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Telemedicine in neurology

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Abstract

Introduction

Telemedicine in neurology has been developed for the last two decades. However, this concept has only been introduced to the emergency scene recently. In the above review current state and prognosis of development of telemedicine would be described.

Material and methods

Articles in the EBSCO database have been analyzed using keywords: telemedicine, neurology. The available literature is subjectively selected. Then, the newest version of every paper was searched for.

Results

Results of researches with applications of telemedicine in neurology in emergency, chronic conditions. Moreover, potential costs and benefits were described.

Conclusions

The involvement of stroke specialists also facilitated the diagnosis of other neurological emergencies such as intracerebral hemorrhage, subarachnoid hemorrhage, hypoglycemia and seizure. Potential barriers to the use of this technology include the initial costs of equipment

and training of personnel. Further development of telemedicine would possibly improve both emergency and long-term care in neurology.

Key words: remote; care; neuroscience; brain

Introduction

Since Levine and Gorman proposed the use of telemedicine for stroke in 1999, this field has been developing in many countries [1]. The architecture and design of rural and urban telestroke networks are now better defined. The technology has been adapted to the needs of a sudden, time-sensitive, acute stroke. There are many telestroke networks around the world and most of them have published their implementation experience and early results.

Telemedicine has been broadly defined as the use of telecommunications technologies to provide medical information and services and more specifically as a process in which electronic, visual and audio communication is used to provide diagnostic and consultative support to doctors in remote locations, to assist or directly provide care medical to patients in remote locations and raise the skills and knowledge of remote medical service providers [2,3]. Telemedicine consultations have been integrated into various aspects of modern healthcare, including home care, primary health care offices and operating rooms. In these settings, telemedicine is used to monitor the patient or education.

The concept of telemedicine has only been introduced to the emergency care recently. Chi et al. assessed the legitimacy of including telemedicine systems in emergency department. They concluded that emergency department is the right place to set up a telemedicine center because the combination of telemedicine can reduce unnecessary patient transfer from a local hospital [4].

In 2012, more than 85% of the leading US neuroscience departments used or plan to implement telemedicine [5]. In the above review, application of telemedicine in acute and chronic conditions in neurology as well as cost and benefits would be examined.

Material and methods

Articles in the EBSCO database have been analyzed using keywords: Telemedicine, neurology. The available literature is subjectively selected. Then, the newest version of every paper was searched for.

Results

3.1. Telemedicine application in emergency neurology

Meyer et al. showed that STRoKE DOC Wireless/Site Independent Telemedicine System is a viable, reliable and important way to assess the deficit in patients with chronic stroke [6]. Handschu et al. examined effects of application of telemedicine in acute stroke [7]. Two district hospitals were connected to stroke centers in northern Bavaria. Patients with

symptoms suggestive of acute stroke were included. Remote video testing provided live audiovisual communication and access to brain images; telephone consultation was carried out via a standard telephone using structured interview. Both methods were changed weekly. Demographics and other data on the process and quality of care, as well as results 10 days after the stroke were recorded and compared between the two groups. During the study, 151 consultations were conducted in patients with acute stroke (mean age 66.8 years). Authors concluded that creating a network improves stroke care by establishing cooperation between hospitals. Telephone consultations could be a simple method of telemedicine supporting cooperation because it is easy and widely available. However, performance parameters, such as mortality, indicate that remote video testing is better than telephone consultation. Therefore, Authors recommended a full-scale audiovisual communication for remote consultation in the treatment of acute stroke [7].

A randomized controlled study between two groups: face to face and telemedicine was conducted by Chua et al. The study was conducted between a neurological center and remote clinics in two remote hospitals connected by identical, average commercial cost interactive video conferencing equipment. The same neurologists conducted a study of both arms of the study. Diagnostic categories were similar between the two groups. Patients in the telemedicine group underwent significantly more clinical examinations. There were no differences in the number of prescribed drugs. Patients were generally satisfied with both types of consultation process, except for concerns about confidentiality and embarrassment in the telemedicine group [8].

Ittrat et al conducted study to compare the assessment and treatment of telemedicine patients with a control group of patients brought to the emergency department via an ambulance in the same year. The median time to telemedicine evaluation was 20 minutes. One connection failure was caused by a crew error and the patient was transported to the nearest emergency department. There were 6 telemedicine disconnections, none of which lasted longer than 60 seconds or had any effect on clinical care. The times from the door to the end of CT (13 minutes) and from the door to intravenous thrombolysis (32 minutes) were significantly shorter in the MSTU group compared to the control group (18 respectively minutes and 58 minutes). Times for CT interpretation did not differ significantly between groups. Conclusions and relevance MSTU using telemedicine is feasible with a low technical failure rate and can be a way to reduce the high costs of such systems [9].

Amandi et al. in their review of literature found conclusive studies on the effectiveness of telemedicine in emergency medicine [10]. The best evidence is stroke treatment, where conclusive evidence of significant positive effects of telestroke on the clinical outcome led to a recommendation for stroke treatment. Meyer et al. was found that consultations on telemedicine after a stroke result in more accurate decision making compared to the telephone and can serve as a model for the effective use of telemedicine in other fields of medicine. More appropriate decisions, a high number of rt-PA users, better data collection, low ICH rates, low technical complications and favorable time requirements support the effectiveness of telemedicine, especially in decision making, and may allow more practitioners to use telemedicine for daily stroke care [11].

