

Poor Outcomes of Gastric Cancer Surgery After Admission Through the Emergency Department

Ian Solsky, MD, Patricia Friedmann, MS, Peter Muscarella, MD, and Haejin In, MD, MPH, MBA

Department of Surgery, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY

ABSTRACT

Background. Outcomes after nonelective surgery for gastric cancer (GC) are poorly defined. Our objective was to compare outcomes of patients undergoing nonelective GC surgery after admission through the emergency department (EDSx) with patients receiving elective surgery or surgery after planned admission (non-EDSx) nationally. **Methods.** The Nationwide Inpatient Sample (NIS) database was used to examine patients undergoing GC surgery between 2008 and 2012. Demographics and outcomes were compared between EDSx and non-EDSx. Multivariable logistic regression was used to examine predictors of discharge to home.

Results. Of 9279 patients, 1143 (12%) underwent EDSx. They were more likely to be female (42 vs. 35%), nonwhite (56 vs. 33%), aged ≥ 75 years (40 vs. 26%), in the lowest quartile for household income (31 vs. 25%), have one or more comorbidities (87 vs. 70%), treated at a nonteaching hospital (46 vs. 25%), and have a concomitant diagnosis of obstruction, perforation, or bleeding (30 vs. 6%). They had longer total length of stay (LOS; 16 vs. 9 days), longer median postoperative stays (10 vs. 9 days), higher in-hospital mortality (8 vs. 3%), and were less likely to be discharged home (63 vs. 82%). EDSx was more expensive (\$125,300 vs. \$83,604). EDSx was associated with a lower likelihood of discharge to home (odds ratio 0.52, 95% CI 0.43–0.62).

Conclusions. Nationally, 12% of GC surgeries are performed after emergency department admission, which occurs more frequently in vulnerable populations and results in worse outcomes. Understanding factors leading to increased EDSx and developing strategies to decrease EDSx may improve GC surgery outcomes.

Despite improvement in 5-year gastric cancer (GC) survival in the United States from 15% in 1975–1977 to 29% in 2004–2010, GC management continues to evolve.¹ In the United States, it was estimated that there would be 24,590 new diagnoses and 10,270 deaths in 2015.¹ This high mortality may be related to a failure to detect GC before symptom development, which usually indicates advanced disease and may prompt patients to seek medical attention through the emergency department (ED).

The ED route to surgical treatment is being increasingly scrutinized as emergency abdominal surgery has been recognized as an independent risk factor for death and complications.² Emergent surgery is associated with higher mortality and costs as compared to the same procedures performed electively.³ Studies exploring outcomes for cancer patients who present through the ED report similar poor findings.^{4–10} An analysis of all cancer cases in England between 2006 and 2008 found that every tumor type examined, including gastric, had significantly lower 1-year survival rates for emergency presentations as compared to nonemergency presentations. The magnitude of survival difference ranged between 20 and 40%.¹¹ A single institution study by Vasas et al. showed that emergent GC presentation was associated with increased likelihood of stage IV disease (45 vs. 25.4%, $p < 0.005$), and decreased survival 1 year (48.3 vs. 63.4%, $p < 0.05$) and 2 years after surgery (25 vs. 67.44%, $p < 0.001$).¹² While poor surgical outcomes after ED presentation may be related to advanced intra-abdominal processes prompting emergency intervention, other factors also likely lead to surgical intervention

Presented in part at the 11th Annual Academic Surgical Congress, cosponsored by the Association for Academic Surgeons and the Society of University Surgeons, February 2–4, 2016, in Jacksonville, FL.

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First Received: 13 August 2016;
Published Online: 1 December 2016

I. Solsky, MD
e-mail: isolsky@montefiore.org

after ED admission such as socioeconomic and insurance status. Disparities in cancer care have been well-established.¹³ However, their relationship to ED use for diagnosis and treatment coordination has not.¹⁴ This area deserves closer examination, particularly for GC.

Our study objective was to compare outcomes of patients undergoing nonelective GC surgery after an admission through the ED (EDSx) with patients receiving surgery electively or after planned admission (non-EDSx) using a national data set. Our primary outcome was discharge location. Our study aimed to examine whether route to surgery influences outcomes for GC surgery and to identify areas to improve GC outcomes.

