COLECTOMY IN CANCER PATIENTS: ANALYSIS OF SURGERY OUTCOMES IN A PRIVATE HOSPITAL IN THE NORTH OF BRAZIL

ABSTRACT

Aims: to analyze results of partial or total colectomies conducted in colorectal cancer (CRC) patients at a private hospital in Belém, Pará, Brazil.
Study design: The study was cross-sectional, retrospective and descriptive. Place and duration of the study: the study analyzed medical records of CRC patients subjected to either partial or total colectomy at a hospital in Belém between 2018 and 2022.
Method: The research abided by ethical norms including the Norms for Research Involving Humans of the Health National Center. The target population was composed of CRC patients of both sexes. The definitive CIDs C18 and C19 and the following keywords "colorectal cancer", "colon cancer", "partial colectomy" and "total colectomy" were used to search the medical records. The analyzed variables were: epidemiologic factors, pre-operative variables, peri-operative and post-operative variables, bleeding, oncological factors, presence of compromised lymph nodes, and early and late complications.
Results: Fistulas were the most common early complication and recurrence the most common late complication with significant association to the presence of positive lymph nodes to pathological staging (p=0.025). Early deaths were most recurrent in stage IV (p=0.003). No statistical relevance was found between the type of colectomy and the presence of early (p=0.906) and late (p=0.237) complications. As for surgeries, conventional surgeries were related to higher rates of complications and prolonged admission.
Conclusion: Negative outcomes for CRC patients are related to pathological staging and patients with positive lymph nodes presented the worst results. In addition, robotic surgery and laparoscopy were related to faster recovery and lessened early complications.

Keywords: Colectomy, Colorectal Cancer, Post-operative Complications, Surgery.

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1. INTRODUCTION

Colorectal cancer (CRC) is the third most recurrent type of cancer and the second cause of cancer-related deaths in the world[1]. These elevated figured are related to modifiable factors such as smoking, alcoholism, diets based on ultra-processed foods and red meat, sedentarism and obesity and non-modifiable factors, such as family history, advanced age, male sex, diabetes previous cholecystectomy, exposure to radiation in childhood, cystic fibrosis, androgenous privation therapy, hereditary CRCs and inflammatory bowel diseases[2,3].
Elevated mortality is mostly related to late diagnosis, since the chances of 5-year survival can reach 90% when the diagnosis is early and followed by proper treatment. It is estimated that unlike developed countries, the prevalence and mortality of this type of cancer is higher in developing countries in development, such as Brazil, where CRC is the third most common type of cancer. That reality is explained in the persistence of risk factors in the population, as well as ambivalence in the diagnostic: the number of diagnostic increases at more advanced stages of the disease - about 28,2 % in stage III and 23,2 % in stage IV [4].In Brazil, these numbers change with regions: in the South and Southeast, the disease is

more prevalent and lethal, whereas in the North and Northeast, the percentage has increased over the years for both sexes [5,6]Pará was the second state in the North region with the highest mortality rates from 1996 to 2015. From 2012 to 2020, CRC became the third most common cancer in the North [7].

CRC can occur sporadically or related to two groups of hereditary diseases: Familial adenomatous polyposis (FAP) and Lynch Syndrome, which increase in 50% the risk of CRC for men in their 70s. FAP is the second syndrome most related to CRC presenting almost 100% risk of CRC for FAP individuals in their 40s. It estimated an interval of 10 to 12 years for the polyps to grow and develop into neoplasia. About 30% of patients diagnosed with CRC have positive family history and the risk is 2 to 4 times higher for individuals whose first-degree relatives have developed neoplasia [8].

Treatment depends on the tumor staging, according to the TNM (T: the extension of the tumor; N: the number of lymph nodes; M: the presence or absence of metastasis). Partial colectomy is the standard procedure for patients of stage I, II and III, followed by adjuvant chemotherapy in stage III. Studies indicate that for late diagnosis (over 12 months from the beginning of the disease), extensive or total colectomy is related to better prognosis, similar to Lynch Syndrome cases [9].

