

Role of Telemedicine in Anesthesia: Are We Ready Yet?

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Abstract

Telemedicine is a modality which utilizes technology to provide and support health care across large distances. It has redefined the practices of medicine in many specialties and continues to be a boon for clinicians on many frontiers. Its role in the branch of anesthesia remains largely unexplored but has shown to be beneficial in all the three phases: pre-operative, intra-operative, and post-operative. Now time has come that anesthesiologists across the globe reassess their strategies and utilize the telemedicine facilities in the field of anesthesia.

Keywords: Anesthesia, challenges, COVID-19, pre-anesthetic evaluation, teleconsultation, telemedicine

INTRODUCTION

Telemedicine was a term which originated in 1970s and means “healing at a distance.”^[1] It has been defined by the World Health Organization as “The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities,”^[2] whereas telehealth is a broader term encompassing all the realms of healthcare system.^[3] Introduction of telemedicine in any healthcare setup should be based on evidence-based approach and cost-benefit ratio, along with keeping in mind the risks and challenges involved.

The advantages^[4-7] and disadvantages^[8-10] of the telemedicine have been highlighted in Table 1.

INFRASTRUCTURE AND MODES OF TELEMEDICINE

Successful teleconsultation requires minimum availability of good hardware, software, and connectivity example in the form of wireless local area network. Different modes of telemedicine such as video, audio, and text have their own share of pros and cons associated with them.

Video communication offers the advantage of seeing the case in real time but complete physical examination is not possible, only inspection is feasible. Also, there is possibility of breach of privacy during video call. Audio consultation is good with the advantage that you do not need expensive gadgets like video facility but examination of patient is not possible. In both audio and video consultations, network connectivity must be good, otherwise there will be frequent interruptions. Text-based mode of teleconsultation is a convenient mode with no requirement of separate infrastructure and has the advantage of good documentation but the drawback is one cannot be sure of the identity of the patient or caregiver, also rapport building is difficult.

TELEMEDICINE IN DIFFERENT SPECIALTIES OF MEDICINE

In specialties such as radiology, pathology, and ophthalmology, telemedicine has established itself well. In tele-radiology, the radiographic images are sent to a radiologist for evaluation, example, X-ray, computed

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Table 1: Advantages and disadvantages of telemedicine

Advantages of telemedicine	Disadvantages of telemedicine
Faster access to healthcare services	Possible legal implications in many countries because of lack of clear-cut guidelines and protocols
Cost-effective as it reduces the travel expenditure to hospitals	Depersonalization
Better maintenance of patient's records and documents. At the same time, better documentation provides legal security for both patients and doctors.	Overdependence on technology that may be unreliable
Educational benefits in terms of continuing medical education. Medical practitioners can utilize the telemedicine services and connect with each other to discuss various realms of medicine.	Clinical risk—As with any other activity, the clinical risks associated with telemedicine must be managed.
Prevention of transmission of infectious diseases especially in times of disease outbreaks and pandemic like the current novel COVID-19 pandemic.	Equipment cost and robust setup
Provides better communication between periphery and tertiary care centers leading to higher quality of health care which can be provided to patients.	

tomography scans, magnetic resonance imaging scans. In tele-pathology, a pathologist can observe, and in some cases also control a distant microscope. In tele-ophthalmology, ophthalmologists are able to screen, diagnose, and monitor the patients residing in far-off areas.

During the ongoing novel COVID-19 pandemic, a board of governors in suppression of Medical Council of India along with NITI Aayog emphasized upon the role of telemedicine and released “Telemedicine Practice Guidelines” and makes telemedicine consultation legal for registered medical practitioners.^[11]

TELEMEDICINE IN THE FIELD OF ANESTHESIA

Though telemedicine has fared pretty well in different fields mentioned above such as radiology and pathology, its role in the branch of anesthesiology is still uncertain and there is limited literature highlighting the role of telemedicine in anesthesia.

