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Introductory Chapter: Advances in Minimally Invasive Surgery

Andrea Sanna

1. Introduction

If we want to begin to describe the history of mini-invasiveness, we should write as a children's book "... once upon a time...". This is because the internal anatomy and pathology of the human body required direct visualization for centuries. The lighting source was the main limiting factor in applications of endoscopic or laparoscopic techniques. The Lichtleiter, described by Philipp Bozzini of Frankfurt in 1805, began the era of illumination. His cystoscope was the first example of inspection using a minimally invasive tool. Therapeutic applications of laparoscopy began in the 1930s by a gynecologist [1]. He initiated this process with the laparoscopic adhesiolysis using electrocautery in 1933. Subsequently, another gynecologist performed a tubal ligation using endoscopic electrocoagulation in 1936. Internists also appreciated the value of this technique using a peritoneoscope to increase their diagnostic accuracy. Laparoscopic cholecystectomy was the intervention that modified traditional surgery, giving impetus to the use of tiny incisions. Minimally invasive surgery has progressed in many surgical disciplines rapidly in the last 30 years [1]. It's known that there is evidence for the safety and efficacy of these approaches. The overall advantages as blood loss, hospital stay, pain control and surgical site infections (SSIs) has been known too in many of the MIS procedures compared with open surgery. Intuitively, patients' satisfaction has helped to drive the discipline of MIS. A rising number of MIS procedures have been exposed and integrated into surgical practice. The first MIS appendectomy was performed by a gynecologist (K. Seem). After this treatment, the attractiveness of this technique by the surgeons allowed to carry on the procedures forward by laparoscopic cholecystectomy in 1987 [1, 2]. Therefore, several surgical treatments became the new minimally invasive standard of surgical care. Consistency in benefits of MIS across procedures of different complexity and surgical subspecialty confers validity, as well as the adoption of MIS as an opportunity to improve quality. In the successful progress of MIS has been fundamentally the incessant achievement of technology equipment and the continuous development of instruments designed especially for this surgical approach.

2. Laparoscopic surgery

Laparoscopic surgery in humans has been developed since the first usage of peritoneoscopy, performed under direct vision to assess the peritoneal cavity, in the 1960s [1, 2]. The pioneers of video-assisted techniques were Semm K, with its laparoscopic appendectomy, and Muehe E, with its laparoscopic cholecystectomy. Those authors changed it from a diagnostic to a surgical procedure at the beginning of the 1980s, and it has since become a frequently applied technique for a wide

field of indications. The procedure has become the standard practice for many surgical interventions performed in different medical fields [1, 2]. This technique has facilitated benefits such as a rapid recovery and shorter hospitalization, in addition to reduced postoperative pain. Despite the acceptance of laparoscopic surgery by a high number of surgeons in various types of abdominal surgery, many clinicians continued to express concerns that this technique would compromise survival by failing to achieve a proper oncologic outcome. After result, some trials demonstrated similar recurrence rates between laparoscopic and open surgery and suggested that laparoscopic surgery is an acceptable alternative approach to open surgery for the treatment of a high number of surgical conditions. It should be considered that minimally invasive surgery requires a longer learning curve than traditional surgery. This typically exhibits improvements in performance over time to ensure adequate outcomes and is an assist-dependent procedure [3–5]. Minimally invasive surgery has often been associated with both technical and technological advances attempting to overcome some limitations by combining open and laparoscopic techniques. For instance, hand-assisted technique was first introduced in the 1990s [1–5]. This technique, which provides excellent capabilities of exploration and safe specimen retraction, was useful because it allowed the use of laparoscopic instruments during colorectal surgery, splenectomy, and other procedures considered too complex for a laparoscopic approach. Unsurprisingly, the role of laparoscopy has increased in clinical practice. This move toward a minimally invasive approach can be seen with a decline in open surgical techniques in favor of percutaneous, endovascular, and minimally invasive interventions. Furthermore, laparoscopy has steadily and systematically become a dominant feature of today's general surgery trainees. Now that laparoscopy is progressively replacing open surgical approaches there may be some opposite problem. We think that for residents, it will become necessary to do learning curve in open surgery than in MIS.

3. Robotic

The da Vinci Standard surgical system was introduced early in the twentieth century. This robotic system was used in some field of surgery as urology, digestive surgery, and cardiothoracic surgery [5, 6]. The next-generation surgical system was introduced in the following years with field indications were enlarged as follows: general surgery, gynecology, and otolaryngology. In some countries, for laparoscopic surgery, the board certification system for physician was required. No board certification system exists in some countries for either society for robotic surgery, and this certification must be obtained from Intuitive Surgical Inc. Recommendations in guideline must start robotic surgery ideally with a single procedure, experience with several patients undergoing surgery, including observation and instructor-supervised surgery, and approval from a panel of experts for a single procedure (e.g., colorectal surgery or abdominal wall reconstructions). The robotic surgery usage increased dramatically from 2012 to 2018. It was found that the use of robotic surgery increased rapidly across numerous different procedures after hospitals begin performing robotic surgery. This trend was associated with a decrease in the use of laparoscopic minimally invasive procedures, which for most surgeons was already considered a safe and effective approach when clinically feasible [5, 6]. The advent of robotic surgery has certainly brought further advances in the field of mini-invasive surgery. However, it has been noted that many surgeons, due to the presence of the robotic platform in their hospital, have increased their use in various types of procedures. This trend has led to a decrease in the use of laparoscopy in some interventions, which for most surgeons was already considered

a safe and effective approach when clinically feasible. It is believed that examining the costs of the method, the best use can be in fields where the limitation of laparoscopic surgery under difficult conditions such as a deep and narrow pelvis has overcome. Robotic surgery yields benefits such as dexterity of movement, a three-dimensional camera view, and reduced assistant-based physiological tremor.

4. Conclusion

The concept of minimally invasive surgery has been in our operating rooms for several years. New methods and new devices are used to minimize discomfort compared to open surgery. However, it should always be remembered that the complications of the new methods must be at least comparable to those envisaged by the standard open procedures.

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