

# WELCOME!

We will start in a few minutes...



## WSA WEBINAR

Advancing the  
Management of Spasticity

February 22nd, 2024 | 2:00 PM CET

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**CHAIR**

PROF. DR. GUSTAVO SAPOSNIK



**MODERATOR**

DR. SHAMALA THILARAJAH



**SPEAKER**  
DR. KWAH LI KHIM



**SPEAKER**  
DR. DENIZ DISHMAN



**SPEAKER**  
EMILY STEVENS (OT)



World Stroke  
Academy

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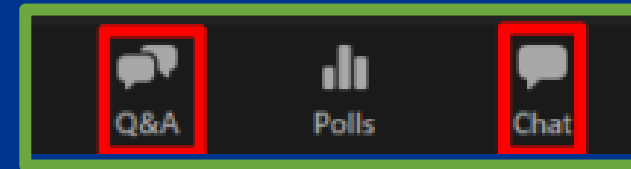
**SPEAKER**

EMILY STEVENS (OT)

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# TODAY'S CHAIR & MODERATOR

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**PROF. DR. GUSTAVO SAPOSNIK**



**DR. SHAMALA THILARAJAH**

## UP NEXT

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# Spasticity After stroke: Treatment intensification among patients with unmet needs

Emily Stevens, MOT, OTR, CSRS

Occupational Therapist

Certified Stroke Rehabilitation Specialist

Stroke Recovery Research

UTHealth Houston - Institute for Stroke and Cerebrovascular Disease



# POLLS

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# Spasticity After Stroke:



## *Treatment Intensification Among Patients With Unmet Needs*

***Emily Stevens, MOT, OTR, CSRS***

Occupational Therapist

Certified Stroke Rehabilitation Specialist

Stroke Recovery Research



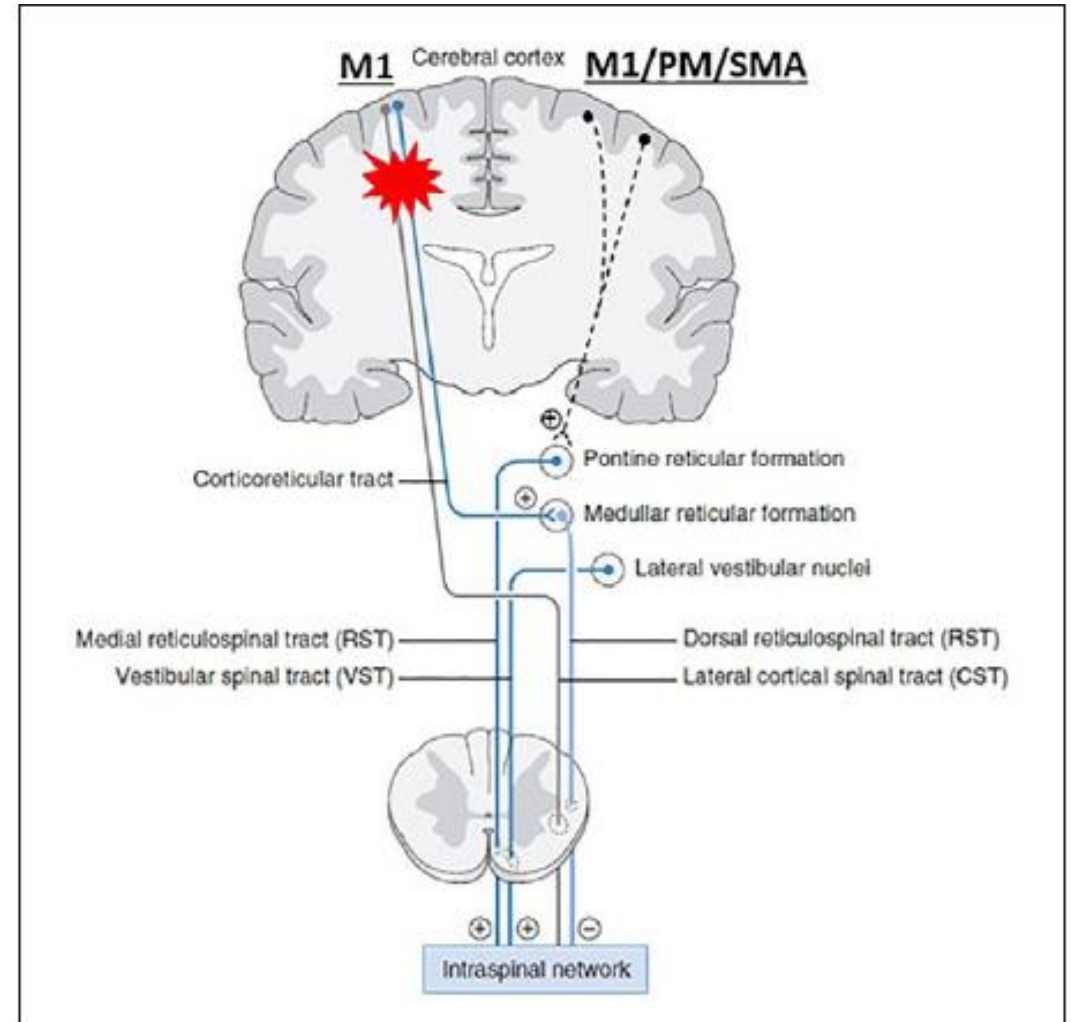
# Learning Objectives

1. Explore ***innovative approaches to intensify the treatment of spasticity*** after stroke, focusing on patients with unmet needs and evolving clinical paradigms.
2. Gain insights into ***adapting spasticity management for special populations***, including the elderly and individuals with limited access to healthcare resources, considering factors like frailty and unique challenges.
3. Recognize the importance of ***multidisciplinary collaboration*** in optimizing spasticity management and learn how different healthcare professionals can contribute to improved patient outcomes.



# Post-Stroke Spasticity: Defined

- Involuntary muscle activity in central paresis
- Affected by slow or rapid passive joint movement or sensory stimulation<sup>1</sup>
- Present in 25% of stroke survivors<sup>2</sup>
  - 39.5% of stroke survivors with paresis
    - Almost 10% of which developed severe or disabling spasticity



# Why focus on spasticity?<sup>1, 2</sup>

- Functional impact
  - Ambulation
  - ADLs
- Hygiene
- Pain
- Musculoskeletal issues (*more pain*)
  - Posture
  - Tendon/muscle/ligament length
- Nerve entrapment (*even more pain*)

