

PROCEEDINGS

HIGH VERSUS LOW INFERIOR MESENTERIC ARTERY LIGATION IN RECTAL CANCER SURGERY. A RETROSPECTIVE ANALYSIS AND REVIEW OF THE LITERATURE

Ivan Semerdzhiev, Bozhidar Nametkov, Deyan Lazarov, Mihail Tabakov, Ersin Hodzhadzhikov, Dimitar Andonov, Antonii Filipov

Clinic of Endoscopic Surgery, St Ivan Rilski University Hospital, Sofia, Bulgaria

ABSTRACT

INTRODUCTION: Colorectal cancer is the leading cause for cancer-related mortality in both sexes worldwide. Around 30% of all colorectal cancers are situated in the rectum. They have worse clinical outcomes. Laparoscopic total mesorectal excision (TME), described first by Heald et al. in 1982, is a gold standard of treatment for rectal cancer. During the procedure the inferior mesenteric artery (IMA) should be ligated. However, whether high or low, the ligation is still controversial.

AIM: The aim of this article is to investigate the advantages and disadvantages of both low and high IMA ligation during laparoscopic TME for rectal cancer treatment.

MATERIALS AND METHODS: We conducted a retrospective study of 77 patients operated in our department for a period of 1 year, between January 2021 and January 2022. We gathered data for gender, hospital stay, pathology findings, and perioperative complications, including anastomotic leakage, anastomotic stricture, genitourinary dysfunction, survival. We conducted a literature review and compared the results with our own experience.

RESULTS: We performed laparoscopic TME with high IMA ligation in 53 men and 24 women. The mean operative time was 270 min. The mean hospital stay was 5 days. During the period we detected anastomotic leakage in 2 patients and no strictures of the anastomosis were identified 30 days after the procedure.

CONCLUSION: High IMA ligation is a safe and effective enough operative technique in rectal cancer treatment, which, when properly performed, does not lead to more perioperative complications than low IMA ligation, except for some anatomically related reasons.

Keywords: *Inferior mesenteric artery, ligation, rectal cancer*

Address for correspondence:

Ivan Semerdzhiev
St. Ivan Rilski University Hospital
15 Akademik Ivan Geshov Blvd
1000 Sofia
Bulgaria
e-mail: ivan.semerdzhiev@gmail.com

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INTRODUCTION

Colorectal cancer (CRC) is common disease in both genders worldwide (1). Around 30% of all colorectal malignancies are situated in the rectum, which worsen the prognosis of the patient. The procedure of choice in rectal cancer is laparoscopic total mesorectal excision (TME), first described by Heald et al. in 1982 (2). During the procedure the inferior mesenteric artery (IMA) is ligated and divided. How-



ever, the level of transection has remained a highly debated issue (3) from early 1908, when Miles et al. suggested low ligation of IMA (4), but Moynihan on the other hand suggested high ligation of IMA (5, 6). Authors have different point of view according to the level of transection (7–10). During the high ligation, IMA is transected just after its origin close to the aorta while paying attention not to harm the superior hypogastric plexus. When the ligation is low, the IMA transection is made after the division of the left colic artery. The left colic artery is not sacrificed this way (11). No difference in oncologic outcomes, such as recurrence or survival, has been observed between high and low ligation (12–14). Some authors suggest high ligation. They consider that it is more likely to harvest a bigger number of lymph nodes performing D3 lymph node dissection, which beneficial for the oncological staging after that. According to them low IMA ligation should only be performed in palliative manner in patients with short life expectancy, when short operative time is important and in patients with chronic occlusive artery disease (15,16). Other authors suggest high IMA ligation only in case of suspecting lymph node metastasis around the origin of IMA (17). According to two randomized controlled trials, there is no difference in urogenital function disorders between low and high IMA ligation (18,19). However, another study claims that patients with low IMA ligation have better urogenital function and fewer complications related to it and no other statistically significant difference was observed in anastomotic leak rate or other complications (19). Immediately after the operation, the blood flow is diminished, because the only remaining artery is the marginal artery of Drummond, which could be considered a disadvantage in high IMA ligation (20,21). Even though the anastomotic leak rate results are variable, reduced blood flow is a significant risk factor, which could lead to higher anastomotic leak rate (22). Some studies state that distal rectal remnant blood supply is a more important factor for anastomotic leak rate results (23). Allison et al. confirmed this by analyzing the angiography of microvascular collateral blood supply of the distal rectal remnant. They claimed that in many cases the collateral blood supply is insufficient, which is a main factor in anastomotic leak rate when low anterior rectal resection is performed (24). Another problem could be the in-

sufficient length of the proximal loop, so there could be tension.

