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Spasticity Outpatient Evaluation via Telemedicine: A Practical Framework

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Abstract

The COVID-19 global pandemic has resulted in significant changes to delivery of care in the field of physiatry. Most prominently, in-person visits have fast-tracked to virtual visits. As we are forced to quickly adopt this new technology for our doctor-patient interactions, many questions remain in regard to structuring telemedicine visits for optimal outcomes. Little has been written on virtual evaluations of patients with spasticity. The intent of this article is to provide a framework for conducting a virtual spasticity assessment via telemedicine. We will provide tips on how to conduct a person-centered virtual examination assessment, and how to document goals related to the virtual assessment.

Keywords: Spasticity, Outpatient, Telemedicine

Manuscript Text:

The COVID-19 pandemic has impacted the field of Physical Medicine and Rehabilitation (PM&R) with many in-person outpatient clinic assessments transitioning to telemedicine visits.[1] Telemedicine is described as "the remote delivery of health care services and clinical information using telecommunications technology.[2]" While reviews discussing the use of inpatient and outpatient telemedicine in PM&R[3,4] exist, none thoroughly describe spasticity evaluation and management. Spasticity, a sensorimotor disorder characterized by intermittent or sustained involuntary muscle activation, is a common consequence of upper motor neuron disorders.[5] Early identification and treatment of problematic spasticity improves quality of life and limits known associated complications.[6]

The focus of this article will be the assessment of patients with spasticity via telemedicine. Telemedicine is feasible for spasticity evaluation and management both for new patient interactions and routine follow up visits after an intervention. Telemedicine is well suited to assess the effect of an intervention (e.g. evaluating neurotoxin effectiveness, assessing side effects after starting a new medication, or checking in with the patient before changing a medication dose).

While this paper emphasizes the evaluation of velocity dependent tone as a component of the upper motor neuron syndrome, the content can generally be applied to individuals with spastic dystonia and other types of hypertonia. We will provide tips on how to conduct the visit, specifically a person-centered virtual examination assessment, and how to document goals related to the virtual assessment.

Access to Care

Patients with spasticity often experience difficulty accessing healthcare services for a number of reasons including impaired mobility and the cost of specialized transportation.[1,3] Additionally, many spasticity patients have underlying health conditions; therefore, limiting unnecessary exposure to crowded hospitals and clinics is beneficial. Virtual visits can address these concerns.

The format for a telemedicine visit may vary depending on the patient situation and needs of the physician and the practice.[1] For instance, a two way synchronous audio/visual platform is preferred for a visual interpretation of physical exam measures whereas some patient interactions may only require a phone call for a quick check-in or a conference call between the patient and multiple providers.[1,7] A telemedicine follow-up may be scheduled while the patient is at a therapy appointment allowing the provider to see what is happening during these sessions, facilitating a multidisciplinary care approach.

It is important to note video virtual visits may not be practical for all patients. Some patients will not have access to the high-speed internet service required for video conferencing due to physical location or cost. Additionally, some may have difficulty setting up more technically complex virtual environments on a computer or smartphone therefore making telephone telemedicine preferable.

Goal Assessment

As with any visit, begin the telemedicine assessment with the patient's concerns, needs, and goals. This approach improves the patient-provider relationship by allowing the patient/caregiver to feel heard, promoting patient/caregiver ownership over the management plan.[8] A direct association exists between the strength of the physician-patient bond and the patient outcome.[8]

In the spasticity evaluation, identify the patient/caregiver goals, negotiate realistic goals, and then agree on the action plan. Setting goals which are specific, measurable, achievable, realistic, and time-bound (SMART) help guide the negotiation phase and the action plan.[8] Managing expectations is a common reality in the negotiation phase. In turn, achieving buy-in and a sense of responsibility from the patient and caretakers is an important part of the action plan phase.[8] Buy-in is needed because most spasticity interventions require home maintenance (i.e. if the action plan is serial casting, the patient and caregiver will need to follow through with an essential home stretching program afterwards). A list of possible goals is listed in **Supplemental Table 1** (Supplemental Digital Content 1, http://links.lww.com/PHM/B130) in the supplementary materials section.

