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Comprehensive Geriatric Assessment in Patients with Gastric and Gastroesophageal Adenocarcinoma Undergoing Gastrectomy

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Abstract

Objective—The purpose of this study was to identify clinical and geriatric assessment variables associated with outcome in patients with gastric adenocarcinoma who have undergone gastrectomy.

Methods—We reviewed demographic, clinical, and geriatric assessment variables, including recent falls, pain, performance status, American Society of Anesthesiologists score, assistive device use, comorbidity, polypharmacy, and weight change, for patients undergoing gastrectomy between 2005 and 2014. Outcome variables included morbidity, mortality, hospital length of stay, and readmission.

Results—Of 279 patients, 133 (48%) underwent total gastrectomy. The 90-day major morbidity rate was 24% and the mortality rate was 1%. Length of hospital stay ≥ 14 days occurred in 38%, with readmission within 30 days in 13%. On multivariate analysis, gastroesophageal junction involvement, (odds ratio [OR] 2.5, 95% confidence interval [1.1–5.8]), additional organ resection, (OR 3.2, [1.6–6.3]), pain score > 0 (OR 3.8, [1.6–8.7]), Eastern Cooperative Oncology Group performance status > 0, (OR 2.3, [1.2–4.6]), and polypharmacy (OR 2.4, [1.1–5.2]) were associated with major morbidity. Hospital stay ≥ 14 days was associated with age ≥ 75 years (OR 3.9 [1.7–9.2]), total gastrectomy (OR 3.5 [OR 2.0–6.3]), performance status > 0 (OR 1.8 [1.0–3.2]), and preoperative chemotherapy (OR 0.3 [0.2–0.7]).

Conclusions—Future studies are needed to identify methods to improve performance status, as this may improve postoperative complications and resource utilization.

Synopsis

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We identified variables associated with gastrectomy outcomes using geriatric assessment tools. We found that age, performance status, surgery type, and preoperative treatment were associated with major morbidity.

Keywords

gastric cancer; geriatric assessment; frailty; gastrectomy; adenocarcinoma

Introduction

The proportion of the United States population aged 65 and older is rapidly growing, and the incidence of cancer in this population is projected to rise dramatically in the next 20 years, placing an enormous strain on cancer hospitals' resources.¹ Many of these future cancer patients will require surgery, which is the only potential cure for the majority of solid-organ malignancies. Advanced age at surgery has been associated with longer hospital stays and increased need for nursing support after discharge, both of which increase costs for patients and hospitals.²⁻⁴

Researchers have sought to use indicators of frailty, including those identified by comprehensive geriatric assessment (CGA) tools, to anticipate surgical patients' subsequent health and need for postoperative care. Although previous studies have investigated the association between CGA variables and surgery outcomes, they have often included heterogeneous populations of patients who underwent procedures with relatively low risks of morbidity.⁵⁻⁹ Additional studies are needed to identify CGA variables associated with the outcomes of patients who have undergone surgery for abdominal malignancies, which pose a significantly higher risk of postoperative complications and, thus, have a greater need for postoperative support.¹⁰⁻¹²

Gastric cancer is relatively uncommon in Western populations, mainly owing to improvements in food preservation, dietary habits, and other epidemiological factors. It is estimated that gastric cancer will account for 24,600 new cases and 10,700 deaths in the United States in 2015.¹³ Population-based studies demonstrate that postoperative morbidity and mortality are particularly significant in patients with gastric cancer who undergo gastrectomy.¹⁴⁻¹⁶ In addition, gastric cancer surgery is associated with many other outcomes related to patient burden and cost.¹⁷ Therefore, the purpose of this study was to determine which geriatric assessment, clinical, and demographic variables are significantly associated with indicators of postoperative complications, including increased length of hospital stay, rates of readmission, and rates of discharge to a skilled nursing facility, in patients with gastric cancer undergoing gastrectomy.

