Telemedicine in the Operating Room

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Telemedicine is the use of electronic information and telecommunications to support health care at a distance. Surgery is the medical specialty of disease treatment by direct physical intervention with the hand or hand-operated tools. These definitions seem to have little in common. However, the highly restricted and isolated environment of the operating room (OR) is being accessed more and more by telecommunications and computing information. Presence in the operating room has meant special training and wearing special clothing to protect patient privacy and avoidance of infection. Now we can consider the power of telepresence to import to the OR vast amounts of information as needed, and to export information and images to inform wide audiences about surgical procedures for the purpose of education and consultation. The OR of the future will be part of the electronic continuum, joining a very large virtual community of caregivers and trainees to enhance patient care and education.

Perhaps the most obvious use of telemedicine for surgery has been with surgical robots. In 2001 Dr Jacques Marescaux employed a control device in New York to robotically remove his patient’s gallbladder across the Atlantic Ocean in Strasbourg. This dramatic demonstration of the power of telemedicine is now routinely used in a program in Canada directed by Dr Mehran Anvari in Hamilton, Ontario.

This extraordinary use of technology is neither the beginning nor the end of surgery, using the advances in telehealth that are changing the practice of medicine from bottom to top. Telemedicine has been used by surgeons to meet, examine and evaluate patients before operation and to follow them in the postoperative period. This use has been well demonstrated in remote situations such as the Amazon and to support the care of incarcerated patients. [2, 3]

The surgeon may have learned about a new procedure through distance learning over the Internet and may have received the critical information for patient consultation by e-mail with sharp images and diagnostic x-rays attached. The patient may have learned about her surgeon and the condition requiring surgery from Internet sources. These uses of general information sharing and communication are not only reserved for primary care but are at the heart of practice changes in surgery as well. [4]

In the OR of the future, the electronic record of the patient will be available; including all biopsies, radiology studies, CT Scans, text data and video for use by the surgeon in the course of a procedure. The images can even be applied directly to the surgical field so that the surgeon is operating with direct guidance of the image that will seem to see through the visual anatomy into the interior structures.

This enhanced reality is already available in neurosurgery, vascular surgery and some cancer operations. The surgeon may import an assistant or consultant or even a student to share in the operation. This could involve simple sharing of voice and images. [5] The OR systems can accommodate superb imaging systems and the procedures can be deconstructed in software to allow full involvement on the cognitive side by a single consultant or audience. [6]

Such systems aim towards an electronic surgical record with full data capture of the event including video, physiologic monitoring, OR statistics or voice recognition transcription and can be readily shared in real time or reviewed later along with other components of the patient record. These digital records make the transcribed narrative of the traditional operative note look like feeble reflections on a very complicated and data rich event. The distance participants can control some of their view of the procedures with robotic cameras. [7] They could be involved through physical telepresence using assisting instruments or they could be the primary surgeon using telerobotics.
Robotic devices may go where surgeons cannot because of size of the hand and the potential injury caused by gaining access with a hand. This has already revolutionised surgery for prostate cancer. Tiny robots are in development for insertion through small openings to target interior structures for surgical purposes.

It is easy to extrapolate these early adaptations to the successor to today’s OR. It is likely that care now restricted to the surgical suite may begin in the field for accident victims or war casualties. Programmed patient assistants may look like a stretcher but have all the equipment and telecommunications to begin lifesaving surgery at the site of injury and continue en route to a full OR. The traumapod developed by the US Army envisions just such early care, and robotic caregivers are at the heart of the concept. The robots will be semiautonomous but mostly instructed by surgeons far away like the operators of drone aircraft in areas of conflict.

When the patient arrives in the physical OR, the surgeon’s assistant may be a robot, as in the Penelope program of the Army, and the human assistant may be on the next continent brought into virtual collaboration by telepresence. The surgeon may have planned the operation by immersing in a virtual reality environment with the patient’s various scans to design just the right approach to the injury or pathology.

Then again there may be no surgeon in the operating room at all!!! Some do envision the obsolescence of human contact in favour of programmed robotic interventions for customary surgical care. This is a long stretch. Even the drone aircraft need a pilot somewhere and passenger aircraft with dazzling electronics and guidance still have pilots on board. The OR of the future almost certainly will evolve as a collaboration of empowered surgeons and marvellous machines, but the ultimate concern for patients will be fully human and not mechanical.

REFERENCES