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Hospital variation in sphincter preservation for elderly rectal cancer patients

Christopher M. Dodgion, MD, MBA, MSPH,[a] Bridget A. Neville, MPH,[b] Stuart R. Lipsitz, ScD,[c] Deborah Schrag, MD, MPH,[b] Elizabeth Breen, MD,[c] Michael J. Zinner, MD,[c] and Caprice C. Greenberg, MD, MPH[a,]*

[a] *Wisconsin Surgical Outcomes Research Program, Department of Surgery, University of Wisconsin, Madison, Wisconsin*

[b] *Center for Outcomes and Policy Research, Department of Medical Oncology, Dana-Farber Cancer Institute, Boston, Massachusetts*

[c] *Center for Surgery and Public Health, Department of Surgery, Brigham and Women's Hospital, Boston, Massachusetts*

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ABSTRACT

Background: The primary goal of an operation for rectal cancer is to cure cancer and, where possible, preserve continence. A wide range of sphincter preservation rates have been reported. This study evaluated hospital variation in the use of low anterior resection (LAR), local excision (LE), and abdominoperineal resection (APR) in the treatment of elderly rectal cancer patients.

Methods: Using Surveillance, Epidemiology, and End Results–Medicare linked data, we identified 4959 patients older than 65 y with stage I–III rectal cancer diagnosed from 2000–2005 who underwent operative intervention at one of 370 hospitals. We evaluated the distribution of hospital-specific procedure rates and used generalized mixed models with random hospital effects to examine the influence of patient characteristics and hospital on operation type, using APR as a reference.

Results: The median hospital performed APR on 33% of elderly patients with rectal cancer. Hospital was a stronger predictor of LAR receipt than any patient characteristic, explaining 32% of procedure choice, but not a strong predictor of LE, explaining only 3.8%. Receipt of LE was primarily related to tumor size and tumor stage, which combined explained 31% of procedure variation.

Conclusions: Receipt of LE is primarily determined by patient characteristics. In contrast, the hospital where surgery is performed significantly influences whether a patient undergoes an LAR or APR. Understanding the factors that cause this institutional variation is crucial to ensuring equitable availability of sphincter preservation.

1. Introduction

Reported rates of sphincter-preserving surgery (SPS) for rectal cancer in the US range from 26.9%–54.3% [1,2]. Preservation of continence is an important goal, but will not be technically feasible in all patients. Although reported rates have increased over time [1] with improved surgical technique [3,4] and preoperative imaging modalities [5], a large amount of

* *Corresponding author*. Wisconsin Surgical Outcomes Research Program, Department of Surgery, University of Wisconsin, 600 Highland Avenue, BX7375 Clinical Science Center, Madison, WI 53792-3284. Tel.: +1 608 263 7309; fax: +1 608 252 0912.
E-mail address: greenberg@surgery.wisc.edu (C.C. Greenberg).

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institutional variability remains [1,6]. A recent evaluation by Temple *et al.* [6] revealed overall SPS rates in seven National Comprehensive Cancer Network institutions to be 77%. However, even among these structurally similar hospitals there was a wide range in the rate of SPS (38%–85%) [6]. Some of this variability was attributed to discordant evidence regarding resection margin [7–9] or to institution-specific culture and views regarding the functional outcomes of low anastomoses. Additional studies of population-based samples have illustrated that decreased SPS rates have been associated with race [1,10–12], low-volume hospitals [13], and lower socioeconomic status [1]. More investigation is necessary to understand the role of hospital-level factors in determining likelihood of sphincter preservation for patients with rectal cancer.

Traditionally, SPS has been defined in research studies as low anterior resection (LAR) or all patients not receiving abdominoperineal resection (APR) [2,6,12,14]. Advances in local excision (LE), such as transanal endoscopic microsurgery, provide a different approach to sphincter sparing surgery for *in situ* tumors and low-grade tumors limited to the submucosa (T1) with similar outcomes to radical resection [15–18]. Additionally, a prior Surveillance, Epidemiology, and End Results (SEER) evaluation showed that increasing age is significantly correlated with greater rates of LE [19]. Therefore, we chose to evaluate both LAR and LE to examine rates of sphincter preservation for selected eligible patients.