A significant benefit of the virtual visit is the ability to include multiple participants in a patient's care.[3] For example, it may be possible to bring in outside family members or the patient's therapist to strengthen the goals discussion. The opportunity for all providers on a patient's team to offer presence in a virtual visit is a significant advantage of telemedicine considering multidisciplinary clinics are difficult to maintain financially and during a pandemic situation such as COVID-19 when the number of caregivers accompanying a patient is

restricted. Consider a situation in which a patient is institutionalized in either a long-term residential facility or skilled nursing facility. Telemedicine allows a provider to monitor institutionalized patients more frequently for development or progression of spasticity as well as assess for possible complications of increased tone such as pressure sores or contracture. This application could prove financially beneficial as there is a significant cost burden associated with these complications.

Performing and Documenting the Virtual Examination

To the authors' knowledge there are no published studies specifically evaluating the validity or reliability of a virtual spasticity examination, therefore, the following paragraphs are based upon a collaborative discussion of a group of clinicians with extensive experience in the area of spasticity management. A benefit of the virtual exam is that the provider has the chance to see the patient and caregiver within their own environment, allowing the provider to better assess barriers or equipment needs and helping create a tailored, specific plan.

The exam will depend on the type and quality of camera set-up, the patient's cognitive and physical abilities, as well as the availability and skill set of the caregiver. Begin with inspection of the patient to evaluate resting posture, deformities, skin integrity. Skin evaluation should be attempted though may be limited by the internet connection or camera quality. In these instances, a still photograph may be uploaded through a secure patient portal.[9] Ask the patient to dress in clothing appropriate for the exam prior to initiating the visit to maximize visibility. If the patient's camera set up allows, consider assessing the home environment for potential challenges and evaluating home durable medical equipment (DME) for safety. In cases of spastic dystonia,

the provider can ask the patient to focus the camera on the affected body part during intentional movement.

There are multiple outcome measures to evaluate spasticity.[10, 11,12] While clinical scales are some of the most common approaches to measurement, there are limitations to many types due to poor reliability. Ultimately, a clinician should use assessment scales they are most comfortable with. Examples of outcome measures for the virtual assessment of spasticity are listed in **Supplemental Table 2** (Supplemental Digital Content 1, http://links.lww.com/PHM/B130). Below is a review of most common measures that are typically performed by a trained healthcare professional and some discussion on how they can be done in a virtual setting. Furthermore, an approach to performing and adopting a virtual physical exam and potential limitations can be found in Table 1 and virtual case examples are found in Table 2.

Measures of passive activity

This assessment is usually conducted by a clinician who passively moves the affected spastic limb within different velocities of movement when the patient is relaxed. The most employed scales used for spasticity involving passive stretch include the Modified Ashworth Scale or Tardieu Scale.[13] The Ashworth and Modified Ashworth scales assess resistance to passive stretch.[14] The Tardieu and Modified Tardieu Scales describe the character of the reaction of muscle to stretch, and also may have ability to differentiate contracture from spasticity.[15] This is important as spasticity is amenable to various conservative and interventional treatments, while contracture, in general, requires surgical intervention.

In the setting of telemedicine, elements of these exams may be performed by a caregiver following brief instruction. Ask the patient's caregiver to perform passive range of motion (ROM) of the limbs and describe any difficulties. If applicable, ask the patient to demonstrate active ROM. Depending on the situation, a caregiver may be coached through a high velocity ROM exam to get a basic sense of the degree of increased tone and allow the provider to evaluate for clonus. Though challenging to appreciate the degree of resistance throughout a range of motion, we suggest categorizing the patient's spasticity into three broad groups: severe tone/contracture, mild/moderate tone, and no increase in tone/hypotonia. A caregiver could also be told to move the limb slowly through range of motion (Slow stretch/Tardieu V1) to the end range to document the Tardieu angle of arrest (Xv1). The caregiver could then be instructed to hold the patient's limb and allow the limb to fall with gravity (Tardieu V2) or move the limb as fast as possible (Tardieu V3) to assess the threshold angle of muscle reaction (Xv2/3) and the spasticity score of the Tardieu scale by viewing the associated muscle reaction. Alternately, a caregiver could also be instructed to perform a Modified Ashworth by demonstrating and verbally describing a patient's limb response to high velocity range of motion around a joint.