The effectiveness of procedures depends on several factors: age, type of colectomy (partial or total), experience of the surgeon, immune and molecular individual factors, among others. Despite the implication of several factors in post-operative complications, studies have shown that TNM staging is best related to the prognosis of surgical treatment [1]. An additional factor to prognostics is the surgical approach, which can be conventional, laparoscopic or robotic. Less invasive approaches lead to faster recovery and to the same oncological result of the conventional approach [10].

Immediate postoperative results of colectomies can include infection and fistulas as most recurrent complications, as well as bowel obstruction, abscesses and bleedings. Moreover, immediate post-operative results can include disturbances, bowel-related issues, such as paralytic ileus and abdominal pain [11,10,1].

Colectomies are frequently indicated as treatment for colorectal patients in stages I, II or III. Despite the long-term positive results, there is the risk of both immediate and long-term complications. The careful analysis of risk factors and the individual approach can help improve the outcomes after procedures in oncological patients. The present study, then, aimed to analyze results of partial and total colectomies in oncological patients as well as their main complications, from 2018 to 2022 in a private hospital in Belém, Pará, Brazil.

2. METHODOLOGY

2.1 Ethical Aspects

The present research adhered to ethical international guidelines outlined in the Helsinki Declaration and in the Nuremberg Code and respected the Research Involving Humans of the Health National Center (Resolution 466/12 by the National Health Council). All data gathered will be retained for a period of five years solely for the purposes of the current investigation, after which will be incinerated according to Resolution 466/12 of the Health National Center. The research was subjected to and approved by the Ethics Committee in Research at the Hospital Porto Dias under process n. 6.482.582.

2.2Study Design

The study was cross-sectional, retrospective and descriptive. Research data was collected from medical records of patients subjected to partial or total colectomy at the Hospital Porto Dias (Belém, Pará, Brazil), from January 2018 to December 2022. The target population was composed of CRC patients of both sexes. The casuistry was determined using the sample calculation formula tailored for finite populations smaller than 10.000, wherein a tolerable sample error of 5% was applied alongside a confidence level of 95%.

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2.3Data Collection

The research was conducted on the medical record system of the Hospital Porto Dias on the data of patients subjected to rectosigmoidectomy, total colectomy or hemicolectomy between January 2018 and December 2022. The search in the medical records was oriented by the definite CIDs C18 and C19 and the keywords “colorectal cancer”, “colon cancer”, “partial colectomy” and “total colectomy”. Information was standardized in a spreadsheet according to epidemiological factors; colectomy preoperative, perioperative and post-operative variables; oncological nature of surgery; bleeding; presence of compromised lymph nodes and early and late complications.

2.4 Inclusion and Exclusion Criteria

The study included data of patients aged 18 years and above subjected to colectomy or hemicolectomy at Hospital Porto Dias between January 2018 and December 2022. Information on patients under 18 years of age subjected to colectomy or hemicolectomy outside the time frame of the study and data from incomplete records or records lacking the necessary information were excluded from the analysis.

2.5 Statistical Analysis

The software Microsoft Excel 2010 was used to organize data. Graphs and tables were built with the tools available in Microsoft Word, Excel and SPSS 26. Quantitative variables were described by minimum, maximum, median and standard deviation, while qualitative variables were described by frequency and percentage. The trust intervals were calculated in relation to the population. The independence or association between variables were tested by chi-square distribution and significant associations were detailed by standardized residual analysis to identify the most relevant categories for the study.

Numeric variables were compared in more than two groups using the Kruskal-Walli test, a non-parametric equivalent of ANOVA. The significant findings were detailed through multiple comparisons of pairwise groups with adjustments of p-value. Results with $p \leq 0.05$ (bilateral) were considered statistically significant.

3. RESULTS AND DISCUSSION

After searching the medical record system of the Hospital Porto Dias for the keyword “colectomy”, 414 patients admitted from 2018 to 2022 were selected, of which 288 were excluded for not fitting the CID C18 or C19 or for missing necessary information to fill the research protocol. Hence, 122 patients were included in the research.