Methods

We retrieved, from a prospectively maintained database, the medical records of patients with histologically confirmed gastric or gastroesophageal adenocarcinoma who were evaluated at M. D. Anderson Cancer Center from January 2005 to April 2014 and underwent subtotal or total gastrectomy. We included patients in whom resection with therapeutic intent was

attempted and excluded patients who underwent palliative resection. The study was approved by the MD Anderson Institutional Review Board. Demographic variables extracted from the database included age, gender, race, and marital status. Clinical variables included involvement of the gastroesophageal junction; moderately vs poorly differentiated histologic grade; presence or absence of signet ring cell histology; type of preoperative treatment (none, chemotherapy only, or chemoradiotherapy); total vs subtotal gastrectomy; extent of lymph node dissection (regional [D1] vs extra-regional [D1+/D2]); and major concurrent surgery (e.g., resection of other organs or jejunal interposition graft placement).¹⁸

The patients' preoperative geriatric assessment was performed within 30 days of surgery and included the following variables: falls within the last month; pain scores (0 vs 1); use of assistive devices; activity level, Eastern Cooperative Oncology Group (ECOG) performance status; American Society of Anesthesiologists (ASA) presurgical fitness score; Charlson comorbidity index; polypharmacy (> 5 daily medications); weight loss > 10% in the past 6 months; and albumin level < 3.3 g/dL.^{19–21} Pain scores were patient-reported on a 0 to 10 scale for pain based on a 24-hour recall from the time of preoperative geriatric assessment. Assistive device use was defined as use of a cane, walker, or wheelchair. ECOG performance status was categorized as 0 vs 1, and ASA score was categorized as < 3 vs ≥ 3. Activity level was assessed as the ability to walk up 2 flights of stairs, walk on level ground less than 3 blocks, and walk from the bed to the bathroom without shortness of breath or needing to rest. Additional physical screening questions included problems with vision or hearing, dizziness upon first sitting up in bed or standing, and feet numbness (yes vs. no). Simple screening tools were used to evaluate cognitive variables, which were assessed by asking patients, family, and caregivers whether they noticed difficulty thinking clearly, memory problems, or distraction in the patient.

Outcome variables of complications or increased resource utilization included discharge to inpatient rehabilitation or skilled nursing facility, readmission within 30 days of surgery, 90-day morbidity, 90-day major morbidity classified as stage III or IV according to an accepted classification system, 90-day mortality, and postoperative hospital length of stay.²²

Variables associated with adverse outcomes or increased postoperative resource utilization were tested with univariate analysis using the chi-square test or Fisher exact test. Stepwise logistic regression analysis was used to assess the multivariate relationships between demographic, clinical, and geriatric assessment variables and our outcome measures. SAS version 9.2 (SAS Institute, Inc., Cary, NC) and S-Plus version 8.04 (TIBCO Software, Inc., Palo Alto, CA) were used for all analyses. A *P* value of < 0.05 was considered statistically significant.

Results

A total of 279 patients were included in the study, with a median age of 64 years (range, 25–88 years). Of this cohort, 129 (46%) patients were age 65 or older. Demographic, clinical, geriatric assessment, and outcome characteristics are summarized in Table 1. Only 45 (16%) tumors extended to the gastroesophageal junction. Signet ring cells were identified on histological examination in 150 (54%). Patients received no preoperative cancer treatment in

101 (36%) cases, preoperative chemotherapy in 62 (22%), and preoperative induction chemotherapy and chemoradiotherapy in 116 (42%). Total gastrectomy was performed in 133 (48%) patients. Extended (D1+/D2) lymph node dissection was performed in 223 (80%) patients. Major concurrent procedures were performed in 105 (38%) patients.

Only 46 (17%) patients reported a pain level greater than 0 in the 24 hours prior to assessment. Most patients (188, 71%) had an ECOG performance status of 0. An ASA score <3 was reported in 54 (25%) patients. A comorbidity index of 4 was identified in 67% of patients. Polypharmacy was present in 20% of patients. Activity level was defined as poor in patients experiencing shortness of breath or need to rest when walking up 2 flights of stairs (N=48), walking on level ground less than 3 blocks (N=13), and walking from the bed to bathroom (N=1). Memory problems, distraction, and difficulty thinking clearly was identified in 19, 12, and 19 patients, respectively. Dizziness upon sitting or standing was identified in 40 patients, with feet numbness in 20. The overall 90-day morbidity rate was 61%, and the Clavien-Dindo class III or IV morbidity rate was 24%. The 90-day mortality rate was 1.4%. Postoperative hospital stay 14 days occurred in 38% of patients, with readmission within 30 days of surgery in 13%. Only 3% of patients (N=8) were discharged to a skilled nursing facility.

