

# Results in Laparoscopic Colon Cancer Surgical Treatment. Retrospective Analysis

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## ABSTRACT

**Introduction:** Colon tumors represent a prevalent disease worldwide and is required for their treatment. The advent of the laparoscopic approach has been associated with better postoperative results.

**Objective:** To compare colon cancer patients treated by laparoscopic and conventional approach.

**Material and methods:** A retrospective analysis of all patients undergoing surgery for malignant colonic tumors in our hospital during a period of 62 months was performed. Patients approached conventionally were compared with those operated on by laparoscopy. All the preoperative data of patients, as well as the characteristics of the technique used, the morbidity and mortality of the procedure and the tumor stage were included.

**Results:** During the evaluated period, 544 surgeries were performed for colorectal conditions, of which 191 met the inclusion criteria: 41 in the conventional group and 150 in the laparoscopic group. There were no differences between groups in terms of age and comorbidities, although the conventional cohort had a higher incidence of previous surgical procedures. The mean operative time was 141.28 ± 51.65 minutes in the laparoscopic group and 176.34 ± 85.02 minutes in the conventional group. Morbidity was 53.66 vs. 28% ( $p = 0.002$ ), mortality 4.88 vs. 0% ( $p = 0.007$ ), and hospital stay 13.04 ± 10,10 vs. 6.95 ± 4.44 days for the conventional and laparoscopic approach, respectively.

**Conclusions:** As other series, this study showed significant differences that favor the laparoscopic approach for patients with colon cancer, with shorter operative time, shorter length of stay and lower rate of complications.

**Key words:** Colon; Cancer; Laparoscopy; Conventional; Morbidity; Complications

## INTRODUCTION

Colorectal neoplastic disease is the third in incidence in both genders worldwide (third in men, second in women) and the second cause of death from cancer.<sup>1</sup> Great advances have been made in early diagnosis of this disease thanks to the development of population-based screening strategies.<sup>2</sup> However, this condition is more and more frequently observed in younger people.<sup>2</sup>

Surgical treatment continues to be the choice for all colonic tumors.<sup>2</sup> In the early 1990s, the first publications on colonic tumor resections via laparoscopy began to appear,<sup>3-5</sup> representing a paradigmatic shift in their approach. Originally received some criticism questioning the oncological feasibility of the procedure and the presence of metastases in port orifices,<sup>6,7</sup> however, currently the laparoscopic approach has been proposed as the standard treatment for colon cancer.<sup>8</sup>

Since its advent, the benefits of minimally invasive surgery have been proven by numerous studies.<sup>9-12</sup> However, this approach has not been universally adopted, reaching only 50% of procedures in developed countries.<sup>13,14</sup> At the national level, a survey headed by Patron Uriburu et al. in 2011,<sup>15</sup> showed that only 23% of colorectal surgeons performed laparoscopic procedures.

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The objective of this study is to present the initial experience of our institution with laparoscopic colectomies and to compare patients operated on by the laparoscopic and conventional approach.

## MATERIAL AND METHODS

This research was carried out with the approval of the institutional ethics committee.

All those patients operated on for colon neoplastic pathology at the CEMIC University Hospital (CABA, Argentina) from January, 2015 to March, 2020 were included. They were divided into two groups according to the surgical approach: conventional surgery and laparoscopic surgery. Fig.1 describes the patient selection process. All patients undergoing an emergency procedure or with a non-neoplastic pathology were excluded.

The selection of the technique was made based on the surgeon experience. Regarding the laparoscopic approach, all surgeries were performed or supervised by a surgeon with experience in this type of procedure.