The selected sample of patients subjected to colectomy in that interval 57.4% (n=70) were females. Ages ranged from 32 to 94. Most subjects (n=93 or 76.2%) were between 60 and 94 years of age. The patients’ average age was 67 ± 12.2 years, of which 19.8% were under 60 years of age and 4.8% under 50. Regarding the year of the surgical procedure, 20.5% were operated in 2018, 16.4% in 2019, 20.5% in 2020, 23% in 2021 e 19.7% in 2022.

The literature describes fistulas as the main early post-operative complication from colectomy procedures [12]. The present study also found the same main complication as well as the group of incidences: male patients over 60 years of age with comorbidities [13].

Considering the records analyzed, 75.4% of patients presented comorbidities, predominantly systemic hypertension (n=72 or 78.3%), followed by Diabetes mellitus (35.9%) and heart diseases (15.2%), whereas pulmonary diseases and chronical kidney disease represented 2.2%. Other comorbidities such as hormonal and psychiatric diseases were less expressive quantitatively.

Considering the number of surgical procedures, 59.8% (n=73) were elective; 54.1% were videolaparoscopy, 33.3% conventional and 12.2% robotic. Concerning the operating time, less than 1% of the procedures lasted less than 90 minutes and 73.8% were longer than 180

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minutes. However, 100% of the robotic surgeries lasted over 180 minutes. In addition, 95.9% of patients experienced blood loss inferior to 250 mL and only 4.9% required blood transfusion during surgery (Table 1).

Table 1. Characteristics of the surgical procedure of patients subjected to colectomy and hemicolectomy at the Hospital Porto Dias (HPD; Belém-Pará), from January 2018 to December 2022.

Variable	Frequence	Percentage
Classification of the Procedure		
Urgent surgery	49	40.2
Elective surgery	73	59.8
Cancer Surgery		
No	8	6.6
Yes	114	93.4
Type of Surgery		
Conventional	41	33.6
Robotic	15	12.3
Videolaparoscopy	66	54.1
Operating time		
<90 min	1	0.8
90-180 min	31	25.4
>180 min	90	73.8
Estimated Intraoperative Blood Loss		
<250 mL	117	95.9
250-500 mL	4	3.3
Not informed	1	0.8
Need for transfusion		
No	116	95.1
Yes	6	4.9

(Percentages are relative to the total of patients n=122)

Regarding the oncological character, 953.5% of patients were subjected to markings and lymphadenectomy. As for the staging, 15.6% (n=19) of the sample was composed of stage I patients; 43.4% (n=53), stage II; 27.9% (n=34), stage III and 10.7% (n=13), stage IV.

The average of lymph nodes removed for anatomopathological studies was 17,7 ± 11,4 (minimum of 1.0 lymph node and maximum of 76.0 with median = 14.0). The number of compromised lymph nodes varied from 0.0 to 38.0, with the average of 1.5 ± 4.1. Lymph nodes were positive for staging for 40.3% of patients. Most of the patients (99,9%) subjected to cancer surgery were stage III patients.

All patients that presented positive lymph nodes went through adjuvant therapy of which 40.7% were subjected to adjuvant chemotherapy; 47,2% of patients were not given adjuvant therapy and 11.4% failed to provide information on adjuvant therapies in their medical records. Recurrence cases displayed positive lymph nodes in 70% of the cases and 50% were stage III (Figure 1).

