

# Laparoscopic Surgery for Colorectal Disease by the Coloproctology Service of the Hospital Militar Central (2005-2015)

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## Abstract

**Introduction:** Various surgical approaches have been established to treat colorectal disease, but in the last 30 years the evidence has shown that laparoscopic techniques produce greater benefits than do laparotomies. This depends directly on continuous training and the practical criteria of colorectal surgeons. **Objective:** This study clinically and surgically characterized patients undergoing colorectal laparoscopic surgery by the Coloproctology Service of the Hospital Militar Central in Bogotá between 2005 and 2015. **Methodology:** This is a retrospective, cross-sectional study. **Results:** Patients' demographic characteristics (clinical and pre-surgery), diseases, times, conversion rates, complications and recovery profiles during the study period were recorded by the Coloproctology service and were similar to those reported elsewhere in the world. **Conclusions:** Although we only collected information related to the last ten years of surgery, this data puts us at the level of centers of excellence in the management of colorectal disease worldwide.

## Keywords

Laparoscopy, colorectal, cancer, conversion.

## INTRODUCTION

Colorectal disease is quite heterogeneous and combines various prognoses and therapies. From this perspective, surgeons who face the selection of a surgical technique are faced with the evolution of intervention strategies. For example, a surgeon must choose whether to use wide resection margins through minimally invasive access in the case of cancer or even whether to delegate the precision of cuts to the robotic sciences. In respect to the latter, a study by Hyuk et al. has compared robotic-assisted low anterior resection (Da Vinci) and standard low anterior resection. (11) Although the evolution of laparoscopy is a topic that has been developing since the 1980s, scientific production in Latin American countries had been scarce until the beginning of the 21st century. (1, 2, 3)

Our country is no exception, and trials of complex technique that take multiple socio-demographic, clinical and surgical variables into account are scarce. For this reason, there is little knowledge and scant analysis of population characteristics associated with colorectal disease in Colombia or of its surgical treatment. Nevertheless, the few publications about laparoscopic techniques in use offer magnificent research scenarios, and it is necessary to comment on the publications of Reis Nieto in Colombia (2000), and Gustavo Rossi in Argentina (2013). (9, 10) In fact, laparoscopic colorectal surgery, despite the passage of time, is a research line now being explored in developing countries like ours. This affirmation is justified by the scarcity of supra-specialists, the meager supply of services, and limited medical coverage for a country that is constantly growing.

Absent relevant information from Colombia on this topic, absent investigation about the characteristics of

interventions carried out in our institution, and considering the unknown effect of generating inferences from foreign populations, we suggest that it is important to determine the demographic, clinical, surgical and postoperative characteristics of patients undergoing surgery for colorectal disease (described in the table of variables) before generating specific research nodes for advancement of laparoscopic colorectal surgery. Through this exercise we hope to be able to answer the following research question: what are the demographic, clinical, surgical and postoperative characteristics of patients who underwent colorectal surgery in the coloproctology service of the Central Military Hospital between 2005 and 2015?

## METHODOLOGY

This is an observational, analytical study based on cross-sectional research carried out in the coloproctology service of the Central Military Hospital. Clinical records of patients who underwent laparoscopic surgery primarily for colorectal disease between 2005 and 2015 were included. By protocol, only those patients whose records were incomplete were excluded.

A secondary database for demographic analysis of patients was developed in an Excel spreadsheet. Qualitative variables were described by frequencies and absolute percentages, and quantitative variables, were described with statistics of central tendency (mean or median) and dispersion (standard deviations or interquartile ranges) after analysis of their distribution (Kolmogorov-Smirnov test). The data was grouped into tables and then presented in this report. The incidence of conversion was calculated on the basis of the number of procedures required from laparoscopic surgery (in the numerator) and the total procedures in the period (in the denominator), and principal causes were specified. Conversions were analyzed according to the year and some lapses. Surgical times were established for procedures and then compared across years. If necessary, hypothesis contrasts were performed to determine statistically significant differences which were standardized from a probability value of less than 5% (for all comparisons).