AIM

The aim of this article is to investigate the advantages and disadvantages of both low and high IMA ligation during laparoscopic TME for rectal cancer treatment.

MATERIALS AND METHODS

Study Design

We conducted a retrospective study of 77 patients operated in our department for a period of 1 year between January 2021 and January 2022. All patients were operated on by different teams, which strictly followed the same protocol for patient perioperative preparation, surgical technique, and postoperative management. Patients suitable for this study met the following criteria: histologically verified rectal or sigmoid colon cancer, all stages of the disease, all patients with rectal cancer underwent neoadjuvant chemoradiotherapy (CRT) and the operation took place 8 weeks after the last procedure, both genders and any age were included. Exclusion criteria were polymorbid patients who needed palliative procedure, patients that chose the conventional type of operation, or those who were converted from laparoscopy during the operation, as well as patients with nonmalignant cause for the operation.

We gathered data for gender, age, perioperative pain, hospital stay, pathology findings, perioperative complications including anastomotic leakage, anastomotic stricture, genitourinary dysfunction, local recurrence, distal metastasis, and survival.

The follow-up period for all patients was 1 year. On the 30th postoperative day, fibrocolonoscopy (FCS) was performed. Every 3 months, the tumor markers and complete blood cells (CBC) were assessed. On the 6th month computed tomography (CT) was done. At the end of the first year, another FCS was done. If elevated values of tumor markers were established, we also did CT. If there were distant metastases or even suspicion for them a PET-CT was performed. We followed the National Comprehensive Cancer Network Guidelines (25).

A literature review of retrospective randomized and nonrandomized controlled trials was conducted, using PubMed and Google databases. We analyzed

and compared our own results to the internationally published data.

Operative Technique

All patients followed a standard preparation protocol before the operation, which consisted of: fasting 48 hours before surgery; a day before surgery, enteral cleaning with 6 sachets of Endofalc dissolved in 3000 mL H₂O was done. Just before intubation the patients received a combined spinal and epidural anesthesia with postoperative epidural patient-controlled analgesia (ePCA), Foley urinary catheter and central venous catheter (CVC). The patient lay on the operation table in supine position with arms straight, close to the body, and open legs. We used a Veress needle to create a pneumoperitoneum with 12 mmHg pressure. We used three working ports: 2 x 5 mm, 1 x 12 mm. and one optical trocar with a 30-degree 10 mm scope. We always performed the procedure observing the following steps: transection the inferior mesenteric vein and artery (we performed high IMA ligation in all patients), left colon mobilization in a medial-to-lateral manner, splenic flexure mobilization in all patients, then TME in all rectal cancers was performed or PME (partial mesorectal excision) in distal sigmoid cancers. We transected the bowel using Echelon Flex linear cutting device, then Pfannenstiel minilaparotomy was performed in order to extract the tumor out of the body. We did the anastomosis using Echelon Circular Powered Stapler. Protective ileostomy was made after the resection for tumors in the middle and distal part of the rectum, which converted to normal bowel continuity after 30 days. This is the time when we did the first colonoscopy to evaluate the anastomosis. We paid significant attention to the so-called “doughnuts” from the anastomosis. The appearance of the mesorectum was also important in order to meet the worldwide accepted criteria to achieve lower local recurrence rate (26).

Statistical Analysis

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences)

RESULTS

All 77 patients (43 males and 34 females) underwent laparoscopic resection with TME when necessary and high IMA ligation. The main data characterizing the patients are presented in Fig. 1 below.