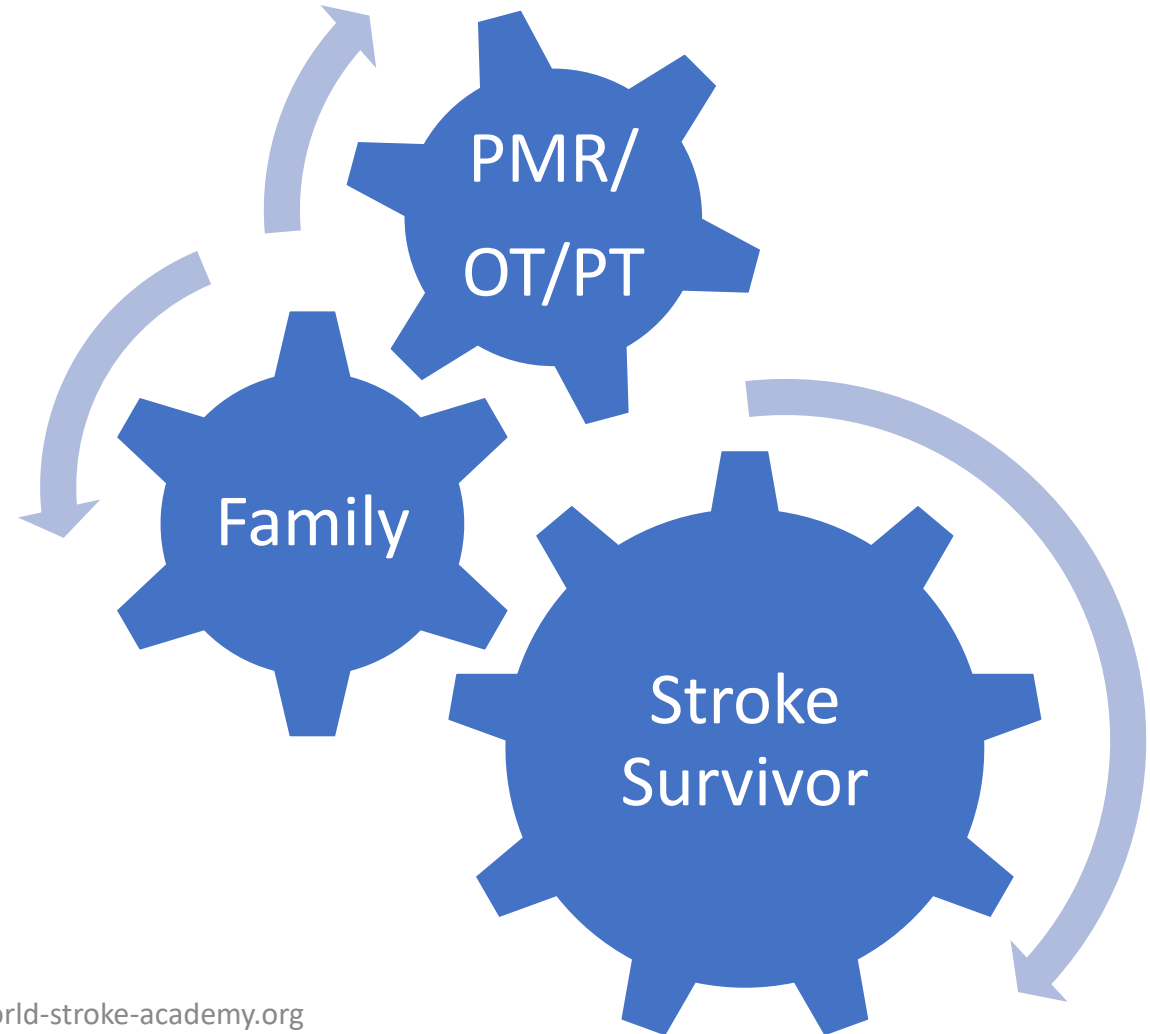


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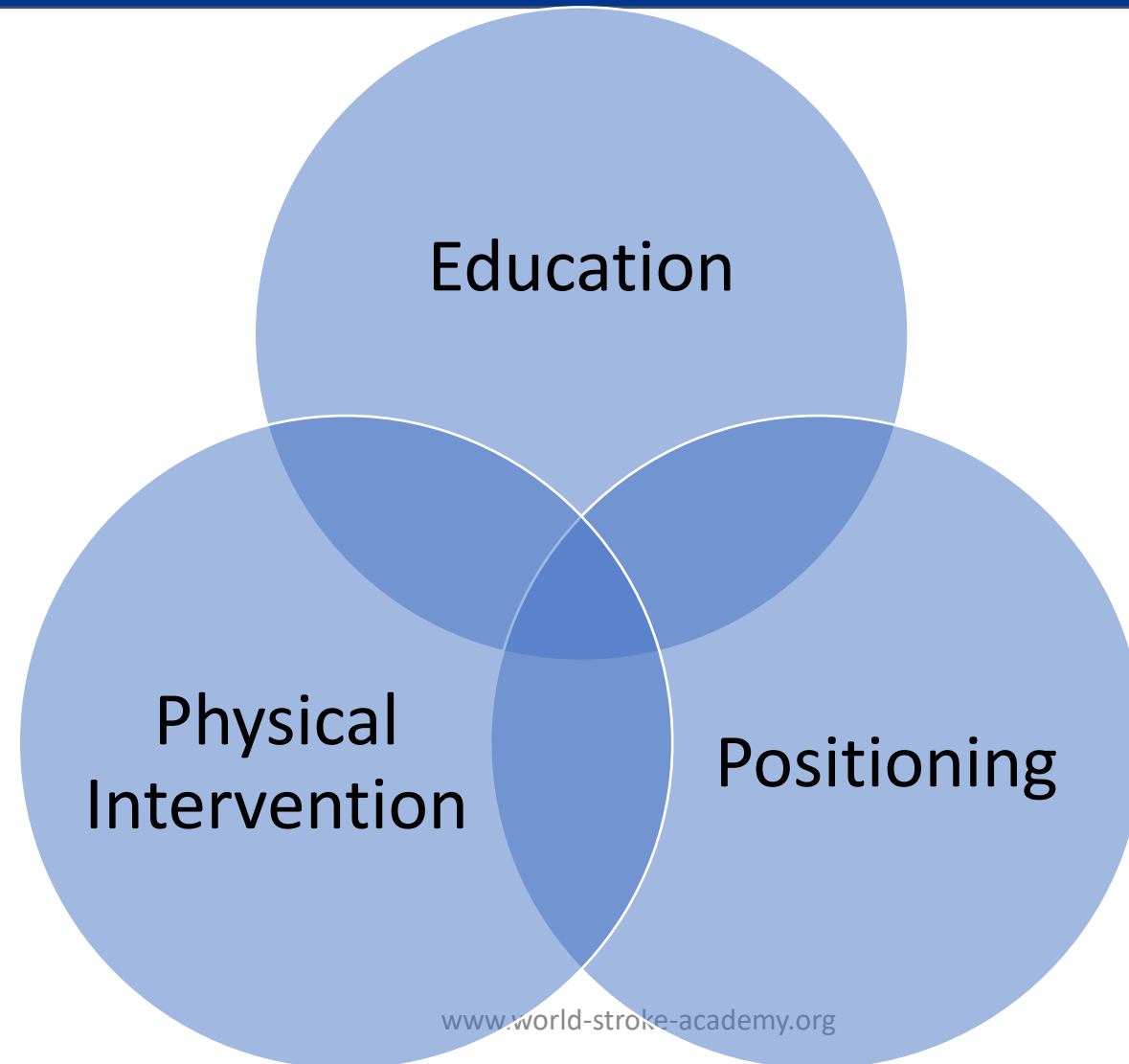


# How do we address spasticity?

**As a multidisciplinary team**



# Rehabilitation Interventions



# Rehabilitation Interventions

Education for self-management <sup>3</sup>	Physical Intervention <sup>3-7</sup>	Positioning <sup>3, 6-7</sup>
<ul style="list-style-type: none"><li>• Exercises</li><li>• Stretches</li><li>• Positioning devices</li><li>• Identifying triggers</li></ul>	<ul style="list-style-type: none"><li>• Active/passive movement</li><li>• Weight bearing (altering sensory input)</li><li>• Strengthening (paired with chemodenervation and electrical stimulation)</li><li>• Prolonged stretch (paired with positioning)</li><li>• Aquatic Therapy</li></ul>	<ul style="list-style-type: none"><li>• Daytime</li><li>• Nighttime</li><li>• Serial casting</li></ul>

# Patients with Unmet Needs

- Stroke survivors in chronic stages need intervention too
  - Refer for outpatient or home-health OT/PT
- Consider in-home or community-based interventions
  - Extension of therapists: personal trainers, community health workers
- Educate, educate, educate
- Think outside the box!



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# References

1. Dressler D, Bhidayasiri R, Bohlega S, Chana P, Chien HF, Chung TM, et al. Defining spasticity: a new approach considering current movement disorders terminology and botulinumtoxin therapy. *J Neurol.* (2018) 265:856–62. doi: 10.1007/s00415-018-8759-1
2. Zeng, H, Chen, J, Guo, Y, Tan, S. Prevalence and risk factors for spasticity after stroke: A systematic review and meta-analysis. *Front. Neurol.* (2021) 11:616097. doi: 10.3389/fneur.2020.616097
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6. Hardy, K., Suever, K., Sprague, A., Hermann, V., Levine, P., Page, S. J. Combined bracing, electrical stimulation, and functional practice for chronic, upper-extremity spasticity. *American Journal of Occupational Therapy.* (2010). 64, 720–726. <https://doi.org/10.5014/ajot.2010.08137>
7. Blanchette AK, Demers M, Woo K, et al. Current Practices of Physical and Occupational Therapists Regarding Spasticity Assessment and Treatment. *Physiother Can.* (2017) 69(4):303-312. <https://doi.org/10.3138/ptc.2016-54>

# Contact



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# POLLS



## UP NEXT

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Management of spasticity in special populations:  
elderly, limited access, frailty

