

Artigo de Opinião

Challenges in evaluating neurological patients in the era of Telemedicine

Desafios na avaliação neurológica de pacientes na era da Telemedicina

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INTRODUCTION

Telemedicine offers multiple advantages to both practitioners and patients with chronic diseases, including Parkinson's disease, Alzheimer's disease, and multiple sclerosis. There is an insufficient number of neurologists providing routine follow-up care for such individuals, and such complex cases require specialist attention. With the COVID-19 pandemic, telemedicine in neurology has been more widely implemented. Convenience and safety may outweigh the limitations for most, including impaired diagnostic accuracy for specific symptoms, limited use of telemedicine in the first week of illness for newly diagnosed patients, and impracticality for patients in nursing homes¹⁻¹⁰.

Overview of Telemedicine in Neurology

Telemedicine, defined as using technology to deliver healthcare within the patient's environment, appears to be a practical and feasible solution to healthcare systems' dilemmas³. The advent of video and audio technology and more widespread access to these technologies has fostered the development of telehealth services. Tele-neurology has become an innovative tool for patients with neurological conditions to diagnose, manage, and counsel. Tele-neurology services may include video-visit evaluation, clinical decision support, patient education, and medication management⁹.

Tele-neurology consultations can relieve patients and caregivers from the burdens of traveling long distances to specialty care centers and can be time-efficient and cost-effective. Many telehealth studies have shown that these services are effective and generate outcomes comparable to usual care. These conditions may include epilepsy, headaches, sleep disorders, multiple sclerosis, dementia, and movement disorders. While prior studies have documented a high degree of patient satisfaction with tele-neurology visits, the specific objectives of this analysis were to discuss the experience and outcomes of tele-neurology services and create a more collaborative model of care. No

studies have documented patient and physician satisfaction with a collaborative model of tele-neurology services, despite patient satisfaction being discussed in prior studies⁸.

Challenges in Neurological Evaluation via Telemedicine

The escalating cost of the healthcare system worldwide directly correlates to the expanding population age and source of chronic health problems, particularly neurological diseases. Over the decades, neurology has been the specialty that needs the most support and development. Established, land-based, hospital-based, or standalone telemedicine services are gaining popularity. Invisible issues in the patient-physician relationship complicate tele-neurology endeavors and pose tough questions for understanding. Nevertheless, it is paramount for longstanding and newly developing tele-neurology programs to understand the difficulties in terms of benign, layperson, and physician views as well as professional, financial, and technical hindrances. The online survey showed that regardless of demographic data and tele-neurology perspectives, clear and vivid synergistic benefits exist across almost every type of participant sub-group. This led to the endorsement of proactive, systematized, and diversified tele-neurology problems with input from benevolent plans and benevolence tales constituting myths, impossible or hardly attainable desires, unattainable wishes, or frightful experiences. Largely discussing the impacts of tele-neurology programs and a significant increase in fear-mongering tactics, specialists focus on profoundly harmful nurturing, perturbation, and destructive pathways that contribute to the spread of diseases, escalation of disabilities, rise in mortality rates, and devastation of order. This has sparked considerable concern and concerted efforts among educational and supportive institutions to combat brain disorders, especially exorbitant vasculopathy and other unprecedented movement-related diseases prevalent in highly contemplative nations¹¹.

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Limited Physical Examination

Many types of neurological patients requiring specialty care would benefit from remote evaluations⁶. Remote evaluation of many neurology patients is significantly limited compared to other medical specialties because on-site physical examinations are often critical to syndromic and topographic diagnosis. For many remote evaluations in different specialties, some forms of physical examination procedures, such as venipuncture, can usually be completed at remote sites, regardless of whether that facility is managed by the same provider as the tertiary care center. However, an on-site physical examination is required for nearly all evaluations for most of the more common cognitive impairment and movement disorder diagnoses. Specially trained personnel are required to complete these assessments, which generally cannot be completed in standard facilities that do not have auxiliary equipment specifically designed to conduct these examinations¹⁰.

Due to constraints, remote cognitive impairment and movement disorder evaluations will be limited to many neurological patients, some with treatable conditions who would otherwise be overlooked as needing further care. Tertiary care centers cannot feasibly provide more traditional care due to the increasing numbers of new and repeat patients each month and current Western medicine policies, which prevent patients with active medical issues at the care center from being treated at a remote hospital or clinic. However, alternative approaches to evaluating these patients should be sought out^{4,9}.

Technological Solutions

The need for telemedicine is all the more pressing during times of upheaval and unpredictability, such as the COVID-19 pandemic that began in 2020¹. To maintain continuity of patient care, due to social distancing mandates, a temporary shift to virtual, remote evaluations was made. However, this posed challenges even in the most straightforward clinical practice operations. The challenges faced on a day-to-day basis in the remote evaluation of neurological patients are more nuanced and complex, ranging from difficulty in accessing appropriate amenities at the patient's home to addressing the impact of significant disabilities on remote evaluation, which is inherently visual and auditory.