METHODS

Database and Patient Selection

Data were obtained from the National Inpatient Sample (NIS). NIS is the largest publicly available all-payer database designed to yield national estimates of hospital inpatient stays.¹⁵ It is a 20% sample of discharges from community hospitals participating in the Healthcare Cost and Utilization Project, and data are available for over 7 million hospital stays each year.¹⁵ Patients were included in our study if they were diagnosed between January 1, 2008, and December 31, 2012, with GC (ICD-9 codes 151.0–151.9) and if GC surgery was performed during their admission (ICD-9-CM codes 43.5–43.99). Analysis was limited to adults (age ≥ 18) with complete information regarding surgery, admission location and whether they were admitted on an elective or nonelective basis (Fig. 1).

Patient and Facility-Specific Variables

Patient specific covariates included sex, age, race, expected primary payer, median household income for zip code by quartile, and whether the patient had a concomitant diagnosis of obstruction, perforation, or bleeding. Facility-specific covariates included location/teaching status, region, hospital ownership, and bed size based on the number of short-term acute beds in a hospital specific to its location and teaching status (small 1–249, medium 24–449, large 45–450+).

Collection of Outcomes and Statistical Analysis

The primary outcome of interest was patient disposition (discharged to home vs. discharged not to home/died in hospital). Secondary outcomes were total median hospital LOS, median days to surgery, LOS after surgery, total admission cost, complications, and in-hospital mortality.

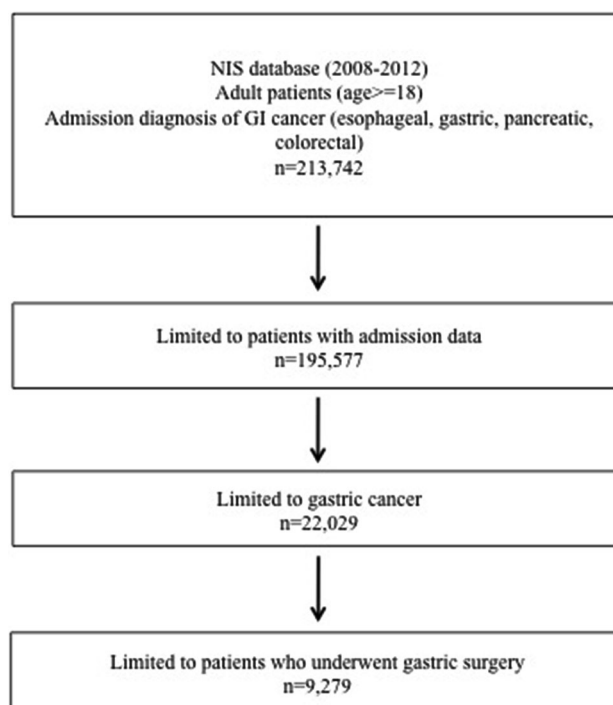


FIG. 1 Inclusion criteria

NIS does not capture events after discharge, so 30- and 60-day mortality could not be calculated. Patient- and hospital-specific variables as outlined above for EDSx and non-EDSx were compared. Categorical variables were compared by the chi-square test. Logistic regression analysis was performed to estimate the odds ratio (OR) of discharge to home for nonelective versus elective surgery. Statistical analyses were performed by SAS 9.3 (SAS Institute, Cary, NC).

RESULTS

Patient Demographics and Hospital Characteristics

Patient demographics and hospital characteristics are summarized in Table 1. Of a total of 9279 patients, 1143 (12%) underwent EDSx. These patients were more likely to be female (42 vs. 35%, $p < 0.01$), nonwhite (56 vs. 33%, $p < 0.01$), elderly ≥ 75 years (40 vs. 26%, $p < 0.01$), in the lowest quartile for median household income (31 vs. 25%, $p < 0.01$), and have one or more comorbidities (87 vs. 70%, $p < 0.01$). They were less likely to have private insurance (20 vs. 38%, $p < 0.01$). They were also more likely to have a concomitant diagnosis of obstruction (4 vs. 1%, $p < 0.01$), perforation (20 vs. 5%, $p < 0.01$), or bleeding (7 vs. 1%, $p < 0.01$). Compared to non-EDSx patients, EDSx patients were less likely to be treated at a large size hospital

