

Are there differences between right and left colectomies when performed by laparoscopy?

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Abstract

Background There is an extended belief that the laparoscopic approach to left colectomy (LC) is technically more demanding and associated with more postoperative complications than to right colectomy (RC). However, there is no consensus in the literature about whether the short-term outcomes of RC differ from those of LC. The aim of this paper was to compare the postoperative course of patients undergoing RC and LC.

Methods We retrospectively analyzed 1000 consecutive patients who underwent a laparoscopic RC or LC between 1998 and 2012. Factors analyzed were intraoperative complications, surgical time, postoperative complications, and length of stay. The two groups were divided into four subgroups (neoplasia, diverticular disease, polyps, and others).

Results LC was associated with more postoperative complications than RC and longer operative time both in the two main groups (postoperative complications 30 vs. 19 %; operative time 139 vs. 118 min) and in the neoplasia subgroups (27 vs. 18 %; 137 vs. 118 min). No differences between groups were found for rates of reintervention or death. Comparison between LC subgroups showed that the operative time was longer and the conversion rate was higher in the diverticular disease subgroup than in the neoplasia subgroup (155 vs. 137 min; 21 vs. 8 %).

Conclusions In this large cohort of patients undergoing laparoscopic colectomy, LC carried a higher risk than RC

of postoperative complications. These findings provide new data on the differences between the two surgeries. Our findings strengthen the notion that right and left colectomies have a different intraoperative and postoperative course and should be analyzed as two separate entities.

Keywords Colorectal · Cancer · Colon · G-I

Concerns raised in the mid-1990s over the oncologic safety and effectiveness of laparoscopic surgery for colon cancer [1, 2] have now been resolved. Clinical trials and recent reports have found a reduction in mortality and morbidity compared to open surgery [3–10], leading to the general adoption of the laparoscopic approach to colonic diseases.

It is commonly believed that left colectomy is more technically demanding than right colectomy as it is considered to hold a higher risk of anastomotic leaks and other surgical complications and requires a longer hospital stay. There is no clear evidence, however, concerning what proportion of the risk of complications is inherent to the surgical intervention itself as opposed to the disease.

Few studies to date have compared the postoperative results of right versus left colectomies, and those comparing these surgical interventions using a laparoscopic approach are even scarcer.

We hypothesized, first, that there are real differences between the postoperative course of right and left colectomies and, second, that the type of disease is an independent factor in the risk of surgical complications. The aims of this retrospective study were to compare the short-term outcomes of right colectomy (RC) and left colectomy (LC) and to identify the risk associated with the disease.

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Methods

Study population

We performed a retrospective analysis using data from the Laparoscopic Surgery Database created in our center in 1998. We analyzed 1000 consecutive patients operated between 1998 and 2012 for right or left colectomies. Use of the database for this study was approved by the local institutional review board.

Definitions

Location of the disease

Disease of the right colon was defined as a lesion located from the ileocecal valve to, and including, the hepatic flexure of the colon. Diseases of the left colon were considered as those located from the splenic flexure of the colon to, and including, the rectosigmoid juncture.

Type of resection

A right colectomy was defined as removal of the terminal ileum and the ascending right colon followed by an ileocolonic anastomosis. A left colectomy was defined as resection of the descending colon or the sigmoid colon followed by a colo-colonic anastomosis.

Eligibility criteria

All patients were at least 18 years old and underwent elective laparoscopy for right or left colectomy. Anastomosis was performed immediately in all patients.

Non-eligibility criteria

Exclusion criteria were: patients younger than 18 years; patients undergoing laparotomy colonic resection, subtotal, or total colectomy; resection without anastomosis (double-barreled colostomy, abdominoperineal amputation, Hartmann's operation); surgery without resection (stoma closure or Hartmann reversal); emergency operations; and resections of the right, middle, or left third of the transverse colon or of the rectum. Patients were not excluded in relation to the type of disease (eg, angiodysplasia, lipoma, neoplasia).