The effect of scarring from previous peritoneal approaches on the rate of conversion and reoperation was determined, leaving the total number of cases converted or reoperated with antecedent of peritoneal approach as the numerator and the absolute number of cases converted or reoperated as the denominator. In an additional bivariate analysis in exploratory mode, estimations of the hypotheses depended on the nature of the variables involved,  $\chi^2$  or Fisher's exact test, Student's T test or the U-Mann Whitney test. In addition, binomial and linear analyses were used as exploratory tests for investigating new research hypotheses.

## RESULTS

After the ethics committees of the Central Military Hospital and the Universidad Militar Nueva Granada approved this study, 351 records of patients who had undergone laparoscopic surgery for colorectal disease in the coloproctology service of the Central Military Hospital between 2005 and 2015 were collected and reviewed. Of these, only 60% of the records met the selection criteria (Table 1).

**Table 1.** Demographic data

Variable	Frequency (%) or average (dispersion) (n = 210)
Age (years)	65 (+/-78)
Gender (male)/(female)	120 (57.1%)/90 (42.9%)
Weight (kg)	70.89 (+/-10.57)
Height (cm)	166 (+/-8.9)
BMI	
<25 m <sup>2</sup> /kg	83 (39.5%)
25-30 m <sup>2</sup> /kg	105 (50%)
>30 m <sup>2</sup> /kg	22 (10.5%)
ASA	
I and II	81.4%
III and IV	18.6%
Comorbidities	48.6%
High blood pressure	28.4%
DM	9.8%
Lung disease	6.9%
Heart disease	5.9%
Multiple (more than 2 simultaneous)	28.4%
Other	16.7%

\* ASA: American Society of Anesthesiology classification of physical state. DM: diabetes mellitus; BMI: body mass index.

Colonoscopies were performed prior to surgical procedures. Table 2 describes indications for surgery and the location of the lesions found endoscopically. The most frequent surgical procedures are presented in Table 3 together with average duration of surgery and volume of bleeding.

Pathology reports indicated that 30.9% of lesions were benign 69.1% were malignant. The most frequent benign tumors were adenomas (52.94%), lipomas (17.65%), familial adenomatous polyposis (17.65%) and ulcerative colitis (11.76%).

Malignant tumors were mostly located in the sigmoid colon (51%), but in 12.2% of the cases they were found in multiple locations in the colon. Benign causes of colorectal disease and benign tumors were local and never multiple (100%) except for familial adenomatous polyposis. In 25.4% of the cases, they were found in the sigmoid colon while 14.5%, were in the ascending colon, 10.9% in the transverse colon, and 4.3% in the descending colon.

**Table 2.** Colonoscopy: indication and location of findings

	Variable	Frequency (%)
Indication	Hematochezia	32.8
	Changes of habit	20.7
	Anemia	12.1
	Abdominal pain	8.1
	Screening	7.1
	Diverticular disease	6.6
	Others	23.7
	Location	Rectum
Upper		38.72
Middle		23.78
Lower		37.50
Sigmoid colon		31.4
Ascending colon		13.7
Cecum and appendix		7.9
Transverse colon		7.8
Pan-colonic		3.4
Descending colon		2.9

