

Surgical Outcomes of Laparoscopic Right Colectomy with Complete Mesocolic Excision

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ABSTRACT

Background and Objectives: Literature demonstrates that colorectal cancer is nowadays one of the most common malignancies. Laparoscopy and robotic surgery are progressively gaining popularity in the treatment of colorectal tumors. Complete mesocolic excision and central vascular ligation have been widely adopted with encouraging results in terms of an improvement of overall survival, but some studies in the literature seem to demonstrate a higher morbidity rate.

Methods: We conducted a retrospective study from 01/01/2010 to 30/04/2019 on a series of 250 patients, 155 males (62%) and 95 females (38%) who underwent right colectomy with minimally invasive approach, complete mesocolic excision, central vascular ligation, and intracorporeal anastomosis.

Results: No perioperative mortality occurred. Postoperative morbidity rate was 6%, including 10 cases of anastomotic leak (5%). Conversion rate was 2.5%. Mean hospital stay was 6 days (range, 4–25 days). Mean operative time was 70 minutes (range, 50–130 minutes). No cases of duodenal or pancreatic damages, no chronic pain or diarrhea, and no severe alteration of bowel function were recorded. We observed only 3 cases of transient delayed gastric emptying.

Conclusions: Laparoscopic right colectomy with complete mesocolic excision, central vascular ligation and intracorporeal anastomosis leads to encouraging oncological mid- and long-term outcomes with low complications rates.

Key Words: Colorectal cancer; Laparoscopy; Laparoscopic right colectomy; Complete Mesocolic Excision; Central Vascular Ligation.

INTRODUCTION

Literature demonstrates that colorectal adenocarcinoma is a very common malignancy worldwide: its incidence amounts to more than 1 million new cases per year with 500,000 deaths per year. About 40% of these cancers involves the right hemicolon.¹

Survival has recently improved considerably, mainly thanks to the development of standardized techniques of resection according to the embryonic fascias,² of adjuvant treatments for resectable stage III cancer,³ of target therapies,⁴ and of the advances in the resection or ablation of liver metastases.⁵

Laparoscopic and robotic approaches warrant significant advantages in terms of recovery time, pain control, and short-term morbidity.^{6,7}

Literature recognizes total mesorectal excision as the gold standard in order to achieve a satisfactory oncological treatment of rectal cancer, with the reduction of the local recurrence rate⁸; recently, the complete mesocolic excision (CME) following embryological planes and the central vascular ligation (CVL) have been introduced in right colon surgery.⁹ The advantages of CME and CVL in terms of disease-free survival have already been recognized¹⁰; but little is known about the perioperative short-term outcomes associated with these procedures. Complications such as delayed gastric emptying, chronic abdominal pain, chronic diarrhea, pancreatic fistula, and postoperative pancreatitis may occur after CME and CVL.¹¹

The present work describes our experience in minimally invasive surgical treatment of right colon diseases with

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routinely CME and CVL, with attention to the technical aspects, surgical method, and postoperative outcomes.

MATERIALS AND METHODS

From 01/01/2010 to 30/04/2019, 250 patients, 155 males (62%) and 95 females (38%), median age, 70 years old (range, 31–93 years), were consecutively admitted to our institution with diagnosis of right colon mass, in order to undergo surgical treatment with right colectomy.

All patients underwent preoperative colonoscopy except 8 cases (3.2%) in which an urgent surgical procedure had been performed because of the onset of acute bowel obstruction due to the involvement of the ileocecal valve.

Preoperative endoscopic biopsy detected adenocarcinoma in 185 cases and high-grade dysplasia (not resectable endoscopically) in 52 cases. Colonoscopy was diagnostic of mucosal alterations in 5 cases; indication of surgical resection was given on the basis of the presence of a right colon wall mass at abdominal Computed Tomography (CT) scan. All patients presenting with bowel obstruction were evaluated with contrast-enhanced preoperative CT scan.

Tumor staging was accomplished with thorax and abdomen contrast-enhanced CT scan in all cases; liver metastasis was detected in 13 patients (5.2%).

No patients underwent neoadjuvant chemotherapy.

All patients eligible for elective surgery were admitted to hospital the day before the procedure; intestinal preparation was never administered; a total dose of 600 mg of simethicone was routinely used in order to reduce bowel distension.

All patients included in the study signed written informed consent for surgical and anesthesiological procedures, blood transfusion, and sensitive personal data processing.

For each patient included in the study, the following data were recorded: sex, age at admission, comorbidities, operative time, total and postoperative hospital stay, and postoperative morbidity.