Telemedicine in the pre-operative phase

The pre-anesthetic evaluation (PAE) was done in the pre-operative phase before any surgery to review the medical history of the patient and to do the complete physical examination including the systemic and airway examination. Along with it, the investigations of the patients are checked, and anesthetic plan and post-operative care are formulated and explained to the patient and caregivers so that they are aware of the whole process of surgery and anesthesia. Inadequately conducted pre-anesthetic checkup leads to frequent surgery delays and cancellations.^[12]

Pre-anesthetic checkup done through telemedicine has been found to be useful in terms of decreasing the need for patients to travel, benefiting those living far off from the clinic or those with physical disabilities, and it is cost-effective by decreasing the overall expenditure. At the same time, it helps in prehabilitation before surgery by explaining about the medical management, role of smoking cessation, and dietary advice.^[13]

Countries such as USA have facility of high-resolution video cameras and electronic stethoscopes, which make airway examination and auscultation of heart and lung sounds easier.^[14]

For the purpose of teleconsultation in pre-anesthetic phase, an explicit consent is required whenever the consult is initiated by a healthcare worker. This could be in a form of text, video, or audio message which has to be recorded and documented.

During the teleconsult, the patients are also told that they would be reviewed again on site before proceeding for surgery; this instills confidence in them. Fear and uncertainty are very common during the novel COVID-19 pandemic, and thus providing good medical and surgical care becomes extremely difficult and challenging. These challenges hamper the quality of life, the treatment process, and the control of disease in patients suffering from diseases such as cancer. Given the COVID-19 pandemic, all the above patients posted for oncosurgery are under the obligation to stay in the house isolated and can no longer come to routine PAE clinic because of their immunocompromised status secondary to disease, chemotherapy, etc.; in such a scenario, telemedicine can prove to be a major boon.

In the future, telemedicine has a good prospect of providing advantage in pre-anesthetic consultations as face-to-face consultation. Face-to-face consultation will be increasingly expensive with restrictions on time and resources during pandemic.

University health network in Toronto developed the system to provide anesthesiologists with the facility of conducting pre-anesthetic examination from a remote setup. Both the patient and clinician have video monitors and cameras installed with a good local area internet network. With the help of attending doctor/nurse at patients' end, auscultation is done with the help of a digital stethoscope. Airway examination is done with the help of video cameras. All the history and examination findings are recorded and documented, which are again verified on the day of surgery.^[15] Remote anesthesia monitoring has

been reported in which a “rapidly deployable telemedicine unit” was utilized for assimilation and interpretation of physiologic data such as electrocardiogram, SpO₂, EtCO₂, blood pressure, breath sounds, heart sounds, and video laryngoscopy.^[16] Rollert *et al.*^[17] highlighted that patients for whom traveling was difficult, they underwent successful telemedicine pre-operative consultation before head and neck surgery with no complications, highlighting the usefulness of telemedicine in this patient subgroup. Mullen-Fortino *et al.*^[18] demonstrated the benefit of teleconsultation in patients undergoing various types of surgeries and reported good patient satisfaction, zero cancellation rate, and reduced hospital visit duration.

Telemedicine in the intra-operative phase

The utilization of telemedicine in the intra-operative phase has been very limited. Two cases of pediatric liver transplantation were performed at Narayana Hospital, Bangalore, India in which intra-operative anesthesia consultation was provided by Children’s Hospital, Philadelphia with the help of Goto Meeting software.^[19]

During intra-operative phase, audio-video equipment which is easily available in the operating room nowadays can be used to transfer video cast between operating rooms, helping us in visualization of anesthesia monitors and the operating room environment. This again proves to be very useful in the era of pandemics such as COVID-19 in which we can limit the number of personnel inside the operating room (OR).

Telemedicine has also been utilized to provide EEG-monitored closed-loop delivery of induction agent, propofol, over a distance of 200 km between Munich and Erlangen with the help of virtual private network in a pilot study of 11 cases undergoing general surgery.^[20]

The potential use for telemedicine during intra-operative phase can also be for teaching purposes. Miyashita *et al.*^[21] described the use of video conferencing to educate anesthesiologists in far areas to conduct ultrasound-guided procedures in real time. It could also prove useful in disaster situations that result in mass casualties requiring emergent care where anesthesiologists are less in number.

