Association for Academic Surgery

Ureteral stenting in laparoscopic colorectal surgery

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ABSTRACT

Background: Few studies have examined the current status of ureteral stent use or the indications for stenting, particularly in laparoscopic colorectal surgery. This study examines current national trends and predictors of ureteral stenting in patients undergoing major colorectal operations and the subsequent effects on perioperative outcomes.

Methods: The 2005–2011 National Surgical Quality Improvement participant user files were used to identify patients undergoing laparoscopic segmental colectomy, low anterior resection, or proctectomy. Trends in stent use were assessed across procedure types. To estimate the predictors of stent utilization, a forward-stepwise logistic regression model was used. A 3:1 nearest neighbor propensity match with subsequent multivariable adjustment was then used to estimate the impact of stents.

Results: A total of 42,311 cases were identified, of which 1795 (4.2%) underwent ureteral stent placement. Predictors of stent utilization included diverticular disease, need for radical resection (*versus* segmental colectomy), recent radiotherapy, and more recent calendar year. After adjustment, ureteral stenting appeared to be associated with a small increase in median operative time (44 min) and a trivial increase in length of stay (5.4%, $P < 0.001$). However, there were no significant differences in morbidity or mortality.

Conclusions: We describe the clinical predictors of ureteral stent usage in this patient population and report that while stenting adds to operative time, it is not associated with significantly increased morbidity or mortality after adjusting for diagnosis and comorbidities. Focused institutional studies are necessary in the future to address the utility of ureteral stents in the identification and possible prevention of iatrogenic injury.

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1. Introduction

Over the past 2 decades, laparoscopy has gained acceptance as a safe and potentially superior technique in many colorectal procedures, and despite the many benefits, one persistent drawback is the lack of tactile feedback present during delicate dissection [1–4]. With this rise in popularity has come renewed concern for iatrogenic ureteral injuries, which can be a source of substantial morbidity. It is estimated that 5%–15% of such ureteral injuries are attributable to

surgical procedures involving the colon and rectum [5]. Although known risk factors for iatrogenic urinary tract injury include previous pelvic operations, infection, and inflammatory bowel disease, the majority of ureteral injuries occur in patients without obvious risk factors [5,6].

The existing literature suggests that early identification of urinary tract injuries is critical to minimizing associated morbidity and preventing long-term renal dysfunction [5,6]. As a result, ureteral stenting has attracted attention as a potential means for identifying iatrogenic injuries in real time, often facilitating intraoperative repair. Although ureteral stents can assist in the identification of injury, small existing studies have suggested a slight increase in operative time associated with stent use but have lacked adequate statistical power to assess other associated complications and morbidity [7–9].

There is a paucity of literature examining the current status of ureteral stent use or the indications for stenting, particularly in laparoscopic colorectal surgery. The purpose of this study was, therefore, to utilize a large, validated clinical database to assess current national trends and predictors of stents use in patients undergoing major colorectal operations and examine associations with urinary tract infections, renal failure, and operative times.

2.   Methods

The National Surgical Quality Improvement (NSQIP) Participant User Files for 2005 through 2011 were used for this retrospective analysis, which was approved by the Duke University Institutional Review Board. Patients were identified by surgical procedure based on Current Procedural Terminology codes: laparoscopic segmental colectomy (44204 and 44205), laparoscopic low anterior resection (LAR: 44207, 44208, and 45397), and laparoscopic proctectomy (abdominoperineal resection (APR) or total proctocolectomy: 45395, 44211, and 44212). Use of ureteral stents was determined using Current Procedural Terminology code 52332, "Cystourethroscopy, with insertion of indwelling ureteral stent", as an associated procedure.

Trends in the use of ureteral stenting were assessed among all laparoscopic colorectal procedures and then stratified by procedure type. Although identification of iatrogenic ureteric injury is the ultimate reason for ureteral stent use in most cases, concerns exist regarding the use of ureteral stenting and the potential for increased postoperative renal complications. In light of these concerns and the inherent limitations of NSQIP regarding the identification of iatrogenic injuries, our primary outcome measure was a composite of any of the following postoperative renal complications: urinary tract infection, acute kidney injury, or renal failure requiring dialysis. Secondary end points were early return to the operating room (OR), postoperative sepsis, and 30-d mortality. Patients were stratified by the use of ureteral stenting or not, and baseline characteristics compared using Pearson chi-square test for categorical variables and Student t test for continuous variables.

To determine predictors of ureteral stent use among laparoscopic colorectal surgery, a forward-stepwise multivariable logistic regression model was created. We made an a priori decision to include the following potential preoperative

variables, which we judged to be potential predictors: procedure type, diagnosis, preoperative radiation and/or chemotherapy, age >60, sex, smoking, body mass index >30, alcohol abuse, diabetes, chronic obstructive pulmonary disease, coronary artery disease, bleeding disorder, ascites, functional status, recent steroid use, recent weight loss, American Society of Anesthesiologists classification, year of operation, preoperative transfusion, and preoperative creatinine level.

To estimate the effect of ureteral stenting on perioperative outcomes, patient cohorts were stratified by stent use and were compared across the 23 main complications captured by NSQIP. In light of the likely fundamentally nonrandom differences between the patients selected for stent placement and those for whom stents were not used, we then conducted a propensity analysis. Using a 3:1 nearest neighbor algorithm, patients were matched based on propensity to receive ureteral stents in an attempt to control for bias at the level of the treatment decision [10–12]. Applying nonparsimonious multivariable logistic regression to this propensity-adjusted cohort, we then estimated the impact of ureteral stent use on our primary and secondary outcomes. The model was constructed to include all variables that might potentially confound the relationship between stent use and postoperative outcomes, including procedure type, diagnosis, wound classification, preoperative radiation and/or chemotherapy, age >60, sex, smoking, body mass index >30, alcohol abuse, diabetes, chronic obstructive pulmonary disease, coronary artery disease, bleeding disorder, ascites, functional status, recent steroid use, recent weight loss, do-not-resuscitate status, American Society of Anesthesiologists classification, year of operation, year of resident assistance in the OR, preoperative transfusion, case relative value units, and preoperative creatinine, hematocrit, and albumin levels.

In light of the substantial completeness of the NSQIP data, missing data were handled using complete case analysis. We made an affirmative decision to control for type I error at the level of the comparison, and P-values <0.05 were used to indicate statistical significance for all comparisons. Analyses were performed using R version 3.0.2, The R Foundation for Statistical Computing, Vienna, Austria.
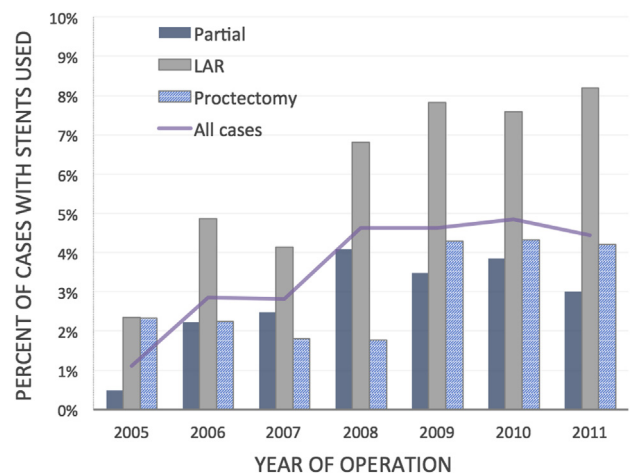

Fig. – **Trends in ureteral stent utilization from 2005 to 2011 during laparoscopic colorectal surgery and stratified by procedure type. (Color version of figure is available online.)**