



Colorectal cancer: Quality of surgical care in Michigan



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ABSTRACT

Objective: Surgery remains the cornerstone therapy for colorectal cancer (CRC). This study assesses CRC quality measures for surgical cases in Michigan.

Methods: In this retrospective cohort study, processes of care and outcomes for CRC resection cases were abstracted in 30 hospitals in the Michigan Surgical Quality Collaborative (2014–2015). Measures were case-mix and reliability adjusted, using logistic regression models.

Results: For 871 cases (640 colon cancer, 231 rectal cancer), adjusted morbidity (27.4%) and mortality rates (1.5%) were low. Adjusted process measures showed gaps in quality of care. Mesorectal excision was documented in 59.4% of rectal cancer (RC) cases, 65% of RC cases had sphincter preserving surgery, 18.7% of cases had < 12 lymph nodes examined, 7.9% had a positive margin, 52.1% of stage II/III RC cases had neoadjuvant therapy, and 36% of ostomy cases had site marking.

Conclusion: This study finds gaps in quality of care measures for CRC, suggesting opportunity for regional quality improvement.

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1. Introduction

Surgical resection is the cornerstone of treatment for non-metastatic colorectal cancer (CRC). Thus, the quality of care provided by surgeons and their teams may have a substantial effect on CRC outcomes. Surgical technique and evidence-based perioperative care may affect short-term morbidity and mortality, while coordination of care and leadership of multidisciplinary teams may affect long-term cancer outcomes, through accurate staging and appropriate adjuvant and neoadjuvant therapy.

Unfortunately published evidence has suggested that care and outcomes vary for CRC in the United States and internationally. Cohort studies demonstrate variable short-term surgical outcomes, with complication rates ranging from 20% to 40%, and mortality rates from 3% to 6%.^{1–3} Healthcare utilization also varies, including length of stay and readmission rates. Most importantly, there is variability in cancer-specific quality measures, such as adequate

lymph node examination, rate of margin positivity, and use of mesorectal excision for rectal cancer.⁴ However, hospitals in United States have limited ability to assess their quality of care for CRC, due to the lack of quality assessment programs, such as those established in Europe and Ontario.⁴ The Institute of Medicine has called American cancer care a “system in crisis”, and calls for increased quality of care measurements to guide improvement in the United States.⁵

In this context, we established a CRC-specific quality assessment program in the Michigan Surgical Quality Collaborative (MSQC) to better understand variability in postoperative outcomes, resource utilization, and CRC-specific process measures. After 18 months collecting data for this program, we present this prospective assessment of quality of care for CRC in 30 Michigan hospitals.

2. Methods

2.1. Study setting

This was a retrospective cohort study of prospectively-collected data from the MSQC. The MSQC is a quality improvement organization funded by Blue Cross and Blue Shield of Michigan. MSQC participants are community and academic hospitals throughout the

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state. Details of MSQC data abstraction and data quality assurance have been previously described.⁶ In brief, 72 Michigan hospitals participate in the MSQC collaborative, and these represent the state's hospitals that perform major surgery. Specially trained data abstractors (nurses) prospectively collect patient characteristics, intraoperative data, laboratory results, and 30-day outcomes for patients undergoing specified general and vascular operations, utilizing a sampling algorithm that minimizes selection bias. For this study, 30 self-selected hospitals participated in a “colorectal cancer project” from 2014 to 2015. These hospitals abstracted additional data on colorectal cancer resections, and account for approximately 40% of all MSQC colorectal cancer cases. These hospitals are a mix of small and large hospitals, academic and community. Data collection and review for MSQC is institutional review board exempt. Per the data use agreement, all analyses are performed on the hospital level.

2.2. Patient population

This study included colorectal cancer resections abstracted into the MSQC registry, with eligibility defined by CPT procedure and ICD diagnosis codes. All cases are adult patients, and eligible cases included colorectal resections for a primary (not recurrent) colorectal adenocarcinoma.

2.3. Outcomes

Data was abstracted from hospital medical records, on clinical and pathologic cancer stage, 30-day outcomes, operative and perioperative care processes, and utilization measures. CRC-specific quality measures included surgeon factors (sphincter preservation rate and documentation of performing mesorectal excision in rectal cancer resections, and use of minimally-invasive surgery), pathology factors (12 or more lymph nodes examined, positive margin rate), and multi-disciplinary factors (neoadjuvant radiation therapy for stage II and III rectal cancer and documentation of preoperative ostomy site marking in rectal cancer cases in which an ostomy was performed).

