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ORIGINAL ARTICLE

Teleneurology in a center for neuromuscular diseases during the COVID-19 pandemic

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Abstract

Objective The coronavirus disease 2019 (COVID-19) pandemic has urged the adoption of telemedicine services as a measure of greater patients' safety. This study aims to investigate efficacy and feasibility of teleneurology care for patients with neuromuscular diseases (NMD).

Methods All patient visits from 4th March 2020 to 27th March 2021, the period of COVID-19 lockdown requiring partial transition to tele-consultation, were reviewed. Demographic data and medical records during the implementation of the "hybrid model" of both remote and in-person visits during COVID-19 era were analyzed and compared to those of the pre-pandemic era.

Results A total of 2179 tele-consultation contacts for 182 patients (mean age 46.4 years, 42.3% female) were conducted. Tele-consultation was primarily performed by telephone calls. During that period, 1745 telephone calls were conducted, resulting in a 4.5 mean increase/patient compared to 2019. There was a 15.1% decrease in first time in-person consultations compared to 2019. However, the mean number of monitoring visits per person during pandemic was no different from previous years. With the exception of 3 patients with advanced stage of amyotrophic lateral sclerosis, no other patients required an unscheduled appointment or hospitalization for unforeseen reasons related to tele-consultation restrictions.

Conclusion Monitoring of NMD patients could benefit from tele-provided multidisciplinary services. The experience gained during COVID-19 pandemic could be useful for further development of tele-medicine.

Keywords Telemedicine · Neuromuscular disorders · COVID-19 · SARS-CoV-2

Introduction

The outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic caused substantial changes to conventional medical services. The high transmission risk of the novel coronavirus disease 2019 (COVID-19) required a rapid adaptation of medical practice to limit exposure and protect patients. Mobility restrictions, as a protective measure, and hospital avoidance behaviors increased the risk of routine follow-up appointment cancellations. In these challenging circumstances, the implementation of telemedicine services converted face-to-face visits to tele-consultation, via telephone, email or video call [1].

Throughout the pandemic, Greek authorities adopted strict restrictions for the prevention of COVID-19, intermittently recommending hospitals to cancel or postpone outpatient appointments. A strategy of virtual care could be used as a solution to provide continuity of standard care to chronic patients with neuromuscular diseases (NMD) [2].

The objective of this study was to evaluate the effectiveness of remote neurological monitoring of NMD patients as an alternative to standard in-person care.

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Materials and methods

The Neuromuscular Diseases Unit of the University Hospital of Patras is a center of excellence for rare neurological diseases, whose multidisciplinary team provides both clinical and paraclinical examinations (electromyography, neuromuscular ultrasound, spirometry, cardiogram, etc.) to NMD patients of all ages. All patient visits from 4th March 2020 (first hospitalized COVID-19 case at the University Hospital of Patras) to 27th March 2021 were reviewed. Data from medical records and variables related to communication with patients were collected. Sociodemographic data and disease-specific characteristics were retrieved from appointment-associated digital files. Data were analyzed and descriptive statistics were performed for both categorical and numerical data. No approval by the local ethical standards committee was obtained since this is not a human research or a clinical study.

Results

In the pandemic period between 4th March, 2020 and 27th March, 2021 a total of 182 patients were scheduled for an appointment and hence included in our study. Sociodemographic and clinical characteristics of the sample are demonstrated in Table 1. For every patient, at least one tele-consultation was performed.

Overall, a total of 2569 visits and contacts with patients were included in the studied period. Transition to a "hybrid" model, i.e. remote and in-person visits, of the unit operation and changes between pre-pandemic and pandemic era are presented in Table 2. Tele-consultation was primarily conducted by telephone calls, followed by email and video apps. Our tele-services included the provision of 24 h telephone support, advice on medication regimen modifications, certificates for job suitability, certificates for allowance, certificates for benefits and online prescriptions. In exceptional cases of patients with myasthenia gravis (MG) who were previously familiar with the quantitative MG procedure, the follow-up was performed via video evaluation and virtual physical examination. In addition to the neurological service, 116 consultations by a pulmonologist and 56 by an infectious disease specialist were carried-out in our patients during the pandemic period. Due to the strict safety measures and precautions that were taken, none of our patients was infected by SARS-CoV-2 in the setting of our unit. Two unit-registered patients with MG who were diagnosed positive for COVID-19 after intra-family transmission and required ICU admission, had a favorite outcome. Three patients with Amyotrophic Lateral Sclerosis in advanced stage were admitted to the emergency room due to respiratory deterioration. No other patients required unscheduled appointments or hospitalization for unforeseen reasons related to compromised medical monitoring.