To date, one study [20] has examined the influence of both patient and hospital characteristics on sphincter preservation rates among a national sample but did not control for tumor characteristics or neoadjuvant therapy. Our study is the first to evaluate the contribution of patient, hospital, and tumor characteristics on rates of sphincter preservation on a national sample of patients older than 65 y with rectal cancer across multiple institutions.

2. Methods

2.1. Data sources

Data from the SEER registries and Medicare claims have been linked to allow for longitudinal analysis of cancer and treatment outcomes. The 17 SEER registries, sponsored by the National Cancer Institute (NCI), represent approximately 28% of the US population and 94% of SEER patients aged 65 y or older have had their records linked to Medicare claims. Additionally, these claims are linked to census (2000) tract and zip code level data to provide further demographic information.

2.2. Study sample

Our study cohort included all Medicare-eligible patients aged 65 y and older, diagnosed in SEER regions with primary rectal cancer between 2000 and 2005. We specifically selected for adenocarcinoma (SEER histology codes 8010, 8140, 8144, 8210-11, 8220-21, 8260-63, 8470, 8480-81, and 8490) and American Joint Committee on Cancer (AJCC) stage I–III disease and excluded patients with stage IV. Patients who were enrolled in health care management organizations or were not in both Medicare part A and part B continuously during the study period were excluded, as were patients with a diagnosis noted exclusively on death certificates or autopsy, and those patients where the month of diagnosis was unknown. To best limit the analysis to rectal cancer where sphincter preservation was a concern, cancers located at the rectosigmoid junction were excluded. For the LE analysis (APR *versus* LE), the cohort was limited to those patients with AJCC stage I disease.

We searched both part A and part B Medicare claim files for rectal cancer operations performed from 30 d prior to 1 y post-diagnosis. Operations were categorized according to the International Classification of Diseases Clinical Modification (ICD-9-CM) and Current Procedural Technology (CPT) classification systems. Only patients who had standard resections for rectal cancer were included: APR (ICD-9-CM 48.5, CPT 45110, 45395), LAR (ICD-9-CM 48.6x, CPT 45111-13, 45119, 45397), and LE (ICD-9-CM 48.35, CPT 45160, 45170). If patients had both an LE code and a subsequent LAR or APR code, they were analyzed in the latter category. Finally, to increase the stability of our results, analysis was limited to only those patients who received care from institutions performing at least five procedures in our cohort. Our final cohort included 4959 patients from 370 hospitals.

2.3. Covariates

Patient demographics, median household income, proportion of those with a college education and tumor-related variables (grade, tumor stage, lymph node status, and size) were obtained from SEER registry data. Comorbidities were captured in the year before diagnosis from the outpatient, inpatient, and carrier claims using the Deyo *et al.* modification [21] of the Charlson comorbidity index [22], applied to both inpatient and outpatient claims as suggested by Klabunde *et al.* [23]. Variables were categorized as in Tables 1 and 2 for univariate analysis but race (white, black, and other), age (65–79, ≥80), and comorbidity score (0, ≥1) were collapsed for multivariable analysis.

We used the unique American Hospital Association hospital identification number to link each patient with the hospital characteristics available in the Medicare hospital file (http://healthservices.cancer.gov/seermedicare/privacy/Hospital.filedescription.pdf). These hospital characteristics included urban location, designation as an NCI cancer center, medical school affiliation, membership in an oncology group, and hospital ownership. The Center for Medicare and Medicaid Services (CMS) region of the treating hospital was used to examine geographic variations for Northeast (Boston, New York, PA), Midwest (Chicago, Kansas City), South (Atlanta, Dallas), and West (Denver, San Francisco, Seattle).

2.4. Statistical analysis

Hospital-specific procedure rates were calculated for APR, LAR, and LE. Temporal relationships in procedure-specific rates were analyzed using the Mantel–Haenszel chi-square test for trend, accounting for clustering of patients within hospital. To evaluate the association between procedure performed (APR, LAR, or LE) and *a priori*–specified patient and hospital characteristics, Rao–Scott chi-square test for categorical variables (such as tumor stage) and generalized