

# Is there still a place for open surgery in the treatment strategy of rectal cancer?

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## Abstract

Over the last 30 years laparoscopic surgery of rectal cancer has been progressively gaining popularity due to expanding experience and the development of technical skills according to the surgeons' learning curves. The report constitutes a review of recently published articles concerning surgical techniques in colon cancer, with special emphasis on rectal cancer treatment. We tried to address the question of whether, in view of further development and broader use of laparoscopic surgery, there still is a place for open surgery in the treatment strategy of rectal cancer.

## Introduction

Since the development of the total mesorectum excision (TME) technique by Heald and Ryall in the 1980s the efficacy of a surgical approach in rectal cancer treatment has systematically increased. The addition of neoadjuvant and adjuvant radiochemotherapy allowed a further increase of the 5-year survival rate up to approximately 70%.

Over the last 30 years laparoscopic surgery of rectal cancer has been progressively gaining popularity due to expanding experience and the development of technical skills according to the surgeons' learning curves [1]. Most of the available literature mentions many short-term benefits of laparoscopic surgery over open surgery in rectal cancer treatment, such as less postoperative pain, decreased blood loss, and shorter duration of hospital stay. In terms of oncological outcomes (overall survival (OS), disease-free survival (DFS), local recurrence rate (LR), distant recurrence rate (DR), number of harvested lymph nodes (LN), circumferential margin (CRM) positivity rate), in recent trials and meta-analyses it has been proven that laparoscopic surgery is not inferior to open surgery and can be safely and feasibly used [2, 3]. Although available non-inferiority analyses suggest that the results of laparoscopic procedures are not worse than those of open surgery, the long-term results of this strategy remain debatable.

The following report constitutes a review of recently published articles concerning surgical techniques in colon cancer, with particular emphasis on rectal cancer. We address the question of whether, in view of further development and broader use of laparoscopic surgery, there is still a place for open surgery in the treatment strategy of rectal cancer.

## Risk of conversion

Laparoscopic surgeries in colon cancer, including rectal cancer, are associated with significant risk of conversion to open technique, which varies from 1.5% up to 34%, depending on the study [4]. Conditions requiring conversion to open surgery represent limitations of laparoscopy and are simultaneously procedures in which open surgery will continue to hold an advantage.

Like every other surgical technique, laparoscopy requires a certain degree of proficiency and is dependent on the operator's learning curve. Son *et al.* proved that 79 laparoscopic rectal resections are the break point, and the rate of complications as well as conversions decrease thereafter [5]. However, it should be underlined that laparoscopic surgeries and other advanced robot-assisted techniques should be utilised by surgeons with enough experience in open surgery to complete the procedure with adequate quality in case of conversion. For that reason, continuous training in open surgery should not be

aborted because only open surgery warrants successful completion of the procedure after conversion.

According to Nienhüser *et al.*, conditions that may be associated with risk of conversion to open surgery include: large tumour size, excessive tumour burden, and uncertainty about radical resection (which, in total, account for 17.7% of all conversion cases), as well as excessive intraabdominal adhesions, difficulties in splenic flexure release and limited access to the tumour (14.5%), obesity (14.5%), narrow pelvis (12.7%), and uncertainty of the following: technical limitations associated with poor visibility, lack of expertise of the equipment or the equipment itself (9.1%), bleeding (3.6%), inability to perform safe resection of the distal part of the rectum (2.7%), damage to the ureter (1.4%), and other reasons (e.g. poor pulmonary condition, damage to adjacent organs) (9.1%) [4]. Several of these aspects are examined below.

### The impact of conversion on surgical outcomes

Kim *et al.* evaluated the effect of the conversion moment on the short-term and oncological effects of the surgery [6]. In their study, the term “early conversion” was used for a conversion decision that was made within 60 min and “late conversion” when it was made over 60 min from the beginning of the procedure. The most common conversion reasons reported by the authors were the presence of a pT4 tumour and positive history of previous abdominal surgeries. The mean operative time was longer in the late conversion. The rates of 30-day postoperative complications (42% vs. 27%), Clavien-Dindo score  $\geq 3$  (22% vs. 11%), intensive care unit (ICU) care (31% vs. 15%), and transfusion (37% vs. 21%) were significantly higher in the late conversion group. The authors concluded that decisions about early conversion made within 60 min of the beginning of surgery do not worsen short-term and oncologic outcomes.

In the MRC CLASICC Trial [7] study it was proven that, in patients who underwent conversion, the death rate was higher compared to patients operated by laparotomy and laparoscopy (9% vs. 5% vs. 1%, respectively). Moreover, the following complications were more frequent in these patients: postoperative wound infection (20% vs. 12% vs. 10%), upper respiratory tract infections (15% vs. 5% vs. 8%), anastomotic leak (15% vs. 7% vs. 8%), and others (43% vs. 25% vs. 19%). In the study an overall 34% conversion rate was observed. If the risk of conversion is high and conversion has a negative effect on the short-term outcomes of surgery, a laparoscopic approach is not recommended. Furthermore, in the CLASICC study, a significantly lower

5-year survival rate was observed in patients who required conversion [8].

Most of the available trials inspected the short-term effect of the conversion on the surgery outcomes; however, there is a need for large studies assessing the effect of conversion long-term oncological treatment efficacy.