The innovative developments in audio-visual technology and artificial intelligence (AI) using innovative technology have shown promise in directly addressing these challenges. Remote care service robots with telepresence capability to bring the evaluation to the patient's side may alleviate issues with access and adjustability of examination materials necessary for proper evaluation. Wearable technology employing AI algorithms to

analyze fine motor performance may provide an egalitarian means of assessing one of the most debilitating neurological disabilities, movement disorders, in a patient-appropriate setting. The relevance of such innovations, presently beneficial in the inpatient setting for other neurological conditions, may be extrapolated to enhance the care of the burgeoning population of neurological patients off-site^{9,10}.

Remote Monitoring Devices

Technological solutions have played a pivotal role in alleviating the burden of these challenges. Remote monitoring is one solution that helps gather critical data and insights for neurological evaluations conducted remotely. Today, many devices are commercially available for remote monitoring of neurological patients. Several remote monitoring devices are broadly classified into platform-based and offline devices⁹. Platform-based devices typically require a robust infrastructure, including Wi-Fi connectivity and assistance from trained personnel, to upload the acquired data to the provider's central servers, enabling further processing and analysis. Prominent examples include Apple's ResearchKit (<https://researchkit.org/>) and the patient monitoring system developed by VitalConnect (<https://vitalconnect.com/>). In contrast, offline devices do not require a trained workforce and significantly reduce infrastructure costs¹⁰. These devices enable raw data storage in a portable memory component or a digital interface, and the data can be post-extracted for further analysis. Examples of offline devices include low-cost wearable accelerometers and gyroscopes.

Remote monitoring devices that assess global metrics such as sleep and movement are commercially available for various neurological disorders. Sleep disorders are common in patients with neurological disorders, mainly neurodegenerative diseases, resulting in impaired quality of life. Portable sleep monitoring devices usually consist of a camera/sound-based system that monitors sleep using electrical signals from a head-mounted electroencephalogram headset or movement data acquired from tri-axial accelerometers worn on the wrist. There are portable sleep monitoring devices commercially available, such as Actiwatch (<https://www.philips.pt/healthcare/product/HCNOCTN445/actiwatch-spectrum-plus-obtenha-a-vantagem-actiwatch#features>), an accelerometer-based wristwatch that detects sleep using raw acc-movement data, which it runs through an adieu algorithm, or MotionWatch (<https://www.camntech.com/motionwatch-8/>), which utilizes wavelet-based algorithms to examine Zangle and Yangle data for sleep classification. Overall, the emergence of new technologies holds great promise for remote monitoring of neurological patients.

Ethical and Legal Considerations

In each patient visit for neurological evaluation, a physician and their assistant perform a thorough interview to gain the history of the problem and past medical history. During these telemedicine visits, the same thorough interview is completed with the same level of detail. Similar questions are asked in the same fashion as usual, and abnormalities noted can be obvious in how the interviews unfold. There are limitations to telemedicine, and some patients will never be fully computerized. The aim is not to have every sick patient evaluated via telemedicine but rather to assess those patients who can be satisfactorily evaluated from a distance. These patients generally have a straightforward neurological problem, sufficient intelligence to work with the physician during the interview, and a supportive spouse or relative nearby to assist if necessary. As experience grows, it becomes possible to recognize many patients who do not fit this model and would be better served with an in-person visit.

The continuous rise in the use of telemedicine highlights the need to evaluate and address the current ethical and legal challenges of this modality of health service delivery to improve and protect patient welfare, acknowledge patient rights and privacy, and maintain ethical and legal accountability. Governments have identified telemedicine as a significant opportunity to bridge the gap between doctors and patients separated by geography. However, there are significant challenges in navigating the burgeoning global telemedicine arena.

Patient Privacy and Data Security

As with any new development or technology in healthcare, ethical and legal concerns regarding telemedicine have arisen. In particular, questions and concerns arise regarding privacy, security, technology, and regulation issues.

Telemedicine can potentially change the delivery of services by offering access to healthcare providers and specialists without requiring patients to travel to a healthcare facility¹³. Considerations of the potential benefits and shortcomings of telemedicine implementation should be part of discussions and planning surrounding its practice to ensure that the technology is used to improve the quality and delivery of health care. As many, if not all, telemedicine applications are technology-dependent, privacy and security issues surround the use of information and communication technology. Privacy protection and management of personal information collected, used, and stored by information technology should be ethical principles regulated within the law¹². The concerns of sensitivity, confidentiality, and control of health data contribute to privacy protection legislation. Yet, as healthcare moves more into digital ways, questions remain about how much an individual's privacy is protected in telemedicine,

considering the technology on which the practice is based. With the advancement and use of high-technology systems, personal information is susceptible to being viewed and misused by unauthorized parties. Most notably, there are concerns about the safety net of cybersecurity concerning teleradiology and teleconsultation, considering the storage and transmission of health information across networks.

Conclusion and Future Directions

The rapid adoption of telemedicine in neurological care has brought both opportunities and challenges. While remote evaluations offer increased access and convenience, they also present limitations in physical examinations and diagnostic capabilities. Moving forward, healthcare providers must develop innovative solutions and standardized protocols to overcome these obstacles. By combining technological advancements with adaptive clinical practices, the field of neurology can continue to provide high-quality care in the telemedicine era, ensuring that patients receive accurate diagnoses and effective treatments regardless of their physical location.

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