guided cryoprobe needle inserted to nerve, nerve stimulated via probe tip
  - Probe cools rapidly to -60 C or -88 C depending on cryogen boiling point, ice ball forms
  - Get Wallerian degeneration while keeping epineurium and perineurium intact
    - Allows for length dependent axonal regeneration

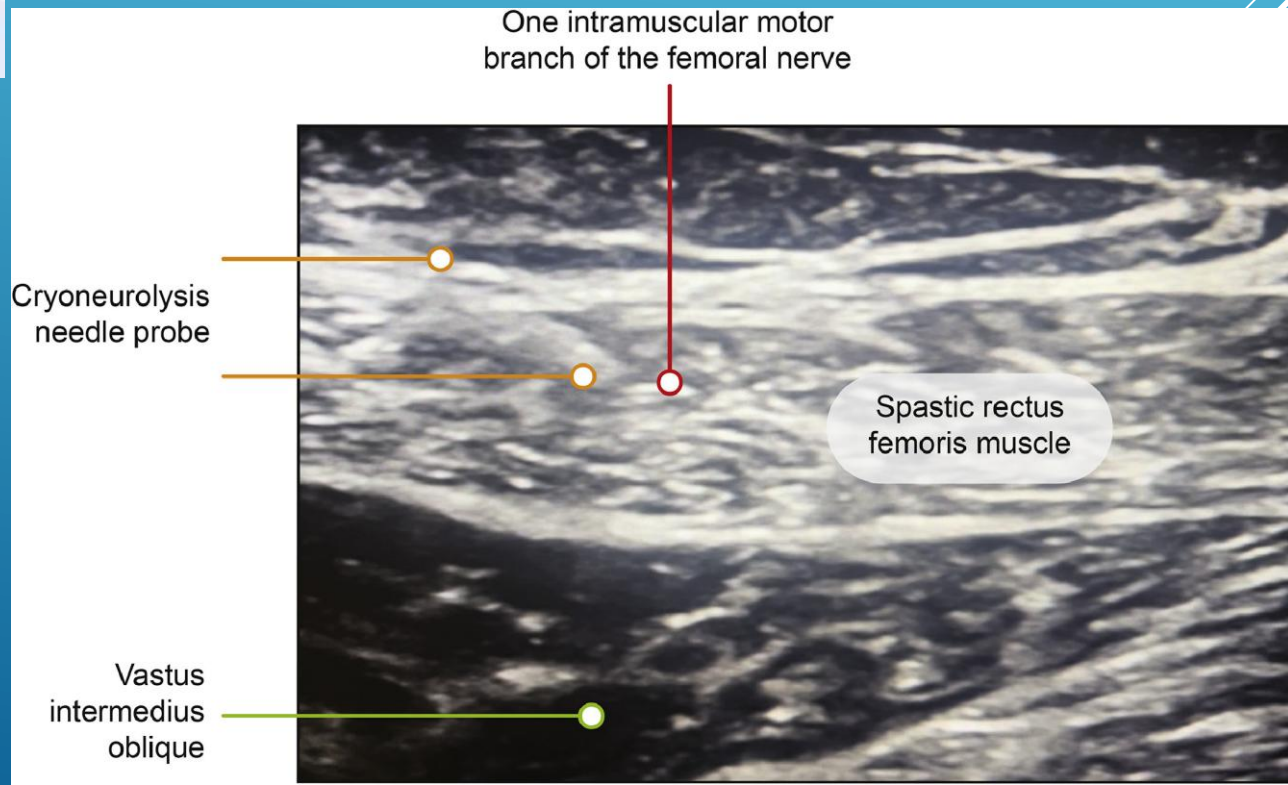


https://www.researchgate.net/figure/A-modern-cryoneurolysis-probe-cannula-produces-extremely-cold-temperatures-at-its-tip_fig1_320622193

CRYONEUROLYSIS

- Probe goes to neuromuscular junction
- Ultrasound guided

https://www.archives-rrct.org/article/S2590-1095%2825%2900001-1/fulltext



WHAT THE STUDIES HAVE SHOWN

- Looking at cryoneurolysis for refractory or plateaued upper limb spasticity
- Hashemi et al (Paul Winston's group) trialed cryoneurolysis in 59 adults with UE spasticity
  - Significant change baseline maximal PROM, AROM, MAS shoulder flexion, abduction, elbow extension
  - MAS improvement wrist extension, MAS and max PROM external rotation shoulder
  - Improved pain, satisfaction, upper limb disability

CRYONEUROLYSIS PARTING THOUGHTS

- Still very novel with studies being completed currently
- Need highly trained individual to perform
- Protocols and specific muscle to address need to be confirmed
- But…promising start

CASE STUDY 1

CASE 1

- 37 yo female s/p CA with ROSC after 40 minutes with cardiogenic shock. Subsequent anoxic BI
  - Spastic quadriparesis with equinovaries deformities bilateral legs
    - Also elements of rigidity
  - Cortical blindness
  - Severe anxiety with behavioral impairments
- Referred after rehab and home with 24/7 assist

CASE 1

- Painful spasms with anxiety with any movement
- Could initiate movement R shoulder, hip and knee but limited
- Communication intact, cognition appropriate but somewhat sedated. Very, very, very, VERY anxious

- High dose baclofen, tizanidine, Sinemet, gabapentin, propranolol, Depakote, Seroquel, trazodone
- Failed cryoneurolysis for legs, has WC and some night splints for arms she doesn't tolerate
- …so now what…???

CASE 1

- A lot of medication weans/adjustments
- Dynamic splinting and stretching (sorta…) once pain & anxiety better controlled
- Botox for UE
- Referral to multispecialty clinic with evaluation for baclofen pump and surgical release for ankles

- Result: less pain, better sleep, less caregiver burden. Pending pump and surgical evaluations – other medical issues ongoing

QUESTIONS?

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