

The impact of surgeon volume on colostomy reversal outcomes after Hartmann's procedure for diverticulitis

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Background. Colostomy reversal after Hartmann's procedure for diverticulitis is a morbid procedure, and studies investigating factors associated with outcomes are lacking. This study identifies patient, surgeon, and hospital-level factors associated with perioperative outcomes after stoma reversal.

Methods. The Statewide Planning and Research Cooperative System was queried for urgent/emergency Hartmann's procedures for diverticulitis between 2000–2012 in New York State and subsequent colostomy reversal within 1 year of the procedure. Surgeon and hospital volume were categorized into tertiles based on the annual number of colorectal resections performed each year. Bivariate and mixed-effects analyses were used to assess the association between patient, surgeon, and hospital-level factors and perioperative outcomes after colostomy reversal, including a laparoscopic approach; duration of stay; intensive care unit admission; complications; mortality; and 30-day, unscheduled readmission.

Results. Among 10,487 patients who underwent Hartmann's procedure and survived to discharge, 63% had the colostomy reversed within 1 year. After controlling for patient, surgeon, and hospital-level factors, high-volume surgeons (≥ 40 colorectal resections/yr) were independently associated with higher odds of a laparoscopic approach (unadjusted rates: 14% vs 7.6%; adjusted odds ratio = 1.84, 95% confidence interval = 1.12, 3.00), shorter duration of stay (median: 6 versus 7 days; adjusted incidence rate ratio = 0.87, 95% confidence interval = 0.81, 0.95), and lower odds of 90-day mortality (unadjusted rates: 0.4% vs 1.0%; adjusted odds ratio = 0.30, 95% confidence interval = 0.10, 0.88) compared with low-volume surgeons (1–15 colorectal resections/yr).

Conclusion. High-volume surgeons are associated with better perioperative outcomes and lower health care utilization after Hartmann's reversal for diverticulitis. These findings support referral to high-volume surgeons for colostomy reversal. (Surgery 2016;■:■-■.)

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SIGMOID COLECTOMY WITH COLOSTOMY CREATION, also known as Hartmann's procedure, is the operation of choice for complicated diverticulitis in the

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emergency setting when restoration of intestinal continuity is deemed inappropriate. It is a common procedure with an estimated 50,000 cases performed for diverticulitis each year in the United States.¹ While the colostomy is often considered temporary, large variations in stoma reversal patterns exist, with rates ranging from 25–90% depending on the case series.^{2–4} In addition, patients with a colostomy often suffer from psychosocial issues related to body image, physical activity restrictions, stoma appliance leakage, and sexual dysfunction, and stoma reversal is associated with an improvement in quality of life.^{5–7}

While colostomy reversal may improve the overall well-being of patients, Hartmann's reversal can be a high-risk procedure with a mortality rate as

high as 4% and significant morbidity, including high rates of anastomotic leakage, wound complications, return to the operating room, sepsis, and other major complications.⁸⁻¹¹ Recent attention has been given to the volume–outcome relationship in an effort to improve the outcomes of other complex operative procedures. Luft et al¹² first introduced this concept in 1979 when they demonstrated a relationship between high hospital volume and lower perioperative mortality after cardiac operations.

More recently, Birkmeyer et al¹³ showed a significant inverse relationship between high surgeon volume and high hospital volume and lower operative mortality for lung resection, cystectomy, esophagectomy, and pancreatectomy for cancer. Most of these studies, however, have focused solely on an end point of mortality. Few studies have focused on other quality metrics, and no study has focused on the association between surgeon and hospital-level factors and outcomes after Hartmann's reversal, which can be a technically demanding and high-risk procedure.

Given the paucity of larger, multi-institutional studies investigating factors associated with postoperative outcomes after Hartmann's reversal, the aim of this study was to identify patient, surgeon, and hospital-level factors associated with the perioperative quality metrics of a laparoscopic approach; intensive care unit (ICU) admission; duration of stay; major complications; mortality; and 30-day, unscheduled readmission after Hartmann's reversal. The hypothesis was that a volume–outcome relationship would be present for each of these end points.

METHODS

For this study, we used the Statewide Planning and Research Cooperative System (SPARCS), a population-based hospital discharge database that includes patient-level data for all non-Veteran Affairs hospital admissions, ambulatory operative procedures, and emergency department visits in New York State. The database has been described in detail previously and has been utilized extensively for research purposes.¹⁴⁻²² To select the study cohort, the SPARCS inpatient data file was first queried for urgent or emergency admissions with a primary or secondary diagnosis of acute diverticulitis (International Classification of Diseases, 9th Edition [ICD-9] = 562.11, 562.13) from 2000–2012.

The study cohort was then limited to patients who underwent Hartmann's procedure (left-sided colectomy [ICD-9 = 17.35–17.39, 45.75–45.79, 48.62–48.63] and colostomy creation [ICD-

9 = 46.10–46.13, 48.62]) during the admission. Patients with a concurrent diagnosis of colorectal cancer (ICD-9 = 153.x–154.x), with permanent residence outside of New York State, who died during the admission for the Hartmann's procedure, who were discharged to hospice, who underwent colostomy reversal during the index admission, or who had a missing unique surgeon identifier were excluded (Fig).

Outcomes. Study end points included perioperative outcomes after Hartmann's reversal. Stoma reversal was captured as colostomy reversal (ICD-9 = 46.04, 46.50, 46.52) within 1 year of the Hartmann's procedure at any non-Veteran Affairs hospital within New York State with follow-up data available from 2000–2013. Outcomes for the Hartmann's reversal included use of a laparoscopic approach (ICD-9 = 17.3x, 54.21, 54.51, V64.41), ICU admission (revenue code = 0200–0202, 0208–0209), duration of stay, major complications, 30- and 90-day postoperative mortality, and unscheduled readmission to any non-Veteran Affairs hospital in New York State within 30 days of discharge. Major complications included operative site infection, intra-abdominal abscess, anastomotic leak, sepsis, pneumonia, pulmonary failure, myocardial infarction, venous thromboembolism, acute renal failure, hemorrhage, and gastrointestinal bleeding captured during the admission for the Hartmann's procedure or an unscheduled readmission within 30 days of discharge. The corresponding ICD-9 codes are listed in Table I.

Additional exclusion criteria for these outcome analyses included colostomy revision (ICD-9 = 46.40, 46.43) or creation of a new colostomy during the Hartmann's reversal and no surgeon identifier match within the American Medical Association (AMA) Physician Masterfile and American Board of Medical Specialties (ABMS) database (Fig). For the outcome of 30-day readmission, patients who died during the admission for the Hartmann's reversal were also excluded.

Procedure volume. Individual surgeon and hospital volumes were calculated as the total number of colorectal resections (ICD-9 = 17.3x, 45.7x, 45.8x, 48.4x–48.6x) performed during that calendar year, using the unique surgeon and facility identifiers. Because both individual surgeon and facility volumes fluctuated over the study period, surgeon and facility volumes were calculated for each individual calendar year as done in previous studies.¹⁶⁻¹⁸ Approximate tertile volume cutoffs were calculated based on all colorectal resections performed in New York State during the 2000–2012 study period and used to categorize low

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