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Chapter

Introductory Chapter: General Surgery in the Era of Modern Molecular Biomarkers

Miana Gabriela Pop

1. Introduction

The history of surgery begins in antiquity, when various maneuvers were performed in order to treat injury and wounds. The results of these procedures were mostly characterized by increased rates of massive bleeding and severe infectious complications. An important role in surgery progress at that time has been the development of varied instruments which have begun to be used more and more in surgical practice. Initially characterized by elevated rates of postoperative mortality, surgery developed furthermore after the introduction, at the end of the nineteenth century, of aseptic and antiseptic methods.

Claudius Galen (129–200 AD) introduces for the first time the use of catgut for surgical sutures. Galen also made important contributions in the field of anatomy; he was the first to describe the anatomy of the recurrent laryngeal nerve [1]. Moreover, he demonstrated their importance in phonetics by cutting, in front of an auditory in Rome, the recurrent laryngeal nerves of a pig that remained afterward mute [1].

The first successful open appendectomy of an 11-year-old boy was reported, back in 1735, by Claudius Aymand (1681–1740), while the first laparoscopic removal of the appendix was realized in 1981 by Kurt Semm [2]. For years after, the gallbladder was removed for the first time through laparoscopy [3]. Before the introduction of laparoscopic techniques as a treatment option in various human pathologies, a large number of experimental interventions were performed on animals. Georg Kelling was the promoter of this learning technique, most of his experimental studies being performed on dogs [4]. The first laparoscopic intervention was performed on a human in 1910 by Hans Christian Jacobaeus and consisted of a "laparothoracoscopy" [5].

Due to the enthusiasm in terms of implementation of minimally invasive surgical techniques, natural orifice transluminal endoscopic surgery (NOTES) has been further developed. In 2004, the team lead by Dr. Kallo at the Johns Hopkins University reported the first NOTES procedure and demonstrated the feasibility of intra-abdominal exploration through the use of an endoscope [6]. Since then, the hybrid techniques have been developed as a combined endoscopic and laparoscopic approach [7].

After the revolution of laparoscopic procedures, robotic-assisted surgery was introduced in 1983, along with increasing interest in virtual reality [8]. Currently, there are several types of robotic systems (AESOP, EndoAssist, Neuromate, da Vinci, PROBOT (surgeon robot for prostatectomies), PAKY (robotic system for percutaneous access)), each with its advantages and disadvantages [8]. Some of the main advantages of robotic surgery are better three-dimensional (3D) vision and better ergonomics; the removal of psychological tremor while increase costs would represent the main disadvantage [9].

The use of ultrasound in surgery or so-called interventional ultrasound has started in the 1960s and has been of great interest since then, developed in various directions such as liver and pancreatic surgery and surgery of the biliary tract but also in cardiovascular surgery and neurosurgery [10]. Even if its importance in intraoperative guidance, accurate diagnosis, and decision-making has been demonstrated, no specific training programs in residency curriculum have been established so far [11].

Indocyanine green (ICG) absorbs near-infrared light and through this mechanism allows for an accurate identification of the vascularization of different organs and tissues [12]. First used in cardiology to measure cardiac output and in ophthalmology to study in detail retinal vessels, in laparoscopic surgery ICG was used as a mean to improve vision [13]. Fluorescence-image-guided surgery (FISG) has been used in sentinel lymph node identification, in neurosurgery, or for neuroendocrine tumor detection. Moreover, the use of ICG in surgery has been shown to intervene in establishing the demarcation limit for surgical resection [12].

Development of mentoring programs through the use of telemedicine could be of great interest in the future from several points of view. First, by addressing this method, the difficulty in providing health care to people from disadvantage areas that do not have access to specialized, healthcare institutions could be overcome [14]. Moreover, a highly specialized level of surgical act could be offered by surgeons with less experience in a particular field. Not least, telementoring could represent an important pylon of surgical training programs and development of surgical techniques.

Through the identification of various biomarkers in cancer pathology, the concept of personalized medical and surgical treatment will be applied more and more in the future. Starting from this concept, patient treatment will need to be applied individually, depending on the molecular characteristics of the tumors. Surgical treatment will not represent a standardized procedure but one centered on patient needs and on its peculiarities.

For personalized surgery, 3D systems and the virtual surgical planning are important tools whose applicability are to be tested in the future more and more. The main advantage of these procedures consists in their ability to reproduce, with high accuracy, and patient's anatomic characteristics and possible variants of a specific organ vasculature; this aspect allows improvement of the surgical procedure due to preoperative assessment of the surgical and technical plan to be applied [15]. So far, 3D systems and virtual surgical planning were mostly used in craniofacial surgery [15, 16].

All in all, there is a tremendous progress in the field of general surgery from its beginnings to the present. Efforts should be made to apply and develop modern available techniques in order to constantly improve surgical outcome and patient benefits.

Conflict of interest

No conflict of interest to declare.

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