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Journal

Journal of Surgical Oncology, 126(4)

ISSN

8756-0437

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Publication Date

2022-09-01

DOI

10.1002/jso.26972

Peer reviewed

HHS Public Access
Author manuscript
J Surg Oncol. Author manuscript; available in PMC 2023 March 21.

Published in final edited form as:
J Surg Oncol. 2022 September ; 126(4): 649–657. doi:10.1002/jso.26972.

Diagnostic laparoscopy is underutilized in the staging of gastric adenocarcinoma regardless of hospital type: An US safety net collaborative analysis

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Abstract

Background: Diagnostic laparoscopy (DL) is a key component of staging for locally advanced gastric adenocarcinoma (GA). We hypothesized that utilization of DL varied between safety net (SNH) and affiliated tertiary referral centers (TRCs).

Methods: Patients diagnosed with primary GA eligible for DL were identified from the US Safety Net Collaborative database (2012–2014). Clinicopathologic factors were analyzed for association with use of DL and findings on DL. Overall survival (OS) was analyzed by Kaplan–Meier method.

Results: Among 233 eligible patients, 69 (30%) received DL, of which 24 (35%) were positive for metastatic disease. Forty percent of eligible SNH patients underwent DL compared to 21.5% at TRCs. Lack of insurance was significantly associated with decreased use of DL (OR 0.48, $p <$

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CONFLICT OF INTEREST
The authors declare no conflict of interest.

ETHICS STATEMENT
This study was approved by the institutional review board at each participating institution, a waiver of consent was granted, and all data was deidentified.

0.01), while African American (OR 6.87, $p = 0.02$) and Asian race (OR 3.12, $p \leq 0.01$), signet ring cells on biopsy (OR 3.14, $p < 0.01$), and distal tumors (OR 1.62, $p < 0.01$) were associated with increased use. Median OS of patients with a negative DL was better than those without DL or a positive DL (not reached vs. 32 vs. 12 months, $p < 0.005$, Figure 1).

Conclusions: Results from DL are a strong predictor of OS in GA; however, the procedure is underutilized. Patients from racial minority groups were more likely to undergo DL, which likely accounts for higher DL rates among SNH patients.

Keywords

diagnostic laparoscopy; disparities; gastric adenocarcinoma; safety net hospital

1 | INTRODUCTION

As of 2020, gastric cancer (GC) was the fourth most common type of cancer in the world and the fourth most common cancer death worldwide. In the United States, there was an estimated 27 600 new cases of GC in 2020, with a 5-year survival rate of 32% based on 2013–2017 American Cancer Society data.[1] Although many patients with GC in the United States are diagnosed with advanced disease, for those without distant metastases, surgery is the mainstay of treatment.[2–4] For nonmetastatic patients with clinical stage ≥T1b primary tumors and/or clinically positive nodes, the National Comprehensive Cancer Network (NCCN) guidelines recommend the use of pretreatment diagnostic laparoscopy (DL) with peritoneal washing and cytology.[5] Because it can identify stage IV peritoneal disease, the results of DL play a crucial role in determining the primary modality of treatment, the intent of surgery, and the prognosis for these patients.[6–8] Despite its utility, and the NCCN recommendations, DL is underutilized in GC patients, with prior studies revealing that only 7.9%–13% of patients receiving any surgery had an initial DL.[9,10]

Previous studies have demonstrated variable usage and positivity of DL that has been linked to various clinicopathologic factors.[3,6,9,10] Two large studies in the last decade have linked non-Hispanic white race/ethnicity, treatment in the Northeastern United States, and proximal gastric tumors (those at the gastroesophageal junction and cardia) to greater usage of DL.[10,11] Other factors including treatment at an national cancer institute-designated cancer center, younger age, and lack of comorbidities have been significantly associated with increased utilization of DL.[9,10] These disparities in DL usage mirror some of the established disparities in overall survival (OS) outcomes in GC, with nonwhite race/ethnicity and increased age being predictive of increased GC incidence and mortality.[12] These prognostic indicators, in addition to other established factors and the increased incidence of GC abroad, make immigrant populations particularly vulnerable to adverse outcomes.[12–14] Urban safety net hospitals (SNHs) deliver a significant level of care to uninsured and Medicaid patients and serve large immigrant populations. In this study, we aimed to (1) assess for differences in the use of DL in SNH compared to their affiliated tertiary care centers, (2) identify clinicopathologic factors associated with receipt of DL and identification of peritoneal disease on DL, and (3) assess the prognostic value of DL for OS.