Outcomes of interest

Preoperative, intraoperative, and postoperative variables were recorded. Preoperative variables were age, gender,

CR-POSSUM [11], diabetes, previous intra-abdominal surgical operations, and the current surgical disease. Surgical diseases were divided into four groups: neoplasia, diverticular disease, polyposic disease, and other conditions.

Intraoperative variables recorded were: operative time, intraoperative complications (such as difficult dissection, difficult insufflation, hemorrhage, adhesions, or perforation), and conversion to open surgery. Postoperative variables recorded were: postoperative complications (classified according to Dindo–Clavien classification [12], reoperation, and length of hospital stay).

End points

The main end points were postoperative complications occurring during the hospital stay or within 30 days after discharge.

Statistical analysis

Data were analyzed with SPSS software (SPSS, Inc). Univariate analysis was performed on all factors with the χ^2 test and Fisher's exact test for qualitative variables and the Student's *t* test for quantitative variables, as appropriate. The Mann–Whitney U test was used when the distribution was not Gaussian. Statistical significance was established for values of $p \leq 0.05$ and odds ratios and CI of 95 %.

Results

Between 1998 and 2012, 1000 patients underwent elective right or left colectomy in our center: 49.9 % had a right colectomy, and 50.1 % had a left colectomy.

The average age of RC patients was higher than that of LC patients (72 vs. 67 years, $p < 0.0001$). There were no differences between the two groups regarding gender, CR-POSSUM, prevalence of diabetes, or previous surgical intra-abdominal operations (Table 1). Table 2 shows the distribution of the population in the subgroups.

Patients undergoing LC had a longer intraoperative time than those undergoing RC (139 ± 47 vs. 118 ± 32 min, $p < 0.001$). Patients who had a RC had a higher rate of intraoperative complications, particularly adhesions and hollow viscus perforation. Differences between the two groups in the conversion rate were not statistically significant. The overall postoperative complication rate was higher in left colectomy patients (30 vs. 19 %, $p < 0.0001$) although there were no differences in the Dindo–Clavien postoperative complications or mortality rates. The median postoperative stay was 7 days, with no differences between groups (Table 3).

Table 1 Demographic and preoperative data

	RC (<i>n</i> = 499)	LC (<i>n</i> = 501)	<i>p</i>
Age (years)	72.2 ± 12	67.54 ± 12	<0.001
Sex			
Male	232 (50.43 %)	315 (58.33 %)	ns
Female	228 (49.57 %)	225 (41.67 %)	ns
CR-POSSUM			
Physiology score	10	9	ns
Operative severity score	8	8	ns
Diabetes	33 (7.17 %)	45 (8.33 %)	ns
Previous surgeries	185 (40.22 %)	192 (35.56 %)	ns

Table 2 Distribution of the population in subgroups

	RC (<i>n</i> = 499)	LC (<i>n</i> = 501)
Neoplasia	476 (95.4 %)	405 (80.8 %)
Diverticular disease	0 (0 %)	71 (14.2 %)
Polyposic disease	13 (2.6 %)	14 (2.8 %)
Others	10 (2 %)	10 (1.9 %)

RC right colectomy, LC left colectomy

Results in the subgroups of patients with neoplasia were similar to those for the main groups. LC neoplasia patients had a longer operative time than those in the RC neoplasia subgroup (137 ± 47 vs. 118 ± 33 min, $p < 0.001$). Statistically significant differences were found in the intraoperative complications concerning difficulty of dissection and adhesions, but no differences were seen in the conversion rate between these two groups. There was a higher postoperative complication rate in LC neoplasia patients (28 vs. 18 %, $p = 0.001$), but no differences were observed in the postoperative stay or mortality (Table 4).

Analysis of the LC neoplasia and DD subgroups showed that patients with diverticular disease (DD) had a longer operative time than those with neoplasia (155 ± 47 vs.

137 ± 47 min, $p = 0.002$). Patients with DD also had a higher rate of intraoperative complications, mainly difficult dissection and adhesions, and a higher rate of conversion. There were no statistically significant differences in postoperative complications or postoperative stay (Table 5).