Patients' surgical risk was classified by the American Society of Anesthesiologists (ASA) physical status classification system.

Overall global and per-stage survival of patients affected by malignant disease was evaluated by drawing Kaplan Meyer curves.

Technical Aspects

Pneumoperitoneum was induced by placing a Veress needle on left hypochondrium. Normally we used three trocars; the standard position for trocars was considered as follows: 12 mm on left hypochondrium, 10 mm on left flank (transverse umbilical line), 5 mm on hypogastrium (**Figure 1**). After the right colon mobilization, the ileocolic vein and artery were isolated; the mesentery was dissected following the ileocolic vascular axis to the left of the superior mesenteric artery (SMA) up to the inferior pancreatic margin. The pancreatic-duodenal fascia was dissected following the superior mesenteric vein (SMV), and the SMA lymph nodes were collected. The Toldt's space was sectioned anteriorly to the ligamentum hepato-colicum, outward to the lateral fusion fascia of colon, and inward to converge with the pancreas-duodenum fascia plane. The lymph node collection was completed, superior mesenteric vein and artery were ligated and sectioned at their origin. The right colic artery, when present, was recognized and ligated. After the identification of the two branches of the middle colic artery, the right branch or the middle colic artery itself if needed was sectioned at the root. The Henle trunk was isolated, the right colic vein was divided, and the right right gastrohepipoic vein was preserved after the collection of the lymphatic tissue. The middle colic vein was divided. The gastrocolic ligament was opened from the inferior pancreatic margin through the anterior pancreatic space and the great omentum was sectioned. In cases of cancer located at the right colon

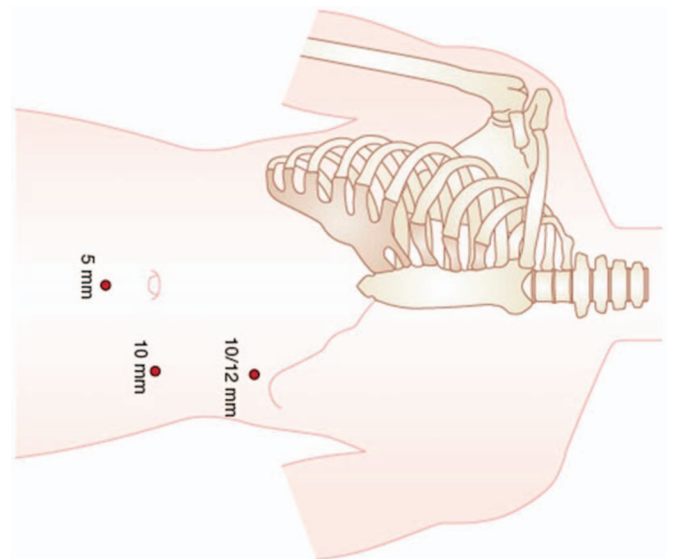


Figure 1. Patient, equip position, and port sites for laparoscopic right colectomy.

flexure, the lymph nodes of gastroepiploic arch were removed. The ligamentum hepatocolicum was divided, and the lateral fusion fascia was converged with the dissected space below. The dissection of the Toldt fascia was completed in order to mobilize the ileum (10 cm from ileo-cecal valve). A 5-cm median supra umbilical mini laparotomy was performed in order to extract the surgical specimen, after the placement of an abdominal wall protector device; this access seems to be preferable instead of Pfannenstiel incision because it allows to easily examine the ileocolic anastomosis and to perform a hand-sewn reinforcement when needed.

After the surgical specimen removal through a small median laparotomy, we performed a side-to-side ileocolic intracorporeal mechanical anastomosis; mesentery was routinely closed with a continuous hand-sewn suture in order to avoid internal hernias. After hemostasis checking, a perianastomotic peritoneal drainage was placed through the 5-mm trocar; the abdominal wall protector device was then removed and laparotomy was consequently closed.

About 80% of the surgical procedures have been performed by a Senior experienced surgeon with an experience of more than 1,000 laparoscopic colorectal resections; the remaining cases have been treated by well-trained surgeons who had previously performed at least 30 minimally invasive colorectal resections, always under the supervision of the senior surgeon.

Postoperative Management

Intravenous nutrition was given for 1–2 days. A liquid diet was started after intestinal function recovery 2–3 days after surgery, and a regular diet was started 3–4 days after surgery. Drainage was removed after the intestinal functions recovery.

Evaluation Indexes

We recorded the surgical time, intra-operative blood loss, number of harvested lymph nodes, time to bowel function recovery, postoperative length of stay, complications, re-admission rate and mortality within 30 days after surgery, and Histopathological Tumor, Nodes, Metastasis classification system (pTNM) stage.