A/Prof Kwah Li Khim (Khim)

Associate Professor and Director of Programmes

Health and Social Sciences

SIT - Singapore Institute of Technology

# Management of spasticity in special populations: elderly, limited access, frailty

**A/Prof Kwah Li Khim (Khim)**

 Singapore Institute of Technology

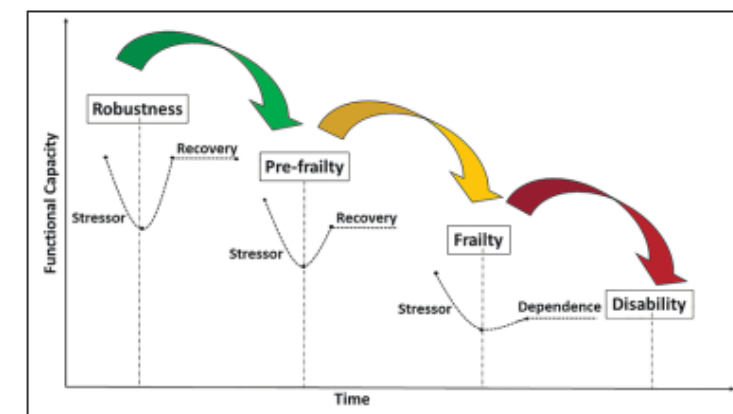
 [likhim.kwah@singaporetech.edu.sg](mailto:likhim.kwah@singaporetech.edu.sg)

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# Introduction

- Management of spasticity covered in Webinar 1: <https://world-stroke-academy.org/webinars/effective-management-of-post-stroke-spasticity/>

- How does management differ in special populations?
- Special populations
  - : elderly who are frail,
  - : living in nursing homes, or
  - : have limited access to treatments





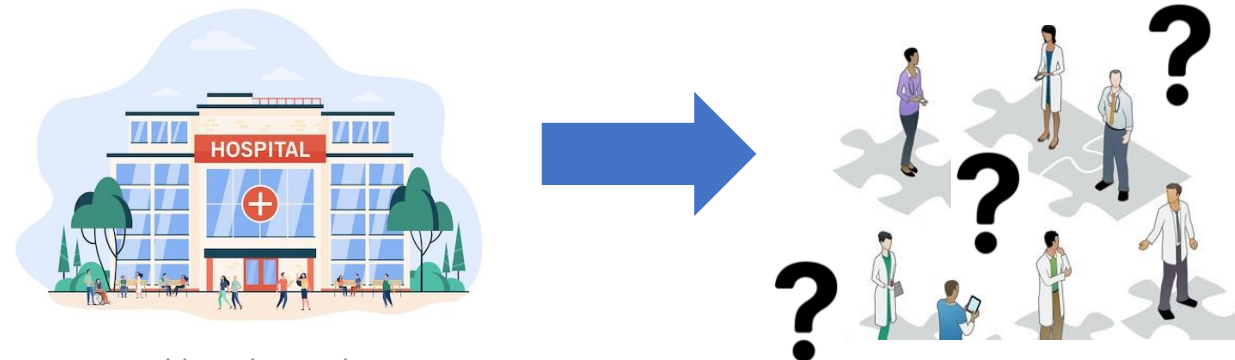
# Learning Objectives

At the end of the lecture, you would be able to

- outline issues with spasticity management in special populations
- recognise scenarios where spasticity management is warranted in special populations
- summarise spasticity management strategies in special populations

# Issues with spasticity management in special populations

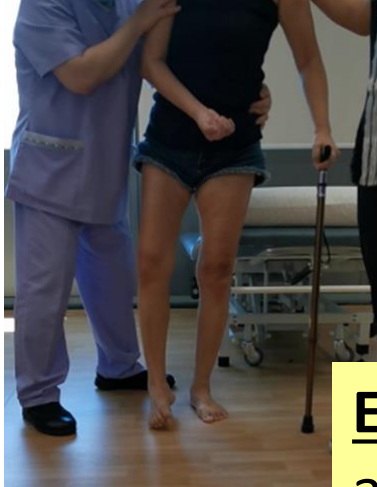
- There is some certainty about **WHAT** to do with spasticity, but less certainty about **WHO** and **WHERE** once stroke survivor leaves the hospital
- **WHAT:** Botulinum Toxin A, Rehabilitation therapy, Adjunct therapies
- **WHO:** Who will screen and refer in the community? Who to refer to?
- **WHERE:** Where will care be provided? Should we develop primary care services (in community), or improve access to specialist services (in hospitals)?



Lim et al (2020) *BMC Fam Practice* 21: 66.

# Scenarios where spasticity management is warranted in special populations

- Is spasticity causing difficulties in activities (e.g., standing, walking)?
- Is spasticity causing pain or discomfort (e.g., cosmesis reasons)?
- Is spasticity causing increase in caregiver burden (e.g., showering, dressing)?



Source: Painalgia Relief Center Orlando

Source: Singapore General Hospital Spasticity Team

Lim et al. *BMC Family Practice* (2020) 21:66  
<https://doi.org/10.1186/s12875-020-01139-4>

BMC Family Practice

RESEARCH ARTICLE

Open Access

When is referral from primary care to specialist services appropriate for survivors of stroke? A modified RAND-appropriateness consensus study

Lisa Lim<sup>1\*</sup>, Jonathan Mant<sup>1</sup>, Ricky Mullis<sup>1</sup> and Martin Roland<sup>2</sup>



**Expert consensus:** Spasticity is a **specialized problem** post-stroke and preference is referral to a **specialist stroke service/spasticity clinic** if the patient is affected by the symptoms.

# Guidelines reference for Stroke and Frailty





Guidelines



## A systematic review and synthesis of global stroke guidelines on behalf of the World Stroke Organization

Gillian E Mead<sup>1</sup> , Luciano A Sposato<sup>2,3,4,5</sup>, Gisele Sampaio Silva<sup>6,7</sup>, Laetitia Yperzeele<sup>8,9</sup> , Simiao Wu<sup>10</sup> , Mansur Kutlubaev<sup>11</sup>, Joshua Cheyne<sup>12</sup>, Kolawole Wahab<sup>13</sup>, Victor C Urrutia<sup>14</sup> , Vijay K Sharma<sup>15,16</sup>, PN Sylaja<sup>17</sup> , Kelvin Hill<sup>18</sup>, Thorsten Steiner<sup>19</sup> , David S Liebeskind<sup>20</sup> and Alejandro A Rabinstein<sup>21</sup> 

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DOI: 10.1177/17474930231156753  
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*J Nutr Health Aging*. 2021;25(3):382-391

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## A SYSTEMATIC REVIEW OF CLINICAL PRACTICE GUIDELINES FOR IDENTIFICATION AND MANAGEMENT OF FRAILTY

P. MEHTA<sup>1</sup>, G. LEMON<sup>2</sup>, L. HIGHT<sup>2</sup>, A. ALLAN<sup>2</sup>, C. LI<sup>2</sup>, S.K. PANDHER<sup>2</sup>, J. BRENNAN<sup>2</sup>, A. ARUMUGAM<sup>3,4,5</sup>, X. WALKER<sup>6</sup>, D.L. WATERS<sup>2,6</sup>

1. University of Technology Sydney, Graduate School of Health, Discipline of Physiotherapy, Sydney, Australia; 2. School of Physiotherapy, Centre for Health Activity and Rehabilitation Research, University of Otago, Dunedin, New Zealand; 3. Department of Physiotherapy, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates; 4. Adjunct Faculty, Department of Physiotherapy, Manipal College of Health Professions, Manipal Academy of Higher Education, Manipal, Karnataka, India; 5. Adjunct Faculty, Department of Physiotherapy, Binawan University, Indonesia; 6. University of Otago, Otago Medical School, Department of Medicine, Dunedin, New Zealand. Corresponding author: Professor Debra L. Waters PhD, Director of Gerontology Research, University of Otago, School of Physiotherapy and Department of Medicine, PO Box 56, Dunedin, New Zealand 9054. Email: debra.waters@otago.ac.nz, Phone: 0064 03 479 7222

Open Access

Research

## BMJ Open Systematic review of clinical practice guidelines to identify recommendations for rehabilitation after stroke and other acquired brain injuries

Laura Jolliffe,<sup>1</sup> Natasha A Lannin,<sup>1,2,3</sup> Dominique A Cadilhac,<sup>4,5</sup> Tammy Hoffmann<sup>6</sup>

Mead et al (2023) *Int J Stroke* 18(5): 499-531.