2 | METHODS

2.1 | Database assembly

This study was conducted as a retrospective study using the United States Safety Net Collaborative (USSNC) GC database. The USSNC is a collaboration between surgical oncologists at major SNHs across the country and their sister academic centers: Bellevue Hospital Center and New York University Langone Health, Grady Memorial Hospital and Emory University, Jackson Memorial Hospital and University of Miami, Parkland Memorial Hospital and University of Texas Southwestern, John H. Stroger Jr. Hospital of Cook County and University of Illinois at Chicago. The database received Institutional Review Board (IRB) approval from all hospital centers involved before beginning data collection. Patients diagnosed with locally advanced primary gastric adenocarcinoma from January 1, 2012 to December 31, 2014 were considered eligible for DL. This was defined as patients with a clinical T2 or greater or node positive GC based on preoperative endoscopic ultrasound (EUS) or cross-sectional imaging. Patients with evidence of metastatic disease on imaging (355 patients), clinically node negative patients diagnosed at an early (less than T2) stage (101 patients), patients with recurrent cancer (45 patients), and patients with inadequate clinical staging or DL data (68 patients) were excluded. Demographic, baseline health, and socioeconomic data were collected in addition to specific diagnosis, treatment, and surgery information. Additional clinicopathological factors including age, gender, race/ethnicity, insurance, EUS staging, and tumor characteristics (differentiation, Lauren classification, presence of signet cells, and location) were assessed along with OS. Tumors located at the gastroesophageal junction or in the cardia were labeled “proximal” tumors and tumors in the body and antrum were labeled “distal” tumors. Patients were categorized into either “SNH” or “tertiary referral center” (TRC) cohorts based on where they received their care. Primary outcome was use of DL. Secondary outcomes were (1) OS, defined as time in months from diagnosis to last follow-up or death, and (2) presence of peritoneal disease on laparoscopy, including patients who only had disease identified on peritoneal cytology.

2.2 | Data analysis

A χ^2 test was used to compare categorical variables and a Student’s *t*-test was used to evaluate continuous variables. Multivariable analysis was performed using simple multivariable logistic regression, excluding missing values, with clustering at the hospital level to assess the relationship between clinicopathologic factors and primary outcomes. Kaplan–Meier analysis and plots were used to illustrate the impact of specific factors on OS. Statistical significance was defined as $p < 0.05$. Statistical analysis was performed using SPSS 25.0 (IBM Inc.) except for the multivariable logistic regression which was run in Stata (version 14.2).

3 | RESULTS

3.1 | Clinicopathologic characteristics associated with utilization of DL

Of the 802 GC patients included in the database, 233 met inclusion criteria for this study. Of the 233 patients, 130 (56%) were treated at TRC and 103 (44%) were treated at SNH. Patients treated at SNH were more likely to be uninsured (42% vs. 6% TRC, $p < 0.001$), Hispanic (37% vs. 14% TRC, $p < 0.001$), and nonwhite race (48% vs. 35% TRC, $p = 0.030$) (Table 1). Of the total 802 patients, there were similar rates of patients presenting with stage IV disease (47% at SNH vs. 40% at TRC, $p = 0.076$), and there was no significant difference in clinical stage distribution between SNH and TRC for the patients eligible for DL. Thirty percent of eligible patients (69/233) underwent DL, of which 24 (35%) were found to have peritoneal metastases either on gross visual inspection or on cytology. The demographic and clinicopathologic characteristics of the entire cohort and the subgroups who did and did not undergo DL are detailed in Table 2. There was no statistical difference between the groups in regard to median patient age, EUS T/N staging, and Lauren classification on biopsy. Patients who received DL were more likely to be treated at SNHs, to have a distal tumor, poorly differentiated cancer, and signet cells on biopsy (Table 2). On multivariable analysis, race/ethnicity was one of the factors significantly associated with utilization of DL; specifically, African American/Black and Asian patients were more likely to undergo DL (Table 3) compared to non-Hispanic Whites. In addition, patients with signet ring cells on initial biopsy and distal tumors were more likely to undergo DL, while uninsured patients were less likely to undergo DL.

Of the patients in our database with locally advanced GC, 68 were diagnosed in 2012, 82 were diagnosed in 2013, and 83 were diagnosed in 2014. The utilization of DL varied over time but without any specific trend, with 22% utilization in 2012, 38% utilization in 2013, and 28% in 2014.