Table 6 lists the postoperative complication rates in the whole sample. There were no statistically significant differences between RC and LC groups regarding the prevalence of anastomotic leak, hemoperitoneum, postoperative ileus, or pneumonia. Anastomotic leak occurred in 55 patients (5.5 % of the total sample).

Discussion

In this single-center retrospective study, we found two main differences between laparoscopic right and left colectomies. Left colectomy (LC) was associated with a longer operative time and also with a higher rate of postoperative complications than right colectomy (RC). These differences in postsurgical complications, however, were not reflected in the different grades of the Dindo–Clavien classification. As expected, the neoplasia subgroups mirrored our general results, as the vast majority of patients in our series had malignant disease.

Surprisingly, we found that surgeons reported more intraoperative complications in the RC group than in the LC group. In particular, adhesions, difficult dissection, and hollow viscus perforation were more frequent in the RC group. It is interesting to note that 37.7 % of patients in our total population had had previous abdominal surgery. In most cases, this was an appendectomy, possibly explaining the high rate of intraoperative difficulties and complications in the RC group.

Concerning the differences between the diagnostic groups (neoplasia, diverticular disease, polyposic disease, and others), we were only able to analyze the differences between the neoplasia and diverticular disease groups due to the small size of the other two groups. In our LC group,

Table 3 Right colectomy (RC) vs. Left colectomy (LC)—General group

	RC (<i>n</i> = 499)	LC (<i>n</i> = 501)	<i>p</i>
Operative time	117.7 ± 32.3	139.07 ± 46.51	<0.001
Intraoperative complications			
Difficulty of dissection	55 (10.87 %)	75 (15.56 %)	ns
Difficulty of insufflation	3 (0.65 %)	5 (0.99 %)	ns
Hemorrhage	3 (0.65 %)	5 (0.99 %)	ns
Adhesions	30 (6.01 %)	6 (1.19 %)	0.0002
Hollow viscus perforation	15 (3 %)	4 (0.8 %)	0.0173
Conversion	62 (12.42 %)	47 (9.38 %)	ns
Postoperative complications	93 (18.6 %)	148 (29.5 %)	0.0001
LOS	7 (4–70)	7 (3–56)	ns

LOS length of stay

Table 4 Right colectomy (RC) vs. Left colectomy (LC)—Neoplasia subgroup

	RC (<i>n</i> = 476)	LC (<i>n</i> = 405)	<i>p</i>
Operative time	117.9 ± 32.6	136.8 ± 46.8	<0.001
Intraoperative complications			
Difficulty of dissection	47 (9.87 %)	15 (3.7 %)	0.0006
Difficulty of insufflation	4 (0.84 %)	0	ns
Hemorrhage	5 (1.05 %)	1 (0.24 %)	
Adherences	20 (4.2 %)	2 (0.5 %)	0.0034
Hollow viscus perforation	16 (3.36 %)	2 (0.5 %)	ns
Conversion	55 (11.55 %)	32 (7.9 %)	ns
Postoperative complications	87 (18.3 %)	112 (27.7 %)	0.001
LOS	7 (4–70)	7 (3–56)	ns

LOS length of stay

Table 5 Diverticular disease (DD) vs. Neoplasia—Left colectomy subgroup

	DD (<i>n</i> = 71)	Neoplasia (<i>n</i> = 405)	<i>p</i>
Operative time	155.3 ± 46.6	136.8 ± 46.8	0.002
Intraoperative complications			
Difficulty of dissection	56 (78.9 %)	15 (3.7 %)	<0.001
Difficulty of insufflation	4 (5.63 %)	0	ns
Hemorrhage	1 (1.4 %)	1 (0.25 %)	ns
Adherences	4 (5.63 %)	2 (0.5 %)	0.0045
Hollow viscus perforation	2 (2.81 %)	2 (0.5 %)	ns
Conversion	15 (21.13 %)	32 (7.9 %)	0.0009
Postoperative complications	15 (21.13 %)	112 (27.7 %)	ns
LOS	7 (4–41)	7 (3–56)	ns

LOS length of stay

Table 6 Postoperative complications according to Dindo-Clavien classification of postoperative complications

