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Laparoscopic bowel resection for pediatric inflammatory bowel disease

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ABSTRACT

Background: To compare 30-d outcomes between laparoscopic and open intestinal resection performed on pediatric patients with ulcerative colitis and Crohn disease.

Materials and methods: We identified all proctocolectomies performed on patients with ulcerative colitis and all intestinal resections with primary anastomosis performed on patients with Crohn disease in the 2012–2013 American College of Surgeons National Surgical Quality Improvement Program Pediatric. We compared demographic, clinical, and 30-d outcome characteristics between patients who underwent an open or laparoscopic resection.

Results: Of the 140 patients with ulcerative colitis who underwent proctocolectomy, 103 (74%) were performed laparoscopically. Patients undergoing laparoscopic colectomy had shorter postoperative length of stay (LOS) and fewer incisional complications. On multivariate analysis, open *versus* laparoscopic proctocolectomy is not an independent predictor of postoperative LOS for patients with ulcerative colitis. Of the 188 patients with Crohn disease who underwent an intestinal resection, 122 (65%) underwent laparoscopic resection. In comparison with patients undergoing open resection, patients undergoing laparoscopic resection had similar rates of complications but a shorter postoperative LOS.

Conclusions: For children with ulcerative colitis, laparoscopic proctocolectomy is not independently associated with a difference in postoperative LOS. In unadjusted analyses, laparoscopic bowel resections for children with Crohn disease may be associated with a shorter postoperative LOS compared with that of open procedures. Additional accrual of cases within the American College of Surgeons National Surgical Quality Improvement Program Pediatric will allow for risk-adjusted analyses of outcomes, including factors independently associated with incisional complications.

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1. Introduction

Inflammatory bowel disease, including ulcerative colitis and Crohn disease, affects 71 pediatric patients per 100,000 children in the United States [1]. Many of these patients will undergo surgery over their lifetime. Current studies indicate that 17%–34% of patients with Crohn disease and 14%–20% of patients with ulcerative colitis will undergo surgery within 5 y of diagnosis [2–5]. Of these patients, 24% of those with Crohn disease and 25%–31% of those with ulcerative colitis will experience complications including wound infections and need for reoperation [6–8]. Likewise, 14%–20% of patients with ulcerative colitis will undergo colectomy within 5 y of diagnosis [2,5], and 25%–31% of these patients will experience a complication [7,8].

Laparoscopic surgery offers potential advantages over open abdominal surgery including reduced postoperative pain, reduced scarring, and a more rapid return to normal function [9]. In adult patients with ulcerative colitis, advantages of laparoscopic proctocolectomy include shorter length of stay (LOS), fewer reoperations, and lower complication rates [6,10,11]. Similarly, other studies have demonstrated shorter LOS and fewer complications in adult patients with Crohn disease undergoing laparoscopic intestinal resection [6,12]. Long-term studies have demonstrated improved cosmesis but no difference in rates of reoperation [13,14].

It is unclear whether laparoscopic surgery provides similar benefits for children with inflammatory bowel disease. Existing data are limited to single-institutional studies and administrative database analyses [3,4,11,15–18]. The purpose of this study was to compare the impact of a minimally invasive *versus* open surgical approach on outcomes after intestinal resection with primary anastomosis for pediatric patients with Crohn disease and proctocolectomy with ileal pouch anal anastomosis (IPAA) for pediatric patients with ulcerative colitis.

2. Materials and methods

The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) Pediatric is a multispecialty program that reports peer-reviewed, risk-adjusted 30-d postoperative outcomes for surgical cases performed on patients <18 y of age from 61 participating institutions for the purpose of benchmarking and quality improvement. Dedicated surgical clinical reviewers at participating institutions collect data on patients selected by a systematic sampling method developed by the ACS NSQIP that selects cases in 8-d cycles distributed on different days of the week and throughout the year. At least 124 variables are collected from the medical records and the patients and their families including information on demographics, preoperative and intraoperative variables, and postoperative occurrence and discharge variables [19–22].

We performed two separate analyses, one on patients with ulcerative colitis and one on patients with Crohn disease. For the first analysis, all instances of open and laparoscopic proctocolectomy with IPAA performed on patients diagnosed with ulcerative colitis in the 2012–2013 NSQIP Pediatric database were identified using Current Procedural Terminology (CPT) codes and *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes. Open proctocolectomy was defined as CPT code 44150, 44155, 44157, or 44158. Laparoscopic proctocolectomy was defined as CPT code 44210, 44211, or 44212. Ulcerative colitis was defined as ICD-9-CM code 556.X. Similarly, for the second analysis, all instances of open and laparoscopic intestinal resection with primary anastomosis performed on patients diagnosed with Crohn disease were identified. Open intestinal resection was defined as CPT code 44120, 44140, or 44160. Laparoscopic intestinal resection was defined as CPT code 44202, 44204, or 44205. Crohn disease was defined as ICD-9-CM code 555.X.

For each analysis, we compared demographic, clinical, and 30-d outcome characteristics between patients who underwent an open *versus* a laparoscopic procedure. Body mass index was calculated based on patient height and weight at the time of surgery and reported as percentiles based on Center for Disease Control and Prevention tables for body mass index accounting for age and gender [23]. Patients with pulmonary risk factors were defined as any patient with a diagnosis of asthma, structural respiratory abnormalities, chronic lung disease, cystic fibrosis, preoperative ventilator dependence, preoperative oxygen requirement, or a preoperative tracheostomy. Structural respiratory abnormalities included all anatomic anomalies interfering with respiration, the most prevalent of which was obstructive sleep apnea. Steroid use before surgery included all instances of oral or parenteral corticosteroid medication use in the 30 d before surgery, excluding topical, rectal, or inhaled corticosteroids. Patients who received a single dose of oral or intravenous steroids within 24 h before the surgery were also not included in this definition. Operation time was defined as time from initial incision to closure. Wound complications were defined as superficial surgical site infections (SSIs), deep SSIs, organ or organ space SSIs, and wound disruption. Respiratory complications were defined as pneumonia, unplanned intubation, pulmonary embolism, and ventilator dependence >48 h. Urinary tract complications included acute renal failure, progressive renal insufficiency, and urinary tract infection. Central nervous system complications included coma >24 h, seizure, and nerve injury. Cardiovascular complications included cardiac arrest requiring cardiopulmonary resuscitation, cerebrovascular accident, and venous thromboembolism. Other complications included graft or prosthesis failure, postoperative systemic sepsis, unplanned reoperation, or death. Additional outcomes investigated included postoperative LOS, unplanned readmission, and transfusion performed intraoperatively or within 72 h of surgery. All categorical outcomes, including complications, are reported as any occurrence of the event within 30 d of surgery.

Continuous variables were compared using Wilcoxon rank-sum tests, and categorical variables were compared using Pearson chi-square tests or Fisher exact tests where appropriate for open *versus* laparoscopic procedures. To compare postoperative LOS between those undergoing open *versus* laparoscopic procedures, we fit Poisson regression models for each cohort. Because overdispersion was noted in both the ulcerative colitis and Crohn disease cohorts, we fit negative binomial