**Table 3.** Surgical variables (type of laparoscopic surgery, duration of surgery, blood loss during surgery)

Procedure	Frequency (%)	Surgical time (min)	Blood Loss (mL)
Right colectomy	16.7	127.5 (+/-190)	Between 1 and 200 (97.1%)
Extended right colectomy (+)	8.1	180 (+/-290)	Between 1 and 200 (88.2%)
Left colectomy	3.3	200 (+/-170)	Between 100 and 500 (100%)
Extended left colectomy	1.9	225 (+/-60)	Between 1 and 500 (100%)
Upper anterior resection	23.8	205 (+/-275)	Between 1 and 500 (98%)
Lower anterior resection	12.9	220 (+/-180)	Between 1 and 500 (100%)
Ultra-low resection (+)	9.0	270 (+/-360)	Between 1 and 500 (88.2%)
Sigmoidectomy	5.2	100 (+/-120)	Between 1 and 100 (100%)
APR (+)	4.8	300 (+/-300)	Between 1 and 500 (77.7%)
Hartmann procedure (+)	2.4	180 (+/-150)	>500 (22.1%)
Total colectomy (+)	2.4	210 (+/-90)	Between 1 and 500 (100%)
Others (rectopexy, transverse colectomy, proctocolectomy) (+)	9.5	—	Between 1 and 500 (80%)

Abdominoperineal resection: APR The transfusion rate of packed red blood cells was 8.6%, but was considerably higher in the procedures marked (+) ( $p = 0.003$ ).

Average measures of resection margins for tumor cases were as follows: proximal margin of 15 cm, distal margin of 8 cm, and circumferential margin of 3 cm. Of the total, only 4.5% of patients were diagnosed with intraoperative metastases. The mean number of resected nodes was greater than eleven in 49.7% of cases and less than eight in 15.9% of cases. Compromised lymph nodes were found in 10.9% of the cases. Of these 12.9% affected two or three nodes and 10.9% affected four or more nodes.

Relapses occurred in 3.3% of the patients: one third of these were cases of multiple locations, and another third were either in the liver or at the surgical site. In 85.7% of these cases, recurrence occurred in the first 5 years. Of patients treated for malignancy, 28.8% received neoadjuvant treatment and 35.5% received adjuvant treatment.

The overall conversion rate was 11.4% (24 of 210). The main causes of conversion were technical difficulties (37.5%), adhesions (20.8%), infiltration to other structures and hemorrhaging (16.7%, each). The reoperation rate was 8.42%, and laparotomy was the most frequently used approach (88.2%). The surgeries that presented the highest conversion rate were Miles operations (30%), extended left colectomies (25%) and rectopexies (25%) ( $p < 0.001$ ). No surgical location was more closely associated with conversion than other locations for this series of patients ( $p = 0.9$ ). The main causes of reoperation were dehiscence of the anastomosis (35.3%) and residual peritonitis (29.4%).

Abdominal surgery had been performed previously in 25.4% of the patients. The most frequent approach was through the infraumbilical median (42.9%), followed by medial supra-umbilical laparotomies (18.4%), Pfannenstiel incisions (12.2%), Rockey-Davis incisions (10.2%) and through the supraumbilical median (10.2%). Patients with scarring from prior surgery had a higher conversion rate (20.4% versus 8.3%,  $p = 0.038$ ) and a higher incidence of reoperation than other patients (10.2% versus 7.6%,  $p < 0.001$ ).

Postoperative ileus occurred in 12.9% of the sample. The median time to initiation of oral feeding was two days with a range of variance to 11 days depending on the severity of the procedure.

The majority of patients (58.97%) had no adverse effects related to surgery, and 54.68% of the patients were classified with Clavien-Dindo levels I and II (Table 4) while 26.56% were assigned to level III and 15.63% were assigned to level IV. Six urogenital complications were reported. They included two cases of erectile dysfunction, one from rectopexy surgery and another from a lower anterior resection, and four cases of retrograde ejaculation, one after lower anterior resection, two after ultralow resection, and one following Miles' operation follow-up.

Overall mortality was 2.9%, of which 57.14% was accounted for by patients with malignancy and tumor recurrence.

Mortality was lower among those who received neoadjuvant therapy (2.2% versus 3.6%,  $p = 0.018$ ). The average hospitalization time was five days and the average follow-up time was 29.28 months (+/- 25).