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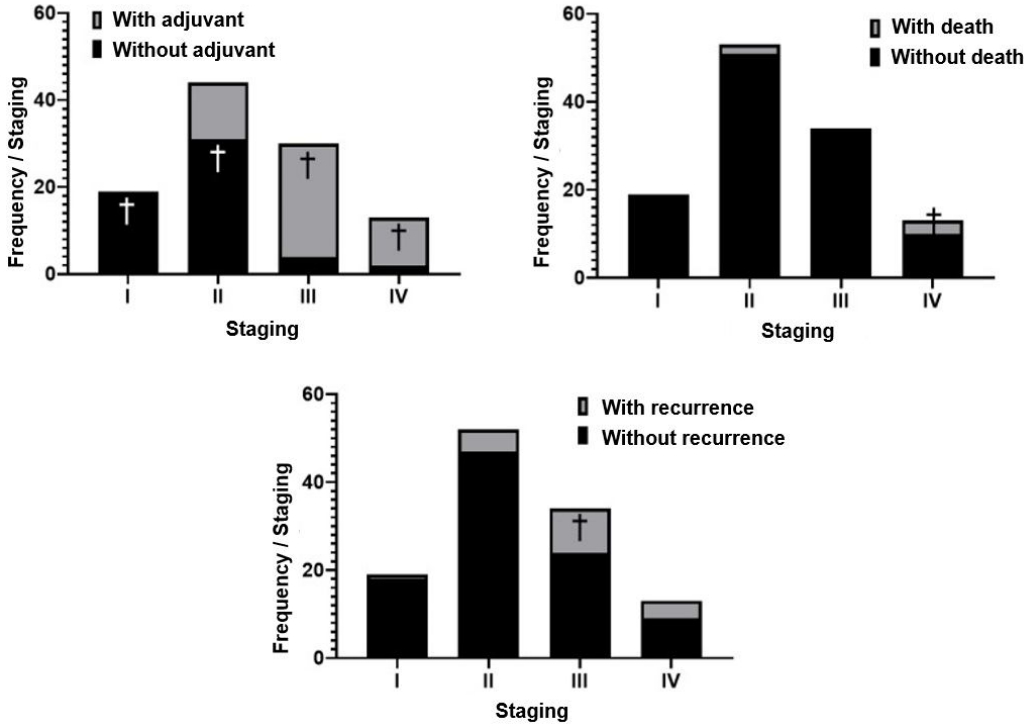

Fig. 1 – Significant factors associated with pathological staging in oncological colectomy patients at the Hospital Porto Dias (HPD; Belém-Pará), from January 2018 to December 2022
(†: Values superior to the expected)

Concerning early complications, 77.9% of patients failed to present complications after surgery, whereas 10.7% of patients developed fistulas, 4.1% died, 3.3% suffered dehiscence of operative wound, 3.2% developed abdominal sepsis, 1.6% local infection, 0.8% bowel obstruction and 0.8% eviscerated. Cancer staging and death were significantly associated (p=0.003): 23.1% of the 13 stage IV patients died, which was higher than the expected for the statistical test (†) (Table 2).

Table 2. Association between staging and early complications in patients subjected to colectomy and hemicolectomy at the Hospital Porto Dias (HPD, Belém-Pará) from January 2018 to December 2022.

Variable	I (n=19)	II (n=53)	III (n=34)	IV (n=13)	p-value
Fistula					0.123
No	18 (94.7)	45 (84.9)	33 (97.1)	10 (76.9)	
Yes	1 (5.3)	8 (15.1)	1 (2.9)	3 (23.1)	
Death					0.003
No	19 (100.0)	51 (96.2)	34 (100.0)	*10 (76.9)**	
Yes	0 (0.0)	2 (3.8)	0 (0.0)	*3 (23.1)†*	

The categorical variables are exhibited as n (%); percentages are relative to the total of each column; chi-square was applied to all cases.: a frequency inferior to the expected. †: Frequency superior to the expected.*

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Among the late complications, recurrence of the disease was the most frequent (16.4%), followed by death (13.9%). It is noteworthy that 23.5% of deaths involved patients with disease recurrence. Other late complications were bowel obstruction (4.1%), fistula (1.6%) and stenosis (0.8%). Staging and recurrence were significantly associated (p=0.025): at stage III, 29.4% displayed disease recurrence, which was higher than the expected for the statistical test (†) (Table 3).

Table 3. Association between staging and late complications in patients subjected to colectomy and hemicolectomy at the Hospital Porto Dias (HPD, Belém-Pará) from January 2018 to December 2022.