Jolliffe et al (2018) *BMJ Open* 8: e018791.

Mehta et al (2021) *J Nutr Health Aging* 25(3): 382-391.

**SR of guidelines used AGREE-II to appraise and identify high quality clinical practice guidelines. They include**

- [Stroke] WSO Guidelines
- [Stroke] SF Guidelines (Australia)
- [Frailty] ICFSR Guidelines

# Guideline recommendations on Spasticity post-stroke

[Guideline] Recommendations	Rating
<p>[World Stroke Organization]</p> <p>Chemo-denervation using botulinum toxin can be used to increase range of motion and decrease pain for patients with focal symptomatically distressing spasticity (upper and lower limbs)</p>	Advanced system
<p>[Stroke Foundation, Australia]</p> <ul style="list-style-type: none"> <li>• For stroke survivors with <b>upper</b> limb spasticity, Botulinum Toxin A in addition to rehabilitation therapy may be used to reduce spasticity, but is unlikely to improve activity or motor function.</li> <li>• For stroke survivors with <b>lower</b> limb spasticity, Botulinum Toxin A in addition to rehabilitation therapy may be used to reduce spasticity but is unlikely to improve motor function or walking.</li> <li>• For stroke survivors with spasticity, adjunct therapies to Botulinum Toxin A, such as electrical stimulation, casting and taping, may be used.</li> </ul>	Weak For
<p>[Stroke Foundation, Australia]</p> <ul style="list-style-type: none"> <li>• For stroke survivors with spasticity, acupuncture should <u>not</u> be used for treatment of spasticity in routine practice other than as part of a research study. (Lim et al 2015 [54])</li> <li>• For stroke survivors, the routine use of stretch to reduce spasticity is <u>not</u> recommended.</li> </ul>	Weak Against

Mead et al (2023) *Int J Stroke* 18(5): 499-531

Stroke Foundation (2024) <https://informme.org.au/guidelines/living-clinical-guidelines-for-stroke-management>



# Guideline recommendations on Frailty

Recommendation	Grade	Certainty of Evidence		
<i>Frailty Screening</i>				
★ 1 All adults aged 65 years and over should be offered screening for frailty using a validated rapid frailty instrument suitable to the specific setting or context	Strong	Low		
<i>Frailty Assessment</i>				
★ 2 Clinical assessment of frailty should be performed for all older adults screening as positive for frailty or pre-frailty	Strong	Low		
<i>Development of a Comprehensive Management Plan</i>				
★ 3 A comprehensive care plan for frailty should systematically address polypharmacy, the management of sarcopenia, treatable causes of weight loss, and the causes of fatigue (depression, anaemia, hypotension, hypothyroidism, and vitamin B12 deficiency)	Strong	Very Low		
4 Where appropriate, persons with advanced (severe) frailty should be referred to a geriatrician	CBR	No data†		
<i>Physical Activity/Exercise</i>				
★ 5 Older people with frailty should be offered a multi-component physical activity programme (or those with pre-frailty as a preventative component)	Strong	Moderate		
★ 6 Health practitioners are strongly encouraged to refer older people with frailty to physical activity programmes with a progressive, resistance-training component	Strong	Moderate		
<i>Nutrition and Oral Health</i>				
7 Protein/caloric supplementation can be considered for persons with frailty when weight loss or undernutrition has been diagnosed	Conditional	Very Low		
8 Health practitioners may offer nutritional/protein supplementation paired with physical activity prescription	Conditional	Low		
9 Advise older adults with frailty about the importance of oral health	CBR	No data†		
<i>Pharmacological Intervention</i>				
10 Pharmacological treatment as presently available is not recommended therapy for the treatment of frailty	CBR	Very Low		
<i>Additional Therapies and Treatments</i>				
11 Vitamin D supplementation is not recommended for the treatment of frailty unless vitamin D deficiency is present	CBR	Very low		
12 Cognitive or problem-solving therapy is not systematically recommended for the treatment of frailty	CBR	Very low		
13 Hormone therapy is not recommended for the treatment of frailty	CBR	Very low		
★ 14 All persons with frailty may be offered social support as needed to address unmet needs and encourage adherence to the Comprehensive Management Plan	Strong	Very low		
15 Persons with frailty can be referred to home-based training	Conditional	Low		

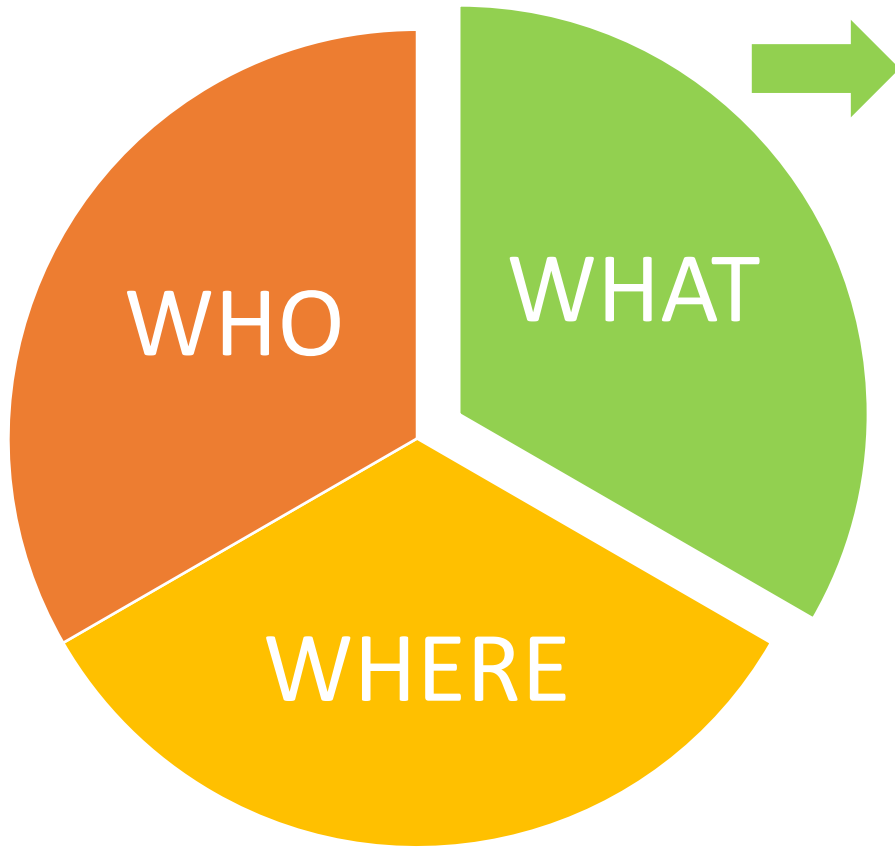
Screen with validated rapid frailty instrument

Assess with clinical assessment

Treat with comprehensive management plan (multi-component, including social support)



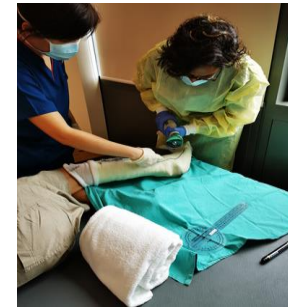
# Spasticity management strategies in special populations



- ✓ Botulinum Toxin A
- ✓ Rehabilitation therapy
- ✓ Adjunct therapies (e.g., electrical stimulation, casting and taping) +
- ✓ Comprehensive frailty management plan (\*targeting sarcopenia, exhaustion, polypharmacy and other conditions)



Source: Lim et al (2006)  
Parkinsonism and Related Disorders  
12: 43-47 (for spastic toe clawing)



Source: Singapore General Hospital Spasticity Team

Stroke Foundation (2024) <https://informme.org.au/guidelines/living-clinical-guidelines-for-stroke-management>

Dent et al (2019) *J Nutr Health Aging* 23(9): 771-787

# Spasticity management strategies in special populations

- ✓ Checklists (e.g., Post-Stroke Checklist, Clinical Frailty Scale)
  - ✓ Connector (e.g., community care staff, family, peers)
  - ✓ Connecting system (e.g., map of local services and how to access, communication and/or referral pathways)
- ? Develop primary care services

This Post-Stroke Checklist (PSC) has been developed to help healthcare professionals identify post-stroke problems amenable to treatment and/or referral. The PSC is a brief and easy-to-use, internet-based tool for completion with the patient and the help of a caregiver, if necessary. PSC administration provides a standardized approach for the identification of long-term problems in stroke survivors and facilitates appropriate referral for treatment.