Measures of voluntary activity

These assessments involve active patient participation. Telemedicine could be used effectively if a patient would be able to measure the home environment and be timed for a Timed Up and Go test, for example, but may be more difficult to implement if a test such as a 9 Hole Peg Test or Fugl-Meyer is attempted.

Passive and active function

Another important consideration is the concept of active versus passive function. Active function is function performed by the patient such as grasping, reaching, and walking. Active function requires volitional motor control, active range of motion, and attention. Passive function, on the other hand, is performed by a caregiver or therapist such as repositioning, transfers, perineal care, or hygiene. If the patient is ambulatory, watch transfers, gait with and without devices/braces, and other functional tasks pertinent to the chief complaint (i.e. if spasticity is limiting self-feeding, watch the patient attempt bringing a utensil to their mouth). Passive function requires passive range of motion and the availability of a caregiver to perform. Active and passive function are both important, but treatment of each requires different considerations. Active functional goals are often more straightforward, but passive functional goals can have negative consequences if left untreated. As such, special attention must be paid to discussion of both active and passive function with the patient and any available caregivers.[16] An example of active versus passive function assessment and goal setting is discussed in the cases studies in Table 2.

Quality of Life (QoL) measures

Common clinician-administered methods for measuring spasticity, such as the Modified Ashworth and Tardieu scale[14,15], may not provide comprehensive assessment of spasticity. Incorporation of patient-reported measures for spasticity is pivotal in the assessment of therapeutic interventions.[17] It is important to address other factors such as pain, incontinence, fatigue and falls, for example, as the interplay of these may have significant negative effects on QoL measures. Forms measuring QoL can be converted into an electronic format and integrated

into the EMR for virtual visits. The percent of function scale, disability scale, spasm frequency scale, and global pain scale are simple scales that could be used effectively during the telemedicine spasticity assessment and can be found in the supplementary material.

Incorporation of this information in combination with the patient's telemedicine history and physical virtual assessment may enhance understanding of the patient's spasticity disease burden on their quality of life.

Goal Attainment Scale

The Goal Attainment Scale (GAS) is a reliable way of identifying, weighting, and achieving patient specific goals.[8,18] To use the scale, a patient or caregiver articulates their own goals and then creates an action plan with their healthcare provider to achieve the goals. The GAS consists of a 5-point scale: -2(much less), -1 (somewhat less), 0 (goal achieved), +1 (somewhat more), +2 (much more) and relies on patient created goals as well as patient weighing of the importance of each goal. Unfortunately, the scale's time intensive nature and complex mathematical makeup limit the GAS from routine clinical use. However, using the scale for qualitative purposes may be clinically meaningful[18] and easy to do even during a telemedicine visit. For this, the provider establishes what achieving a '0' score means (goal achieved) based on the patient's goal. Then, at follow up, it is easy for the patient, caretaker, and provider to determine whether there was somewhat more, much more, somewhat less, or much less improvement from the expected outcome.[18] Though simple, having numerical values supported by the patient and physician can help guide clinically relevant treatment decisions for the future.[8]

Patient Reported Supplemental Material

Virtual medicine can be supplemented by electronic materials to enhance the patient and provider experience.[1] For example, a patient-reported spasticity symptom questionnaire such as the 13-item scale developed by Zorowitz et al. could be sent to the patient before the visit to provide helpful information to the clinician.[12] Incorporating forms like this scale into the electronic medical record (EMR) system allows patient completed questionnaires to be easily uploaded and integrated into the chart by support staff. These strategies can improve visit efficiency and make individual goals and treatment responses easier to track over time (included in the supplemental material is **Supplemental Figure 1**, Supplemental Digital Content 2, http://links.lww.com/PHM/B131, demonstrating a spasticity visit template). Additionally, templates can be converted into smart phrases to pull patient information into a note during provider documentation.