3.2. Telemedicine application in chronic conditions

Seizures can be a debilitating disease and yet difficult to diagnose. Diagnosis could be made based on the observation of the seizure, and in the absence of it, rely on the description of the bystander. Patients with epilepsy and multiple disabilities have travel restrictions for consultation and examinations, which may involve different centers, and sometimes examinations may need to be repeated. Telecommunications can significantly help communication between different hospitals and doctors epilepsy diagnosis [12]. This would not only avoid frequent and sometimes onerous visits to experts in different hospitals and repeated examinations, but would also allow the simultaneous opinion of different doctors or experts. In remote areas where neurologists are not available, telemedicine is used to provide outpatient consultation of neurological patients.

3.3 Costs and benefits of telemedicine in neurology

Mehrotra et al. described usage of telemedicine in rural areas of Medicare customers [13]. Although the number of telemedicine visits to Medicare has increased by more than 25% per year over the past decade. In 2013, less than 1% of rural Medicare clients had a telemedicine visit, which is a smaller percentage than in veterans' administration, where 12% of beneficiaries receive some form of telehealth in a given year [14]. Mehrotra et al. have found that state laws that require the reimbursement of telemedicine insurance costs under commercial insurance were not associated with a faster increase in the use of Medicare telemedicine [13].

Disabled rural beneficiaries with mental illness, who were relatively sick and poorer, most likely used telemedicine services. Although telemedicine appears to serve people with poor access, it is not known whether this increased access translates into better results. Teleneurology was propose to be highly useful in sub-Saharan Africa [15]. Underestimated locations include geographically isolated rural areas as well as urban cores with insufficient neuroscience specialists available could be benefited the most with telemedicine [16].

In addition, the telemedicine neurosurgical rescue network confirmed the clinical effectiveness and cost-effectiveness of neurosurgical consultations in a population of 329 patients from the group of underestimated risks [17]. The risk of transport or discrepancy of the radiological review in 35 months of the evaluated data was assessed. It was noted that, the main benefit of the telemedicine system for consultation in acute stroke is the provision of specialized resources not available in the community hospital [18]. Telemedicine consultation on acute stroke at St Mary's hospital enabled intravenous administration of rtPA in 24% of patients for whom this technology was used. After considering all requests for consultation with St Mary's, 5 out of 50 (10%) were treated thrombolytically with telemedicine, twice as much as the national average. This allowed treatment options not previously available in a remote location [19].

Early neurological assessment reduced hospital stay for patients with neurological conditions outside of neurological centers. This can be achieved safely remotely using a real-time video link [20]. Vassallo et al. examined result of cooperation between the Paralyzed Rehabilitation

Center (CRP) in Dhaka and medical consultants abroad. This inexpensive telemedicine system used a digital camera to take pictures, which were then sent by email. In the first 12 months, 27 telemedicine referrals were made. The following specializations were consulted: neurology 0.44%, orthopedics 40%, rheumatology 8%, nephrology 4% and pediatrics 4%. The advantages included establishing a diagnosis, ensuring patient and referring doctor safety, and changing behavior. Four patients (0.15% of the total) and their families were saved considerable expenses and unnecessary stress associated with traveling abroad to obtain a second opinion, and the savings alone exceeded the costs of setting up and operating in Bangladesh. The latter are limited to an email account with an Internet service provider and local telephone fees from CRP. This effective telemedicine system is a model for further telemedicine projects in the developing world [21].

In collaboration with a vascular neurologist, application of telemedicine provide timely telemedicine consultations, accurate diagnosis, and proper treatment for patients with acute stroke who have reported to remote rural emergency departments within the center and conversations [22]. Craig et al. concluded, that neurological diagnosis with telemedicine application is not worse than face-to-face diagnosis performed by young physician [23].

Conclusions

The involvement of stroke specialists also facilitated the diagnosis of other neurological emergencies such as intracerebral hemorrhage, subarachnoid hemorrhage, hypoglycemia and seizure.

Potential barriers to the use of this technology include the initial costs of equipment and training of personnel. The trap associated with our current telemedicine system is the lack of a 24-hour connection with specialist consultants due to the permanent location of the equipment. The optimal system will enable audiovisual communication in real time with the community hospital from anywhere (hospital or home). We also realized the challenges of ongoing training needs in response to frequent changes in emergency department staff. Episodic refresher courses and the orientation of new staff are necessary to maintain the competences needed to use technology for post-stroke consultations.

The future direction of telemedicine can connect many community hospitals throughout the state to regional STC. Technology to send audio and video images of patients during ambulance transport to shorten the time for treatment after arriving at the receiving facility was also tested [24]. All these advances are aimed at increasing patients' access to stroke specialists and acute stroke care resources.

Telemedicine, although feasible in the some settings, is less well accepted than direct consultation and leads to excessive investigations [8]. However, in a remote area where the number of neurologists is too low, telemedicine may become a viable option, especially in developing countries.

Telemedicine plays an important role in emergency consultation. Professionals can use their expertise to assess and treat stroke patients through a real-time audiovisual connection with remote physicians. Further investigation of patient results, impact on hospital costs and quality control is necessary. Unfortunately, the availability of this promising technology will

be limited until further funding and reimbursement mechanisms are established [25].

Importantly, the sophisticated 2-way audiovisual telestroke consultations are rigorously compared with simple pragmatic telephone consultations in potential randomized controlled trials [26]. Successful telestroke promises include remote immediate expert diagnosis of stroke, delivery of short-term therapies, and advice on secondary prevention. The promises of telestroke applications that are slower to implement include the widespread national and international telestroke networks that offer standardized evidence-based care, telestroke research networks for testing new stroke therapies, standardized measurements of the quality of telestroke care, and acceptable guidelines for telestroke practice. The long-term stability and growth of telestroke practices are still threatened by unresolved legal, economic and market factors. Telestroke practitioners and researchers should focus on analyzing and solving business practice problems to enable further progress in the field of telestroke and longevity of telestroke practice [26].

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