



Assessing disability and relapses in multiple sclerosis on tele-neurology

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Abstract

Background As a consequence of the coronavirus disease 2019 (COVID-19) pandemic, a large amount of consultations will be delivered through tele-medicine, especially for diseases causing chronic disability and requiring immunomodulatory treatments, such as multiple sclerosis (MS).

Methods We have hereby reviewed available tools for tele-neurology examination in MS, including components of neurological examination that can be assessed through video, patient-reported outcome measures (PROMs), and digital technology.

Results Overall, we have suggested a battery for assessing MS disability and relapses on tele-medicine, which brings together conventional examination, PROMs (e.g., Patient Determined Disease Steps, MS Impact Scale), and cognitive tests (Symbol Digit Modalities Test) that can be delivered remotely and in multiple languages.

Discussion The use of common tools for neurological examination could improve tele-neurology practice for both general neurologists and MS specialists, and quality of care for people with MS.

Key words Multiple sclerosis · Tele-neurology · Tele-medicine · COVID

From the end of December 2019, coronavirus disease 2019 (COVID-19) has progressively spread through the world, and,

on March 11, the World Health Organization declared COVID-19 as a pandemic [1]. Healthcare resources and staff have been immediately redeployed towards COVID-19 management, with consultations for chronic diseases being canceled, postponed, or converted to tele-medicine [1, 2]. However, in the upcoming months, COVID-19 is expected to circulate and, thus, a large amount of consultations will be converted to tele-medicine, especially for diseases causing chronic disability and requiring immunomodulatory treatments, such as multiple sclerosis (MS) [3].

MS is characterized by acute-onset neurological symptoms (relapses), and chronic disability, which are primarily evaluated on neurological examination [4]. Following the COVID-19 emergency, the American Academy of Neurology (AAN) has published recommendations for implementing a tele-medicine service, suggesting that general neurological examination is feasible remotely, but with some caveats [5]. For instance, there are difficulties in comprehensive examination of eyes (i.e., fundoscopy), neuro-muscular components (i.e., reflexes), and vestibular system (i.e., Dix-Hallpike maneuver), while the evaluation of other neurological systems depends on the tele-neurology setup (i.e., space enough for gait examination), and

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Table 1 Suggested battery for assessing MS disability and relapses on tele-medicine. The table shows suggested tools for assessing MS disability and relapses on tele-medicine. In particular, PDDS and MSIS-29 could be administered before tele-consultation, and, then, integrated with history, taking more detailed neurological examination, and cognitive screening (SDMT), as necessary

	Tool	Advantages	Limitations
Before consultation	PDDS	Available in multiple languages Available for self-assessment Already validated online	Limited representation of brainstem and cognitive function
	MSIS-29	Available in multiple languages Available for self-assessment Already validated online	To be integrated with more detailed scales/questionnaires, as necessary
During consultation	Full neurological examination	Flexible (depending on patients' symptoms)	Specific setup Caregiver to help Time consuming
	Examination of brainstem function	Largely feasible remotely	To be integrated with PDDS
	EDSS	Current standard in MS clinical practice and research	Specific setup Caregiver to help Time consuming
	SDMT	Suitable for all languages Available for self-assessment Already validated online	More detailed tests for diagnosis of cognitive impairment

the availability of a caregiver to help (i.e., sensory examination) [5]. Remote examination could be further implemented with the use of digital technology, such as smartphone accelerometers for gait, posture, and balance assessment [6]. Similarly, over the past years, different studies have already explored the feasibility of remote counseling in MS, but have focused on specific aspects of the disease (e.g., treatment adherence, mental health) [7–9]. As such, there is no general agreement on MS-specific neurological examination on tele-consultations. Hereby, we have briefly reviewed available tools for remote evaluation of disability progression and relapses in MS, and have suggested a battery for tele-neurology examination in MS.