Thus, in the intra-operative period, telemedicine can be of advantage in the form of providing remote guidance in austere environments and real-time surveillance of multiple operating rooms at the same point of time. But, for telemedicine to be successful in the intra-operative phase, it is imperative that there is proper relay of intra-operative parameters and there is no communication breakdown or technical issue leading to default in transmission of vital parameters.

Telemedicine in post-operative phase

Telemedicine is useful even in post-operative phase in intensive care unit and post-anesthesia care unit by providing virtual surveillance. It helps the clinicians

in planning rehabilitation by recording post-operative milestones and careful planning of pain management, especially in day care surgeries.^[22] A recently conducted study regarding enhanced recovery program post-colorectal surgery highlighted the importance of mobile applications to record post-operative milestones by the patients.^[23] But further research is warranted to see which subgroup of patients can be monitored remotely at home post-surgery and which subgroup of patients needs care in the hospital.

Role of telemedicine in simulation, training, and market growth

A high fidelity medical simulation facility has been developed in the UK, in which through two-way video conferencing using didactic lectures and video demonstrations, students can direct the course of simulation from a distant place. The advantage being that heavy bulky instruments need not be moved from one place to the other and problems can be easily identified before actual live teleconsultations.^[24]

Telemedicine in anesthesia will also provide a new launchpad through which new models for enhanced recovery after surgery could be implemented.^[25] Recently, Kishimoto *et al.*^[26] reported usefulness of tele-monitoring and tele-sedation for systemic management during dental procedures in four cases. They performed a study group to provide education to dental providers and encouraged others to attend the program if they intend to use telemedicine in their practice.

Video towers with handheld camera, digital stethoscope, and otoscopic attachments are now available in USA; also airway examination complying to American Society of Anesthesiologists (ASA) standards is available which can be very useful to assess difficult airway cases. Services of communication software like Zoom and GoTo meeting can be utilized in the absence of full telehealth video facilities.

LIMITATIONS OF TELEMEDICINE IN ANESTHESIA

Telemedicine in the field of anesthesia is totally unheard of from the Indian context. It has its own limitations such as

- Telemedicine facility is still in its nascent phase and not available at most of the places.
- With help of phone screening, we cannot do airway examination, heart and lung auscultation, investigations such as ECG and spirometry.^[27]
- Efficient use in remote locations with poor internet connectivity is questionable.
- Telemedicine usage in pre-operative phase in the pediatric age group would be difficult.^[28]
- Patient privacy is a matter of concern during teleconsultations.
- Apprehension of the patient because of being examined from a remote location and inability to develop a rapport

with the clinician. The same was highlighted by a study conducted by Fishman *et al.*, in which they highlighted the patient preferences on telemedicine for PAE.^[29]

- There is no standard operating protocol and guidelines developed till now for usage of telemedicine in anesthesia.

Keeping in mind the limitations, anesthesiologists need to regularly conduct audits to see the impact of telemedicine in clinical situations.

CONCLUSION

Technological advancements across the globe have made world a smaller place by allowing real-time communication and transmission of information over long distances. The same advancements have translated in the field of medicine and have led to the evolution of concept of telemedicine. In the era of pandemic such as novel COVID-19, the need for the role of telemedicine is felt even more by all the clinicians so as to minimize the chances of infection spreading between patients and healthcare workers. Role of telemedicine in the field of anesthesia, even though limited till now in literature, has been proven to be very useful in all the three phases: pre-operative, intra-operative, and post-operative periods. It can also be used to provide assistance and education across institutions and between different countries also. Its usefulness in PAE has been demonstrated in few studies, but the question remains that are we prepared yet to translate it into our clinical practice or not? With the ever-evolving technology, it is time we must embark on a new journey in the field of anesthesia and prepare ourselves to utilize the services of telemedicine in anesthesia in coming years. It will help the anesthesiologists to extend their spectrum of services not just within the hospital premises but also outside the hospital leading to overall improvement in healthcare system.

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