4. SPASTICITY					
Since your stroke or last assessment, do you have <b>increasing</b> stiffness in your arms, hands, and/or legs?	<table border="1"> <tr> <td><input type="checkbox"/> NO</td> <td>Observe Progress</td> </tr> <tr> <td><input type="checkbox"/> YES</td> <td>Is this interfering with activities of daily living? <span style="float: right;">If YES, refer to a physician with an interest in post-stroke spasticity for further assessment and diagnosis</span></td> </tr> </table>	<input type="checkbox"/> NO	Observe Progress	<input type="checkbox"/> YES	Is this interfering with activities of daily living? <span style="float: right;">If YES, refer to a physician with an interest in post-stroke spasticity for further assessment and diagnosis</span>
<input type="checkbox"/> NO	Observe Progress				
<input type="checkbox"/> YES	Is this interfering with activities of daily living? <span style="float: right;">If YES, refer to a physician with an interest in post-stroke spasticity for further assessment and diagnosis</span>				

### CLINICAL FRAILTY SCALE

<b>1</b>	<b>VERY FIT</b>	People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.
<b>2</b>	<b>FIT</b>	People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g., seasonally.
<b>3</b>	<b>MANAGING WELL</b>	People whose medical problems are well controlled, even if occasionally symptomatic, but often are not regularly active beyond routine walking.
<b>4</b>	<b>LIVING WITH MILD TO VERY MILD FRAILTY</b>	Previously "vulnerable," this category marks early transition from complete independence. While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "blowed up" and/or being tired during the day.
<b>5</b>	<b>LIVING WITH MILD TO MODERATE FRAILTY</b>	People who often have more evident slowing, and need help with high order instrumental activities of daily living (finances, transportation, heavy housework). Typically, mild frailty progressively requires shopping and walking outside alone, meal preparation, medications and begins to restrict night housework.

<b>6</b>	<b>LIVING WITH MODERATE FRAILTY</b>	People who need help with all outside activities and with keeping house inside. They often have problems with stairs and need help with bathing and might need minimal assistance (using, standing) with dressing.
<b>7</b>	<b>LIVING WITH SEVERE FRAILTY</b>	Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within 6 months).
<b>8</b>	<b>LIVING WITH VERY SEVERE FRAILTY</b>	Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness.
<b>9</b>	<b>TERMINALLY ILL</b>	Approaching the end of life. This category applies to people with a life expectancy of months, who are not otherwise living with severe frailty. (Many terminally ill people can still exercise until very close to death.)

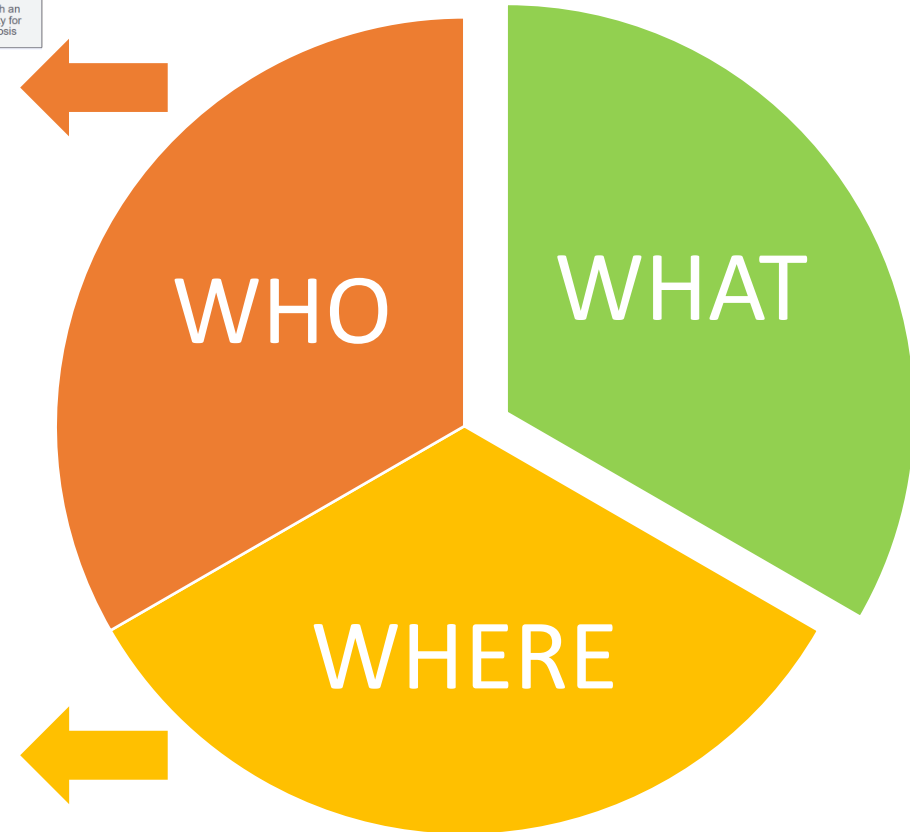
### SCORING FRAILTY IN PEOPLE WITH DEMENTIA

The degree of frailty generally corresponds to the degree of dementia. Common symptoms in mild dementia include forgetting the details of a recent event, though still remembering the event itself; repeating the same question/story and social withdrawal.

In moderate dementia, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In severe dementia, they cannot do personal care without help.

In very severe dementia they are often bedfast. Many are virtually mute.



Philp et al (2013) *J Stroke Cerebrovasc Dis* 22(7):e173–e80 (WSO adapted: <https://www.world-stroke.org/assets/downloads/psc-uk-version-wso-livery-03-20-13.pdf>)

Turner et al (2019) *BMC Fam Prac* 20(1): 2

# Spasticity management strategies in special populations

- ✓ Checklists (e.g., Post-Stroke Checklist, Clinical Frailty Scale)
  - ✓ Connector (e.g., community care staff, family, peers)
  - ✓ Connecting system (e.g., map of local services and how to access, communication and/or referral pathways)
- ? Develop primary care services


## When to call SORT

- New onset spasticity.
- Spasticity that worsens rapidly without any triggers.
- Fail to tolerate or respond to oral anti-spasticity medications.
- Posture, mobility, and care affected.
- Spasticity associated with considerable pain and discomfort.

\*There is no fixed criteria as we would like to encourage early screening. Pls do call even if you have questions regarding spasticity.

## How to call SORT

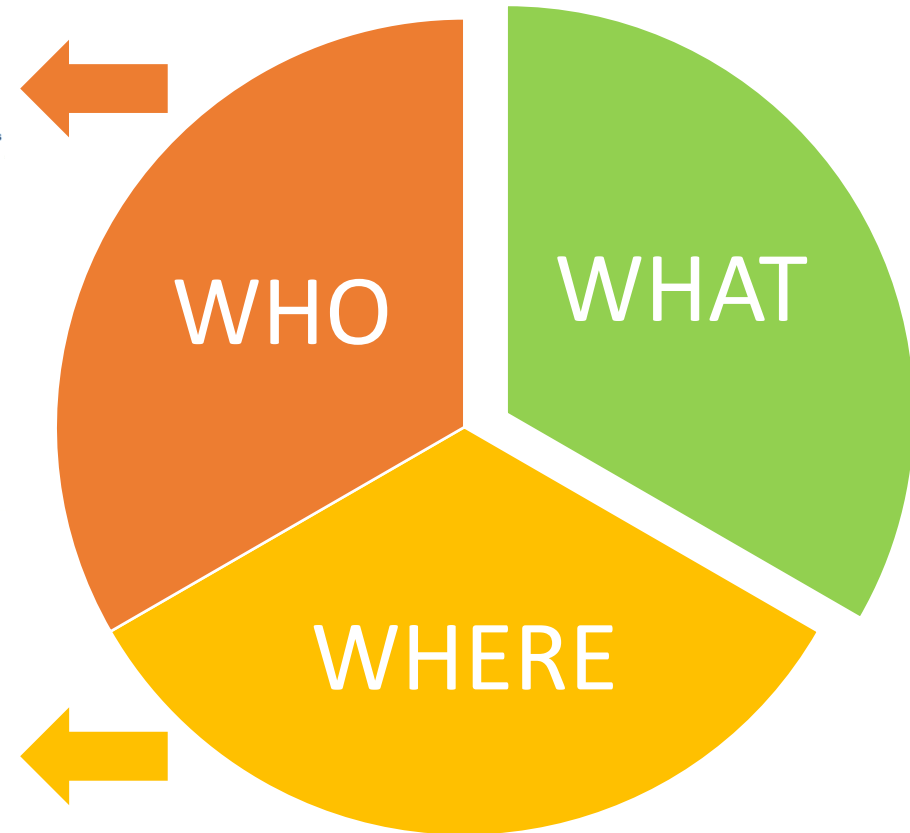
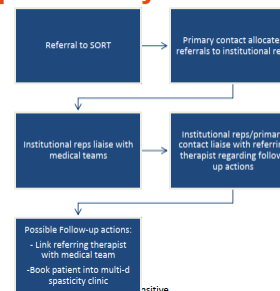


