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EDITORIAL AND COMMENTARY

The future today: new options for surgical care

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It is a great pleasure for us to introduce this special section of Updates in Surgery focused on "New technologies in surgery".

Technology has always been used in applied sciences to solve practical problems, to optimize procedures and to define operative strategies to achieve a goal. This process has always happened, but until the late 80s it moved very slowly. More recently, with the exponential growth of electronics and information technology, as well as the intuition of some great medical pioneers, technology in the biomedical field has generated very accurate and sophisticated diagnostic tools and many minimally invasive treatment options available, in addition to different and more effective ways to train people.

Thus, all the aspects of surgical practice, such as planning, surgical procedures and training, have been considerably affected by technologic evolution over the years. Innovations have stimulated radical changes in the way surgical procedures are performed, from the traditional open approach to minimally invasive surgery (MIS), which has become more and more widespread thanks to the undisputed advantages such as diminished postoperative pain, decreased length of hospital stay and accelerated recovery with early return to activities of daily living. The desire to continue to improve and increase the spread of MIS, with a view to further reduce surgical trauma, has led to the development of smaller and more effective laparoscopic instruments, the evolution of single incision or natural orifice endoscopic surgeries (SILS/NOTES), and of course to the implementation of robotic-assisted surgery (RAS) as well. Today robotic surgery is widely used in general surgery, urologic surgery, and gynecologic surgery and to a lesser extent in vascular surgery, cardiac surgery, and otolaryngology. However, high costs, bulkiness and time needed to set up the equipment, joint to absence of overwhelming data that demonstrate the superiority of robotic-assisted procedures over procedures done by well-trained laparoscopic surgeons, have frequently claimed criticisms [1].

As MIS has changed the way to operate, it has introduced the need for surgeons to acquire new and different skills. Technology has then been helpful to simulation which allows for the acquisition of skills through practice in a safe environment. Trainees can acquire the fundamental motor skills such as depth perception, hand–eye coordination, and bimanual dexterity in a simulation center, allowing them to focus on operative strategy, anatomy, and judgment in the operating room. Today many models of virtual simulators for laparoscopic and robotic surgery, for endovascular and urologic procedures, and for endoscopy are available on the market and curricula for training in laparoscopic (FLS—Fundamentals of Laparoscopic Skills) and robotic (FRS—Fundamentals of Robotic Skills) surgery have been validated [2]. The importance of simulation as part of training has been recognized by the American College of Surgeons with its Accredited Education Institutes (ACS-AEI) program and the accreditation of institutes for surgical education and training. In this respect, the Italian Center, Endocas (Center for Computer-Assisted Surgery, www.endocas.org), of the University of Pisa has been appointed this special and high honor privilege.

Technology has changed diagnostic tools and the way to plan surgical procedures as well. With technology, the concept of telemedicine has emerged making it possible to obtain, in real time, an expert second opinion [3]. Technology has made it possible to use CT and MRI images to generate a virtual 3D image of the target anatomy starting from a standard medical image dataset which is useful for the planning of surgical procedures [4]. Moreover, thanks to 3D printing technology, which emerged in the mid-1980s and rapidly spread around the world, it is possible to reproduce

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any physical object starting from a virtual model, retrieved from a series of 2D medical images after a specific image elaboration process [4]. The potential uses of this technology in medicine are vast, and this technology has only just begun to be explored for medical and surgical applications. Today 3D printers are used for the planning of surgical operations because the tactile feedback is able to increase the proper comprehension of any 3D object. Moreover, 3D virtual models can be used for training and for pre-operative counseling with patients [5].

Some of these topics will be covered in this volume; thanks to the contribution of Italian and international authors. Indeed, two articles focus on the use of technology during preoperative management and specifically focus on the potential clinical use of 3D printers in surgery and a tele-ultrasonographic platform for obtaining second opinions. Two articles focus on the use of simulators and on the evolution of surgical training programs in robotic surgery. One article focuses on the use of telemedicine and telerobotics for distant diagnosis and the delivery of expert care in distant locations. Finally, four articles deal with the use of technology during the surgical procedure itself, and are focused on robotic trans-anal surgery, the impact of the use of a robot on the outcomes of rectal resection, the use of green indocyanine fluorescence in robotic abdominal surgery, and the potential use of augmented reality in open surgery.

We wish to thank all the authors for their efforts to provide better insight into the present and future use of technology in surgery, and hope the readers will appreciate this effort to open a window on tomorrow that is waiting for us.

Compliance with ethical standards

Conflict of interest The authors declare that they do not have any conflict of interest.

Ethical standards All procedures in our paper were in accordance with the ethical standards of the institutional as well as national research committee and with the 1964 Helsinki Declaration and its later amendments.

Research involving human participants and/or animals This article does not contain any studies with human participants or animal performed by any of the authors.

Informed consent No informed consent is required.

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