A database was created that included:

- Preoperative information: Demographic data, tumor location, comorbidities, history of colon cancer, history of abdominal surgery (defined as any type of procedure that involves access to the abdominal cavity by either approach).
- Information on surgery and hospitalization: Operative time, associated abdominal surgery, length of

stay, postoperative complications (stratified according to the Dindo-Clavien classification),<sup>16</sup> incidence of anastomotic dehiscence and its classification according to the International Study Group of Rectal Cancer (being those classified as A and B minor and those classified as C major).<sup>17</sup>

- Follow-up information: Pathological report (histopathology characteristics, stage according to the American Joint Committee on Cancer classification).<sup>18</sup>

### Surgical technical description

- Laparoscopic right colectomy: Three ports are used, two 10-mm ports in the umbilicus and the left flank and one 5-mm port at the suprapubic level. A medial to lateral approach and an extracorporeal side-to-side double-stappling anastomosis with a linear cutting device is performed
- Laparoscopic left colectomy: Three ports are used, two 10-mm ports at the umbilicus and the right flank and one 10-mm port at the right lower quadrant. A medial to lateral approach, and an end-to-end intracorporeal colorectal anastomosis with a circular device is performed.
- Laparoscopic approach to tumors of the transverse colon: For those located on the right side of the transverse colon, an extended laparoscopic right colectomy is performed, following the principles already described. Tumors adjacent to the splenic flexure are treated by a medial approach and a side-to-side anastomosis with a circular device.
- Conventional right and left colectomy: A supra- and infra-umbilical midline laparotomy and a lateral to medial approach was performed. The anastomosis is made with the same principles used in laparoscopic surgery.

## RESULTS

One hundred and ninety-one patients were included. The mean global age was 68.17 years. Table 1 summarizes the preoperative characteristics of the patients, 41 (21.5%) approached conventionally and 150 (78.5%) by laparoscopy with conversion requirements in 15 (10%) of them. There were no significant differences regarding age, gender, and comorbidities between both groups. Significant differences were found in the percentage of tumors located in the transverse colon (24.4% for the conventional group vs. 11.3% for the laparoscopic group,  $p = 0.03$ ). There were also differences in the history of previous abdominal surgeries, greater in the conventional group (82.9% vs. 55.3%,  $p = 0.02$ ).

Table 2 outlines the operative data of the patients. Di-

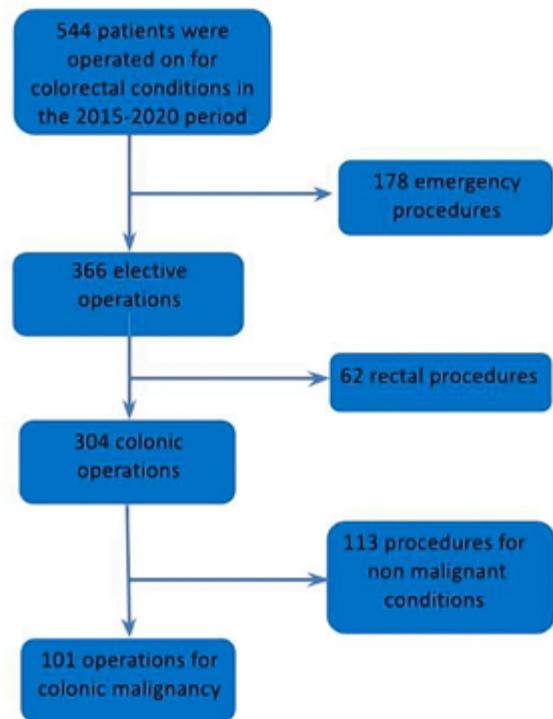


Figure 1: Patient selection process.

fferences were found in the approach to patients with tumors of the transverse colon, with the number of conventional procedures being greater in this group (26.8% vs. 12.7%,  $p = 0.03$ ). There were no differences in the approach of tumors located elsewhere in the colon, including those requiring a total colectomy.

The mean operative time was  $141.28 \pm 51.65$  minutes in the laparoscopic group vs.  $176.34 \pm 85.02$  minutes in the conventional group, and there were also differences in the number of patients to whom a primary anastomosis was performed, this percentage being higher in the case of laparoscopic surgery. In the postoperative period, 9.7% of patients operated on by conventional approach required intensive care vs. none of those operated on by laparoscopy ( $p = 0.001$ ).

Table 3 summarizes the postoperative period data. Significant differences were found in the average length of stay required by each group, being  $13.04 \pm 10.10$  vs.  $6.95 \pm 4.44$  days for the conventional and laparoscopic approach, respectively.