Approaches to Special Populations

Non-English-speaking patients deserve equal treatment including the ability to access and converse with their healthcare team.[19] Most standard interpreter services offer video conferencing as well as three-way phone calls though this may require the provider and patient/caregiver to be on speakerphone while also on the video telemedicine conference.[20] If possible, have administrative staff flag patients who require interpreter services and arrange the additional set up in advance. Elderly patients may struggle with the technology and a test-run tutorial per support staff before their first visit should be arranged.[1] Similarly, patients in rural areas without high speed internet access may either need to come into a designated satellite clinic for a telemedicine visit or use phone conferencing.[21,22] Some patients have significant cognitive

and/or communication deficits in which case having a designated caretaker to speak on their behalf will help. Additionally, during the global COVID-19 pandemic it is important to consider patients who are medically fragile and for whom the risk of exposure to illness during a clinic visit outweighs the benefit of the visit itself should be prioritized for telemedicine technology.[23]

Education

Treatment plans for patients with spasticity should be multidisciplinary and patient centered for optimal outcomes.[8] The delivery and content of educational material to achieve the desired goal should be individualized and occur in a way the patient or caregiver can easily understand. Telemedicine offers the ability to provide patient and caregiver education regarding diagnosis, treatment options and rehabilitation recommendations.

Patient/Caregiver Education

Education regarding the etiology of spasticity as well as the time course for possible interventions and outcomes can be effectively conducted verbally using telemedicine. Given the variability in onset and severity of spasticity, it is important for the clinician to provide diagnosis specific information for the patient to understand implications of spasticity including physical presentation, evolution or risk of exacerbation, possible pain and risk of alterations to functional progression with mobility, activities of daily living, positioning or quality of life.

Telemedicine may provide earlier access to care along with earlier reassessment following interventions to ensure goal attainment. Educational discussions via telemedicine can happen in real time or, following a visit, written educational materials can be sent to a patient

electronically. This allows patients the ability to repeatedly retrieve the information later or pass along copies to caregivers.

Function and Rehabilitation Related Education

In addition to verbal education for the patient and caregiver, telemedicine allows clinicians to demonstrate therapeutic exercises with patients and caregivers while simultaneously considering the home environment. As previously mentioned, there is a potential for physical, occupational, or speech therapists to demonstrate this home exercise plan alongside clinicians for a multidisciplinary approach to the treatment plan. The therapist may be able to perform the telemedicine visit in conjunction with the clinician and patient or alternatively, the clinician may have the opportunity to view a caregiver assist with a transfer to and from bed or other functional task and can provide direct input into the treatment plan specific for the home environment, something that could not have been directly visualized prior to telemedicine. The direct observation of whether home modifications and adaptations are present via telemedicine can also help in safety assessment.[24] The use of telemedicine may have the ability to bypass geographical and socioeconomic restrictions[25] for those who otherwise may not have access to direct housing and environmental assessment. The possibilities for direct activity education within the home via telemedicine is promising to better understand potential physical and environmental barriers to completion.

Medical Education Considerations

To date, telemedicine has been relatively absent from medical education,[25] but can be a powerful educational tool for spasticity teaching regarding taking a complete and relevant functional and

spasticity history, observing a patient in their home setting, and for home exercise teaching. Through use of split screens on video conferencing, telemedicine can allow the instructor to evaluate a trainee's neurologic examination skills as well as virtual interprofessional and communication skills, a necessary skill set in the management of spasticity patients.[26]

Limitations

While there are many advantages, telemedicine clearly cannot replace an in-person spasticity evaluation in every situation. Establishing a standard triage system within a spasticity practice using telemedicine will help patients get the in-person care they need at the appropriate time.[27] Spasticity visits which need to be scheduled in the clinic can be divided into urgent, semi-urgent and non-urgent issues. Urgent issues are those which must be set up as an in-person visit as soon as possible to avoid the need for emergency services or hospitalization. Urgent issues include concern for ITB pump failure or malfunction. Semi-urgent issues are those that will require an in-person visit in the near future and include skin breakdown due to spasticity, routine ITB pump refills, unexplained worsened spasticity requiring further medical workup, and situations in which spasticity is directly causing caregiver burnout or inability for a patient/caregiver to perform necessary hygiene or ADLs. Non-urgent issues might include lack of or less than expected response to an intervention (i.e. no or minimal improvement with most recent botulinum toxin injection), and routine follow up after an injection or medication change.