Multivariate analysis revealed that gastroesophageal junction involvement, major concurrent procedure, pain scale score > 0, ECOG performance status 1, 10% weight loss, and polypharmacy were independently associated with postoperative major (class III or IV) morbidity, as shown in Table 2. Variables independently associated with hospital readmission included more advanced endoscopic ultrasound stage (T3 or T4) and ECOG performance status 1 (Table 3). Multivariate analysis for variables positively associated with length of hospital stay 14 days identified the age groups of 55–74 and 75, patients with total gastrectomy, and ECOG performance status 1. Preoperative chemotherapy was negatively associated with length of stay 14 days. Due to the low rates of 90-day mortality and discharge to nursing home, we were not able to identify variables significantly associated with these outcome measures.

Discussion

In response to the rapid growth of the 65-and-older population and in anticipation of this population's increasing need for health care, the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) and American Geriatrics Society have constructed a best practices guideline for preoperative geriatric assessment.²³ The guideline is a comprehensive compilation of current methods of assessment and recommendations for improving perioperative care to be used as a general guide in conjunction with clinical judgment. However, the current guideline is an extensive tool that would require considerable time for administration and every component may not be necessary for patients undergoing specific types of operations. Our retrospective study sought to identify which geriatric assessment and clinical variables included in our current preoperative evaluation are significantly associated with postoperative complications or increased need for postoperative support. The identification of predictors of outcome could then help us refine and improve our preoperative assessment to create an optimal focused comprehensive geriatric

assessment for our population of patients undergoing gastrectomy for adenocarcinoma, many of whom are treated with preoperative therapy.

In a previous prospective study of 111 patients undergoing abdominal cancer surgery, we administered an extensive battery of surveys and identified variables associated with discharge to a nursing home and longer hospital stays.⁴ The heterogeneous cohort of surgical procedures represented in that study, however, likely limited our ability to distinguish variables associated with postoperative complications. Our current study attempted to address this limitation by focusing on a single cancer--gastric or gastroesophageal adenocarcinoma--and operation type--gastrectomy. This approach allowed us to identify associations between major morbidity and geriatric assessment variables, specifically pain scores, polypharmacy, weight loss, and ECOG performance status.

As there are considerable disparities in the epidemiology, diagnosis, treatment, and outcome for gastric cancer between Eastern and Western populations, Western studies of geriatric assessment may be more relevant to our current study. The only other study of geriatric assessment prior to gastrectomy in a Western population is from the Netherlands. To explore potential associations with mortality, researchers administered the Groningen Frailty Indicator survey to 125 patients undergoing curative-intent gastrectomy.²⁴ They observed that the postoperative mortality rate was 27% for patients with frailty index ≥ 3 , compared to 6% for patients with an index < 3 . A higher frailty index was also associated with major morbidity (Clavien-Dindo class $\geq III$), but not with length of hospital stay.

Enough studies of geriatric assessment in surgical oncology have been performed to allow for a recent systematic review.¹⁰ While this review included many types of cancer surgery and did not identify any reliable predictors of mortality, it did find that several tools were predictive of postoperative complications and discharge to a nonhome institution. As there have been few randomized trials of geriatric assessment, future reviews will be critical in efforts to streamline assessment and incorporate guidelines into standard clinical practice.²⁵

Considerable diversity exists in the various frailty and geriatric assessment tools reported among these studies. Although guidelines exist for a comprehensive geriatric assessment tool through the American College of Surgeons, it is unclear if the entire tool should be administered to all patients and global scores have not been constructed similar to scores with general frailty scales such as the Edmonton Frail Scale and Groningen Frailty Indicator.^{23, 24, 26–29} Many assessments also combine laboratory and physical testing with survey administration, which adds to the complexity of administration and generating a global assessment score.

