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Original Article

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Limb spasticity and telemedicine consultation for reconstructive surgery: patient perspectives of surgical assessment

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Abstract

Context: Spasticity is characterized by increased muscle tone and stretch reflexes, often caused by an upper motor neuron (UMN) syndrome. Many patients live with their dysfunction of their upper or lower limbs for many years and are managed by a multidisciplinary team including physical medicine and rehabilitation specialists, neurologists, and/or physical therapists in an attempt to decrease their spasticity and enhance their quality of life. Reconstructive surgery is a treatment option for many patients living with spasticity. The goal of surgery is to permanently decrease their spastic tone and improve their quality of life. Spastic hemiplegia or hemiparesis is an area of orthopedic surgery that is uniquely suited to telemedicine evaluation. Telemedicine visits can lower the threshold for patients to obtain consultation, receive second opinions, and determine whether traveling for an in-person assessment might be worthwhile, particular to larger medical centers.

Objectives: The objective of our study was to characterize patient perceptions of telemedicine consultation for spasticity surgery and to determine its effectiveness for indicating reconstructive procedures.

Methods: An electronic survey consisting of 16 questions was distributed to all patients after the virtual consultation from April 2020 to September 2022 as part of a neuro-orthopedic evaluation. Domains of inquiry included patient demographic and diagnosis information, satisfaction with provider assessment, ease of use, appointment preference, and whether surgery was eventually performed. Identifying information was voluntarily provided by patients and allowed for survey data to be linked to the medical record. Patients were included in the study if they were diagnosed with upper and/or lower extremity spasticity, were evaluated by telemedicine visit, and were over the age of 18. They were excluded from the study if they were evaluated for any condition aside from spasticity or returned an incomplete survey. Patients who completed the survey were prospectively followed through December 2022 to determine whether a subsequent in-person visit was pursued and/or reconstructive surgery was performed.

Results: A total of 19 of 36 patients completed surveys, for a response rate of 52.7 %. Nearly all (94.7 %, n=18) patients felt that the provider expressed maximal concern for patient questions/worries, included them in decisions regarding care, and appropriately discussed treatment strategies. Similarly, the majority (89.5 %, n=17) were maximally satisfied with explanations about their condition and would recommend the care provider to others. Most patients (84.2 %, n=16) also felt that the ease of communication via the virtual platform was very good. All patients were eventually indicated for and subsequently underwent reconstructive surgery for spasticity.

Conclusions: Spasticity patients were overwhelmingly satisfied with their initial virtual consultation as an alternative to face-to-face visits. Telemedicine provides a clinical opportunity for seeking information about spasticity surgery and offers a cost-effective and convenient option for patients who find travel to specialty centers prohibitive.

Keywords: reconstructive surgery; spasticity; stroke; telemedicine

While virtual teleconferencing predated the COVID-19 pandemic, it was not routinely employed for medical care. Due to the public health emergency that was initially declared in January 2020, care providers were able to provide telehealth visits across state lines without the need for medical licensure in those states. The COVID-19 pandemic

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allowed video-conferencing software companies to grow exponentially. These advancements in technology and accessibility have made telemedicine encounters increasingly more common. Although the adoption of telemedicine was largely out of the necessity to limit personal contact during the pandemic, virtual visits have proven to be a useful adjunct for patients who do not require an in-person evaluation irrespective of current health policy recommendations [1].

Several studies have supported the use of telemedicine visits within the surgical subspecialties, including orthopedic surgery [2–5]. These virtual encounters have multiple potential benefits for providers and patients alike. Virtual visits are time-efficient, can be performed during irregular hours, avoid the need for travel, and do not occupy clinic space or require ancillary clinic staff. Importantly, virtual visits allow for an early initial evaluation for patients, determine the need for additional diagnostic testing or advanced imaging studies prior to an initial in-person consultation, and can broadly assess the patient for their indication and suitability as a surgical candidate. As such, telemedicine visits among orthopedic practices have garnered high levels of patient satisfaction [6].

Spastic hemiplegia or hemiparesis is one area of orthopedic surgery uniquely suited to telemedicine evaluation. Spasticity is characterized by increased muscle tone and stretch reflexes. It represents a predominant clinical symptom among others that can be present in upper motor neuron (UMN) syndrome. Spasticity can occur in patients who have sustained an UMN injury, such as in cerebral palsy, spinal cord injury, cerebrovascular accident, and brain injury. Patients with spasticity have often lived with dysfunction of their upper limb for many years and are most often managed medically by physical medicine and rehabilitation specialists, neurologists, and/or physical therapists to decrease spasticity and enhance quality of life.