Conclusion

Though considerable adaptations to healthcare systems during the COVID-19 global pandemic were required, certain changes will remain. It is likely that the use of telemedicine will continue,

and it will become increasingly necessary to develop protocols with objective guidelines for the assessment, treatment and monitoring of patients with spasticity. Even after the current pandemic, experience with virtual visits may lead to routine implementation in "normal" times including utilizing telemedicine visits for initial consultation for a patient who lives far away or has a difficult time attending in-person visits. Virtual visits can also be used to follow-up patients in between neurotoxin injections when treatment-effect is maximal as well as used for triaging patients who require in-patient assessments. Additionally, the patient can be assessed in their home environment to truly assess their function in a real-life setting.

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Table 1: An approach to performing and adopting a virtual physical exam and potential limitations

Part of Examination	Adaption to Virtual Care	Potential Limitations
Inspection	Visualize patient positioning of limb, posture in chair, wheelchair, or bed If able to stand safely to inspect anterior, lateral, and posterior positioning of limb Inspect associated spastic dystonic positions Inspect for deformities (such as significant flexion at wrists or equinovarus at ankles) Inspect for wound/skin breakdown/maceration of skin (or may utilize patient portal to upload skin pictures in advance) Inspection of positioning in durable medical equipment (DME) Inspection of condition of DME Encourage appropriate clothing to visualize necessary body areas (i.e. skin maceration, wounds)	Unable to perform palpation exam Without proper assistance and correct placement of camera, may not be able to visualize from all angles/planes If patient requires assistance for ADLs or in-home care and does not have caregiver/family member present may be difficult to expose areas for inspection May require additional caregivers for adequate positioning
Passive ROM	Demonstrate passive ROM for caregiver to perform Assess concern for contractures	Patient may perceive caregiver ROM is painful
Active ROM	Demonstrate active ROM for patient to perform Observe for co-contraction that may limit active ROM	Cognitive impairments or aphasia may limit understanding of directions Co-contraction may limit active ROM

Transfers	Advise patient to set up in an area in which a transfer can occur at even and uneven transfers	Lack of needed assistance for safety Lack of appropriate DME within the home
Gait	Advise patient to ensure set up allows for adequate space prior to encounter Encourage patient to have necessary DME and orthotics readily available	Lack of space Lack of needed assistance for safety Lack of appropriate DME within the home Poor connection/video quality can make gait assessment difficult
Spasticity Measures	Educate patient/caregiver on MAS testing and visualize a potential velocity dependent catch with passive ROM Educate patient/caregiver on Tardieu testing • slow stretch (V1 Tardieu) to assess end-range (Xv1) • fast stretch (V3 Tardieu) or allowing the limb to fall through gravity, (V2 Tardieu) to visualize threshold angle (Xv2/3) and muscle reaction as in spasticity grade of Tardieu Scale Visualize ROM limitations when contracture may be present Assessing whether limb is functional or non-functional based on functional tasks (i.e. grasp, flexed elbow that could be used for holding a bag)	Unable to do electrophysiologic measures Caregiver not trained to perform MAS, Tardieu No caregiver available to assist
ADLs	Ask patient to perform specific ADL such as feeding self, donning and doffing socks and shoes, etc.	Lack of adequate DME or adaptive device Lack of space within the viewing area

Task Specific Activities	Patient/caregiver can replicate specific task within the home	Lack of therapeutic equipment Lack of space within the viewing area
Pain	Patient/caregiver can show area or position of discomfort	Self-reported

