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REVIEW ARTICLE

Telemedicine in neurosurgical emergency: Indian perspective

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ABSTRACT

Telemedicine is rapidly developing telecommunication technology to provide medical information and services. The importance of telemedicine for neurosurgical emergencies was established with the fact that majority of the neurosurgical specialists are practicing in urban settings and in most of the rural areas, neurosurgical care is far off or non-existing. Countries with inadequate health care must incorporate telemedicine in their health care system. Telemedicine offers real benefits in a country as vast as India, where the majority of the population lives in remote areas with no access to even the most basic healthcare. Issues pertaining security, privacy, maintaining standards, and legal aspects are relevant. A recommended set of standards and guidelines for telemedicine needs to be set in place and constantly refined to promote the integrated growth of telemedicine in the country. The paper discusses various issues, shortcomings, and utility of telemedicine in India.

Key words: Tele-education, telemedicine, neurosurgical emergency

Introduction

Telemedicine is rapidly developing telecommunication technology to provide medical information and services. The importance of telemedicine for neurosurgical emergencies was established with the fact that majority of the neurosurgical specialists are practicing in urban settings and in most of the rural areas, neurosurgical care is far off or non-existing. The country has nearly 70% of rural population which has limited or no access to speciality neurosurgery care. Fortunately, India has a very good foothold in Information technology sector. So telemedicine and tele-educaton in the health sciences is gradually adopted into the Indian health care system.

The objective of telemedicine in neurosurgical emergencies was to enable less trained on-site medical personnel, placed in geographically distant and medically deprived areas, with information, advice and guidance so that they are able to deliver necessary advice and treatment. So that in cases of emergency, he can accelerate the transfer of victim and can manage life threatening conditions. This could be achieved by connecting the far off center with highly specialized center, where desired specialities are operational, through the satellite. Not only is this being done on an increasing scale day-by-day worldwide, but it has also become a very strong tool for poor countries with limited resources to address their impoverished areas in a much better way in terms of health care delivery and health education.

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History

The exact time when telecommunication was used for the first time in health care is unknown (Brown). In civil wars, in 1900, the telegraph technique was used to treat casualty list and order of medicine supply. In April 1924, issue of the Radio News magazine included a drawing of a physician viewing his patient over the radio, which include a TV screen although the television was not discovered by that time. This was a giant leap which catapulted the very concept of a remote medical aid. First cross state demonstration of telemedicine probably occurred in 1951 New York World´s Fair. In 1957, Albert Jutras started doing tele-radiology in Montreal, and in 1959, Cecil Wittson started a tele-education and tele-psychiatry program at the Nebraska Psychiatric Institute.[1] Owing to realization of its importance and impact on medical practice worldwide, in 1993, telemedicine became a medical subject heading to prepare the future generation of medical practitioners who will take this novel idea from infancy to its full potential.

In India, Telemedicine activities were started in 1999. Telemedicine center at Apollo Aragonda Hospital, in the state of Andhra Pradesh, was inaugurated by the then US President Bill Clinton in 2000. Today, about 500 telemedicine centers linked with about 50 specialist hospitals across the country are actively providing medical care.[2] Now the telemedicine centers are proving medical care to millions of patients countrywide. The government's 11th Five-Year-Plan (2007–2012) allocated 2000 million rupees (about US$50 million) for the development of telemedicine in the country. The goal envisioned by India is: "Access all the Inaccessible parts" of the country in the next five years. India with its large medical and IT manpower and expertise in these areas have emerged as a leader in the field of telemedicine.

Discussion

Telemedicine may be as simple as two health professionals discussing a case over the telephone and as complex as using satellite technology and video-conferencing equipment to conduct a real-time consultation between medical specialists in two different countries. It can be applied to a varied number of specialties of clinical care like anesthesia, psychiatry, oncology, dermatology, radiology, cardiology, critical care, continuing medical education, home monitoring, and patient education. The list is increasing with new avenues opening up every day with the progress of medical science and technology.

The most challenging aspect of a neurosurgical emergency comprise of establishing the diagnosis and safe transportation of the patient in time with all due precautions and commencing intervention and treatment required at the earliest. This challenge can be very well met by telemedicine by reducing time of transportation by early diagnosis and communication of emergency situation. Correct diagnosis at the shortest possible time and interaction between the treating specialists at the distant center with the neurosurgery expert can save precious minutes and enable starting crucial treatment at the site. The specialist care in the presence of the virtual specialist and expediting transfer of the patient requiring neurosurgical care are the two important factors to ensure prevention of secondary injury. An interaction in real time would require a state of the art software module with access to good internet connectivity.

The global leaders in telemedicine are in developed countries that have large segments of their populations living in remote areas, such as Canada, Australia, and Norway. India faces a shortage of doctors, particularly in rural areas, where nearly 70% of the population lives. Doctors and hospitals are largely concentrated in cities, and as a consequence, health care in rural India is inadequate or in a wanting state. The judicious use of information and communication technology can overcome some of the limitations imposed by scarce resources. Multimedia messaging service can be used to transmit important scan images to experienced staff to facilitate accurate and prompt diagnosis and commence optimal treatment.