The effectiveness of telemedicine visits for evaluating patients with spasticity and providing education and counseling for possible upper or lower limb reconstructive surgery has not yet been described. The purpose of this study was to characterize the patient perceptions after their telemedicine consultation for spasticity and to determine its effectiveness in adequately indicating a patient for reconstruction surgery.

Methods

From April 2020 to September 2022, patients referred to a quaternary neuro-orthopedic clinic with the diagnosis of spasticity were evaluated during a telehealth consultation. The purpose of this visit was to: (1) attain a clinical history; (2) perform a virtual examination: (3) provide information regarding the surgical management of spasticity; (4) assess the utility of an in-person clinic appointment; and (5) determine candidacy for reconstructive procedures. All telemedicine visits were conducted by a single provider (P.C.R.). The same synchronous, HIPAA-protected video conferencing application was utilized for all encounters (Zoom Video Communications, San Jose, CA).

At the time of appointment scheduling, patients are instructed to login to the virtual telehealth platform via their electronic medical record patient portal (Epic Systems Corporation, Verona, WI) and to ensure that the software is downloaded and functioning prior to the visit. The patient is asked to facilitate the transfer of additional documents and imaging studies as needed. Fifteen minutes before their virtual appointment, patients check-in with an operations specialist to ensure that the software is fully functional prior to interfacing with the provider. Medical records and imaging studies can be referenced and reviewed in real-time by the patient and the provider utilizing the “share screen” function.

Immediately following each visit, an electronic survey was sent to each patient. Our patients did not fill out a written informed consent to be included in the study. The survey consisted of 16 questions to assess the patient experience during the telemedicine visit (Supplementary Material, Appendix 1). Most of the questions were acquired from the Press Ganey (PG) Medical Practice Telemedicine Survey distributed by PG (Press Ganey Associated LLC, South Bend, IN) [7]. Categories of inquiry included patient demographic and diagnosis information, satisfaction with provider assessment, ease of use, and appointment preference. Identifying information was voluntarily provided and allowed for survey data to be linked to the medical record.

Patients were included in the study if they were diagnosed with upper and/or lower extremity spasticity, were evaluated by telemedicine visit, and were over the age of 18 years. Patients were excluded from the study if they were evaluated for any condition aside from spasticity or returned an incomplete survey. Patients who completed a survey were prospectively followed through December 2022 via chart review to determine whether a subsequent in-person visit was pursued and/or reconstructive surgery was performed. Institutional Review Board approval was obtained for this study (Mayo Clinic Institutional Review Board, IRB ID 20-004078).

Results

A total of 19 of 36 patients completed surveys for a response rate of 52.7 % (Table 1). Patients were predominantly male (n=14, 73.7 %), and the majority were over 40 years old (n=13, 68.4 %). Thirteen patients (68.4 %) lived over 300 miles away from the sponsoring medical center. The etiology of spasticity was most frequently cerebrovascular accident (n=10, 52.6 %), followed by traumatic brain injury (n=4, 21.1 %). Fourteen patients (73.6 %) were evaluated for upper-extremity spasticity alone, while the remaining five (26.3 %) had both upper- and lower-extremity spasticity.

The vast majority (n=18, 94.7 %) of patients felt that the provider expressed maximal (“very good”) concern for questions or worries, included patients in decisions about

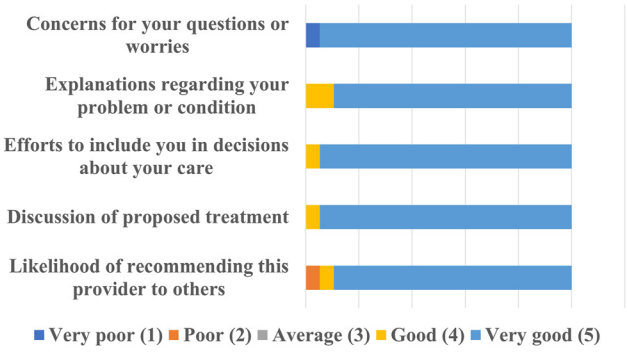

Figure 1: Satisfaction with provider assessment.