TABLE 1 Demographics and hospital characteristics

Characteristic	Variable	Non-EDSx (%) (n = 8136)	EDSx (%) (n = 1143)	<i>p</i>
Sex	Male	65.49	58.36	<0.01
	Female	34.51	41.64	
Race	White	67.12	44.15	<0.01
	Black	13.16	24.88	
	Hispanic	11.87	18.88	
	Asian or Pacific Islander	7.85	12.09	
Age	<55 years	18.87	17.85	<0.01
	55–64 years	24.45	18.99	
	65–74 years	30.24	23.62	
	≥75 years	26.45	39.55	
Expected primary payer	Medicare	53.29	59.66	<0.01
	Medicaid	7.16	15.14	
	Private insurance	37.68	20.13	
	Self-pay	1.87	5.08	
Median household income for patient's zip code (percentile)	0–25	24.62	31.06	<0.01
	26–50	24.25	23.45	
	51–75	23.57	22.92	
	76–100	25.50	20.30	
	Other	2.05	2.27	
No. of comorbidities	0	30.13	13.04	<0.01
	1	37.08	30.36	
	2	20.59	29.40	
	≥3	12.21	27.21	
Concomitant diagnosis	Obstruction	0.43	4.20	<0.01
	Perforation	4.84	19.69	
	Bleeding	0.45	6.65	
	Obstruction, perforation, or bleeding	5.63	30.01	
Hospital bed size	Small	8.63	8.30	<0.01
	Medium	17.11	21.98	
	Large	74.26	69.73	
Hospital location/teaching status	Rural	3.80	4.41	<0.01
	Urban nonteaching	24.74	46.25	
	Urban teaching	71.46	49.34	
Region of hospital	Northeast	23.11	24.85	<0.01
	Midwest	21.37	13.65	
	South	34.12	37.36	
	West	21.40	24.15	
Ownership of hospital	Government, nonfederal	15.90	12.80	<0.01
	Private, nonprofit	76.53	70.08	
	Private, invest-own	7.57	17.12	

EDSx nonelective surgery after admission through emergency department

(70 vs. 74%, $p < 0.01$). They were more likely to be treated at a hospital that is urban nonteaching (46 vs. 25%, $p < 0.01$), located in the South (37 vs. 34%, $p < 0.01$), and privately owned (17 vs. 8%, $p < 0.01$).

Outcomes

Data regarding resource utilization are summarized in Table 2 and outcomes regarding disposition are listed in

TABLE 2 Resource utilization

Characteristic	Non-EDSx (%), (n = 8136)	EDSx (%), (n = 1143)	p
Days of stay	9 (7–14)	16 (11–23)	<0.01
Days to surgery	0 (0–0)	7 (2–8)	<0.01
Days after surgery	9 (7–13)	10 (7–15)	<0.01
Total charges	\$83,603.5 (\$52,752–\$140,817)	\$125,300 (\$77,211–204,804)	<0.01

Data are presented as median (interquartile range)

EDSx nonelective surgery after admission through emergency department

TABLE 3 Outcomes

Characteristic	Variable	Non-EDSx (%), (n = 8136)	EDSx (%), (n = 1143)	p
Disposition	In-hospital mortality	3.17	7.79	<0.01
	Discharged to home	81.81	62.69	<0.01
Complication	Bleeding	2.61	2.36	0.63
	DVT/PE	1.01	1.40	0.22
	Cardiac	5.40	2.97	<0.01
	CNS	0.25	0.61	0.03
	Pulmonary	4.28	3.76	0.42
	Sepsis	0.05	0.17	0.12
	Wound infection	5.52	6.12	0.40
	Surgical complication	4.40	5.16	0.24
	Any complication (not death)	19.06	17.24	0.14
	Any complication (including death)	20.94	22.75	0.16

