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Failure to operate on resectable gastric cancer: implications for policy changes and regionalization



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ABSTRACT

Background: A significant proportion of patients never receive curative-intent surgery for resectable gastric cancer (GC). The primary aims of this study were to identify disparities and targetable risk factors associated with failure to operate in the context of national trends in surgical rates for resectable GC.

Methods: The National Cancer Database was used to identify patients with resectable GC (adenocarcinoma, clinical stage IA–IIIC, 2004–2013). Multivariate modeling was used to identify predictors of resection and to analyze the impact of surgery on overall survival (OS).

Results: Of 46,970 patients with resectable GC, 18,085 (39%) did not receive an appropriate operation. Among unresected patients, 69% had no comorbidities. Failure to resect was associated with reduced median OS (44.4 versus 11.8 mo, hazard ratio [HR]: 2.09, $P < 0.001$). In the multivariate analysis, the most critical factors affecting OS were resection (HR: 2.09) and stage (reference IA; HR range: 1.16–3.50, stage IB–IIIC). Variables independently associated with no surgery included insurance other than private or Medicare (odds ratio [OR]: 1.60/1.54), nonacademic/nonresearch hospital (OR: 1.16), non-Asian race (OR: 1.72), male (OR: 1.19), older age (OR: 1.04), Charlson-Deyo score >1 (OR: 1.17), residing in areas with median income $< \$48,000$ (OR: 1.23), small urban populations $< 20,000$ (OR: 1.41), and stage (reference IA; OR range: 1.36–3.79, stage IB–IIIC, $P < 0.001$).

Conclusions: Over one-third of patients with resectable GC fail to receive surgery. Suitable insurance coverage and treatment facility are the most salient (and only modifiable) risk factors for omitting surgery. To mitigate national disparities in surgical care, policymakers should consider improving insurance coverage in underserved areas and regionalization of gastric cancer care.

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Introduction

Gastric cancer is the fifth most common cancer and third leading cause of cancer death worldwide, with an estimated 26,270 new diagnoses in the United States in 2016.^{1,2} After the publication of two landmark studies, namely the Intergroup Trial 0116 (2001) and the MAGIC Trial (2006), multimodality therapy was recognized as superior to surgery alone.^{3,4} For stage IB through stage IIIC gastric cancer, a potentially curative resection is one that achieves negative microscopic margins using subtotal, near-total, or total gastrectomy, with appropriate modified D2 lymphadenectomy.⁵ Patients with stage IA (T1, N0) gastric cancer can achieve curative resection by means of endoscopic mucosal resection (EMR) or gastrectomy.⁵

Despite the fact that surgery is required as part of any treatment plan for potential cure, a significant proportion of patients in the United States never receive curative-intent surgery. In this context, the primary aim of this study was to identify disparities and barriers associated with failure to operate. Secondary aims included evaluating national trends of curative-intent surgery for resectable gastric cancer, identifying targetable risk factors associated with failure to receive surgery, and confirming the importance of surgery in overall survival (OS), to highlight the areas for improvement in the treatment of gastric cancer in the United States.

Patients and methods

Data collection

The National Cancer Database (NCDB) Participant Use File (PUF) for gastric cancer was used for data collection. The NCDB requires the following statement of disclosure: “The NCDB is a joint project of the American Cancer Society and the Commission on Cancer (CoC) of the American College of Surgeons. The CoC’s NCDB and the hospitals participating in the CoC NCDB are the source of the deidentified data used herein. They have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors. The NCDB, established in 1989, is a nationwide, facility-based, comprehensive clinical surveillance resource oncology data set that currently captures 70% of all newly diagnosed malignancies in the US annually.”^{6,7} For the purpose of this study, gastric cancer was defined as adenocarcinoma only.

Patient selection

Inclusion criteria included adults (18-90 y) diagnosed with gastric adenocarcinoma between 2004 and 2013. American Joint Committee on Cancer (AJCC) sixth edition was used to represent patients’ cases diagnosed from 2004-2009.⁸ AJCC seventh edition was used to represent patients’ cases diagnosed from 2010-2013.⁹ Only those patients with pretreatment AJCC clinical stage IA to IIIC were included, as these were the patients whose optimal treatment regimen included resection. Patients with AJCC clinical stage 0, stage I (with no substaging of IA or IB), stage IV, and unknown clinical stage were excluded from

analyses. Clinical stage I patients who were not stratified to IA or IB were excluded to ensure that EMR was used only for stage IA patients, as appropriate, and not for higher T-stage patients. Curative-intent surgery included any form of gastrectomy (e.g., partial gastrectomy, subtotal gastrectomy, total gastrectomy, and gastrectomy not otherwise stated) for stage IB through stage IIIC, and EMR or some form of gastrectomy for stage IA.

Patients were grouped by resection status. Patients were then classified by demographics, clinicopathologic factors, Charlson-Deyo comorbidity index score (CCI), insurance status, income, and geographic factors.^{10,11} The primary end point was to identify factors associated with failure to operate on clinically resectable gastric cancer. Secondary end points included national trends in performance of curative-intent surgery, identification of modifiable risk factors for failure to operate, and confirmation of the impact of surgery on OS.

Statistical analysis

Univariate and multivariate modeling were used to identify predictors of resection and impact of surgery on OS. Multivariable Cox regression was used to estimate the independent effect of risk factors on OS. Statistical significance was defined as $P < 0.05$, and all tests were two-tailed. Statistical analysis was performed using SPSS, version 22 (IBM Corporation, SPSS, Chicago, IL) and R Software, version 3.2.3 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Of the 46,970 total patients from the 2004-2013 NCDB PUF who met inclusion criteria, 18,085 (38.5%) failed to undergo curative-intent surgical resection (Table 1). The median age of patients was 69 y (interquartile range [IQR]: 59-78 y). The majority of patients were male (65.6%) and Caucasian (78.1%). Other common factors listed in Table 1 included resection at an academic/research facility (45.3%), Medicare insurance (54.0%), residence in a metropolitan area with >1 million residents (56.3%), and CCI of 0 (69.0%).

Surgical resection rates

During the time period surveyed in this study, the proportion of patients with clinically staged, resectable gastric cancer who underwent curative-intent surgery increased from 51.7% in 2004 to 62.0% in 2013 ($P < 0.001$, Fig. 1). On multivariate analysis, women were 19% more likely than men to undergo surgical resection, independent of hospital type, geographic location, age, race, comorbidities, income, insurance status, or AJCC clinical cancer stage (odds ratio, OR 1.19, $P < 0.001$, Table 2). Some of the factors independently associated with increased likelihood of receiving surgery included the following: Asian race (OR: 1.72), having Medicare or private insurance (OR: 1.54 and 1.60, respectively), residing in an area where the median annual income was \geq \$48,000 per household (OR: 1.23), living a greater distance (NCDB’s “crowfly” metric) from the treatment facility (OR: 1.08), CCI \leq 1 (OR: 1.17),

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