3.2 | Factors associated with peritoneal disease or positive cytology on DL

Among the 69 patients undergoing DL, only diffuse/mixed classification was significantly associated with identification of peritoneal disease on DL (45% vs. intestinal 10%, $p = 0.048$); however, there was a trend toward lower positivity rate for well/moderately differentiated compared to poorly differentiated tumors (0% vs. 38%, $p = 0.124$). There was no significant association between race/ethnicity and likelihood of positive laparoscopy with 18% of Asian, 48% of Hispanic White, 45% of non-Hispanic Whites, and 35% of African American patients having a positive laparoscopy ($p = 0.248$). Of the 24 patients with a positive DL, 19 (79%) patients were positive for metastatic disease on both gross laparoscopy and peritoneal washing on cytology. Two (8%) patients were positive only on cytology/peritoneal washing. Three patients were laparoscopy positive and washing negative indicating a false negative rate of washing of 13%.

3.3 | DL use in cT2N0 patients

Of the 34 cT2N0 patients included in the study, only 9 (26%) underwent DL, of which 3 (33%) were positive. The three patients with positive DL had metastatic disease on both gross laparoscopy and on peritoneal washing cytology. Demographically, the three patients with positive DL were diverse; two of the patients were male, two were treated at SNH, one was Hispanic White, one was Hispanic African American, and one was non-Hispanic White. Full biopsy pathologic data was not available for any of the patients, but all available data indicates these were distal tumors, diffuse type, and poorly differentiated. None of the patients with a positive DL received any surgery as a part of their treatment, while two received chemotherapy, and the third was not treated at the study hospital, so data on their treatment and outcomes was unavailable. These patients had an OS of 9 and 17 months, respectively.

3.4 | Impact of laparoscopy on management strategies

For the patients with locally advanced disease, the majority (68%) received surgery as their primary treatment modality, however, for patients with positive DL, only 21% received surgery as any part of their treatment (Table 4). Surgeries recorded in Table 4 are not only curative intent surgeries but also include bypasses, feeding tubes, and other palliative surgeries. These patients with positive DL undergoing surgery either received it as palliative therapy (one patient) or as a component of a multimodal treatment who underwent curative resection (Table 4). Patients with positive DL were more likely to receive chemotherapy as their primary treatment modality (Table 4).

3.5 | Factors affecting survival

There was no significant difference in median OS between hospital types (SNH 29 months 95% confidence interval [CI] [20, 39 months] vs. TRC 41 months 95% CI [15, 66 months], $p = 0.226$). DL adequately stratified all patients in distinct risk categories: patients who had a negative DL had a significantly better median OS than those who did not undergo DL or had a positive DL (not reached vs. 32 vs. 12 months, $p < 0.005$; Figure 1). Patients who underwent surgery had better median OS than those who did not (76 vs. 13 months, $p < 0.001$). For patients with positive DL, there was not a significant difference in median OS between those who received surgery and those who did not (12 vs. 10 months). Patients who received neoadjuvant therapy trended toward a better OS than those who did not (not reached vs. 58 months, $p = 0.115$).

4 | DISCUSSION

This study demonstrated that DL is underutilized at both SNHs and TRCs, with only 22% of eligible TRC patients receiving DL and 40% of eligible SNH patients receiving DL. This underutilization is consistent with previous studies conducted on the Surveillance, Epidemiology and End Results (SEER)-Medicare database which demonstrated that, of patients receiving surgery for treatment of their cancer, only 7.9% (from 1998 to 2005) and 13% (from 2004 to 2013) received DL.[9,10] Both of these studies demonstrated an increase in DL utilization among patients aged 65 years or older over time, with percent utilization starting from <6% in 1998 to 22.2% in 2013. Our study included 3 years of data, making it difficult to establish a trend, but notably the utilization rates were at or above the utilization rate established by previous studies. These changes in utilization could be attributed to changes in training over the past few decades encouraging evidence-based practice.

One potential explanation for underutilization is the slight variability in different national guidelines. The current NCCN guidelines recommend DL for patients with clinical stage T1b or greater without evidence of metastases, however, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) and the German S3 guidelines both only recommend DL for clinical stages T3 or T4 while recommending those with stage T2 go directly to surgery.[5,15,16] There has also been a change in the NCCN guidelines over the study period. The 2012 and 2013 NCCN guidelines state that patients with clinical T3 disease or node positive disease should be *considered* for laparoscopic staging with peritoneal washing, while concurrently presenting a workflow indicating DL should be considered in locoregional (>cT1a) nonmetastatic disease. In 2014, the NCCN guidelines were updated to *recommend* DL in patients with clinical T1b and above disease when considering chemoradiation or surgery, but not for palliative surgery. Importantly, the NCCN guidelines began to specifically state that one should consider DL for stage T1b+ starting in 2014, so to stay consistent with recent literature and account for guidelines changing during the study period, we excluded data on clinical stage T1b from this study.[7,10] Our study demonstrated that only 26% of T2N0 patients received DL which is slightly lower than the overall population of the study (30%). Of the nine patients who received DL, three were positive, and none of those three patients received any surgery as part of their treatment. Patients with stage T2N0 typically receive surgery as their primary treatment modality with the role of adjuvant therapy continually debated, indicating that the positive DL result of our three patients likely altered their treatment.[17] The positivity rate of 33% likely also reflects a selection bias in which cT2N0 patients were selected to undergo DL. Previous studies have demonstrated the value of DL for influencing management and we present in Table 4 further evidence of this impact.[18] Additionally, 8% of patients demonstrated metastatic disease only on peritoneal washing, which further supports the use of DL as a separate staging procedure as it may alter further management and prognosis. These results argue for increased use of DL for all patients with locally advanced GC, including those with stage cT2N0 GC.

