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Impact of complications on length of stay in elective laparoscopic colectomies



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ABSTRACT

Background: Length of hospital stay (LOS) is an indirect measure of surgical quality and a surrogate for cost. The impact of postoperative complications on LOS following elective colorectal surgery is not well defined. The purpose of this study is to determine the contribution of specific complications towards LOS in elective laparoscopic colectomy patients.

Materials and methods: American College of Surgeon's National Surgical Quality Improvement Program database (2011-2014) was queried for patients undergoing elective laparoscopic partial colectomy with primary anastomosis. Demographics, specific 30 d postoperative complications and LOS, were evaluated. A negative binomial regression adjusting for demographic variables and complications was performed to explore the impact of individual complications on LOS, significance set at $P < 0.05$.

Results: A total of 42,365 patients were evaluated, with an overall median LOS 4.0 d (interquartile range, 3.0-5.0). Unplanned reoperation and pneumonia each increase LOS by 50%; superficial surgical site infections (SSIs), organ space SSI sepsis, urinary tract infection, ventilation >48 h, pulmonary embolism, and myocardial infarction each increase LOS by at least 25% ($P < 0.0001$). When accounting for additional LOS and rate of complications, unplanned reoperation, bleeding requiring transfusion within 72 h, and superficial SSIs were the highest impact complications.

Conclusions: In laparoscopic colectomy, each complication uniquely impacts LOS, and therefore cost. Utilizing this model, individual hospitals can implement pathways targeting specific complication profiles to improve care and minimize health care cost.

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Background

The contemporary focus on quality of health care has brought complication rates, length of stay (LOS), and readmission rates

to the forefront of the surgical community. Voluntary participation in the American College of Surgeon's National Surgical Quality Improvement Program (NSQIP) database demonstrates a growing awareness and commitment to quality

Data references: ACS NSQIP Participant User Files, 2011-2014.

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improvement (QI) and surgical outcome management.¹ Centers for Medicaid and Medicare Services,² NSQIP, and the Agency for Healthcare Research and Quality³ define LOS as an important quality and resource utilization metric. In 2015, the average national hospital expenses per patient were estimated between \$1800 and \$2400/d, based on hospital funding status.⁴ Therefore, minimizing LOS is an important target for hospital QI initiatives and cost reduction strategies.

Postoperative complications increase LOS and cost.⁵⁻⁸ Colectomy is a high-volume procedure with approximately 15% complication rate,^{9,10} carrying an estimated cost of complications that exceeds \$150 million annually.¹¹ Individual complications affect cost depending on the severity and added resources required for treatment. On a per complication basis, the following complications have been shown to increase cost by different amounts: urinary tract infections (UTIs) add \$3400/event; cardiac complications add \$7000/event; mechanical wound complications add \$8000/event; and pulmonary complications add \$9400/event.¹¹ Efforts toward improving colectomy outcomes such as Enhanced Recovery After Surgery pathways demonstrate decreased complications, LOS, and cost, especially in elective laparoscopic procedures.¹²⁻¹⁵

A number of postoperative complications are predictive variables of increased LOS in major elective surgery.¹⁶ Predicted ranges of LOS have been documented for traumatic injuries¹⁷; however, the magnitude of how discrete complications increase LOS with respect to specific procedures or patient populations is unclear. If known, LOS based on individual postoperative complications would be of great value for hospital-driven QI and national initiatives. Our objective was to define the increase in LOS related to postoperative complications following elective laparoscopic colectomy and the highest impact complications, as defined by increased LOS burden.

