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Urinary tract infection after surgery for colorectal malignancy: risk factors and complications

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Abstract

BACKGROUND: Over 4% of patients undergoing colorectal surgery develop postoperative urinary tract infection (UTI).

METHODS: Using 2005 to 2012 American College of Surgeons National Surgical Quality Improvement Program data for 47,781 patients, we examined independent risk factors and complications associated with UTI using multivariate logistic regression.

RESULTS: Independent predictors of UTI included female sex (odds ratio [OR] 1.705, 95% confidence interval [CI] 1.508 to 1.928), open procedure (OR 1.419, 95% CI 1.240 to 1.624), rectal procedure (OR 1.267, 95% CI 1.105 to 1.453), age greater than 65 years (OR 1.322, 95% CI 1.151 to 1.519), nonindependent functional status (OR 1.609, 95% CI 1.299 to 1.993), steroid use (OR 1.524, 95% CI 1.116 to 2.080), higher anesthesia class, and longer operative time. Patients with UTI had longer hospital stays (7 vs 12 days), higher reoperation rates (11.9% vs 5.1%), and higher 30-day mortality (3.3% vs 1.7%). Postoperative UTI correlated with other complications, including sepsis, surgical site infections, and pulmonary embolism ($P < .001$).

CONCLUSIONS: Postoperative UTI in colorectal surgery patients correlates with increased morbidity and mortality. Patients who contract postoperative UTI may be more likely to develop multiple complications.

Despite aggressive prevention programs and best practice recommendations, urinary tract infection (UTI) remains a prevalent hospital-acquired infection, particularly in patients with an indwelling urinary catheter.[1–3] UTI has been shown to prolong hospital stay, increase cost of care, and increase mortality.[4–6] In 2008, the Centers for Medicare

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and Medicaid Services began a policy of nonpayment for hospital-acquired UTI and several other "reasonably preventable events."[7] This policy, however, fails to account for differences in the risk of UTI because of intrinsic patient and procedure factors.

In surgical patients, a disparity in UTI incidence has been identified between different types of procedures, with rates of UTI significantly higher after colorectal resection than other surgeries. One study found crude UTI rate after colorectal resection (4.1%) to be more than twice that as after other gastrointestinal procedures (1.8%) and more than 3 times higher than after nongastrointestinal procedures (1.2%).[8] Colorectal procedure is an independent risk factor for postsurgical UTI.[9] While colorectal surgery sees a disproportionate share of surgical morbidity because of UTI, few studies have examined the relationship between UTI and other postoperative complications.

In the setting of increasing scrutiny on postsurgical outcomes, nonpayment for the so-called "preventable" complications, and significant increased risk of UTI in patients undergoing colorectal surgery, we sought to identify independent risk factors for UTI in patients undergoing resection procedures for colorectal malignancy. Additionally, we examined the relationship of UTI to other postsurgical complications, as clusters of complications may be to blame for the high excess morbidity and mortality caused by UTI. By identifying these high-risk patients and their related complications, we hope to aid the design of evidence-based interventions to prevent excess morbidity and mortality associated with postoperative UTI in this population.

Patients and Methods

Data acquisition and patient selection

The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database collects preoperative, operative, and 30-day outcome data on patients undergoing major operations at both academic and community hospitals around the United States. This database, including sampling methods, data collection, and outcomes, has been described in detail elsewhere.[10] We obtained the participant use files for the NSQIP database from 2005 to 2012. NSQIP participant use files have been considered exempt from institutional review board review at the University of Wisconsin-Madison. All 1,904,781 patients in this dataset were considered for inclusion in this study. Patients were selected using International Classification of Diseases-9 codes for colorectal malignancy (153.0 to 153.9, 154.0 to 154.1). Resection procedures were selected using Current Procedural Terminology (CPT) codes (44140, 44141, 44143, 44144, 44145, 44146, 44147, 44150, 44151, 44152, 44153, 44155, 44156, 44157, 44158, 44160, 44204, 44205, 44206, 44207, 44208, 44210, 44211, 44212, 45110, 45111, 45112, 45113, 45119, 45120, 45395, 45397). Emergency cases, American Society of Anesthesiologists (ASA) Class 5 patients, and patients with preoperative sepsis, shock, ventilator dependence, or coma were excluded.

Risk factor and outcome variables

Preoperative variables studied included sex (categorical: male, female), age (categorical: <20, 20 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 to 79, 80 to 89, 90+ years; <65 and 65+ years), race (categorical: American Indian or Alaska Native, Asian, black or African American, Native Hawaiian or Pacific Islander, white, unknown), body mass index (calculated from given height and weight; categorical: <18.5 [underweight], 18.5 to 24.9 [normal], 25.0 to 29.9 [overweight], 30.0 to 49.9 [obese], >50.0 [superobese]), admission quarter (categorical: 1, 2, 3, 4), and comorbidities (diabetes mellitus, current smoker, alcohol use of >2 drinks/day, dyspnea, nonindependent functional status, pneumonia, ascites, esophageal, gastric, or intestinal disease, history of congestive heart failure, history of myocardial infarction, previous percutaneous coronary intervention, previous cardiac surgery, history of angina, history of hypertension, history of peripheral vascular disease, rest pain, dialysis, impaired sensorium, hemiplegia, history of transient ischemic attack (TIA), history of cerebral vascular accident or stroke with neurological deficit, history of cerebral vascular accident or stroke without neurological deficit, tumor invading central nervous system, paraplegia, quadriplegia, disseminated cancer, open wound or wound infection, steroid use for a chronic condition, >10% loss of body weight in the past 6 months, history of bleeding disorder, transfusion of >4 U of packed red blood cells in the 72 hours before surgery, neoadjuvant chemotherapy, neoadjuvant radiotherapy, prior operation within 30 days, and meeting systemic inflammatory response syndrome (SIRS) criteria; categorical: yes, no). Operative variables included wound class (categorical: 1 [clean], 2 [clean contaminated], 3 [contaminated], 4 [dirty/infected]), anesthesia class (categorical: 1 [no disturbance], 2 [mild disturbance], 3 [severe disturbance], 4 [life-threatening disturbance]), procedure type (determined by CPT code; categorical: laparoscopic, open), anatomic location (determined by CPT code; categorical: colon, rectum), total operative time (continuous; minutes), and units of blood transfused during surgery (categorical: 0, 1, 2, >2).

The primary outcome variable of interest was UTI within 30 days of the index operation, as defined by the NSQIP.[11] Additional 30-day outcome variables studied (all categorical: yes, no) included superficial surgical site infection (SSI), deep SSI, organ/space SSI, wound disruption, pneumonia, reintubation, pulmonary embolism, greater than 48 hours on ventilator, progressive renal insufficiency, acute renal failure, stroke or cerebral vascular accident, coma, peripheral nerve injury, cardiac arrest, myocardial