## DISCUSSION

The Hippocratic mandate of “do no harm” combined with the critical objective of maximizing benefit at the lowest operating cost and financial burden has led the scientific community to a modern and technology-based vision that promotes advanced systems and devices to provide the global population with treatments that are better in terms of efficiency and safety.

This approach has helped laparoscopy as a technical and technological development in our field of coloproctology to optimize both surgical approaches and intraoperative and postoperative care. Large case series from the 1980s have shown how the results of oncological and non-oncological interventions following appropriate training and experience have achieved the levels of procedures performed through laparotomy. (4, 6, 12-17) This analysis and report demonstrates the medical experience of a subspecialized medical center that trains human talent for the Andean region and is an axis for assistance and academic results in this area.

Although our intention was to detail each one of the procedures carried out over a ten year period of time, it is necessary to clarify two key main points. First, our analyses are the product of a rigorous and strict selection of cases:

the only cases included had complete and reproducible records. For this reason we excluded more than 140 cases. Secondly, despite the fact that are patient populations float from one medical entity to another because our country lacks any mandatory monitoring by a single entity, more than 200 patients in this study preferred to undergo surgery performed by our team and also completed or have continued follow-up here.

Considering the still controversial assertion that each population's conditions are unique and that their demographic characteristics therefor only affect peoples with similar socio-cultural and economic conditions, (8) we present a sample of elderly subjects without prevalence of gender half of whom were overweight and the great majority of whom were classified according to the scale of the American Society of Anesthesiologists (ASA) at level I or II (81.4%). Close to the half had at least one comorbidity and 28.4% had several. These statistics agree with those published by Sánchez et al. who analyzed 763 Spanish subjects for 10 years from 2003 to 2013 and found an average age of 58.07 years and an average BMI of 27.9 kg/m<sup>2</sup> (overweight). (12) These data are similar to those of Barros Lima et al. who analyzed hospital records of 90 patients who had been operated on by the coloproctology group of Santa Casa de Belo Horizonte in Brazil over a 12 month period. They found that nearly 53.3% of the patients were between 51 and 70 years old and that 57.8% were women and 42.4% were men. (13) These results were similar to those reported by Jiménez-Bobadilla et al. in Mexico who

**Table 4.** Clavien-Dindo Classification

Grade	Definition	Example	Percentage
I	Any deviation from normal postoperative development that does not require open or endoscopic reintervention.	Operative site infection, cardiac arrhythmia, atelectasis, non-infectious diarrhea, emesis, postoperative ileus.	54.68
II	Change of pharmacological treatment is required. Use of blood transfusions or blood products and parenteral nutrition.	Infectious diarrhea, urinary tract infection, pneumonia, refractory postoperative ileus, digestive bleeding.	
III	Requiring surgical or endoscopic intervention.		26.56
a	Without general anesthesia	Drainage of collections of liquid, correction of skin dehiscence, digestive bleeding.	
b	With general anesthesia	Generalized peritonitis, leaks, dehiscence of anastomosis, severe digestive bleeding, internal hernia.	
IV	Complications that threaten life and require intermediate or intensive care.		15.63
a	Single organ dysfunction (includes dialysis)	Acute pulmonary edema, respiratory failure requiring orotracheal intubation, acute renal failure.	
b	Multiple organ dysfunction	Heart failure associated with renal failure, respiratory failure associated with renal failure, septic shock.	
V	Death of the patient		



recorded an average age of 60.3 years for their patients with no preponderant gender. (4)

Of our cases, 53.5% were associated with hematochezia or changes of habit as a primary symptom. These are considered to be secondary not only to non-specific clinical symptoms, but also to the disease found (70% of the cases were patients with pathology studies indicating malignant adenocarcinoma of the colon or rectum). Although studies similar to the present have not reported similar data because publication was not considered essential, we suggest that this provides important clinical value because it provides readers with associations between the semiological description and the cellular subtype of the malignant neoplasm. It even shows how little the natural history of colorectal disease changed despite the passage of time. This not only stands as additional testimony to the validity of the data evaluated but is also as an integral argument for the analysis provided.