Primary contact:   
Dr Shamala Thilarajah,  
Principal Physiotherapist SGH,  
One Rehab Protocol Lead

Institutional Reps:  
Ms Mah Shi Min, SKH  
Ms Melissa Tan, CGH

\*If whatsapp/message pls do not use any identifiable patient data;  
\*Obtain patient's consent to share information and document the consent according to your institution's requirements

## What happens after you call SORT



Philp et al (2013) *J Stroke Cerebrovasc Dis* 22(7):e173–e80 (WSO adapted: <https://www.world-stroke.org/assets/downloads/psc-uk-version-wso-livery-03-20-13.pdf>)

Turner et al (2019) *BMC Fam Prac* 20(1): 2

# Take Away Messages

- The biggest issues surrounding spasticity management in special populations is with detection of spasticity (“who”) and location of management (“where”).
- Spasticity management is warranted if spasticity is causing difficulties in activities, pain or discomfort, and increase in caregiver burden.
- In addition to Botulinum Toxin A, rehabilitation and adjunct therapies, management in the community should also include screening with “checklists”, identifying person to screen/detect and refer (“connector”), and creating resources/pathways to aid referral back to stroke specialist services (“connecting system”).

# References

1. Lim L et al (2020) When is referral from primary care to specialist services appropriate for survivors of stroke? A modified RAND-appropriateness consensus study. *BMC Fam Pract* 21(1): 66.
2. Mead GE et al (2023) A systematic review and synthesis of global stroke guidelines on behalf of the World Stroke Organization. *Int J Stroke* 18(5): 499-531.
3. Jolliffe L et al (2018) Systematic review of clinical practice guidelines to identify recommendations for rehabilitation after stroke and other acquired brain injuries. *BMJ Open* 8: e018791.
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8. Turner GM et al Using a checklist to facilitate management of long-term care needs after stroke: insights from from focus groups and a feasibility study. *BMC Fam Pract* 20(1):2.

# POLLS

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## UP NEXT

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# Beyond Chemodenervation: Effective co-adjuvant therapies in the management of spasticity after stroke

Dr. Deniz Dishman

Faculty appointment, Department of Research at Cizik School of Nursing

Lead in Post-Stroke Pain Management Program

UTHealth Houston - Institute for Stroke and Cerebrovascular Disease

# POLLS

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# Beyond Chemodenervation

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UTHealth Science at Houston

Institute for Stroke and Cerebrovascular Disease

# Introduction



Deniz Dishman holds a faculty appointment at the University of Texas Health Science Center at Houston in the Department of Research at Cizik School of Nursing. She also is leading the Post-Stroke Pain Management Program at UTHealth Science at Houston Institute for Stroke and Cerebrovascular Disease. Dr. Dishman's research aims to improve post-stroke pain assessment and management, including the discovery of novel pain treatments.

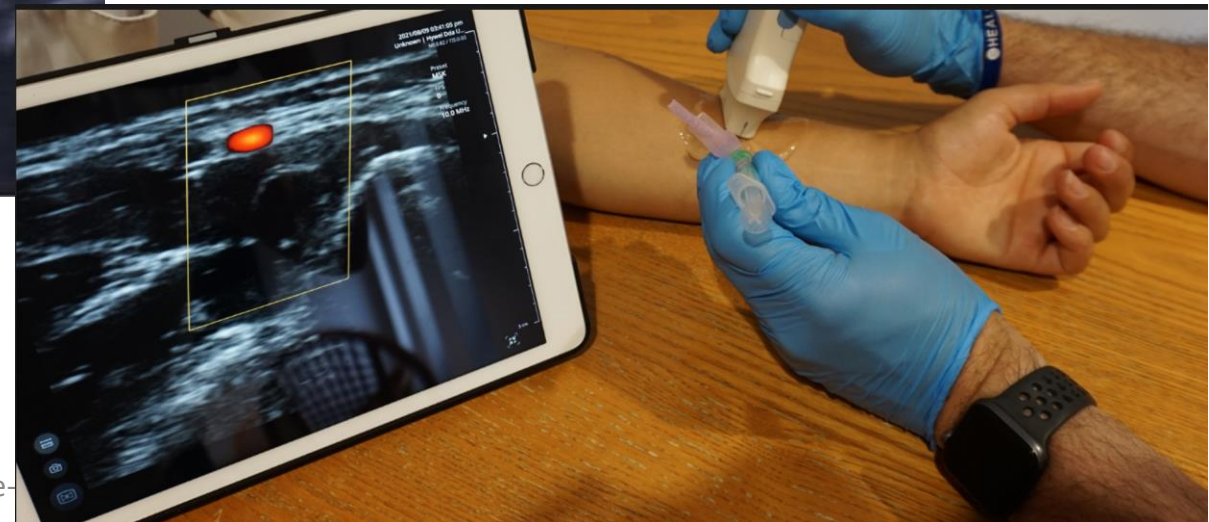
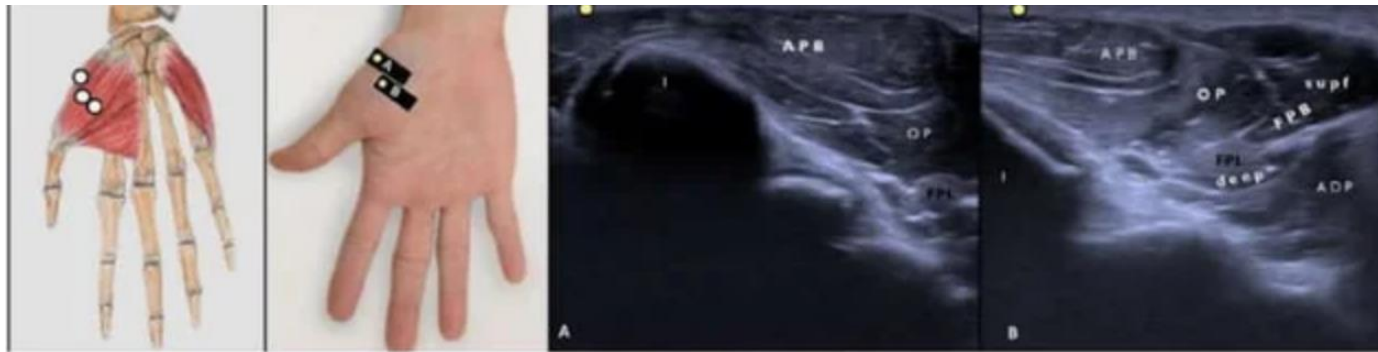
# Learning Objectives

- Describe the tight coupling between spasticity and pain.
- Identify non-pharmacologic co-adjunct therapies in spasticity management
- Describe the evidence supporting the use of non-pharmacologic treatment modalities
- Describe the benefits and role of ultrasound imaging for precise, focal spasticity management
- Identify interventional modalities that may be useful as a co-adjunct therapy in spasticity treatment