This study assessed for factors associated with the utilization of DL and found that African American or Asian race, presence of signet ring cells on biopsy, and distal tumor location was associated with increased use of DL, while being uninsured was associated with decreased use of DL. These findings are contrary to previous studies, which found that non-Hispanic white race/ethnicity was associated with increased use of DL.[9,10] However, both of these studies were conducted on the SEER-Medicare database including patients only over 65 years old, older than the median age of our study cohort and therefore could be less applicable to this data set and less representative of what is occurring at some of our public SNHs. Interestingly, the multivariable regression also demonstrated that uninsured patients were less likely to receive DL, which *is* consistent with previous studies[10] Also consistent with previous studies, patients treated at SNH were more likely to be younger, be of a race/ethnicity other than non-Hispanic white, be a non-US citizen, and not have a primary care physician.[19,20] Therefore, the demographic characteristics found to be associated with DL likely contribute to the finding that treatment at SNH is associated with receipt of DL on univariable, but not multivariable analysis.

One potential explanation for this finding is that patients who present to SNH are more likely to present in advanced stages.[19,20] Surgeons working at these institutions may therefore expect these patients to present at a more advanced disease, which, if not captured on imaging, they seek out using DL before deciding on a treatment plan. Similarly, surgeons may perceive that patients from certain racial or ethnic minority groups may be more likely to present with advanced disease and seek it out with a DL. Another potential explanation for our findings is that insured patients and non-Hispanic White patients are more likely to be seen at tertiary care centers where financial incentives and associated conscious or unconscious bias could lead to patients going straight to major gastric resection upfront rather than utilizing DL.[21,22] This data set does not fully capture other clinical reasons a patient may proceed to surgery first such as bleeding, obstruction, or perforation. However, previous studies have found this to represent less than 1% of cases of GC[23,24] and likely does not account for the majority of eligible patients who did not undergo DL. Additionally, given the relatively small number of patients eligible for DL in this study, it is possible that the practice of a small group of surgeons at the included SNHs can account for this difference. However, this study was conducted as a multi-institutional study, only at centers with fellowship-trained surgical oncologists in an effort to minimize the impact of a single surgeon on the outcomes. Clustering at the hospital level in the multivariable analysis was also done to decrease the impact of a single surgeon or group practice.

Patients who are at higher risk of peritoneal metastasis should be evaluated with DL to assess for the presence of these metastases. Previous studies have demonstrated that diffuse type cancers, the presence of signet ring cells, distal tumors, and Hispanic patients are at the highest risk for developing these metastases.[25,26] In this study, increased use of DL was associated with distal tumors and those with signet cells on biopsy, consistent with those at higher risk likely being more thoroughly evaluated initially using DL.[27] This study found that cytology/peritoneal washing has a false negative rate of 13% in this study highlighting the importance of both elements of DL: direct inspection and cytology. This is similar to prior reports demonstrating a false negative rate for peritoneal cytology of 10%–13%.[28,29] Ultimately, surgeon bias regarding an individual patient's cancer prognosis based on the factors explored here likely influenced who receives DL.

In our analysis, diffuse/mixed Lauren classification was the only variable significantly associated with a positive laparoscopy. This is consistent with the established understanding that diffuse type cancer is associated with higher risk of peritoneal metastases.[3,25] Further analysis was limited by the very small number of patients in this group who had a positive DL. Interestingly, despite higher rates of intestinal-type GC (as opposed to diffuse type) in East Asia due to a strong association with *Helicobacter pylori* infection, there was no significant difference in positive DL between the race/ethnicity groups.[30] Analysis of a larger cohort would be necessary to determine any association between race/ethnicity and positive DL rates.