All patients underwent colonoscopies, and it was found that 64.2% of surgical diseases were located in the rectum or sigmoid colon and only 13.7% in the ascending colon. For clinical purposes, we consider that these data are not only biased by the surgical service consulted, but that they lose relevance when we group data from the medical care subspecialty. If the objective was to determine the most common location of lesions treated surgically in our patient cohort, it could be stated safely that 79.9% of the cases treated laparoscopically were located in the ascending colon, sigmoid colon or rectum. Nevertheless, it cannot be inferred that these were the only anatomical regions affected in the patients treated for colorectal disease in our institution. Institutional statistics from other areas of our institution and other entities must be combined in the analysis. It is also relevant to consider an important selection bias given that our management has derived from more complex cases and diseases confined to anatomical regions that demanded greater expertise for study and treatment. Therefore, the only palpable inferential capacity of what is presented here can be projected to sub-specialized services of coloproctology at the orbital level.

In 69.1% of the cases, surgical procedures were performed to treat colorectal cancer which agrees with the reported by Barros Lima et al. (13) Their article described how approximately 66.7% of their cases were derived from colorectal cancer. This can be considered secondary to the fact that, in services of this level, the intention of the report is derived mainly from abdominal or major intestinal procedures, and not from common diseases treated by a group that is not necessarily as specific as ours.

Of the cancer patients, 50.7% were classified as T3, and 72.2% were classified as either T2 and T3. Forty percent of those classified as T3 presented lymph node involvement, while 2.38% of them presented metastasis. In about half of

the cases (49.7%), twelve or more lymph nodes were resected while in only 15.9% of the interventions less than eight lymph nodes were resected. Although there is no minimum standard for surgical service, and the only reference considers that at least twelve lymph nodes should be obtained for the surgical procedure to be considered successful, it is striking that less than a sixth of the patients had less than eight lymph nodes resected. This may be related to refined and advanced technique. Similarly the proximal, distal and circumferential margins complied with the macroscopic distance required, but it was not possible to associate them with the presence or absence of positive margins. We consider that it would be ideal to include this measure in a future study through integral histopathological analysis of specimens.

Duration of surgery broken down by type of surgery was similar to durations found by other groups in Brazil, Spain and Mexico. (4, 12, 13) These do not differ from durations of open surgical technique. This suggests that, although many consider that there large differences of the times required for laparoscopic procedures and open surgery, at present when laparoscopy is performed by expert coloproctologists these times should not differ. (5)

Analysis of surgical times of the three procedures used were calculated by staff from 2005 to 2010 and, separately for those performed from 2011 to 2015. Thus, no statistical or clinical differences were found in the time used for high anterior resection from first period: 210 min (+/- 120 min) to the second period: 200 min (+/- 275 min);  $p = 0.846$ . No statistically significant differences were found for right colectomies either: 150 min (+/- 180 min) versus 120 min (+/- 130 min);  $p = 0.137$ . Similarly, no statistical or clinical differences were found in the times used for low anterior resection: 200 min (+/- 90) versus 225 min +/- 180 min;  $p = 0.543$ . It is suggested that, although the technique has been refined and overall conversion rates may have dropped, prolongation of the objectives to be achieved has not allowed a considerable decrease in surgical times. On the contrary, it has imposed more aggressive and careful tumor resection.

Bleeding rates were consistent with other series of patients. In our cohort, approximately 6.4% of the patients presented bleeding of more than 500 mL and only 8.6% of the patients required a PRBC transfusion. Miles' surgery was the only procedure that required more than 500 mL of PRBC in 22.1% of the cases. These findings are similar to those found by Jiménez et al. who report blood loss averages between 200 and 310 mL. (4) Our reports found a linear relationship between surgical time and volume of blood loss ( $p < 0.001$ ) and excluded a logarithmic relationship between procedure times used and the need for transfusion ( $p = 0.192$ ).