RESULTS

All patients were approached laparoscopically regardless the tumor extension, the presence of bowel obstruction, or the history of previous abdominal open surgery.

ASA classification score was I in 81 cases (32.4%), II in 160 cases (64%), and III in 9 cases (3.6%).

All cases underwent local radical R0 resection; the median number of harvested lymph nodes was 30 (range, 14–40); CME, CVL, and intracorporeal anastomosis was achieved in all surgical procedures; no cases required extracorporeal anastomosis manual reinforcement.

Synchronous surgical treatment of single liver metastasis was performed in 8 cases (3.2%).

Mean operative time was 70 minutes (range, 50–130 min); Median intra-operative blood loss was 70 mL (range, 30–300 mL); no patients required intra-operative blood transfusion.

Conversion rate was 2% (5 cases): 2 cases presenting bowel obstruction because of the presence of an extreme bowel distension; in the remaining 3 cases, conversion has been performed in order to achieve radical liver metastasis resection not manageable laparoscopically (2 patients) and because of duodenal infiltration (1 patient).

Histological examination detected high-grade dysplasia/“in situ” carcinoma in 52 cases (20.8%), stage I adenocarcinoma in 59 (23.6%), stage IIA adenocarcinoma in 70 (28%), stage IIB adenocarcinoma in 5 (2%), stage IIIA adenocarcinoma in 6 (2.4%), stage IIIB adenocarcinoma in 20 (8%), stage IIIC adenocarcinoma in 15 (6%), stage IV adenocarcinoma in 16 (6.4%), bowel lymphoma in 3 (1.2%), neuroendocrine tumor in 3 (1.2%), and mesothelioma in 1 (0.4%).

No perioperative mortality occurred.

Overall major postoperative morbidity was 4.8%; we recorded 1 case of peritoneal bleeding (0.4%) successfully treated with relaparoscopic approach; 1 case of peritoneal collection (0.4%) drained by percutaneous approach; anastomotic leak occurred in 10 patients (4%); 1 case of anastomotic leak was treated conservatively; in the remaining 9 cases redo surgery was performed (in 5 cases laparoscopically) with peritoneal washing, anastomosis reinforcement, and temporary loop ileostomy.

No cases of pancreatic fistula, postoperative pancreatitis, or duodenal lesion occurred; no chronic diarrhea or abdominal pain were recorded; we recorded only 3 cases of delayed gastric emptying (1.2%) successfully treated with gastric tube placement and intravenous administration of Metochlopramide.

Mean postoperative stay was 6 days (range, 4–25 days).

All data are summarized in **Table 1** and **Table 2**.

Table 1.
Results of Histological Examination

| Diagnosis | No. of Cases (%) |
|--|------------------|
| High-grade displasia–in situ carcinoma | 52 (20.8) |
| Stage I adenocarcinoma | 59 (23.6) |
| Stage IIA adenocarcinoma | 70 (28.0) |
| Stage IIB adenocarcinoma | 5 (2.0) |
| Stage IIIA adenocarcinoma | 6 (2.4) |
| Stage IIIB adenocarcinoma | 20 (8.0) |
| Stage IIIC adenocarcinoma | 15 (6.0) |
| Stage IV adenocarcinoma | 16 (6.4) |
| Neuroendocrine tumor | 3 (1.2) |
| Bowel Lymphoma | 3 (1.2) |
| Mesothelioma | 1 (0.4) |
| Total | 250 |

Table 2.
Perioperative Outcomes

| Complication | No. of Cases (%) |
|----------------------------|------------------|
| Overall major morbidity | 13 (5.2) |
| Anastomotic leak | 10 (4.0) |
| Peritoneal bleeding | 1 (0.4) |
| Peritoneal collection | 1 (0.4) |
| Conversion to open surgery | 5 (2) |

Overall survival analysis divided for stage of patients affected by malignant disease is shown in **Figure 2**.

DISCUSSION

Colon cancer remains a complex surgical problem despite the decline in incidence and the improvement of postoperative outcomes because of the identification of risk factors, early diagnosis, and of the improvements in surgical and oncological therapies.¹²

Historically, surgery has played a key role in the treatment of resectable malignancies; the first studies on patients series undergoing resection of colon cancer had shown nonoptimal results; in the last decades, radical techniques including central vascular ligation and CME have been introduced. CME has been proposed as the standard surgery for colon cancer⁹ with the following principles: 1) accurate dissection of the Toldt's space preserving the

mesocolon; 2) vascular ligation at the root; 3) extended lymph nodes should be harvested.