Variable	I (n=19)	II (n=52)	III (n=34)	IV (n=13)	p-value
Disease recurrence					0.025
No	18 (94.7)	47 (90.4)	*24 (70.6)**	9 (69.2)	
Yes	1 (5.3)	5 (9.6)	*10 (29.4)†*	4 (30.8)	
Death					0.547
No	18 (94.7)	44 (84.6)	29 (85.3)	10 (76.9)	
Yes	1 (5.3)	8 (15.4)	5 (14.7)	3 (23.1)	
Bowel Obstruction					0.832
No	18 (94.7)	50 (96.2)	32 (94.1)	13 (100.0)	
Yes	1 (5.3)	2 (3.8)	2 (5.9)	0 (0.0)	
Late fistula					0.409
No	18 (94.7)	52 (100.0)	33 (97.1)	13 (100.0)	
Yes	1 (5.3)	0 (0.0)	1 (2.9)	0 (0.0)	
Stenosis					0.477
No	19 (100.0)	52 (100.0)	33 (97.1)	13 (100.0)	
Yes	0 (0.0)	0 (0.0)	1 (2.9)	0 (0.0)	

The categorical variables are exhibited as n (%). Percentages are relative to the total of each column. Chi-square was applied to all cases.: a frequency inferior to the expected. †: Frequency superior to the expected.*

Data on early and late complications are also presented (Table 4).Such characteristics can be seen as independent complication factors, thus elevating the combined risks for its occurrence. Moreover, contrary to the literature, there was no great association between urgency surgery and fistulas[14]. As for the surgical technique, the statistical difference between the group of patients with fistulas and the total sample was not relevant, which corroborates previous studies, thus showing that its occurrence is related to the factors listed above [15].

Disease recurrence was the most significant of late complications in association to stage III. That means the presence of positive lymph nodes in the anatomopathological test, despite proper lymphadenectomy to extract an average of 18 lymph nodes against the recommendation of the minimum of 12 nodes[16]. A single case of recurrent disease was not subjected to cancer surgery. In addition, recurrence was more common in patients subjected to left colectomy, which can be related to a greater number of stage III patients in the group.

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Table 4. Prevalence of early and late complications of patients subjected to colectomy and hemicolectomy at the Hospital Porto Dias (HPD, Belém-Pará) from January 2018 to December 2022 in Belém, Pará, Brazil.

Variable	Frequency	Percentage	IC95%
Early Complications			
No complications	95	77.9	69.3 - 84.7
Fistula	13	10.7	6.0 - 17.9
Death	5	4.1	1.5 - 9.8
Dehiscence of Operative Wound	4	3.3	1.1 - 8.7
Infection of Operative Wound	2	1.6	0.3 - 6.4
Post-operative bleeding	2	1.6	0.3 - 6.4
Bowel obstruction	1	0.8	0.0 - 5.2
Others	7	5.7	2.5 - 11.9
Late complications			
No complications	84	68.9	59.7 - 76.8
Disease Recurrence	20	16.4	10.5 - 24.4
Death	17	13.9	8.6 - 21.7
Bowel obstruction	5	4.1	1.5 - 9.8
Late fistula	2	1.6	0.3 - 6.4
Stenosis	1	0.8	0.0 - 5.2

Concerning the interval between surgery and release, in all surgical procedures, the average time of admission was 9.4 ± 8.9 days, with the minimum of 1 day and maximum of 61 days (median = 6.0). Patients subjected to conventional surgery were admitted for the average of 13.2 ± 11.0 days; to robotic surgery for 7.8 ± 7.7 days ($p << 0.001$; multiple significant comparisons: “Conventional” versus “Robotic” (p=0.002), “Conventional” versus “Videolaparoscopy” (p=0.001). The numeric variables are represented as the average±standard deviation. The Kruskal-Wallis’ test was used.

Regarding the type of colectomy, rectosigmoidectomy was the most frequent procedure (n=55; 45.1%), followed by right colectomy (n=45; 36.9%), left colectomy (n=12; 9.8%), cross-sectional colectomy (n=8; 6.6%), total colectomy (n=2; 1.6%) and expanded right colectomy (n=1; 0.8%). Moreover, 16.4% (n=20) patients were subjected to ostomy, opposed to 101 patients (82.8%) and one patient (0.8%) not informed about that approach.

