

PROCEEDINGS

LEARNING CURVE IN LAPAROSCOPIC COLORECTAL SURGERY. RESULTS OF A RETROSPECTIVE PERSONAL STUDY

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ABSTRACT

INTRODUCTION: Nowadays the term learning curve is widely accepted in the colorectal minimally invasive surgery and defines the level of education in the performance of a specific minimally invasive operation. The term has its own graphical image. The learning curve is completed when variations in one operative procedure have a stable level and the results are comparable with the published in the literature. The results can be identified by perioperative data—operative time, perioperative blood loss, level of conversions, perioperative morbidity, mortality rate, wound infection, rehospitalizations. On the other hand, in oncological cases, the number of harvested lymph nodes, tumor and circumferential resection margins, disease free survival are indicators which can be measured. There are a lot of approaches applied in surgical practice to complete the learning curve faster. The number of operations to achieve a plateau in the learning curve is under debate in the literature.

AIM: The aim of this article is to analyze perioperative data and define the number of laparoscopic colorectal operations until reaching a plateau in the learning curve.

MATERIALS AND METHODS: A single surgeon-based retrospective study on 183 minimally invasive colorectal resections analyzed the perioperative results in the time to achieve a plateau in the learning curve. The analyzed criteria were median operative time, blood loss, perioperative morbidity, level of conversions, median hospital stay, number of harvested lymph nodes. All the clinical methods were included.

RESULTS: The level of perioperative complications decreased from 30% in 2014 to under 15% in 2018, with small variations up to date. The median hospital stay dropped from 7.5 days at the beginning to 6.5 days in 2018, blood loss became stable in median range of 73 mL in 2018. The number of extracted lymph nodes rose from 9.6 to 13.22 and more. After 2018, the conversion rate became stable in range of 16%.

CONCLUSION: To complete the learning curve, we identified 38 personally performed laparoscopic colorectal resections. The surgeon had previous personal experience of more than 100 open colorectal resections before the first laparoscopic one.

Keywords: *learning curve, laparoscopic, colorectal resection*

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INTRODUCTION

Learning curve is a widely accepted term and defines the level of learning in performing procedure. The definition itself has a graphic expression. The term was introduced in the 19th century and was subsequently used in the aircraft industry in the 1930s. Graphically, the learning curve is complete when certain variations in the performance of a procedure reach a stable level and results are comparable to those in the literature. Nowadays, *learning curve* is a widely accepted term in laparoscopic colorectal surgery. How can learning curve outcomes be defined? On the one hand, these are the early perioperative outcomes—duration of the laparoscopic colorectal procedure, intraoperative blood loss, conversion rate, perioperative morbidity and mortality, wound infection, rehospitalization rate. On the other hand, in patients with oncological diseases, these are the number of extracted lymph nodes, level of positive resection lines, distance from the tumor, level of positive circumferential resection line in rectal carcinoma, disease-free survival, level of recurrences. In present times, the quality of a laparoscopic colorectal procedure should not depend on variable circumstances because patient safety is a priority. Therefore, different approaches in the training process of specialists have been introduced in practice along with factors such as initial experience in open colorectal surgery, performing stages of one colorectal resection in the course of training with a proctor, performing whole resections with an expert, training with simulators, and others. There is a debate in the current literature regarding the number of self-performed colorectal resections until reaching a plateau in outcomes comparable to those in the literature.

MATERIALS AND METHODS

In an ambispective study of 285 patients with colorectal resections over an 11-year period performed by a single surgeon, of which 183 were minimally invasive, perioperative outcomes were assessed and investigated until a plateau in performance of minimally invasive resection was reached. The evaluation criteria were median operative time, blood loss, level of perioperative complications, level of conversions, median hospital stay, number of extracted lymph nodes in cases of colorectal cancer, and number of extracted lymph nodes in rectal carcinoma af-

ter neoadjuvant therapy. All clinical research and statistical methods available in software packages IBM SPSS Statistics 25.0, MedCalc Version 19.6.3, and Excel Office 2021 were used.

RESULTS

The first of the investigated parameters was the level of perioperative complications. After 2015, a permanent trend of a prevalence of laparoscopic over open colorectal resections was observed (Fig. 1).

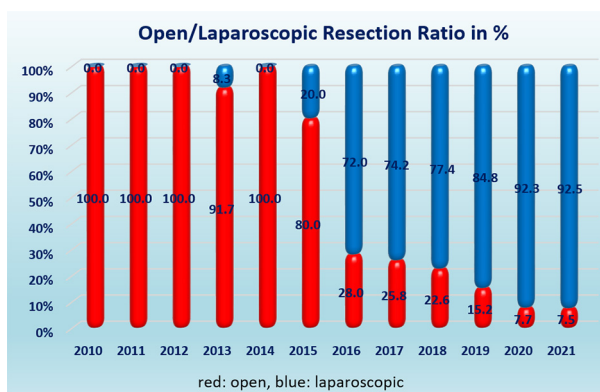


Fig. 1. Ratio of types of operative interventions over time.

During the period 2015–2016, relatively low levels of perioperative complications were observed. This is the period of transition of planned colorectal surgery from open to laparoscopic in specific groups of patients. In 2017, there was an increase in perioperative complications, after which there was a tendency of stabilization of the levels of perioperative complications (Fig. 2).