Legend: ROM = range of motion; DME = durable medical equipment; MAS = Modified Ashworth Scale; ADL = activities of daily living

Table 2. Spasticity Telemedicine Case Examples

	Case 1	Case 2	Case 3
Patient Scenario	New referral in patient with stroke and resultant spastic left hemiplegia. On oral baclofen since inpatient rehabilitation stay four month ago. Patient presents via telemedicine to establish care with Physiatrist and has concerns for skin breakdown in clenched fist.	Patient with history of MS with previous neurotoxin injection to quadriceps and gastrocnemius. Initial goal was to improve positioning in chair to allow knees to flex and flat foot contact. She reports using quadriceps tone for transfer and previous injection making her weak. Prior transfer in clinic required excess assist as her aid was not present.	Patient with history of spastic quadriplegic cerebral palsy with intrathecal baclofen pump for spasticity management. Patient has aged out of pediatric neurosurgery care and presented as new patient referral for ITB management.
Telemed Visit	*Inspection* Patient seated in a chair by his bed with camera placed on a table. He was comfortable sitting upright. Resting elbow at 90 degrees, decreased from previous documentation while at rest. *Caregiver assisted exam* Caregiver instructed to move camera closer to patient and slowly open clenched fist which revealed skin erythema and open skin breakdown in the palm. Caregiver asked to remove AFO to inspect foot which revealed slight erythema to lateral malleolus. *Spasticity Measures* Caregiver asked to slowly stretch elbow to maximum extension revealing 110 degrees. Then asked to bring elbow back to neutral positioning and perform this as a quick movement which revealed 100 degrees. This was recorded as Modified Tardieu of V1 110 degrees and V3 100 degrees.	*Inspection* Instructed to be in bed with camera set up to allow whole body in view and with patient in shorts for adequate visualization. Normal posture in hospital bed with bed trapeze. No gross deformities. *Observe Function* Patient asked to perform her preferred method of out-of-bed transfer. She does bed transfer with trapeze with only handheld assist from her aid for bed transfer. She utilizes her quadriceps tone for this transfer to minimize assist. *Patient assisted exam* Patient struggled to maintain upright posture due to plantarflexion tone and could not maintain flat foot contact while standing. *Goals* Goals readjusted to allow	*Inspection* Awake, restless, resting in wheelchair. Right upper limb is fully externally rotated and extended at shoulder, flexed at elbow. Bilateral hips are externally rotated in chair. *Caregiver assisted exam* Family can actively stretch left shoulder to 30 degrees of flexion. Passive elbow extension meets resistance beyond 90 degrees. ADLs Family reports recurrent intermittent increased diffuse spasticity in all limbs which correlates in low urine output. *Pain* Family report grimacing and notable discomfort when spasticity increases. *Goals* Control diffuse spasticity to allow for comfort at

	Environmental Assessment Hospital bed, walk in shower with grab bars, and bath bench are noted. There is also a commode chair located next to the bed. *Global pain scale*: 30 of 100 in left hand. *Goals* Reduce clenched fist to allow skin healing and prevention of further breakdown.	safe transfers at home instead of wheelchair positioning to align with overall safety and quality of life.	rest and to allow for adequate bladder emptying which may be impaired due to urinary sphincter or pelvic floor spasticity.
Telemed Assessment	Skin breakdown secondary to clenched fist in setting of poorly controlled spasticity.	Spastic paraparesis impairing standing and transfers. Patient using her spastic quadriceps to aid with transfers.	Poorly controlled diffuse spastic quadriplegia resulting in patient discomfort and inability to evacuate bladder.
Plan	This patient was triaged into a semi-urgent in-person appointment due to negative consequences of spasticity with plan for focal chemodenervation to finger flexors.	Patient triaged to return for a semi-urgent in-person appointment for focal chemodenervation to gastrocnemius (and to discontinue quadriceps injection, as she was using this tone for her function and quality of life).	Education provided regarding transfer of ITB care including a discussion of goals and long-term monitoring and process for emergency care needs. Plan to increase ITB dosing to optimize spasticity. A home health company was identified to present to home to make the adjustments.