### Obesity and male patients

In an article published in 2017 [9], Jayne *et al.* observed a significantly increased risk of conversion in obese patients compared to patients with underweight or normal body size (adjusted OR = 4.69, 95% CI: 2.08–10.58;  $p < 0.001$ ). The second important observation was significantly more frequent conversions in men compared to women (adjusted OR = 2.44, 95% CI: 1.05–5.71,  $p = 0.04$ ). As many as 16% of men required conversion to laparotomy, while in a group of women it was only 4.1%. Similar observations often appear in the literature.

### Intra-abdominal adhesions

Most operations in the abdominal cavity are associated with the appearance of intra-abdominal adhesions in the postoperative period.

Kim *et al.* [10] performed a study on patients undergoing colon cancer surgery with a positive history of a previous abdominal surgery. The authors concluded that intestinal manipulation during abdominal surgery induces postoperative adhesion formation. Intestinal manipulations are more often necessary during gastrointestinal surgery than in the case of operations not related to the gastrointestinal tract (e.g. gynaecological surgery), thus gastrointestinal operations more often cause adhesions that are more difficult to safely separate. The risk of conversion from the laparoscopic to open method was higher in the group of patients with positive history of previous gastrointestinal tract surgeries. However, the study concluded that laparoscopy may be the method of choice in patients with a positive history of surgery in the abdominal cavity but not related to the gastrointestinal tract.

### Locally advanced tumour (TNM cT4)

Because of the large size of the colon cancer cT4, and infiltration of surrounding tissues and adjacent organs, laparoscopic operations are extremely difficult and carry a high risk. Generally, in most of large studies, cases of T4 tumours were rare or not taken into account at all, hence the knowledge and research on laparoscopic resection are limited. Even if these patients are undergoing neoadjuvant treatment, downstaging is not always the case.

In the work published by Yang *et al.* [11], patients with cT4 tumours were operated. In the group of patients operated on using the open method, in 21 cases, multivisceral resections were needed (the most frequently infiltrated organs were: small intestine, gynaecological organs, and duodenum). In contrast, in the group of patients undergoing laparoscopic surgery only five such cases were found, and the difference was statistically significant ( $p = 0.001$ ). This is consistent with the results of available trials. Data published in study demonstrate that tumour stage cT4 should be an important consideration for surgeons when qualifying patients for open rather than laparoscopic surgery, because it is very difficult to achieve the goal of complete resection using the “no touch” principle (sharp separation, blood vessels first, tumour isolation, etc.). To reduce the risk of conversion and ensure the safety of surgery, the authors recommend qualification for laparoscopic surgery only in experienced centres, in patients with cT4 tumour size below 5 cm and with a maximum of one organ being infiltrated.

The American Joint Committee on Cancer (AJCC) classifies T4 colorectal cancers as those that invade into other organs and structures and/or perforate the visceral peritoneum. The AJCC and European Association of Endoscopic Surgery do not recommend laparoscopic treatment of all pathological T4 colorectal cancer [8].

Furthermore, Feinberg *et al.* emphasised in their meta-analysis that in clinical practice, due to the significant technical challenges, laparoscopic attempts of multivisceral resection should be reserved only to experts in advanced laparoscopic surgery [12].

## Technical aspects

Laparoscopic instruments have their limitations. This is particularly important in the case of surgery of low rectal tumours, in patients with narrow and deep pelvis. Chand *et al.* [13] stressed in their study that such an operation may be exceptionally demanding when using rigid laparoscopic instruments with a limited range of motion. Development of tools that would allow free manoeuvring, especially in the narrow pelvis, and achieving the right angles during surgery is needed.

## Pathological outcomes

The main goal of the TME procedure is total mesorectal excision and achievement of a negative circumferential resection margin (negative CRM). Meeting both of these criteria significantly reduces the risk of local recurrence of rectal cancer. In 2017 Martínez-Pérez *et al.* conducted a meta-analysis and systematic review evaluating pathological outcomes of laparoscopic vs. open mesorectal excision for rectal cancer [14]. The aim of

the study was to evaluate the frequency of positive circumferential resection margin (CRM), defined as 1 mm or less from the closest tumour to the cut edge of the tissue, and the quality of mesorectal excision (complete, nearly complete, or incomplete). The study found that positive CRM was 17% more common in patients operated laparoscopically (7.9%) than in those operated by open method (6.1%), although this difference was not statistically significant. However, non-complete (nearly complete or incomplete) mesorectal excision was 31% more frequent in patients in the laparoscopic group (13.2%) than in the open group (10.4%), and the difference was statistically significant. These reports question the oncological safety of laparoscopic surgery in the case of rectal cancer.

## Summary

Open surgery should be considered as a first choice if the risk of conversion is high. Conversion may have an impact on early outcomes of surgery (increasing the risk of perioperative mortality and infectious complications) and long-term effects (worsening the prognosis).

Only continuous training in open techniques and routine conduction of these procedures will allow the high quality of the surgery to be maintained in case of conversion during laparoscopy.

Due to significantly more frequent non-complete mesorectal excision in the laparoscopic method, and thus the greater risk of local recurrence of cancer in the pelvis, further large randomised trials assessing homogeneous groups of patients with similar characteristics of rectal tumour are necessary.

## Conflict of interest

The authors declare no conflict of interest.

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