Material and methods

The ACS NSQIP database offers a robust, risk-adjusted database evaluating 30 d postoperative outcomes, with currently greater than 675 sites participating.¹ NSQIP enables national benchmarking of complication rates and surgical outcomes.^{18,19} In this study, approved by the Scott & White Medical Center Institutional Review Board, we performed a retrospective review of (dataset) NSQIP data from 2011 to 2014. Patients ≥ 18 y undergoing laparoscopic partial colectomy with primary anastomosis for malignancy, diverticular disease and/or benign neoplasms, and polyps were included. Current Procedural Terminology (CPT) codes were used to identify right versus left/sigmoid (L/S) laparoscopic partial colectomies. Right included CPT 44205 (laparoscopic colectomy, partial with removal of terminal ileum with ileocolostomy) and L/S included CPT 44204 (laparoscopic colectomy, partial with anastomosis) and 44207 (laparoscopic colectomy, partial with low pelvic anastomosis). International Classification of Diseases (ICD)-9 and ICD-10 codes were used to identify resections for primary malignancy and benign disease. Primary colorectal malignancy included ICD-9 codes: 153, 153.0, 153.1, 153.2, 153.3, 153.4, 153.6, 153.7, 153.8, 153.9, 154, 154.0, 154.1,

154.2, 154.3, 154.8, 230.3 and ICD-10 codes: C180, C182, C183, C184, C185, C186, C187, C188, C189, D010. Benign disease included diverticular disease without abscess or perforation (ICD-9562.1, 562.11, 562.12, 562.13 and ICD-10 K5730, K5731, K5732, K5733) and benign colorectal neoplasms and polyps (ICD-9211.3, 211.4 and ICD-10 D120, D126, D127, D128, D129, K635).

The following cases were excluded: colon resection requiring ostomy creation; diverting ileostomy as a secondary procedure; open procedures; total colectomy or abdominal-perineal resections; all emergency or nonelective cases; and any cases with the diagnoses of Ulcerative colitis, Crohn's disease, ischemic colitis, and diverticular disease with abscess, perforation, or hemorrhage requiring emergent resection. Patients whom were pregnant had preoperative ventilator dependence or those with infectious complications present at time of surgery (PATOS) were also excluded. PATOS conditions included: skin, wound, and organ space infections, UTIs, pneumonia, sepsis, and septic shock. Additionally, patients with LOS >45 d were excluded. Figure 1 illustrates inclusion and exclusion criteria for our NSQIP data query.

Demographic variables included year of operation, age, gender, body mass index (BMI), diabetes mellitus (requiring oral agent and/or insulin therapy), tobacco use within 1 y of surgery, current alcohol use, recent immunosuppression (including chemotherapy within 30 d, radiation with 90 d, and/or oral or parental steroids/immunosuppressant medication within 30 d), functional health status prior to surgery, cardiac comorbidities (including congestive heart failure within 30 d, myocardial infarction (MI) within 6 mo, previous percutaneous coronary intervention and/or previous cardiac surgery), severe chronic obstructive pulmonary disease (COPD), preoperative dialysis requirement, and liver disease (including ascites and/or esophageal varices). Recent chemotherapy excludes patients only receiving hormonal therapy and any chemotherapy agents given for nonmalignancy diagnoses. One-time or short course (<10 d) steroids and topical steroids were not considered to be recent steroid use. Radiotherapy includes any treatment or radiation seed implantation within

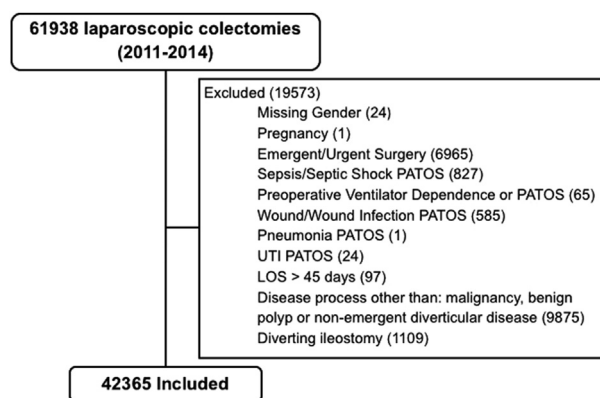


Fig. 1 – NSQIP data 2011-2014 was queried for laparoscopic colectomies with primary anastomosis (CPT codes 44204, 44205, and 44207). Patients meeting inclusion criteria were 61938. Exclusions and respective numbers are included.

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