Another parameter was the median hospital stay. In the period of prevalence of open surgery, the median hospital stay was 7.5 days. In 2016, parallel to

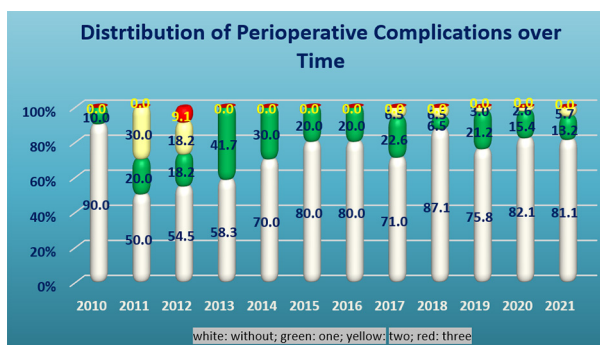


Fig. 2. Perioperative complications over the time.

the sharp increase in laparoscopic resections, a slight increase to 7.8 days was observed. This is due to the higher number of perioperative complications in the laparoscopic resection group and the more complicated cases of patients selected for open surgery. Subsequently, this parameter marks a plateau and has a relatively stable value of 6.5 days.

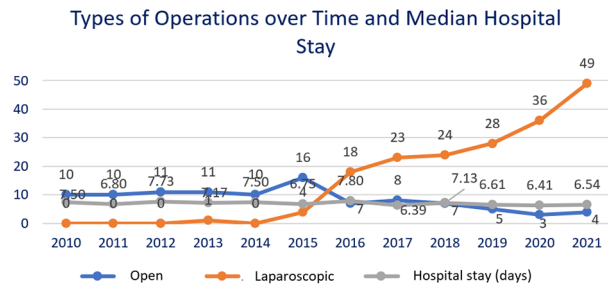


Fig. 3. Median hospital stay.

Intraoperative blood loss is another parameter of analysis. On Fig. 4 it can be seen that for levels above 150 mL until 2014, during the period of domination of open surgery, with the increase in the number of laparoscopic procedures, the average blood loss dropped sharply and since 2018 relatively stable levels have been reached over time.

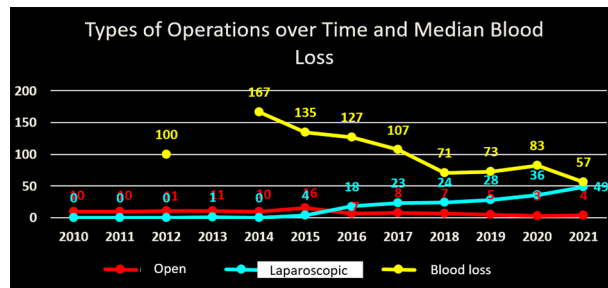


Fig. 4. Types of operations and median blood loss.

When analyzing the number of extracted lymph nodes, it was found that a permanent tendency to increase was observed over time. With an average of 9.6 lymph nodes extracted at the beginning of the study period, levels of 17.8 were reached in 2021. Between 2016 and 2020, a certain stabilization of this parameter was observed with the average number of extracted lymph nodes being within the 11.8–13.22 range (Fig. 5).

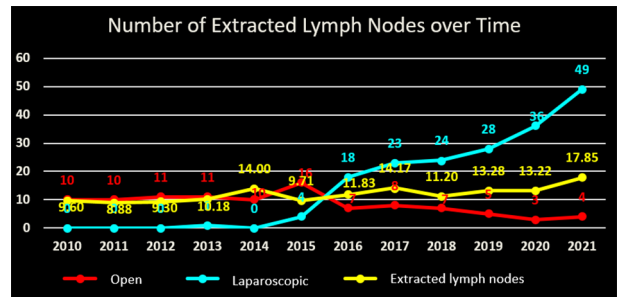


Fig. 5. Number of extracted lymph nodes.

Analyzing perioperative parameters over time, it is seen that there are variations and the results become stable from July 2017. If the laparoscopic resections are summarized with conversions, we could come to the conclusion that the number of personally performed colorectal resections until reaching plateau is 38. In this setting it must be noted that personal experience of the surgeon in open colorectal surgery consisted of more than 100 colorectal resections before the first laparoscopic one. This fact affected the results in the control group of patients with open operations, as well as those in the group of converted patients. Presumably, there would also be an impact on laparoscopic resections, but such a claim is difficult to prove in the course of this study.

DISCUSSION

The aim of the study was to analyze the experience of the surgeon in laparoscopic colorectal resections and its impact on the perioperative parameters and outcomes. The very design of the study, excluding operations by other surgeons, allows such an assessment. The parameters for evaluating perioperative outcomes are complications, including anastomotic insufficiency, wound infection, operative time, blood loss, mortality, rehospitalization, excised lymph nodes, disease-free survival (1,2). Some authors have reported equivalent results in operative interventions performed by trainee and expert surgeons (3). However, according to others, trainee surgeons have worse results in terms of number of lymph nodes extracted and 5-year survival (4). For the faster achievement of the expertise, some authors recommend the use of training protocols, including the implementation of stages of operations, operations on animals, cadavers, simulators (5,6). The participation of trainee surgeons in real laparoscopic operations with the assistance of an expert proc-

tor is associated with the fastest learning curve and the best outcomes (5,6). There are conflicting data in the literature regarding the number of laparoscopic resections performed until reaching expertise, varying between 5 and 310 cases (7). In the present study, we report 38 self-performed laparoscopic colorectal resections until reaching a plateau in the perioperative outcomes. Belev et al. reported a significant reduction in operative time in right hemicolectomy and low anterior resection of the rectum. No significant difference in other perioperative outcomes was established (8).

CONCLUSION

The learning curve in laparoscopic colorectal surgery is a long process in which many factors are extremely important, such as volume of activity, availability of training experts, technical assurance. Last but not least, experience in open surgery is essential. The learning process itself can be tracked with the perioperative results and instructions for a certain number of personally performed colorectal resections until expertise is reached could be provided.

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