

How to Optimize the Learning Curve in Laparoscopic Colorectal Surgery

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Surgical treatment of colorectal neoplasms has been developed in recent decades with a mini-invasive approach. The generally accepted purpose is the strict adherence to the modern guidelines and oncological principles. Most of the conventional-open surgical procedures could be done laparoscopically nowadays, moreover the lap-approach gets a better intraoperative view, especially into the small pelvis. Thus, high-quality surgery can be achieved, with maximum decrease of the resection limits, with minimal blood loss and quicker recovery of the patients.

Laparoscopic colon surgery is described for the first time in 1991 [1]. It has been developing for over 20 years and the operational results have improved [2]. The efficacy of the laparoscopic approach in the treatment of CRC (colorectal cancer) is demonstrated [3,4]. A review of randomized trials shows that long-term oncological results in LR (laparoscopic resections) are similar to those in open resections [5]. There are also many studies showing that this colo-rectal cancer surgery has oncological and functional results similar to the open method [3,6,7]. A large randomized trial shows that LR is achievable and safe and has short-term benefits compared to open-conventional surgery in neo-adjuvant radio-/chemotherapy-treated rectal cancer patients [3]. Several prospective randomized trials show that it does not compromise oncological results in low rectal cancer [8].

Because of its advantages such as mini-invasiveness, faster recovery and shorter hospital stays, laparoscopy has been widely used in the CRC over the past decade [9]. With its wider introduction, most surgeons realize that LR is one of the most challenging techniques to study. According to the literature the LC (learning curve) is a graphical representation of a process where surgeons develop their skill by learning from their mistakes which is expressed by the time required to learn and acquire certain skills and the rate of progress represented on a graph. The steeper it is, the faster is the process of skills acquisition [7,10].

The LC reported in the literature is highly variable ranging from 20 to more than 120 cases [11-14]. The main reasons for such rigor are the difficulties in colon exposure and inadequate tactile sensation [4,13]. In 2008, the American Committee for Thoracic and Rectal Surgery (AVCRS) introduced minimum requirements for a 3-year training period. Specialists are expected to complete at least 50 laparoscopic operations per year. After more than 10 right-side and 30 left-sided operations, surgeons feel comfortable with these procedures. LR for rectal cancer, however, is more controversial due to its technical complexity due to anatomical localization, the need for total mesorectal excision (TME) within adequate boundaries, the sphincters preservation, the vulnerability of the hypogastric plexus and, in most cases, colorectal anastomoses, may be very complex [7]. LC is technically more complex and the acquisition of meticulous laparoscopic skills is still one of the obstacles to the widespread introduction of rectal surgery. More often findings of cancer-cells positive circumferential resection margin [15] and anastomosis [16] in the rectal LR [17] have been reported. Surgeons must have experience in the open rectal cancer surgery to be competent in more sophisticated laparoscopic surgery. Only one study reported that rectal laparoscopic surgery could be studied without first attempting in open surgery [17]. During the training period, few surgeons successfully undergo surgical procedures for rectal cancer because complexity requires a high level of skills and technical abilities [7]. The most commonly used parameters for evaluating LR competence for colorectal cancer are operating time, number of lymph nodes retrieved, level of conversion, type and frequency of perioperative complications, length of hospital stay (29,30). Additional recovery endpoints have been considered: mean time to flatus, mean time to solid stool, time to oral feeding, mean time to quit intravenous analgesics [7] Some authors report "hand-assisted" technique as an attempt to shorten the learning curve of sigmoidectomy. Chang, *et al.* report less conversions and

shorter operating time during training on the LR of the sigma [18]. The ideal method of training and accreditation of a surgeon in new surgical procedures has not yet been established. In our case, we rely on surgeons who have been trained in laparoscopy, but also with a lot of experience in open surgery. It has been successfully used in LR for adequate orientation in dissection plans, as in extracorporeal anastomoses, which most contribute to reducing operating time and costs.

In order to recommend a widespread use of LR in the treatment of CRC, it should be proven to be cost-effective and oncology safe. Economic optimization takes place at an individual budgetary level as well as for health insurance institutions [19,20]. A shorter hospital stay, a lesser need for analgesia, and rare complications compensate for increased operating costs [9]. A randomized study from Sweden compared the laparoscopic with open surgery to CRC and found that within 12 months of surgery there were no significant differences in overall costs to society [9,21]. The economic effectiveness of laparoscopic surgery is linked to variations in the surgeon's skill level which is subjective by definition but it has been formally achieved only when the learning curve reaches its plateau [22-30].

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