



Analyzing clinical outcomes in laparoscopic right vs. left colectomy in colon cancer patients using the NSQIP database



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ABSTRACT

Introduction: Optimization of surgical outcomes after colectomy continues to be actively studied, but most studies group right-sided and left-sided colectomies together. The aim of our study was to determine whether the complication rate differs between right-sided and left-sided colectomies for cancer.

Methods: We identified patients who underwent laparoscopic colectomy for colon cancer between 2005 and 2010 in the American College of Surgeons National Surgical Quality Improvement Program database and stratified cases by right and left side. The two groups were matched using propensity score matching for demographics, previous abdominal surgery, pre-operative chemotherapy and radiotherapy, and pre-operative laboratory data. Outcome measures were: 30-day mortality and morbidity.

Results: We identified 2512 patients who underwent elective laparoscopic colectomy for right-sided or left-sided colon cancer. The two groups were similar in demographics, and pre-operative characteristics. There was no difference in overall morbidity (15% vs. 17.7%; p value < 0.08) or 30-day mortality (1.5% vs. 1.5%; p value < 0.9) between the two groups. Sub-analysis revealed higher surgical site infection rates (9% vs. 6%; p value < 0.04), higher incidence of ureteral injury (0.6% vs. 0.4%; p value < 0.04), higher conversion rate to open colectomy (51% vs. 30%; p value < 0.01) and a longer hospital length of stay (10.5 ± 4 vs. 7.1 ± 1.3 days; p value < 0.02) in patients undergoing laparoscopic left colectomy.

Conclusion: Our study highlights the difference in complications between right-sided and left-sided colectomies for cancer. Further research on outcomes after colectomy should incorporate right vs. left side colon resection as a potential pre-operative risk factor.

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1. Introduction

Laparoscopic colectomy is a common surgical procedure for both the benign and malignant diseases of the colon [1,2]. Patient's characteristics, comorbidities, nature of the disease process, and nutritional status have all been shown to affect surgical outcomes after colon resections [3]. Patients with right-sided colon cancer are significantly older, predominantly women, with a higher rate of comorbidities [4]. Similarly, surgical techniques, details and nature of the surgery also play important roles in determining the operative outcomes [5]. In a surgical community, it is a common belief that left colectomy, which is often more technically challenging and requires a colocolic or colorectal anastomosis, has a

significantly higher incidence of anastomotic leakage, wound infection, overall complication rate, and longer length of hospital stay than right colectomy, which utilizes an ileocolic anastomosis with an adequate blood supply [6–8].

To our knowledge, most studies do not differentiate between right-sided and left-sided colectomies. As a result, our objective was to evaluate the differences in patient characteristics and perioperative outcomes between elective right colectomy and left colectomy for colon cancer.

2. Methods

We identified patients who underwent laparoscopic colectomy for colon cancer between 2005 and 2010 in the American College of Surgeons National Surgical Quality Improvement Program database and stratified cases by the right and left side.

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Table 1
The admission characteristics of patients that underwent right and left colectomy.

Variables	Right colectomy (n=1256)	Left colectomy (n=1256)	p-value
Age, mean \pm SD	65 \pm 19	65 \pm 21	0.9
Male (%)	51%	50%	0.8
White (%)	71%	70.5%	0.7
ASA > 3 (%)	41%	42%	0.6
BMI > 35 (%)	12.5%	13.3%	0.7
Smoker (%)	10%	11.3%	0.8
Abdominal surgery (%)	12%	13.1%	0.9
Frail (%)	13%	12.5%	0.7
Diabetic (%)	19%	17.9%	0.9
Cardiac disease (%)	16.3%	16.7%	0.8
Renal failure (%)	11.3%	10%	0.9
Pre-op chemotherapy (%)	13.1%	12%	0.8
Albumin < 3 (%)	17%	16.3%	0.9
WBC > 11 (%)	11%	10.9%	0.8
Platelet count < 150 (%)	7%	6.5%	0.7

Table 2
The intra-operative characteristics for the patients with right and left colectomy.