In MS, different neurological systems are combined into the Expanded Disability Status Scale (EDSS), which is the standard tool for clinical practice, observational studies, and clinical trials [4]. The possibility of assessing the EDSS remotely has been explored, but would require to use an “in-home neuro kit” with vision card, tuning fork, pin, cotton swab, and alcohol swab [10], to have a caregiver helping with the examination [9, 10], and to combine records from wearable devices (e.g., accelerometer-based step counts) [7, 9]. As such, remote EDSS faces some organizational issues, which would be difficult to overcome in the short term, but could be considered when strictly required (e.g., patients included in research protocols). Also, data from wearable devices should be interpreted cautiously, considering that the occurrence of new or recurrent neurological symptoms may not necessarily correspond to reduced physical activity in patients already self-isolating at home.

On the contrary, patient-reported outcome measures (PROMs) would remain entirely feasible online. The Patient

Determined Disease Steps (PDDS) has been specifically developed as a PROM of MS disability and has been validated in multiple languages, and also for online administration [11]. The PDDS is strongly correlated to EDSS, and especially to visual, pyramidal, cerebellar, sensory, bowel/bladder, and ambulatory functional systems, leaving brainstem and cerebral functions relatively unexplored [12]. As such, if patients are required to fill in the PDDS before tele-consultations, remote examination could specifically focus on brainstem function (e.g., ocular movements, trigeminal damage, hearing loss, dysarthria, and dysphagia), which is possibly easier to examine remotely or, at least, on history taking. Looking at cerebral function, different neuropsychological tests have been assessed for remote use [13]. Among them, the Symbol Digit Modalities Test (SDMT), which measures attention and processing speed, holds strong correlates to disability progression, and has been suggested as a screening tool for cognitive impairment in MS [14]. The oral version of the SDMT has already been validated for remote use (e.g., online or during functional-MRI acquisitions), is ideally suitable for all languages [14], and, thus, could be easily used on tele-neurology.

Relapses are defined as the occurrence of new or recurrent neurological abnormalities, which are separated by ≥ 30 days from the onset of the preceding event, last for ≥ 24 h, and occur without fever or infection [4, 15]. Thus, if some elements are relatively easy to evaluate on remote history taking (e.g., timeline, concomitant fever or symptoms of infection), neurological abnormalities would need to be detected as suggested above, along with other neurological tests in relation to reported symptoms. However, relapses also affect quality of life and activities of daily living [15], and, thus, the inclusion

of MS-specific PROMs measuring physical and psychological health could support the assessment of relapse severity. For instance, the MS Impact Scale (MSIS-29) has been used in clinical trials to evaluate recovery from relapses [15], and has been tested for remote administration [16]. Alternative scales could be considered depending on prevalent patients' symptoms (e.g., mood, fatigue). However, in-person examination and/or MRI should be considered for cases where a relapse cannot be fully ruled out, in order to make timely treatment decisions [4].

Overall, we have suggested a battery for MS assessment in tele-neurology, which strongly leverages patients' empowerment and PROMs (Table 1). In particular, we recommend MS patients fill in the PDDS and the MSIS-29 before the tele-consultation, so that neurologists have a full view on the overall physical and psychological status. Then, during the tele-consultation, neurologists can focus on history taking and examination of brainstem function and other neurological systems, as required by patients' symptoms. Finally, if necessary, the examiner could administer the oral version of the SDMT by showing the test form on patients' screen. Alternatively, patients could be provided with PDDS, MSIS-29, and an electronic version of the SDMT [17], for self-assessment, and, then, request tele-neurology if necessary. The PDDS, the MSIS-29, and the SDMT could be integrated to video-consultation platforms or electronic health record systems, or be implemented using other online tools, such as Google Forms.

Limitations of tele-neurology include the availability of technology to deliver tele-consultations (e.g., webcam quality, high-speed connection), which need to be accounted for by policymakers to avoid healthcare inequalities.

In conclusion, though the medical management of COVID-19 is the current healthcare priority, chronic diseases should not be left unattended, and the use of common tools for neurological examination could improve tele-neurology practice, and quality of care for people with MS.

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Conflict of interest None

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