The factors related to that type of colectomy were investigated. Videolaparoscopy was the predominant type and the presence of complications was not related to the type of colectomy (p=0.906). The differences in late complications were not statistically relevant (p=0.237), that is, it was not possible to claim that the type of surgery and the occurrence of early or late complications varied significantly with the types of colectomies (Table 5). The variables type of surgery and presence of early complications were significantly related (p=0.002): 39% of the 41 patients subjected to conventional surgery, did not experience early complications, a proportion higher to the expected; 100% of the 15 individuals subjected to robotic surgeries did not experience early complications, also a proportion higher than the expected (†). It was not verified significant associations between the type of colectomy and the disease recurrence (p=0.064), bowel obstruction (p=0.315), late fistula (p=0.773) or stenosis (p=0.940).

Table 5. Association of type of colectomy, type of surgery, presence of complications and stage of the disease in patients subjected to colectomy and hemicolectomy in the Hospital Porto Dias (HPD, Belém-Pará-Brazil) from January 2017 to December 2022.

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Variable	Rectosig-moidectomy (n=55)	Direct Colectomy (n=45)	Left Colectomy (n=12)	Transverse Colectomy (n=7)	Total Colectomy (n=2)	p-valor
Type of Surgery						0.300
Conventional	12 (21.8%)	18 (40.0%)	6 (50.0%)	3 (42.9%)	2 (100.0%)	
Robotic	8 (14.5%)	6 (13.3%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	
Video-laparoscopy	35 (63.6%)	21 (46.7%)	5 (41.7%)	4 (57.1%)	0 (0.0%)	
Early complications						0.906
No	11 (20.0%)	10 (22.2%)	3 (25.0%)	2 (28.6%)	1 (50.0%)	
Yes	44 (80.0%)	35 (77.8%)	9 (75.0%)	5 (71.4%)	1 (50.0%)	
Late complications						0.237
No	13 (24.1%)	13 (28.9%)	7 (58.3%)	3 (42.9%)	1 (50.0%)	
Yes	41 (75.9%)	32 (71.1%)	5 (41.7%)	4 (57.1%)	1 (50.0%)	

Categorical variables are exhibited as n (%). Percentages are relative to the total of each column. Chi-squared distribution was applied to all the cases.

Videolaparoscopy was the predominant type of surgical procedure, followed by conventional surgery. The number of early and late complications was higher in cases of conventional procedures, followed by videolaparoscopy. No complications were verified for robotic surgeries. Furthermore, the average admission time between procedure and release was higher in conventional surgery, reaching almost twice as many days than in robotic surgeries. The data is consistent with meta-analyses and explained by the more invasive nature of conventional surgeries, with greater manipulation and extended postoperative paralysis of the ileus [17, 18]. For the operating time, robotic surgeries were longer, which is consistent with meta-analyses data and justified in the experience of the surgeon, many of whom are still learning the technique [19, 20].

The oncological nature of the procedure was equivalent between conventional and robotic procedures, but considerably lessened for videolaparoscopies, which is justified in the difficulty of this surgical technique limited to the manipulation of structures and the needed for experienced surgeons in laparoscopies and CRC. That explains the small number of cancer surgeries in right colectomy, as the ileocolic artery and middle colic artery are in close anatomic proximity to the superior mesenteric vein [19, 21, 18]. Such a limitation is reduced in robotic surgery because of the tridimensional image and the greater mobility of the clips[22, 23], hence the equivalence of the oncological and the conventional nature of the procedure.

4. CONCLUSION

The present study showed that patients subjected to conventional colectomy reach display outcomes and longer admission times compared to patients of less invasive surgeries. The best results are achieved by robotic surgery. In addition, the relation between the presence of complications and pathological staging was statistically significant, with predominant negative outcomes for advanced stages of the disease. Fistulas were the main early complication of patients subjected to colectomy, positively related to the male sex, advanced age and comorbidities. The predominant late complication was recurrence of the disease related to the presence of the disease in advanced stages and positive lymph nodes.

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ETHICAL APPROVAL

The present research adhered to ethical international guidelines outlined in the Helsinki Declaration and in the Nuremberg Code and respected the Research Involving Humans of the Health National Center (Resolution 466/12). All data gathered will be retained for a period of five years solely for the purposes of the current investigation, after which will be incinerated according to Resolution 466/12 of the Health National Center. The research was subjected to and approved by the Ethics Committee in Research at the Hospital Porto Dias under process n. 6.482.582.

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