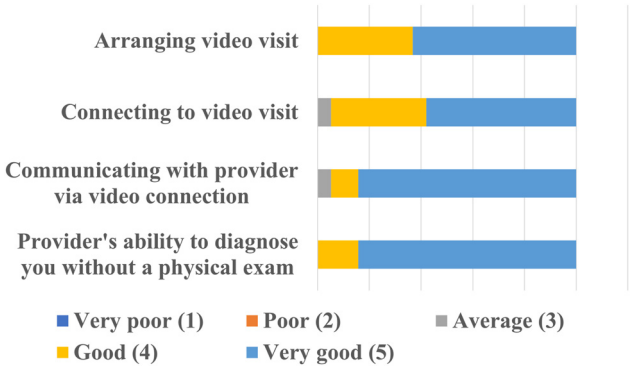

Figure 2: Satisfaction with telemedicine format.

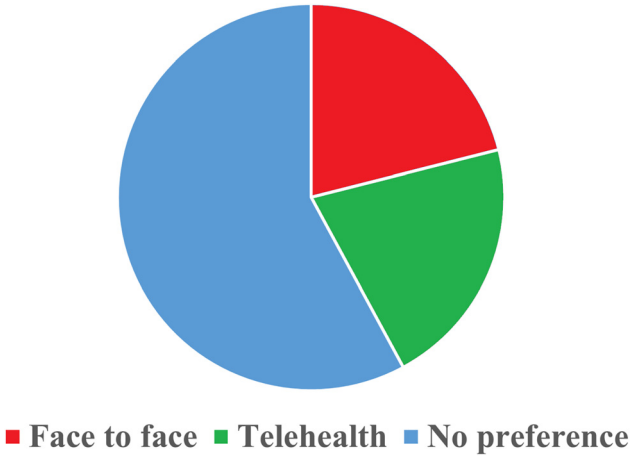

Figure 3: Appointment preference.

care, and appropriately discussed proposed treatments (Figure 1). Similarly, most (n=17, 89.5 %) were maximally satisfied ("very good") with the explanations provided about their condition and would recommend the care provider to others.

Most patients (n=16, 84.2 %) rated the ease of talking to the provider as "very good" (Figure 2). The same proportion also rated the provider's understanding of the problem and diagnosis without an in-person physical examination as "very good." Most patients rated the ease of connecting the video visit as either "good" (n=7, 36.8 %) or "very good" (n=11, 57.9 %). All patients rated the ease of arranging the video visit as either "good" (n=7, 36.8 %) or "very good" (n=12, 63.2 %).

If the patient had the option to choose whether their initial visit was face-to-face or via telehealth, the majority (n=11, 57.9 %) had no preference (Figure 3). The remainder were evenly divided between preferring an in-person visit and telemedicine (n=4, 21.1 % for each response, respectively).

Among the 19 patients who completed surveys, all but two had a subsequent in-person evaluation (n=17, 89.5 %). The average time to in-person evaluation was 91 days (standard deviation [SD], 41; range, 24–142 days). All patients had a reconstructive procedure for spasticity at an average of 152 days (SD, 58.5; range, 64–253 days) after initial evaluation. Four patients (21.1 %) had a next-day surgery after their first in-person evaluation. Every patient underwent an in-person evaluation for their first postoperative visit, and nearly all patients had a telemedicine follow-up appointment during the postoperative period (n=17, 89.5 %).

Discussion

Although the COVID pandemic has had profound impacts on patient care and medical education, not all adjustments were negative. The widespread adoption of telemedicine modalities – while principally utilized to limit personal contact – also had secondary benefits of allowing convenient and time-efficient patient–physician interactions. Telemedicine visits for surgical subspecialties have included initial consultations, preoperative discussions, and postoperative follow-up care [8]. Future studies should investigate the use of telehealth to close health gaps and disparities in a greater effort to understand barriers of care.

Virtual visits lower the threshold for patients to obtain consultation, receive second opinions, and determine whether traveling for in-person assessment might be worthwhile, particularly to larger medical centers. Most relevant to this study, telemedicine visits allowed the surgeon to effectively screen for potential reconstructive surgery for spastic upper and lower limb candidates prior to an in-person visit. Associated studies have shown that virtual healthcare encounters effectively address patient concerns and adequately triage the need for in-person evaluations [9–11]. Furthermore, virtual visits do not have higher no-show rates compared to in-person appointments [12].

Table 1: Patient demographics.