We prefer a “medial to lateral” approach instead of “lateral to medial” approach in order to achieve more comfortably a central vascular ligation, without the obstacle that could be represented by the mobilized right hemicolon falling into the surgical field.

CME offers a longer central pedicle containing a great number of more lymph nodes, being an extended lymph node harvest is a very useful tool to obtain an accurate oncological staging and a quality marker of radical surgical resection.¹⁰ The introduction of CME brought from 2009 to an increased detection of lymph nodes cancer localization in about 20% of cases with otherwise no tumor diffusion, thus leading to a “stage migration;” these cases might have developed a recurrence without the application of CME.¹³ Disease-free survival might be improved by CME, and significantly more lymph nodes are resected (median, 34 vs. 19).¹⁴

About 20% of the patients treated in our series presented at histological examination or “in situ” lesions; most cases were stage I and II cancers, which appear as the best candidates for CME/CVL with minimally invasive surgery.

Although CME and CVL should be considered the standard of oncological surgery, some concerns emerged in the literature due to the potential increasing of perioperative mortality and morbidity; Prevost et al¹⁵ demonstrated an higher mortality in patients treated with CME/CVL mainly due to aspiration pneumonia; recent data did not demonstrate a significant advantage of CME/CVL in regard to long-term disease-free survival, but the literature failed to demonstrate the advantages of CME/CVL in term of severe morbidity, chronic pain, and delayed gastric emptying or peristalsis.¹⁶ A careful patient selection, with particular attention to general health conditions, to associated comorbidities and to tumor stage seems to be crucial in order to avoid to nullify the potential advantages of a more efficient oncological procedure with an unacceptable perioperative morbidity rate.

Right colon resection with CME and CVL is achievable with minimally invasive approach on surgeons' expert hands, combining the oncological mid- and long-term good outcomes with the advantages of laparoscopic approach in terms of morbidity (including anastomotic leak), hospital stay, and total hospital costs.⁷ Several studies demonstrated the superiority of intracorporeal anastomosis, with significantly shorter intestinal recovery time, less

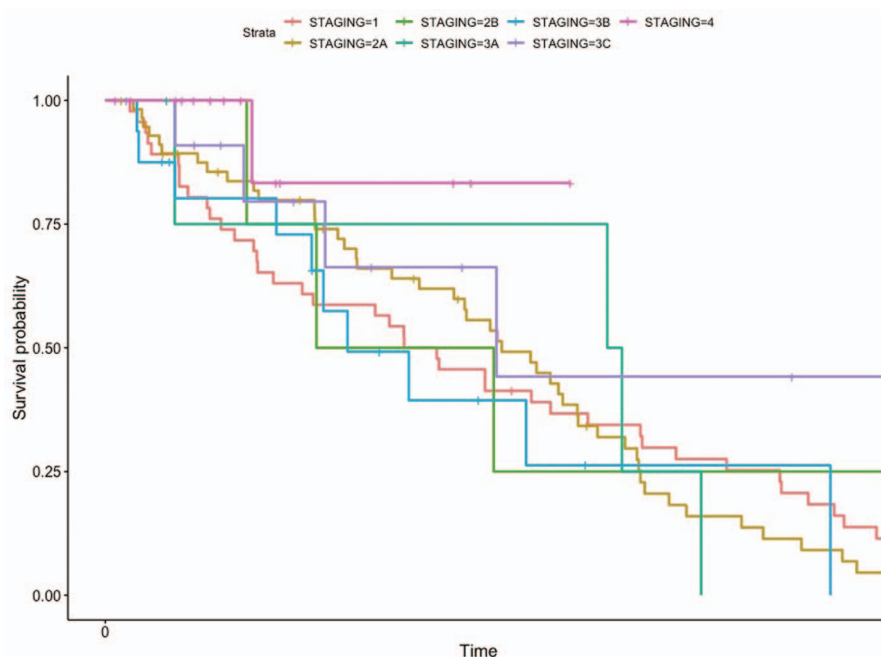


Figure 2. Kaplan Meier curves showing overall survival divided for stage disease.

analgesic requirement, shorter hospital length of stay, and less complications rate.^{17,18}

CONCLUSIONS

Our retrospective study, conducted on a series of 250 patients, demonstrates that CME/CVL right colectomy conducted with minimally invasive approach and intracorporeal anastomosis leads to good postoperative outcomes without increased rate of chronic pain, visceral damages and gastrointestinal function alteration; a satisfactory overall survival even in IIIA stage patients emerged at the follow-up analysis.

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