EDSx nonelective surgery after admission through emergency department, DVT/PE deep-vein thrombosis/pulmonary embolism, CNS central nervous system

Table 3. EDSx patients had a longer total LOS (16 vs. 9 days, $p < 0.01$), number of days to surgery (7 vs. 0, $p < 0.01$), and LOS after surgery (10 vs. 9, $p < 0.01$). EDSx was more expensive (\$125,300 vs. \$83,604, $p < 0.01$). EDSx patients were less likely to be discharged to home (63 vs. 82%, $p < 0.01$). EDSx patients had greater than double the mortality rate compared to non-EDSx (8 vs. 3%, $p < 0.01$). Complication rates were similar among survivors.

Multivariable Analysis of Predictors Associated with Being Discharged to Home

Using a multivariable logistic regression model, we evaluated independent predictors of discharge to home (Table 4). EDSx was associated with nearly a 50% reduction in the likelihood of being discharged to home (OR 0.52, 95% confidence interval [CI] 0.43–0.62). Older age (age ≥ 75 years, OR 0.16, 95% CI 0.12–0.21), increasing number of comorbidities (1 comorbidity, OR 0.64, 95% CI 0.54–0.77; 2 comorbidities, OR 0.40, 95% CI 0.33–0.48; ≥ 3 comorbidities, OR 0.24, 95% CI 0.20–0.29), Medicare insurance (OR 0.54, 95% CI 0.44–0.66), and lowest quartile of median household income (OR 0.75,

95% CI 0.44–1.27) were all associated with lower odds of discharge to home. Patients treated in a small hospital (OR 0.73, 95% CI 0.59–0.9) or a private, investor owned hospital (OR 0.71, 95% CI 0.57–0.87) had lower odds of discharge to home. Patients with a concomitant diagnosis of obstruction (OR 0.25, 95% CI 0.15–0.43) and who had any complication during hospitalization (OR 0.43, 95% CI 0.37–0.50) also had lower odds of discharge to home. Interestingly, patients of black (OR 1.26, 95% CI 1.04–1.51) and Hispanic racial ethnicity (OR 1.76, 95% CI 1.41–2.19) were more likely to be discharged to home than white patients.

DISCUSSION

Our findings show that 12% of GC surgeries occur during hospitalization after ED presentation. Similarly, Vasas et al. reported 14% of GC patients at a single center presented as emergencies.¹² This high proportion of emergencies is troubling given that such presentations are associated with worse outcomes, including a doubling of in-hospital mortality, prolonged LOS after surgery, and higher costs.

TABLE 4 Multivariable analysis of factors associated with being discharged to home (*c* statistic = 0.80)

Characteristic	Variable	OR (95% CI)	<i>p</i>
Admission	Non-ED admit	Ref.	<0.01
	ED admit	0.52 (0.43–0.62)	
Age	<55 years	Ref.	<0.01
	55–64 years	0.64 (0.48–0.85)	
	65–74 years	0.36 (0.27–0.48)	
	≥75 years	0.16 (0.12–0.21)	
Gender	Female	Ref.	0.43
	Male	0.95 (0.84–1.08)	
Race	White	Ref.	<0.01
	Black	1.26 (1.04–1.51)	
	Hispanic	1.76 (1.41–2.19)	
	Asian or Pacific Islander	1.16 (0.91–1.48)	
No. of comorbidities	0	Ref.	<0.01
	1	0.64 (0.54–0.77)	
	2	0.40 (0.33–0.48)	
	≥3	0.24 (0.20–0.29)	
Expected primary payer	Private insurance	Ref.	<0.01
	Medicare	0.54 (0.44–0.66)	
	Medicaid	0.76 (0.56–1.05)	
	Self-pay	0.75 (0.44–1.27)	
	Other	0.69 (0.43–1.09)	
Median household income for patient's zip code (percentile)	76th–100th	Ref.	0.04
	0–25th	0.747 (0.44–1.27)	
	26th–50th	0.88 (0.74–1.06)	
	51st–75th	0.85 (0.71–1.02)	
	Other	0.75 (0.46–1.23)	
Hospital bed size	Large	Ref.	<0.01
	Small	0.73 (0.59–0.9)	
	Medium	0.86 (0.73–1.00)	
Hospital location/teaching status	Urban teaching	Ref.	0.30
	Rural	0.85 (0.62–1.15)	
	Urban nonteaching	0.91 (0.78–1.05)	
Hospital region	Northeast	Ref.	<0.01
	Midwest	1.20 (0.98–1.47)	
	South	1.45 (1.22–1.72)	
	West	1.25 (1.03–1.51)	
Ownership of hospital	Private, nonprofit	Ref.	<0.01
	Government, nonfederal	1.03 (0.85–1.25)	
	Private, invest-own	0.71 (0.57–0.87)	
Concomitant diagnosis	Other	Ref.	<0.01
	Obstruction	0.25 (0.15–0.43)	
	Perforation	0.98 (0.78–1.23)	
	Bleeding	0.69 (0.42–1.15)	
Complication	No complication	Ref.	<0.01
	Any complication	0.43 (0.37–0.50)	