# Chemodenervation

- Botulinum toxin (BoNT) – high level of evidence for its effectiveness in spasticity.<sup>1</sup> Most widely used over the past 30+ years.
- Induces relaxation - inhibits the presynaptic release of acetylcholine which keeps the muscle from contracting.
- Provides analgesia – proposed mechanisms include blockade of the cholinergic transmission in the nociceptive system, interaction with TRPV1 receptors, and inhibition of substance P, glutamate, and CRGP synaptic release, which are excitatory neurotransmitters that influence pain generation and transmission.<sup>2</sup>
- There is a large amount of data of its use in the chronic phases after stroke but further investigation is needed in the acute and subacute phases of stroke.<sup>2</sup>





- Guided ultrasound injection allows for more precise injection at target muscles – minimizes spread and subsequent weakness of nearby muscles. Better outcomes with US over electrical nerve stimulation.<sup>3</sup>
  - Lungo et al. 2022 found better reported outcomes in VAS, discomfort, and weakness in a 2-center RCT crossover study of BoNT-A injections using ultrasound vs. electrical nerve stimulation.<sup>3</sup>
- Asimakidou and Sidiropoulos (2023) - Bayesian Network Meta Analysis/SR showed that US is the best method to guide BoNT injections in limb spasticity, followed by ES and EMG.<sup>2</sup>
  - All three approaches were superior to manual needle placement based on surface anatomy with regard to the clinical outcome as assessed by MAS at 2 to 4 weeks after BoNT treatment of limb spasticity in adults.<sup>2</sup>
- 600u dosage limitation – if large muscle groups need to be treated then use in tandem with another therapy, i.e. stretching, casting, and more recently used techniques such as extracorporeal shock wave therapy
  - Intiso et al (2023) – Systematic Review investigated relationship between high dosing and improved function and analgesia – insufficient evidence<sup>4</sup>

# Chemical Neurolysis – Phenol and Alcohol

- Phenol and alcohol neurolysis used for many years – pain and spasticity (spasticity treatment requires higher concentration than anesthetic doses). Works at alpha motoneurons – causes Wallerian degeneration of the axon.
- Faster onset (minutes vs 1 week), effects last longer than botulinum – months rather than weeks (3 to 9 months – depends on axonal regrowth)
- Ultrasound nerve identification decreases potential adverse effects i.e. loss of sensation, chemical neuritis, dyesthesia, neuropathic pain.<sup>7</sup>
- Further studies needed to identify optimal dosing.<sup>8</sup>

# Adjuvant Therapies

Acupuncture – all types including using electrical stimulation, acupressure

- Yi et al (2024): Overview of systematic reviews - much variability (and weakness) in methods and reporting – weak evidence despite many clinical trials.<sup>5</sup>

Electroshock Waves – high-pressure air wave - targeted to specific location.

- Yang, Lew, Ozcakar, Wu (2021) – Systematic review showed ESWT has prominent/direct effects on spasticity parameters such as MAS and MTS scores; however, mixed results were shown regarding functional recovery. No standardized treatment.<sup>6</sup>

Repetitive Transcranial Magnetic Stimulation (rTMS)

- Xu et al (2020) SR/MA no significant improvement in MAS over sham treatment but subjects did demonstrate a change in MAS over the course of treatment.<sup>9</sup>

Transcranial Direct Stimulation (tDCS)

- Alsharam et al (2022) – Systematic review showed limited evidence and unclear treatment dosage among RCTs.<sup>10</sup>

# Cryoneurolysis – “freeze” therapy

Uses specialized probe capable of freezing ranging from  $-60^{\circ}$  to  $-90^{\circ}$  C - Joule-Thomson effect (compression of gas through narrow aperture), depending on the type of gas used as the cryogen.

Tip of the cold probe causes body fluid to generate a ball of ice.

Rapid plunge in temperature causes Wallerian degeneration of targeted nerve, causing a secondary axonotmesis.

Epineurium and perineurium maintained - allows for axonal regeneration.

Blood vessels and surrounding tissues not affected - their freezing occurs at lower temperatures.

Axon will regrow after 3–6mos



- Winston et al (2023) prospective observational study followed subjects with spasticity over 1 year following therapy.<sup>11</sup>
- 113 patients treated – ongoing study (only adverse event reporting)
- 9 (3.25%) had dysesthesia attributed to application to mixed motor/sensory nerve – mostly transient and did not warrant treatment.

**TABLE 3.** Summary of adverse effects reported from all participants in all clinical trials

Adverse Effect	No. Patients Affected	Duration of Symptoms	Treated Nerve(s) Related to the Adverse Effect	Treatment for Adverse Effect
Skin infection	1	1 mo	MSCN	Antibiotics
Bruising or swelling	2	2 wks	Median trunk and MSCN	No treatment
Nerve pain or dysesthesia	9	1 mo	Tibial trunk	No treatment
		1 mo	Ulnar trunk	Lidocaine and NSAID
		1 mo	Median trunk	No treatment
		2 mos	Median motor branch to flexor digitorum superficialis	Lidocaine and cortisone injection, topical lidocaine
		1 mo	Tibial trunk	No treatment
		Pain in 3 mos, numbness beyond 6 mos	Tibial motor branches to medial and lateral gastrocnemius	No treatment
		3 mos	Tibial trunk	No treatment
Cramping in antagonistic muscle	1	3 mos	Tibial trunk	Gabapentin 50% and cortisone injection
		1.5 mos	Tibial trunk	Gabapentin
		3 mos	Tibial trunk	Botulinum toxin injection
		3 mos	Tibial trunk	Topical treatment and 50 units of botulinum toxin
		3 mos	Tibial trunk	Topical treatment and 50 units of botulinum toxin

MSCN, musculocutaneous nerve; NSAID, nonsteroid anti-inflammatory drug.