Table 1 Demographic and disease-related characteristics of the patients served during COVID-19 pandemic

Sociodemographic characteristics	*n* (%)
Total number of patients served	182
Sex: F/M	77/105 (42.3/57.7)
Age (mean years ± SD[a]); range	46.4 ± 18.7; 6–83
Type of disease	
Myopathy	46 (25.3)
Myasthenia	92 (50.5)
Neuropathy	25 (13.7)
Motor neuron disease	15 (8.2)
Other	4 (2.2)
Mobility status	
Ambulatory	157 (86.3)
Not ambulatory	25 (13.7)
Caregiver dependence	
Yes	74 (40.7)
No	108 (59.3)
Distance: center and patients' residence	
Within 10 km	91 (50.0)
Within 50 km	45 (24.7)
More than 50 km or island	46 (25.3)

[a]*SD* Standard Deviation

Discussion

Telemedicine in neurology was initially developed for the remote management of stroke, introducing the telestroke technology, whose success paved the way for corresponding applications for other neurological disorders [3]. Availability of synchronous (telephone or video consultation) and asynchronous (e-mail communication) models broadened the spectrum of tele-provided medical services, when progressing disability of chronic neurological patients impedes access to care. The evolution of mobile technology makes teleneurology approachable to more chronic patients [4], hence constituting the basic type of communication between neurologists and patients in our unit during lockdowns.

Although teleneurology approaches are gradually developed, the outbreak of COVID-19 pandemic was in fact the major catalyst for tele-care adoption in neuromuscular disorders [5, 6]. Based on case-to-case assessment of COVID-19 risk in NMD patients [2], outpatients of "high-risk" have been exclusively included to our tele-consultation

Table 2 Monitoring data during pandemic era

	P1[a]: 03/2020–03/2021	P2[a]: 02/2019–02/2020	Mean difference between P1and P2
Patients served, no	182	166	+9.64%[b]
Tele-consultation visits, no[c]			
Via telephone	1745 (9.59)	843 (5.08)	+4.51
Via email	434 (2.38)	286 (1.72)	+0.66
In-person appointments, no[c]	390 (2.14)	340 (2.05)	+0.09
First visit	62	73	−15.07%[b]
Follow-up (1st visits excluded)	328 (2.73)	267 (2.87)	−0.14
Prescriptions, no[c]	554 (3.04)	603 (3.63)	−0.59
Provided certificate for allowance/work, no[c]	63 (0.35)	41(0.25)	+0.10

[a]P1: pandemic period, P2: pre-pandemic period

[b]Percentage change from P2 to P1 values

[c]Numbers in brackets indicate mean values per patient

model. When this transition was impractical, e.g. due to medical emergencies or patients' unwillingness, safety guidelines were followed to perform neurological and electrodiagnostic testing in hospital [7].

The main findings of this retrospective analysis were: (1) Increased number of telephone communication; this was attributed either to the patients' reluctance to approach the unit, knowing that COVID-19 units were also located in the same hospital, or to the patients' need to be informed about SARS-CoV-2 infection risk related to their disease and the vaccinations. (2) Reduced number of new referrals possibly since a consultation by a private neurologist outside the hospital environment appeared to be a safer option. On the other hand, the mean number of monitoring in-person visits per patient during pandemic was approximately 2.7 per year which was no different from previous years 2.9, reflecting the need for re-assurance of vulnerable persons under uncertain conditions. (3) The quality of medical care via the "hybrid" model of both tele-consultation and safe face-to-face visits did not change from that provided during pre-pandemic era, as indicated by the limited number of cases required emergency medical attention.

Although an overall gratification for the novel approaches was expressed by patients and their families, their appreciation was not systematically assessed in the analysis. Previous studies have shown that during the COVID-19 era, patient's experiences with tele-consultation led to high satisfaction, depicting the long-term potential of teleneurology in chronic illnesses [8]. Neurologists were overall satisfied with the use of teleneurology as well [2], whereas uncertainty focused on conditions, when decision-making demands neurological examination [9]. Caregivers contribute substantially to the procedure of virtual examination and in general to the effectiveness of teleneurology models [5].

Experience with teleneurology during COVID-19 pandemic will impact the future of care in chronic NMD patients. Stable NMD patients could be monitored by their attending physician from satellite clinics (e.g. collaborating neurophysiology laboratories) or via home-services. This application of tele-care will support rural practice in chronic follow-up of NMD patients, in case of local shortage of specialists on NMDs [10]. In addition, patients and health-care systems could financially benefit from low-cost setting of tele-care [3, 11]. Funded learning programs could promote the familiarization of NMD patients and their caregivers with modern audiovisual equipment, establishing a new era on NMD patients' follow-up.

Conclusion

Feasibility of tele-consultation in care of NMD patients during COVID-19 pandemic could be a solid proof for the opportunities, which exponential technological progress provides to physicians and patients. Chronic care of NMD patients could benefit from tele-provided multidisciplinary services. Therefore, further studies may contribute to the establishment of a consensus framework for the teleneurology of NMDs, after COVID-19 era.

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Declarations

Conflict of interest The authors have no conflicts of interest to declare.

Ethical approval Collection and analysis of medical data were conducted in accordance with the 1964 Helsinki Declaration and its later amendments. The practices of the center are known and written approved by the local ethics committee. No formal consent was obtained for this particular retrospective, observational study.

Informed consent All patients have signed informed consent allowing their demographic data and medical records, including visits, to be used for medical purposes by the scientists of the center of excellence for neuromuscular diseases providing their anonymity.

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