The morbidity of conventional procedures was significantly higher. In this group, 55% of complications were major (Dindo-Clavien classification IIIA or higher), while in the laparoscopic procedures 58.4% of complications were minor (Dindo-Clavien classification I or II).

Global dehiscence was 6% (11/182 patients who underwent primary anastomosis), more frequent in the conventional group. In the latter group, 4 out of 6 patients had major dehiscences, and 2 minor. In the laparoscopic

TABLE 1: PATIENT CHARACTERISTICS.

Variable	Conventional surgery n (%)	Laparoscopic surgery n (%)	P value
n	41 (100)	150 (100)	
Female gender	20 (49)	69 (46)	0,75
Age	69.10 (37-91)	67.92 (28-90)	0,30
<b>Comorbidities</b>			
Hypertension	23 (56.1)	74 (49.3)	0,44
Diabetes II	7 (17.1)	18 (12)	0,39
Dyslipidemia	18 (43.9)	51 (34)	0,24
Smoking	6 (14.6)	17 (11.3)	0,28
Chronic obstructive pulmonary disease	5 (12.2)	8 (5.3)	0,12
Chronic kidney disease	2 (4.9)	4 (8)	0,47
<b>Location</b>			
Right colon	19 (46.3)	79 (52.7)	0,36
Transverse colon	12 (29.3)	21 (14)	0,02
Left colon	8 (19.5)	47 (31.3)	0,62
More than one segment affected	2 (4.9)	3 (2)	0,31
Previous abdominal surgery	31 (82.9)	83 (55.3)	0,02

group, 3 patients had major and 2 minor dehiscences. The mean age of the patients who presented this complication was 70 years. Four patients had undergone major associated surgery during the procedure.

The reoperation rate was significantly higher in the conventional group, as was the mortality associated with the procedure.

Table 4 shows the tumor stage of those patients operated on for adenocarcinoma (93.2%). The remaining patients (6.8%) were operated on for malignant tumors of another lineage.

All patients with stage 0 disease were approached laparoscopically (p = 0.01). On the other hand, those with stage IIIC and IVB were mostly approached conventionally (p = 0.009 and 0.004, respectively), although in neither group associated surgery for resection of extracolonic oncological disease was performed. There were no differences in the surgical approach. For the rest of the tumor stages.

## DISCUSSION

Malignant colon disease requires surgical treatment, originally described by the open approach. However, since its introduction, the laparoscopic approach has proven to be better because of having lower morbidity and mortality, shorter hospital stay and faster return to habitual activities, with oncological results equivalent to that achieved by conventional surgery.<sup>8-12,19,20</sup> Due to all said, today the

TABLE 2: OPERATIVE DATA.

Variable	Conventional surgery n (%)	Laparoscopic surgery n (%)	P value
n	41 (100)	150 (100)	
<b>Type of surgery</b>			
Right colectomy	16 (39)	75 (50)	0.21
Extended right colectomy	4 (9.8)	7 (4.7)	0.21
Segmental colectomy	11 (26.8)	19 (12.7)	0.03
Left colectomy	8 (19.5)	46 (30.7)	0.16
Total colectomy	2 (4.9)	3 (2)	0.31
Associated surgery	16 (39)	10 (6.7)	0.001
Operative time, minutes (range)	176.34 (60-460)	141.28 (60-325)	0.0006
Primary anastomosis	36 (87.8)	146 (97.3)	0.01
Intensive post-operative care	4 (9.7)	0	0.001

TABLE 3: POSTOPERATIVE DATA.