Our study has several limitations. Its retrospective nature limited our ability to perform complete assessment in all patients. Our geriatric assessment methods, though progressive at the start of the study period in 2005, are now relatively crude in comparison to the guidelines published in 2012.²³ Nonetheless, a thorough review of our experience has allowed us to identify important areas for more focused assessment and to incorporate many aspects of the new guidelines into our clinical assessments. Another potential limitation is MD Anderson's institutional preference for preoperative chemotherapy and chemoradiotherapy. Although it

is consistent with National Comprehensive Cancer Network Guidelines, this practice may affect the generalizability of our findings to institutions that prefer an upfront surgical approach to gastric cancer.³⁰ Lastly, despite limiting our study to a single malignancy and operation type, the limitation of heterogeneity still exists with respect to surgeon variation in technique and extent of lymphadenectomy.

Clearly, more research is needed from high-volume centers and population-based collaborative groups. Our results are consistent with those of a study of the NSQIP database, in which the 30-day mortality rate for patients treated with total gastrectomy was 5%, and age > 70 years was significantly associated with mortality.¹⁴ Similarly, a recent multi-institutional study from the U.S. Gastric Cancer Collaborative reported 90-day mortality rates of 20% in octogenarians vs 8% in patients younger than 80 years, demonstrating the importance of measuring longer-term outcomes and keeping in mind the increased potential for complications and death in older patients.³¹ In another recent study of the NSQIP database, which compared gastrectomy and esophagectomy for gastric cardia cancer, the authors noted that postoperative morbidity and mortality did not differ between the two surgical approaches; nonetheless, these results highlight the lack of attention given to risk classification and regionalization with gastrectomy, compared with other high-risk surgical procedures.^{15, 32}

Remarkably few studies have focused on frailty and geriatric assessment of patients undergoing gastrectomy in non-Asian populations;³³ ours is the largest study of geriatric assessment in a U.S. population undergoing gastrectomy. Despite its relatively crude geriatric assessment methods, our study has identified several areas for focused assessment in future research efforts. First, ECOG performance status was predictive of major morbidity, readmission, and length of hospital stay. This finding reflects the physical stress of surgery; thus, we plan to incorporate methods of physical assessment such as hand-grip strength and the timed up-and-go test into our future preoperative consultation visits. Second, pain was also associated with major morbidity and may limit a patient's ability to stay active prior to surgery. Many of our patients received preoperative chemotherapy or chemoradiotherapy in accordance with National Comprehensive Cancer Network guidelines; we found an association between such treatment and shorter hospital stays.³⁰ Although it may seem counterintuitive to think of chemotherapy or chemoradiotherapy as a path to performance status improvement, we are currently assessing how preoperative treatment affects the functional status of our patients preparing for surgery. The time period associated with preoperative treatment could offer an excellent window for methods of intervention such as prehabilitation.

Our study concluded that ECOG performance status was the main modifiable variable associated with gastrectomy outcome. Although gastrectomy for cancer is a relatively infrequent procedure in the U.S., its associated morbidity, readmission rates, and long hospital stays justify future research efforts into geriatric assessment and intervention. As national guidelines support preoperative chemotherapy and chemoradiotherapy prior to gastrectomy, future studies of prehabilitation during this time may further improve postoperative complications and mitigate patients' need for additional support resources.

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Table 1

Demographic, clinical, and geriatric assessment variables and outcomes of 279 patients who underwent gastrectomy for gastric or gastroesophageal adenocarcinoma.

Demographic Variables	N	%
Sex		
Female	121	43.4
Male	158	56.6
Age		
<55	85	30.5
55–74	142	50.9
75	52	18.6
Race		
Caucasian	139	51.3
African American	27	9.9
Hispanic	60	22.1
Asian	39	14.4
Other	6	2.2
Marital status		
Married	219	78.8
Other	59	21.2
Clinical Variables		
Gastroesophageal junction involved		
No	234	83.9
Yes	45	16.1
Histological grade		
Moderately differentiated	60	22.5
Poorly differentiated	207	77.5
Signet ring cells on histological examination		
Present	150	53.8
Absent	129	46.2
Endoscopic ultrasound T stage		
0–2	75	33.5
3–4	149	66.5

