Video acquisition in operating rooms improves patient care

Umberto Nocco

The new operating rooms of Varese Town Hospital incorporate a computerized image acquisition and distribution system that can be used in medical education.

Clinical engineers are professionals who participate in the healthcare process through the appropriate and cost effective incorporation of technology. Much work focuses on operating rooms (ORs) where many technologies are supposed to work together or, at least, on the same patient. In such an environment, an engineer’s interest should be focused either on a single device and its implementations and upgrades, or on the workflow of surgery and the surgeon’s needs.

A recent study conducted at Varese Town Hospital in Italy showed that surgeons are extremely interested in image acquisition and storage since images can be used both for documentation and education. High quality videos and images can effectively support surgical reports, can be handed to the patient in some cases, and can be used for future evaluation. In addition, recordings can allow medical students to view more surgeries from a better point of view than they can achieve in an operating room. A previous study showed that in minimally invasive surgery, task performance improves when the image display is placed in front of the operator. The presence of many operators in the surgical theater suggests that more than one display should be installed in the OR to grant each operator an optimal viewing angle. This means that images produced in an OR should be acquired by a system able to broadcast them to different displays, or outputs. Furthermore, videoconferencing can help fulfill students’ need to view live surgery without their needing to be inside the OR. Real time audio and video connections can be used for consultation as well.

Taking into account operating workflow, surgeons’ comfort, and image acquisition, we have developed ‘Operating Suite’, an OR where image handling, room layout, and device control are designed to provide the surgeon and his staff with the most efficient environment. Such an environment is supposed to enhance the surgical equipment’s performance and, of course, patient outcomes. Operating Suite is a highly computerized OR where all controls are concentrated on a touch screen monitor. From this screen, nurses or surgeons can activate the video distribution system by simply selecting a video source and one or more destinations where it should be viewed. They can also modify the working parameters of medical equipment (i.e., electrosurgical generators, CO₂ insufflators, etc.), the intensity of the OR lights, and even temperature and humidity. The touch screen can be placed on the sterile field so that the surgical team can operate the device rather than needing an OR nurse to do so. This results in a more efficient environment and more effective use of human resources.

Twenty ORs were built in the new Varese Town Hospital, and each of them is equipped with a computerized video matrix

Continued on next page
operating together with a medical device controller. The video matrix acquires video signals as inputs and assigns them to video outputs (see Figure 1). The number of video inputs and outputs to be connected to the video matrix can be chosen based on the user’s needs. In this case, 16 × 16 video matrices (inputs × outputs) were installed in the ORs since evaluations suggest that an operating team is very unlikely to simultaneously require more inputs and outputs in a single OR. The standard video inputs are an OR camera for viewing the entire operating room, a surgical camera for viewing the surgical theater during open surgery, and an endoscopic camera, which is used in minimally invasive surgery only. The standard outputs are boom hung LCD monitors; a DVD recorder was also connected to the video matrix. An additional cable provides remote control of the monitor to set it to the type of signal sent by the video matrix. All these cables have a significant impact on OR architecture, so particular attention was paid to the cable layout and boom choice so that enough space would be available.

Varese Town Hospital, which recently opened, is equipped with 20 ORs, all of which contain a video acquisition and distribution system (see Figure 2) so that surgery may be better documented. Videoconferencing is used for teaching purposes as appropriate. The clinical engineer in this case proposed a cost-effective project to the hospital administration that fulfilled both the surgeons’ needs and the chief executive officer’s need to equip the hospital with state-of-the-art technology without a deep impact on hospital finances. Future work on system implementation will include conversion of the system to high-definition video signal so that surgeons have access to even more detailed images.

**Author Information**

**Umberto Nocco**  
A.O. Ospedale di Circolo e Fondazione Macchi  
Varese, Italy

Umberto Nocco earned a degree in biomedical engineering at the Politecnico di Milano. Since 2002, he has been head of the Clinical Engineering Department at Varese Town Hospital and a teacher at the University of Insubria. He presented papers on nuclear medicine and imaging informatics during the 2006 and 2007 SPIE medical imaging conferences. Lately, Nocco has focused his attention on digital operating rooms and computer and information technology.

**References**