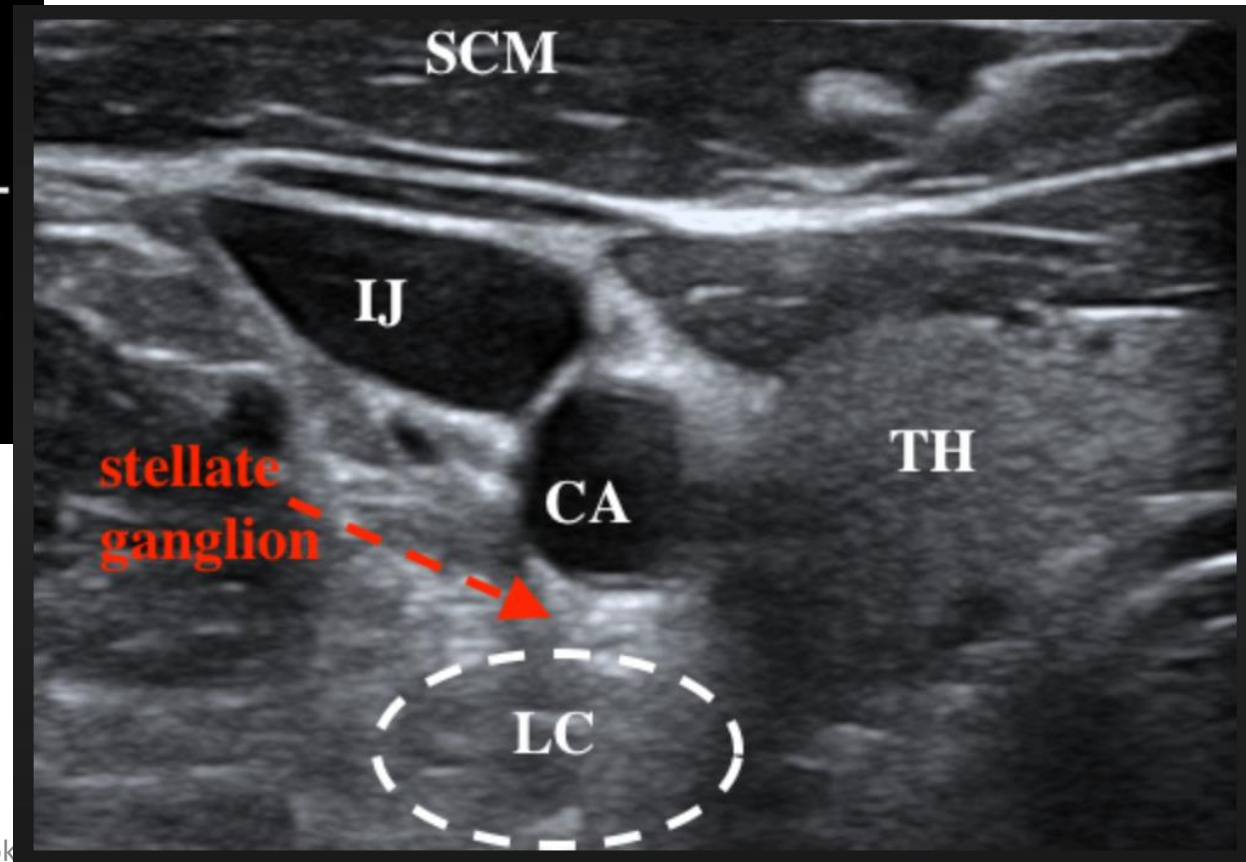
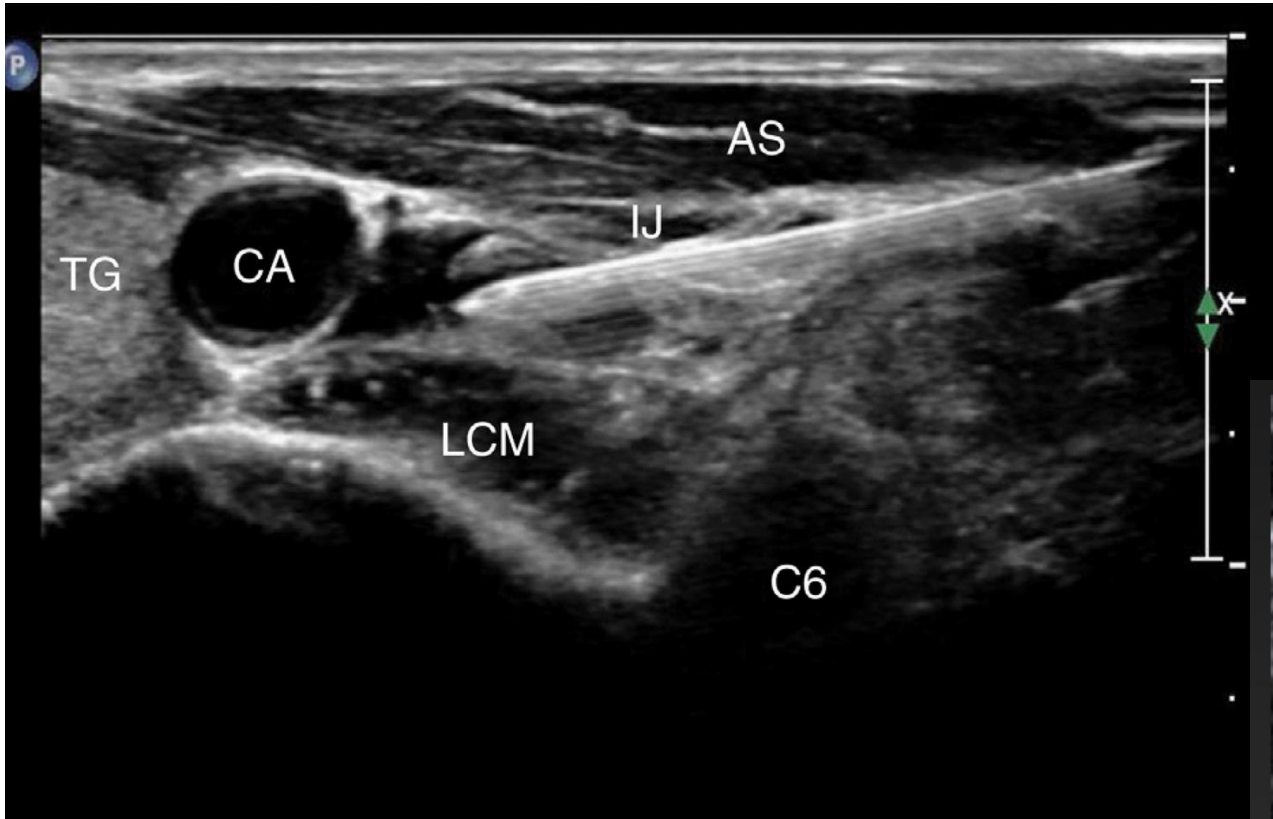
# Stellate Ganglion Block

Local anesthetic induced block of the sympathetic nervous system at the stellate ganglion, which is a synapse of sympathetic fibers in the sympathetic chain that lead to the head, face, neck, upper extremities, and heart.<sup>12-15</sup>

Found anterior to the neck of the first rib and can extend up to the inferior aspect of the transverse process at C7 in 80% of individuals.<sup>14</sup>

Historically used to treat pain in the upper extremities, neck and face including complex regional pain syndrome, peripheral vascular disease, phantom limb pain, and postherpetic neuralgia.<sup>14</sup> More recently, evidence demonstrates its effectiveness in the treatment of post-traumatic stress disorder and chronic, intractable, atypical chest pain.<sup>12,13,15</sup>

Originally performed under fluoroscopy with increased rates of adverse events, such as intraarterial puncture. US guidance affords safety, relatively quick delivery, and increased patient comfort.





Can block peripheral nervous system, inhibit the function of preganglionic and postganglionic fibers, and suppress the muscle tension dominated by the sympathetic nerve fibers.

- Observational case of good efficacy and long standing (9 month) relief of generalized dystonia in head, jaw, and neck

Yung et al. (2023) examined SGB vs extracorporeal shock wave therapy in an RCT in 60 stroke survivors with limb spasticity

- SGB, ESWT, and SGB + ESWT groups + control group
- Upper limb score based on Fugl-Meyer Assessment in the SGB, ESWT, and SGB + ESWT groups were significantly increased ( $P < 0.05$ ) over control.
- Compared with the SGB and ESWT groups, SGB + ESWT exhibited a higher upper limb function score ( $P < 0.05$ ), while the MBI score was not significantly different ( $P > 0.05$ ).

Shi et al (2023) Rat model (diabetic) of induced thalamic stroke to identify the effects of SGB on ischemic stroke.<sup>16</sup>

- SGB could effectively improve the cerebral ischemia and neurological function of diabetic rats
- Main mechanism uncovered was that SGB reduced the phosphorylation of NF-κB p65 and inhibited inflammatory response
- SGB can improve brain blood circulation, aid damaged brain neurons, improve the blood supply of the limbs, relieve muscle spasticity, promote tissue metabolism and restore the limb functions by regulating the function of central and peripheral nerves

- Growing body of evidence suggests that SGB significantly improves the prognosis of cerebrovascular events by alleviating cerebral vascular spasm, increasing brain oxygen supply, reducing the inflammatory response, and decreasing oxidative stress.
- Recently, SGB has emerged as a novel treatment for various pathological pain conditions, such as complex regional pain syndrome, postoperative pain, and orofacial pain as well as conditions such as fibromyalgia and long covid.<sup>15</sup>
- For CPSP, case studies showed that a single SGB treatment considerably alleviated somatic pain and decreased the usage of analgesic medicines for at least one month.<sup>17</sup>
- Lynch et al (2023) reported in a case series of 285 patients GAD7 scores reduced by 50% in patients treated with SGB.<sup>18</sup> Decreased anxiety and PTSD would also be of benefit to stroke survivors.



# Take Away Messages

BoNT is an effective treatment for spasticity and spasticity related pain but better when used with imaging and other therapies.

Dosage ceilings limit the use of BoNT injections.

Effectiveness of BoNT, Phenol, cryoneurolysis depends on provider skill including the use of ultrasound.

Adjuvant therapies are available but further rigorous trials are needed.

Therapies provide analgesia however additional pain assessment and treatment is critical.

# Conclusions

- Spasticity is the most commonly reported sequela of stroke that hinders achieving better quality of life for stroke survivors and caregivers.
- The tight interlink between pain and spasticity warrants focused efforts to establish evidence-based guidelines for the early assessment and treatment of pain and spasticity after stroke.

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Q&A





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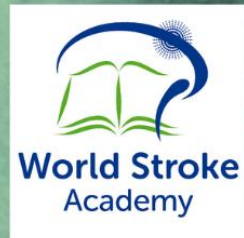
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current data on clinical trials, hormonal  
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