2.4. Statistical analysis

Descriptive statistics were used to characterize the cohort of patients. Outcomes and utilization were summarized at the patient level, with point estimates and 95% confidence intervals (CI) based on logistic regression models. All case-mix adjustment models included the following covariates – surgical acuity, gender, BMI, ASA, tumor stage, age, and number of comorbidities present. Additional variables of clinical importance – or found empirically to be statistically associated with an outcome – were added to individual models. Specifically, mortality rate also adjusted for steroid/immunosuppressive use, ostomy creation, wound classification, nutritional status, operative duration, functional status, cardiac disease, and preoperative sepsis. The model for morbidity adjusted for steroid/immunosuppressive use, ostomy creation, wound classification, nutritional status, and operative duration. The length of stay model added to the mortality model the following variables: open wound, anemia, pneumonia, cirrhosis, ascites, lactic acidosis, COPD, and hyperglycemia. The operative duration model included nutritional status, ostomy creation, sleep apnea, bilirubin, and lactic acidosis. The readmission model included steroid use, ostomy creation, wound classification, nutritional status, operative duration, and open wound. Reoperation and transfusion models used the same adjustments as readmission except that reoperation included cardiac disease and dialysis, and transfusion included cardiac disease and anemia.

To compare hospitals' performance on the process of care measures, we generated hospitals' case mix- and reliability-adjusted rates using two-stage logistic regression models. All of the models adjusted for surgical acuity, gender, BMI, ASA, tumor stage, age, tumor location, type of surgical resection, and number of comorbidities present. The adjustments were accomplished using a two stage approach. Stage one involved case-mix adjustment at case or patient level for case mix as a fixed effect. The second stage was reliability adjustment at the hospital level. Reliability adjustments were performed to ensure that risk-adjusted outcomes from hospitals with small case numbers were not skewed due to statistical “noise.” These calculations shift the estimate for complication rate back toward the average rate for the entire cohort, with the degree of shift proportional to the reliability measure of each hospital. Statistical analyses were performed using SAS Analytics Software version 9.4 (College Station, Texas).

3. Results

3.1. Patient characteristics

871 patients underwent resection for CRC in 30 hospitals. 73% were colon and 27% were rectal cancer resections. Patient demographic, clinical, and tumor characteristics are presented in [Table 1](#). The majority of cases were Stage II and III. Most colon cancer resections were partial colectomies and most rectal cancer operations were low anterior resections. Of the rectal cancer resections, location was evenly distributed between upper, mid and low rectum. Surprisingly, 24% of resections were urgent or emergent (29% of colon cancer operations and 8% of rectal cancer resections).

3.2. 30-day outcomes

The adjusted mortality rate was 1.5% (95% CI 0.0%–3.1%) for colon cancer and 1.4% (95% CI 0.0%–3.5%) for rectal cancer. Morbidity rate for colon cancer was 26.2% (95% CI 20.3%–32.2%) and 30.7% (95% CI 23.4–38.1%) for rectal cancer. SSI rate was 7.6% for colon cancer and 11.0% for rectal cancer, with a SSI distribution for superficial, deep and organ space of 3.3%, 1.0%, and 2.8% for colon cancer and 1.2%, 4.5%, and 1.3% for rectal cancer, respectively. Anastomotic leak rates were 1.6% (95% CI 0.2%–3.0%) for colon cancer and 1.3% (95% CI 0.0%–3.3%) for rectal cancer.

In terms of resource utilization, the average length of stay was 7.6 days (95% CI 6.7–8.6). Readmission rates for colon cancer resection were 11.8% (95% CI 7.9%–15.7%) and 15.1% (9.9%–20.4%) for rectal cancer. Reoperation rates for colon cancer and rectal cancer were 7.7% (4.6%–10.8%) and 9.4% (5.2%–13.5%), respectively. Blood transfusions were required at a rate of 9.0% (95% CI 6.2%–11.8%) for colon cancer and 8.6% (95% CI 4.6%–12.5%) for rectal cancer.

3.3. CRC quality measures

CRC care quality was assessed using process measures abstracted from hospital medical records, and organized into 3 domains: surgery quality, pathology quality, and multidisciplinary care quality. In terms of surgery quality ([Fig. 1a](#)), there were gaps between optimal and observed performance. In rectal cancer cases, only 59.4% of operative reports documented performing a mesorectal excision. We also found underuse of minimally-invasive surgery for colon cancer, with 59% of cases performed MIS (95% CI 49.9%–68%). Finally, performance of sphincter preservation surgery (SPS) for rectal cancer was lower than expected at 64.5% (95% CI 41.1%–88.0%). For pathology quality ([Fig. 1b](#)), we found that

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