Variable	Conventional surgery n (%)	Laparoscopic surgery n (%)	P value
n	41 (100)	150 (100)	
Mean length of stay, days (range)	13.3 (3-58)	6.9 (3-28)	0.0001
Complications	22 (53.6)	42 (28)	0.002
<b>Complications (Dindo-Clavien Classification)</b>			
I	1 (2.4)	2 (1.3)	0.61
II	9 (22)	22 (14.7)	0.27
IIIA	2 (4.9)	3 (2)	0.31
IIIB	5 (12.2)	13 (8.7)	0.49
IVA	2 (4.9)	1 (0.7)	0.06
IVB	1 (2.44)	0	0.06
Surgical site infection	8 (19.5%)	18 (12)	0.21
Anastomotic dehiscence	6 (16.7)	5 (3.4)	0.006
Re-operation	9 (22)	15 (10)	0.04
Mortality	2 (4.9)	0	0.007
Re-admission	4 (9.8)	9 (6)	0.40

laparoscopic approach is indicated for the treatment of colon tumors. However, there are still great problems for the standardized use of this technique, either due to difficulty in reaching the learning curve or lack of access to the necessary materials.<sup>13,14</sup>

In our cohort, with a limitation in terms of the number of patients included, we have found significant differences on morbidity and mortality in favor of laparoscopy, consistent with that presented in other studies comparing the

short-term results of the laparoscopic and conventional approach.<sup>8,21</sup> Of a total of 114 patients who had a history of previous abdominal operations, 83 (73%) underwent laparoscopic surgery. However, there is still a significant percentage of patients who were operated on by conventionally, which could indicate that a history of previous surgery continues to represent a relative contraindication for the laparoscopic approach. This comment also applies to those patients with transverse colon tumors, most of whom underwent an open approach.

The minimally invasive approach presented significant differences in terms of operative time, postoperative intensive care requirement and morbidity and mortality rates, with a higher rate of severe complications (Clavien-Dindo greater than IIIA) in patients operated on by an open approach. The history of previous abdominal surgery (higher in the conventional group) could be a predisposing factor for more complications. However, staging the groups by history of previous surgery and incidence of complications, no significant differences were found between those who had been operated on previously and those who had not (36 vs. 30%, respectively;  $p = 0.381$ ). Also, there were not differences in this respect between groups operated on or not for recurrent disease.

The percentage of patients with surgical site infection was higher in the open group, however, this difference was not statistically significant.

The global rate of anastomotic dehiscence was 6% for both groups, a result comparable to other national series.<sup>22</sup> This complication was more frequent in the conventional group (16.7 vs. 3.4%,  $p = 0.006$ ), which also presented more complications that needed reoperation and an average length of stay close to twice that of the group operated on by laparoscopy. This is a significant finding considering that an argument against laparoscopy is the costs associated with the procedure (it requires more materials), but the best results reduce the costs associated with hospitalization and consequently the procedure itself. This has

TABLE 4: TUMOR STAGE.

Variable	Conventional surgery n (%)	Laparoscopic surgery n (%)	P value
n	34 (100)	144 (100)	
Stage 0	0	22 (15.3)	0.01
Stage I	7 (20.6)	30 (20.8)	0.975
Stage IIA	9 (26.5)	41 (28.5)	0.815
Stage IIB	2 (5.9)	9 (6.25)	0.936
Stage IIIA	1 (2.9)	12 (8.3)	0.277
Stage IIIB	3 (8.8)	18 (12.5)	0.550
Stage IIIC	7 (20.6)	9 (6.25)	0.009
Stage IVA	2 (5.9)	2 (1.4)	0.112
Stage IVB	3 (8.8)	1 (0.7)	0.004

already been demonstrated in other countries.<sup>23</sup>

A final aspect that should be mentioned in this discussion is the approach to advanced colon tumors. In our experience, these tumors were mostly operated on conventionally. However, we must emphasize that these patients can be safely approached laparoscopically with good postoperative and oncological results, as it has already been shown.<sup>24,25</sup> We must take this into consideration prospectively in order to start surgery in this type of patient in a minimally invasive way.

This is the first laparoscopic colorectal surgery series published by the surgical service of our university hospital and, as it falls within the learning curve of the service, the selection bias remains high. This is reflected in the fact that the open group is largely comprised of advanced tumors and patients with a history of prior surgery. Future experience will surely make it possible to further reduce the number of patients approached openly. Another limitation is the retrospective nature of the study.

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