OR odds ratio, CI confidence interval, ED emergency department

Our study found that the EDSx group was more likely to have a concomitant diagnosis of bleeding, perforation, or obstruction (30.0 vs. 5.6%). These presentations portend poorly for outcomes. A study of patients with disseminated cancer undergoing emergency surgery for perforation or obstruction found a 30-day mortality rate of 18–34%, with 41–67% having complications and 52–60% being discharged to an institution.¹⁶ Practically a fifth to a third of these patients died within 30 days and the debilitating nature of emergency cancer surgery was highlighted by the fact that over half of them could not be discharged home. This is consistent with our findings that show almost 40% of patients undergoing EDSx were unable to be discharged home.

Discharge location was an outcome of primary interest as it is a rich patient-centered variable that provides a sense of patients' functional status. Discharge to a nonhome facility suggests an impairment of function necessary to live independently.¹⁷ In a study by Berian et al., discharge to nonhome institutions was considered part of their definition of loss of independence, which was associated with postoperative readmissions and death.¹⁸ This has significance to our study in which long-term mortality or rehospitalization rates could not be explored. The study by Berian et al. gives evidence to suggest that the ED group with its higher percentage of nonhome discharges may also have worse long-term outcomes than their non-ED counterparts.

Our study also gives insight into the types of patients presenting as emergencies. With greater percentages of ED-presenting patients being nonwhite, elderly, female, of lower socioeconomic status, and having comorbidities, our study highlights that EDSx patients tend to have characteristics associated with vulnerable populations. Other studies have also pointed to age, gender, socioeconomic status, and comorbidities as variables associated with cancer patients presenting emergently.^{19–23} Given that our study shows that EDSx patients tend to have characteristics of at-risk individuals, our findings highlight that the reason for worse outcomes in these patients is multifactorial and may further have to do with their characteristics as with their route to diagnosis. These patients may have difficulty accessing care or have low health literacy, which could explain their reliance on the ED. Furthermore, it has been shown that patients with rectal, breast, or lung cancer from socioeconomically deprived areas are less likely to receive recommended procedures such as anterior resection, breast-conserving surgery, and lung resection, respectively, which may also hold true for GC patients.²⁰

A greater proportion of EDSx was also noted in small- and medium-size hospitals and urban nonteaching hospitals. Urgency may result in presentation to the nearest ED and these may be located in lower volume, nonteaching

hospitals. One study on national outcomes for GC patients undergoing resection showed that higher annual surgical volume is predictive of lower in-hospital mortality.²⁴ Nevertheless, the relationship between teaching status and outcomes remains debatable.^{25,26} The increased proportion of EDSx seen in small- and medium-size hospitals may suggest a lack of complex cancer care coordination or a tendency of surgeons in nonteaching facilities to operate without attempts to coordinate neoadjuvant therapy. This is concerning because most GC patients in the United States present with later stage cancers for which preoperative systemic chemotherapy may offer benefit.^{27,28} Interestingly, we observed that the EDSx group had similar rates of complications but higher in-hospital mortality compared with the non-EDSx group. While this finding may be due to the EDSx group being comprised of sicker patients, it is also possible that it could be the consequence of the EDSx group receiving suboptimal postoperative management at facilities with individuals less experienced in managing and anticipating GC complications. This “failure to rescue” patients from complications is a reasonable explanation for our results that is supported by a study by Ghaferi et al., in which the rates of “failure to rescue” after high-risk cancer operations including gastrectomy were found to be strongly associated with hospital volume whereas the percentages of postoperative complications were not.²⁹