Simultaneously with other studies carried out in subgroups treated by our work team, a conversion rate of 11.4% was found. This is similar to, and in agreement with,

rates found by other groups in Hispanic America such as the 13.2% found by Barros et al. and the 12.5% provided by Niño et al. in Bogotá, Colombia. (13, 14)

Conversions were mainly due to technical difficulties in 58.3% of the conversion cases. According to the data provided by Barros and reproduced and analyzed by Niño, 75% of the cases refer to failure or technical difficulty of dissection or laparoscopic exploration. (4, 14) In addition, we have reported a low reoperation rate of 8.42% which is not very different from those reported for other diseases treated laparoscopically. It is important to clarify that severely invasive surgery such as Miles's operation and extended left colectomies were responsible for most of these cases. In fact, they differed clinically and statistically from the other surgical groups ( $p < 0.001$ ).

Stratified descriptions of conversion rates differ according to whether surgery was performed before or after 2011. Although the average conversion rate of 11% in the most recent group was lower than the rate for the earlier group of 12.2%, this difference was not statistically significant ( $p = 0.565$ ). The initial years of 2005 and 2006 had conversion rates of 25% and 21.4%, respectively while those calculated for the last three years (2013 = 9.7%, 2014 = 5.3% and 2015 = 5.9%) were considerably lower, and the differences are statistically significant ( $p = 0.047$ ). These data agree with those from well-established and trained surgical teams acting under solid surgical protocols which have low conversion rates. They are similar to those presented by recognized groups worldwide such as Marusch et al. (5.2%), Tekkis et al. (3%), Köckerling et al. (7%) and Yamamoto et al. (7.3%). (7, 16, 18, 19)

The conversion rates in articles such as that by Martínez et al. are subject to the expertise and learning curve achieved by the surgical center. (20) In that retrospective paper, laparoscopic procedures for the treatment of colorectal cancer were analyzed for a period of 17 years. At the end, it was concluded that conversion rates decreased markedly after the team had performed a minimum of 50 laparoscopic procedures per year (from 17% in the first year to 4% in the last year analyzed). In our study, it is suggested that the drop in the conversion rate by approximately 20 points may be due to the fact that a stable volume of procedures had been achieved and that the learning curve establishes the training of our specialists. This agrees with other referral centers that perform laparoscopic colorectal surgery.

Unlike many other studies in which the impact previous approaches on conversion is not measured, this study has been able to deduce clinically and statistically which patients had previous peritoneal surgery, and that they had a higher conversion rate (20.4%) than did other patients (8.3%) ( $p = 0.038$ , odds ratio [OR] = 2.99) The reoperation rate in this subgroup of patients was higher still (10.2%

vs. 7.6%,  $p < 0.001$ ). From the previous analysis, it is concluded that patients with previous peritoneal surgery may have higher rates of conversion and reoperation and therefore a greater frequency of complications.

Finally, rates of postoperative ileus and other complications expected following surgery did not differ among centers. In spite of the severity of the techniques used, their values were not more relevant and did not modify initiation and tolerance of oral feeding.

## CONCLUSIONS

The experiences covered in this paper not only evidence the advanced practice of the coloproctology group of the Central Military Hospital, they also express the important evolution of surgical technique and of key results of major abdominal procedures.

It is not our intention to suggest that this approach is innovative, since it is already considered to be habitual, but rather to highlight essential elements of study that not only serve for the approach's continuous evolution but also for postulation of hypotheses of invention.

We believe that continuity of in-hospital research records in which prospective measurements must be fully completed in order to conclude the benefits of the therapy in detail is very important. It also makes inferences based on our knowledge possible for the population of the rest of the world.

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We declare that we have no conflicts of interest and that resources were contributed by the principal investigators.

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