Variables	Right colectomy (n=1256)	Left colectomy (n=1256)	p-value
Clean/Contaminated (%)	91%	90%	0.8
Contaminated (%)	6%	6%	0.8
Dirty (%)	3%	4%	0.8
Operative time (mean \pm SD)	140 \pm 60	180 \pm 40	0.03
Transfusion			
None	85%	78%	0.02
1–2 units	14%	13%	0.8

2.1. Inclusion

Patients who underwent a right-sided colectomy were defined as those patients who had a partial colectomy with ileocolic anastomosis (CPT code 44160 or 44205) and had an *International Classification of Diseases, Ninth Revision* diagnosis code for malignancy of the cecum (153.4), ascending colon (153.6), or hepatic flexure (153.0). Patients who underwent left-sided colectomy were defined as those who had a partial colectomy with anastomosis (CPT codes 44140, 44204, 44145, or 44207) and had an *International Classification of Diseases, Ninth Revision* diagnosis code for malignant neoplasm of the descending colon (153.2) or sigmoid colon (153.3).

2.2. Exclusion

Patients who underwent colectomy for non-malignant etiologies were excluded. Also, patients who underwent an emergency procedure were excluded. Patients who did not have an anastomosis were excluded from the study as well.

Table 3
Differences in clinical outcome measures in two groups, right and left colectomy.

Variables	Right colectomy (n=1256)	Left colectomy (n=1256)	p-value	OR [95%CI]
Wound infection (%)	6%	9%	0.01	1.3 [1.1–4.1]
Ureteral injury (%)	0.49%	0.6%	0.03	1.9 [1.34–4.1]
MI/cardiac arrest (%)	18%	16%	0.1	1.1 [0.7–3.9]
Stroke (%)	30%	20%	0.03	2.9 [1.3–3.4]
Renal failure (%)	23%	13%	0.02	2.1 [1.9–4.1]
PE (%)	11%	17%	0.04	1.7 [1.4–2.5]

PE: Pulmonary embolism.

2.3. Outcome measures

Primary outcome measure was mortality. Secondary outcome measure was post-operative complications. Complications were defined as deep incisional infection, organ-space SSI, wound disruption, pneumonia, reintubation, pulmonary embolism, progressive renal insufficiency, acute renal failure, cerebrovascular accident, coma, cardiac arrest, myocardial infarction, sepsis, septic shock, the need for return to the operating room, or more than 48 h on a ventilator. Major complications did not include superficial SSI, deep venous thrombosis, or urinary tract infection. Cardiac disease was defined as history of congestive heart failure, MI, angina within 1 month of surgery, PCI, or cardiac surgery. Pulmonary disease was defined as dyspnea with moderate exertion or at rest, history of severe COPD, or current pneumonia. Renal failure was defined acute renal failure in the 24 h prior to surgery or pre-operative acute or chronic hemodialysis. Superficial SSI involves only skin or subcutaneous tissue and at least one of the following: purulent drainage, with or without laboratory confirmation, pain or tenderness, localized swelling, redness, or heat. Deep SSI was defined as Incisional SSI that extends into the fascial and muscle layers.

2.4. Statistical analysis

A propensity score was generated for each patient based on all the confounding factors using a logistic regression model. In our study, the two groups were matched in 1:1 ratio. The two groups were matched using propensity score matching for demographics, previous abdominal surgery, pre-operative chemotherapy and radiotherapy, and pre-operative laboratory data. The groups were also matched for intraoperative blood transfusions and wound classifications. We quantified the accuracy of the model based on the area under the Receiver Operator characteristic curve.

Data are reported as mean (SD) for continuous variables, median (range) for ordinal variables and as proportions for categorical variables. To explore the differences between two groups, Mann–Whitney *U* test and Student's *t*-test for continuous variables and χ^2 test for categorical variables were performed. Univariate analysis was performed to compare the outcomes among patients. *p*-values less than 0.05 were considered statistically significant. All statistical analyses were performed using SPSS (version 18, SPSS, IBM Inc., Armonk, NY). The groups were matched using propensity score matching for demographics, operative time, previous abdominal surgery, pre-operative chemotherapy and radiotherapy, and pre-operative laboratory data.

3. Results

We identified 2512 patients who underwent elective laparoscopic colectomy for right-sided or left-sided colon cancer. The two groups were similar in demographics, and pre-operative characteristics. Table 1 highlights the admission characteristics.

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