GC is often a silent disease. Patients may remain asymptomatic until advanced stages. Dyspepsia and alarm symptoms such as weight loss, dysphagia, and gastrointestinal bleeding are insensitive predictors of malignancy and are inconsistently used to select patients for endoscopy.³⁰ Countries such as Korea and Japan have national screening programs resulting in discovery of over 50% of their GC at early stages.^{31,32} Patients in countries without screening programs are more likely to present with symptoms, often resulting in ED visits. Other countries may benefit from the development of programs to screen for GC before symptom development.³³ In low-incidence regions like the United States, this may be feasible through identifying high-risk groups that may benefit from selective screening.

Improving health care access for vulnerable populations is critical. Many advanced cancer patients who present via the ED may be utilizing it inappropriately for their primary care needs. Such patients may benefit from health care management programs that could identify high-risk patients and facilitate earlier diagnostic assessments to identify cancers in a nonemergent setting.³⁴ Programs targeting vulnerable populations to encourage primary care use and provide education about cancer warning signs may help prevent diagnostic and treatment delays.^{35,36}

While we found racial minorities were more likely to present in the ED, they were also more likely to be

discharged home. Although discharge to home is generally considered a positive outcome, given that black and Hispanic patients were more likely to be admitted through the ED and more likely to be discharged home, it is questionable in this case that being discharged to home is a positive outcome given that prior studies have reported worse cancer outcomes in minorities.^{37–39} This finding may suggest that minority groups are less likely to receive additional posthospital resources, such as subacute rehabilitation, possibly due to lack of knowledge of discharge options, cultural beliefs, or other health care–related reasons. While the literature currently debates the extent to which racial and ethnic variation influences patients' discharge locations, discharge location should continue to be monitored and assessed with other outcomes.⁴⁰ The appropriate utilization of rehabilitation facilities after GC resection in vulnerable populations may result in decreased hospital LOS, decreased overall health care costs, decreased readmission, and improved patient satisfaction and outcomes.

Although this study is an important step in elucidating the national impact of ED presentation on surgical outcomes for GC, it has several limitations. A major limitation is that NIS data do not contain cancer stage information. Nonetheless, as shown in a study by Vasas et al. advanced disease alone may not fully explain worse outcomes in patients presenting via the ED.¹² Their study reported that GC patients presenting as emergencies had worse outcomes when compared stage for stage.¹² Additionally, although emergency surgery within 24 h is rare—in our study, median time to surgery in the EDSx group was 7 days—it is more likely when GC manifests with bleeding, perforation, or obstruction.¹² Such emergencies can complicate the oncologic integrity of the operation; the diagnosis of GC may not be confirmed until the postoperative pathologic examination of the specimen and the emergent nature of the surgery may require the surgical focus to be on stabilization and not on oncologic principles. This suggests that emergency presentation could be a useful independent prognostic factor for GC patients.¹²

In addition to long-term mortality and readmission, the NIS database also does not provide information on receipt of neoadjuvant chemotherapy and whether surgery was performed for curative or palliative intent.⁴¹ This information would further help in determining patient prognosis and could assist with perioperative decision making. Also, given that this study only included patients who underwent surgery, it does not capture the entire population of GC patients who actually present as emergencies, which emphasizes the magnitude of this problem and the need for further research.

CONCLUSIONS

A considerable number of GC surgeries are performed after admission through the ED and have worse outcomes than elective or planned admission surgeries. These patients tend to be from vulnerable populations and have greater probabilities of undergoing surgery in smaller, nonteaching hospitals. Suggestions to address these findings include development of targeted screening programs, improved access to health care services for vulnerable populations, and improved patient and provider education regarding GC diagnosis and management.

DISCLOSURE The authors declare no conflict of interest.

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