Demographic Variables	N	%
Endoscopic ultrasound N stage		
0	136	60.2
1–2	90	39.8
Preoperative treatment		
No therapy	101	36.2
Chemotherapy	62	22.2
Chemoradiotherapy	116	41.6
Surgery type		
Subtotal Gastrectomy	146	52.3
Total Gastrectomy	133	47.7
Lymph node dissection stages		
D1	56	20.1
D1+/D2	223	79.9
Major concurrent surgery		
Yes	105	38.3
No	169	61.7
Comprehensive Geriatric Assessment Components		
Falls		
No history of falls within last month	199	98.5
History of falls within last month	3	1.5
Pain		
No pain (score = 0)	231	83.4
Any pain (score = 1)	46	16.6
ECOG^a performance status		
0	188	70.7
1	67	25.2
2	10	3.8
3	1	0.4
ASA^b score		
< 3	54	24.6
3	166	75.5
Assistive device use		

Demographic Variables	N	%
No	173	97.2
Yes	5	2.8
Charlson Comorbidity Index		
< 4	91	32.6
4	188	67.4
Polypharmacy		
No	222	79.9
Yes	56	20.1
Weight loss in past 6 months 10% of body weight		
Absent	248	96.5
Present	9	3.5
Albumin		
3.3 g/dL	15	5.5
>3.3 g/dL	256	94.5
Outcomes	N	%
Discharge to nursing home		
No	271	97.1
Yes	8	2.9
Readmission within 30 days of surgery		
No	242	86.7
Yes	37	13.3
90-day morbidity		
Absent	110	39.4
Present	169	60.6
90-day major morbidity (Clavien-Dindo class III or IV)		
Absent	212	76.0
Present	67	24.0
90-day mortality		
No	275	98.6
Yes	4	1.4
Length of postoperative hospital stay		

Demographic Variables	N	%
< 14 Days	173	62.0
14 Days	106	38.0

^aEastern Cooperative Oncology Group,

^bASA, American Society of Anesthesiologists

Table 2

Multivariate analysis of variables associated with postoperative major morbidity (Clavien-Dindo class III or IV) in 279 patients who underwent gastrectomy for gastric or gastroesophageal adenocarcinoma.

Variables	Odds Ratio (95% CI ^a)	P Value
Involvement of gastroesophageal junction	2.52 (1.09–5.82)	0.03
Major concurrent procedure	3.18 (1.61–6.31)	<0.01
Pain score > 0	3.76 (1.62–8.74)	<0.01
ECOG ^b performance status 1	2.30 (1.16–4.58)	0.02
Weight loss within 6 months 10%	11.21 (2.16–58.24)	<0.01
Polypharmacy	2.36 (1.08–5.17)	0.03

^a confidence interval,

^b Eastern Cooperative Oncology Group

Table 3

Multivariate analysis of variables associated with hospital readmission within 30 days in 279 patients who underwent gastrectomy for gastric or gastroesophageal adenocarcinoma.

Variables	Odds Ratio (95% CI ^a)	P value
Endoscopic ultrasound T stage T0, T1, or T2 (vs T3 or T4)	0.29 (0.12–0.7)	<0.01
ECOG ^b performance status 1	3.55 (1.45–8.69)	<0.01

^a confidence interval,

^b Eastern Cooperative Oncology Group

Table 4

Multivariate analysis of variables associated with length of hospital stay 14 days in 279 patients who underwent gastrectomy for gastric or gastroesophageal adenocarcinoma.

Variables	Odds Ratio(95% CI ^a)	P value
Age groups		<0.01
55–74	2.22 (1.16–4.23)	
75	3.93 (1.68–9.22)	
Total gastrectomy (vs subtotal)	3.54 (1.98–6.32)	<0.01
ECOG^b performance status 1	1.81 (1.02–3.23)	0.04
Preoperative treatment		0.02
Preoperative chemotherapy (vs none)	0.33(0.15–0.74)	
Preoperative chemoradiation (vs none)	0.83 (0.45–1.53)	

^a confidence interval,

^b Eastern Cooperative Oncology Group