	General (<i>n</i> = 1000)	RC (<i>n</i> = 499)	LC (<i>n</i> = 501)	Neoplasia (<i>n</i> = 881)	DD (<i>n</i> = 71)
Total	241 (24.1 %)	93 (18.6 %)	148 (29.5 %)	199 (22.59 %)	15 (21.13 %)
Type 1	61 (6.1 %)	27 (5.4 %)	36 (7.18 %)	56 (6.36 %)	3 (4.2 %)
Type 2	64 (6.4 %)	25 (5.01 %)	39 (7.78 %)	57 (6.47 %)	6 (8.45 %)
Type 3a	12 (1.2 %)	5 (1 %)	7 (1.4 %)	11 (1.25 %)	1 (1.4 %)
Type 3b	60 (6 %)	27 (5.4 %)	33 (6.59 %)	52 (5.9 %)	6 (8.45 %)
Type 4a	13 (1.3 %)	3 (0.6 %)	10 (2 %)	12 (1.36 %)	0
Type 4b	9 (0.9 %)	2 (0.4 %)	7 (1.4 %)	9 (1.02 %)	0
Type 5	13 (1.3 %)	4 (0.8 %)	9 (1.8 %)	13 (1.48 %)	0

RC right colectomy, LC left colectomy, DD diverticular disease

patients with DD had a longer operative time than neoplasia patients, probably due to their higher rate of intraoperative complications. They also had a higher rate of conversion. Nonetheless, there were no statistically significant differences between these two groups in the postoperative course.

Few studies to date have analyzed differences between right and left colectomies, and those that exist mainly refer to open surgery for neoplasia [16–20]. Even fewer studies compare the surgical outcomes of the two procedures according to the diagnosis, and those comparing the

laparoscopic approach are even scarcer. The few reports published to date consider that RC and LC are different operations, with a different subset of patients and their particular postoperative course. It remains controversial, however, whether the short-term outcome is better in RC or LC.

Concerning the differences between RC and LC regarding the populations, our results support those of a systematic review [13] and two epidemiological studies [14, 15] that found that the origin of colon cancer shifted from left to right with increasing age.

In respect of the postsurgical course, our results support the general belief that LC is associated with more postoperative complications than RC, but they differ from data presented by other authors regarding the subgroups of complications and LOS. Although other authors have reported differences in the major and minor complications between LC and RC patients [16, 17, 19, 20], we found that there were no statistically significant differences between the two groups. It is also of interest to note that our results confirm the lower rate of postoperative complications in the RC group reported by Hinojosa [20]. These studies and our own contrast with those of Masoomi et al. [17] who found that RC carried a higher risk of postoperative complications than LC.

Surprisingly, the higher rate of intraoperative complications in our diverticular disease subgroup did not translate into a higher rate of postoperative complications than in the neoplasia patients. These results contrast with those of Van Arendonk [21] who found a higher rate of intraoperative complications, a higher mortality rate, and a longer length of stay in the diverticular disease subgroup than in the neoplasia subgroup.

Our study has several limitations. First, due to its retrospective nature, the possible loss of information could alter results in morbidity and mortality. Second, complications such as wound infection, urinary tract infection, or deep venous thrombosis may be underreported. This bias could lead to an underestimation of the frequency of complications. However, one would expect such bias to be present equally across all groups, and therefore it would unlikely generate an artificial difference in complications between groups. Third, the low number of patients with diseases other than neoplasia hinders statistical analysis of the influence of the surgical disease on the postoperative course.

In conclusion, in our series, left colectomy carried a higher risk of postoperative complications and a longer operative time. Patients with diverticular disease had a higher risk of intraoperative complications and conversion than cancer patients. We found no differences in mortality or length of stay between groups. These data support the notion that right and left colectomies are different operations and have a different intraoperative and postoperative course. We suggest that the outcomes of these two procedures should therefore be analyzed separately.

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Compliance with Ethical Standards

Disclosures Victor Turrado-Rodríguez, Eduard Targarona, Jesús Bollo Rodríguez, Carme Balagué, Pilar Hernández, Carmen Martínez, and Manel Trias Folch have no conflict of interest or financial ties to disclose.

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