Sex	n, %
Female	5 (26.3)
Male	14 (73.7)
Age group, years	
0–10	–
11–20	1 (5.3)
21–30	5 (26.3)
31–40	–
41–50	4 (21.1)
51–60	6 (31.6)
61–70	3 (15.8)
71–80	–
>80	–
Distance (miles)	
0–50 miles	1 (5.3)
50–100 miles	1 (5.3)
100–200 miles	–
200–300 miles	4 (21.1)
>300 miles	13 (68.4)
Etiology	
Cerebrovascular accident	10 (52.6)
Traumatic brain injury	4 (21.1)
Anoxic brain injury	1 (5.3)
Cerebral palsy	1 (5.3)
Iatrogenic	1 (5.3)
Unknown	2 (10.5)
Spasticity	
Upper extremity	14 (73.7)
Lower extremity	–
Upper and lower extremity	5 (26.3)

Nearly all patients in this study had subsequent face-to-face evaluations after their initial telemedicine consultation, and 100 % of them went on to have surgery to correct spastic deformities and improve quality of life. Although there may be a response bias for patients who were offered surgery to complete surveys, we have found that a virtual assessment paired with a review of prior medical documentation is effective in determining the patient's candidacy or meeting the indications for spasticity surgery. That being said, determining the exact procedure(s) to be performed requires an in-person physical examination to individualize the surgical approach to the patient's severity of dysfunction, spastic deformity, and goals of care.

Spasticity patients in this study reported that telemedicine consultations allowed for a close and careful assessment by the provider. The vast majority were satisfied with the time allotted for their visit, the quality of the discussion, and the way in which their concerns were addressed. In other words, patients did not feel rushed, were able to accomplish their goals for the initial evaluation, and the quality of the physician–patient interaction from a humanistic perspective was at a high level. These perceptions are reflected in other studies of telehealth evaluation of neurosurgical [13] and orthopedic patients [14].

The majority of the patients in our study felt that there were no technical barriers to virtual assessment. In fact, 18 of 19 respondents rated the ease of use of the telehealth interface as "good" or "very good." It is important to note that this finding is even more meaningful for patients with brain injuries who may or may not have cognitive issues such as receptive or expressive aphasia in addition to their spastic hemiplegia or hemiparesis. We anticipate that continued integration of telehealth into medical practices at large will further improve accessibility for patients with such limitations.

Patients with upper or lower limb spasticity are uniquely well suited for telemedicine evaluations. Travel to medical centers offering such specialized services can be prohibitive, especially for patients who simply want more information about surgery and are unsure if they would qualify as a surgical candidate. Specifically, travel for patients with spasticity may be even more challenging, requiring assistive devices and potential caregiver support for in-person appointments. In this study, most patients (68.4 %) lived over 300 miles away. Single-day travel in this context is not often feasible. Outpatient clinical visits may subsequently require patients to stay overnight for their appointment, which further increases the patient's time, energy, and financial investment, especially if they are not surgical candidates or if they primarily want to explore their therapeutic options.

In addition to the difficulty with travel, few providers are familiar with the spectrum of reconstructive procedures available for spastic limb deformities. As such, local providers, including physiatrists and neurologists, may not be able to explain the risks and benefits of such procedures prior to referral. Virtual visits allow patients contemplating surgery to gain more information without a significant commitment of time and resources. As such, 4 of 19 patients were able to have their first in-person visit, after initial telemedicine consultation, with a next-day reconstructive surgery to minimize travel.

Patients with spastic disorders were able to be adequately assessed virtually, and respondents felt that an acceptable evaluation was able to be conducted over a telemedicine visit. Other studies have validated musculoskeletal examinations via telemedicine visits [15, 16]. It is important to

note that a physical examination alone does not determine candidacy for surgery. The findings of spasticity and/or contracture are assessed in the context of pain, barriers to hygiene, limitations in function, and other aspects of caregiver support.

Study limitations

This study is subject to several limitations. These include a response bias for those who were satisfied with the format of a virtual telemedicine visit. Those who were identified as surgical candidates during their consultation were more likely to respond. Another limitation is the small sample size despite this series being relatively large for a study on the surgical treatment of upper and lower extremity spasticity. Finally, with evolving restrictions of the COVID-19 health crisis, state licensure may soon be required for telemedicine evaluation across state lines, thereby limiting the benefit of virtual evaluation.

Conclusions

Overall, patients were considerably satisfied were their initial telemedicine consultations as a substitute for face-to-face visits. The opportunity for telemedicine not only increases care for those who live further away, but also offers a cost-effective and convenient option for patients who find travel even for short distances challenging.

Research ethics: The Mayo Clinic Institutional Review Board approved the study (IRB ID: 20-004078), which was conducted in accordance with the Declaration of Helsinki (as revised in 2013).
Informed consent: Informed consent was obtained from all individuals by agreeing to participate in the study survey.
Author contributions: The authors have accepted responsibility for the entire content of this manuscript and approved its submission.
Competing interests: None declared.
Research funding: None declared.
Data availability: The raw data can be obtained on request from the corresponding author on a case by case basis.

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