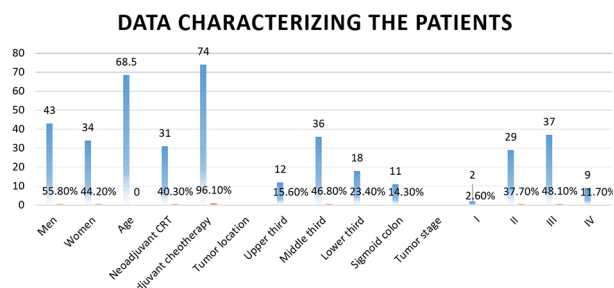


Fig. 1. Main data characterizing the patients.

The mean operative time was 270 min. The mean hospital stay was 5 days (between 4 and 6). The complications were 5, which accounted for 6.5%.

All complications are presented in Fig. 2.

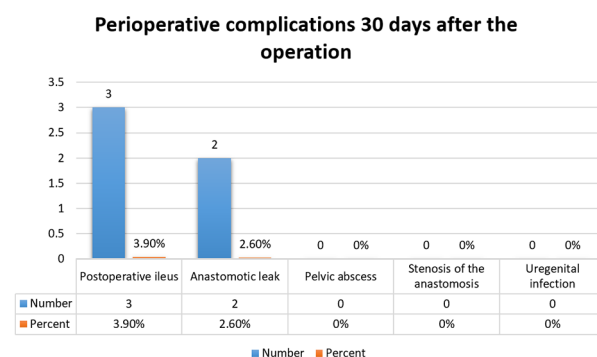


Fig. 2. Perioperative complications 30 days after the surgery.

Three of the patients required prolonged treatment and a stay in the department due to complications—postoperative ileus. All three were treated conservatively with decompression of the gastrointestinal tract using nasogastric tube (NGT), prokinetics and laxatives, as well as adequate parenteral nutrition due to the inability to feed enterally for a long period of time. In 2 of the patients, anastomotic leak was detected 30 days after the operation. In both, the anastomosis was performed low in the distal third of the rectum. Fibrocolonoscopy was routinely performed on postoperative day 30 to assess the integrity of the anastomosis. In both patients, a small insufficiency not exceeding 25% of the circumference of the anastomosis itself was found. It was clinically not manifested most likely due to the presence of a protective ileostomy. In both patients, a wait-and-see approach was taken for 30 days, during which

a course of broad-spectrum antibiotics was administered, followed by a new FCS without evidence of failure. This allowed the restoration of the intestinal passage. Due to ePCA, in all patients the transurethral catheter was maintained until the removal of the epidural catheter on the third postoperative day, after which it was removed and patients reported the presence or absence of urinary disturbances. None of the patients had stenosis, urogenital disturbances, or formed pelvic abscesses. During the follow-up period, there were no local recurrences, but in 2 patients distant lung metastases were demonstrated by imaging studies. It is possible that they were not proven in the preoperative staging of the disease. All patients survived the study period.

Our reported results did not differ significantly from other retrospective studies worldwide in criteria such as incidence of anastomotic failure and postoperative ileus. There are differences in parameters such as hospital stay, operative time, and urogenital disturbances, which are most likely due to different internal protocols in medical institutions or to a failure to follow the rules of excellent surgical technique in high IMA ligation (5,14,27–30).

CONCLUSION

Our study does not aim to set new standards or create treatment algorithms, because its retrospective nature and the small number of patients included does not allow it. On the other hand, it shows our experience with a problem that has been debated for more than a century in scientific circles and still has no definitive answer. Despite the small number of patients included in the specific study, our department aims to continue working on the problem, paying special attention to the quality of life and survival in patients after high IMA ligation. Adequate blood supply is an important factor in the success of any anastomosis performed, but it is also naive to believe that a high ligation compromises it in all patients. Complications related to anastomosis as a consequence of ischemia are only 2% (31), and they mainly occur in elderly patients with atherosclerosis, cardiovascular disease, cerebrovascular disease, and hypertension (31,32). High IMA ligation does not lead to a significant increase in perioperative complications and especially insufficiency of the performed anastomosis, except in cases of anatomically determined

variations (18,33,34). The operative technique, when performed correctly, is a reliable and effective method, including preservation of the urogenital function in patients (35–37).

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