Advancement in telecommunication, information science, and technology provides an opportunity to exchange knowledge and skill across geographically dispersed organizations. The common theme in neurological emergencies lies with prompt diagnosis, rapid access to scans, accurate scan interpretation, and quick institution of appropriate treatment. Failure in any one of these vital steps can result in devastating and permanent neurological deficits or death.[3]

Availability of indigenous satellite communication technology and the government policy of free bandwidth provision for societal development sector have added strength to set up infrastructure to pilot several telemedicine educational projects across the country. Rough calculations suggest that only about 0.1% of the potential telemedicine demand from the developing world is being met.[1] Possible reasons include the referrers being too busy and a perceived loss of control. Efforts are taking place in the field of medical e-learning by establishing digital medical libraries. Some institutions that are actively involved in telemedicine activities have started curriculum and noncurriculum telemedicine training programs. Teleradiology is the best method to avoid unnecessary transportation or deleterious delays before transfer. Limitations of telemedicine can be reduced by uniform standard care dependent on availability of an excellent infrastructure. Such infrastructure includes qualified teachers, knowledge resources, learning materials, and advanced education technology, which is a challenge in developing countries due to financial and logistic constraints. As the practice of telemedicine spreads, maintaining standards, security and privacy will be a challenge especially with regard to legal and regulatory measures in cases of failure of telemedicine system during emergency that should be made responsible? Is it the surgeon, the satellite provider, or the software/hardware engineer? The legal status of telemedicine-based diagnosis and treatment needs to be established and constantly updated in terms of rapidly changing scenario of this growing field.[4]

There are a few practical problems related to telemedicine as exemplified by Krishnan Ganapathy,[5] Joint Secretary of the Telemedicine Society of India and President of the Apollo Telemedicine Networking Foundation who says "I can tell a patient in a village what drug to take, and I can fax a prescription. But where will the patient buy the drug?", Moreover, telemedicine has obvious limitations when it comes to both diagnosis and surgery. For any of the "major problems", he needs to meet his patients' face-to-face. "It is very difficult to convince someone that I can check their pulse from 5000 miles away", he says.

Few Facts

Mrak *et al*,[6] has published his experiences with telemedicine in Zagreb, Croatia, and has found the results promising. In 1998, a teleradiology system was established in Croatia connecting 34 computed tomography (CT), magnetic resonance imaging (MRI) and digital subtraction angiography (DSA) scanners in 29 hospitals with a referral center in the neurosurgery department in Zagreb. In the first three years of its use, the network saved more than 400,000 km of patient transportation (i.e. without a teleconsultation, all of the patients would have had to be transported to the nearest referral neurosurgical unit). During the first seven years, an archive with 25,366 expert opinions was collected. A total of 7103 (28%) expert opinions were provided for the distant regional hospitals. The most common diagnoses for patients from regional hospitals were neurotrauma (53%), cerebrovascular diseases (22%), and brain tumors (19%). The teleradiology system was used less often for lumbar disc disease (4%), hydrocephalus or other neurosurgical disorders (2%).

Servadei,[7] has similar sentiments. During January 1998 to December 2000, 1665 CT examinations were sent via image transfer to the Neurosurgical Unit in Rome, Italy; 637 first examinations (47%) and 206 second examinations (70%) were related to acute trauma cases. Out of 637 first examinations, 150 patients were actually transferred to the Neurosurgery Unit (23%), whereas of 206 second examinations, only 10 patients were secondarily transferred (5%). Only one case died due to delay in transferring the patient. In his opinion, it is quite feasible to coordinate management in head injuries with telemedicine.

Telemedicine in urgent neurosurgery, as reported by Rudinsky *et al*,[8] can have dramatic results in terms of reduction of time of transfer and starting definitive specialty care and thus outcome. The time of 6-8 hours could be possibly reduced into 2-2.5 hours. The process of mailing the request for consultation with picture documentation and receiving a qualified evaluation from a distant center takes about 10-15 minutes.

Sinha V.D. in his two-year experience with six telemedicine centers provided a total of 89 consultations, out of which neurotrauma consisted of 49%, space occupying lesions 24%, cerebrovascular accidents 20%, and others 5%. No of cases transferred to neurosurgery center were 47% among them 30% were subjected for surgery. Not only the process identified target patients earlier but also avoided unnecessary transfers.

Telemedicine, CT scan facility at periphery and other important factors such as good pre-hospital care, rapid transportation etc. leads to early reference of head injury especially in cases that required surgery. It decreases trauma operation interval and improves outcome, which is well proved by the facts, where mortality in epidural hematoma (EDH) reduced from 19 to 11.2% and SDH 51.2 to 27.9%, respectively.

Future

India with diverse land mass and huge population is an ideal setting for telemedicine.[9] The future of telemedicine in India is bright as it has the potential to become a tool to ensure equity of healthcare among the most needy and poor populations of the country. Not only will it connect these areas to the health map with regard to the specific healthcare requirements, but also help in their progress in terms of the health care planning and education. For the needy and the poor, it will be free of cost as one of the main aims of telemedicine is to provide healthcare to the population in rural and distant areas.

Conclusion

Countries with inadequate health care must incorporate telemedicine in their health care system. Telemedicine offers real benefits in a country as vast as India, where the majority of the population lives in remote areas with no access to even the most basic healthcare. Issues pertaining security, privacy, maintaining standards, and legal aspects are relevant. A recommended set of standards and guidelines for telemedicine needs to be set in place and constantly refined to promote the integrated growth of telemedicine in the country.

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