Importantly, this study has reinforced the powerful prognostic value of DL with dramatic differences in OS between the negative DL and positive DL groups and the no DL group falling in the middle. These results suggest that the no DL group could be significantly better risk-stratified with routine use of DL. This, in turn, should help better select patients who would benefit from curative-intent resection.

This study has several potential limitations. This study was conducted as a retrospective chart review, which limits the ability to capture the diagnostic decision-making surrounding using or not using DL as well as the impacts of the DL results on management. Additionally, this study did not capture what type of doctor the patient initially presented to (e.g., medical oncologist, surgical oncologist, etc.) which may have had an impact on initial management. This study was most consequentially limited by the small sample size, particularly the small number of patients who received DL and even fewer who had a positive DL. The small sample size limited the statistical analysis, making it difficult to find associations between clinicopathologic variables and the use of or the results of DL. Additionally, the small sample size makes it likely that individual surgeon practice greatly influenced the results, although we attempted to minimize this effect by including only fellowship-trained surgical oncologists who may be more likely to follow NCCN guidelines and clustering at the hospital level for the multivariable analysis. This study was also limited by the amount of missing data particularly regarding complete tumor node metastasis (TNM) staging, Lauren classification, and tumor differentiation which were all excluded from the multivariable regression. TNM staging typically had enough information for us to determine if the patient would be recommended to undergo DL even if not all elements were complete. Finally, our study was limited to SNH/TRC hospitals and may not be reflective of the GC seen at community centers where the majority of cases occur.[31]

In conclusion, we have demonstrated that DL was underutilized despite its strong prognostic value. Furthermore, care at a SNH does not appear to explain this deficit as DL was utilized more in SNH and for racial/ethnic minorities. Future prospective studies could allow more insight into why DL is underutilized and the clinical decision-making process for patients with locally advanced GC. Given its clear association with oncologic outcome, this study highlights the importance of utilizing DL for patients presenting with locally advanced GC including clinical stage T2N0 to inform management and prognosis.

ACKNOWLEDGMENT

We thank Dr. Sarah Kaslow for providing assistance and her statistical expertise on this project.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Abbreviations:

DL	diagnostic laparoscopy
EUS	endoscopic ultrasound
GA	gastric adenocarcinoma
GC	gastric cancer
IRB	Institutional Review Board
NCCN	National Comprehensive Cancer Network
OS	overall survival
PCP	primary care provider
SAGES	Society of American Gastrointestinal and Endoscopic Surgeons

SEER	Surveillance, Epidemiology and End Results
SNH	safety net hospital
TRC	tertiary referral center
USSNC	United States Safety Net Collaborative

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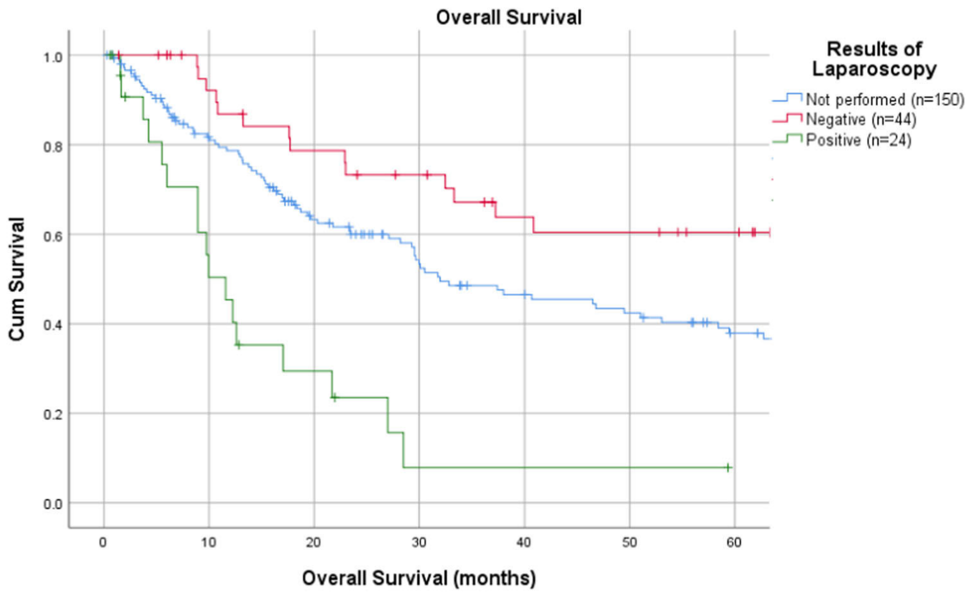

FIGURE 1.

Overall survival in months of patients who did not receive a diagnostic laparoscopy (blue), those who received a laparoscopy that was negative (red), and those who received a laparoscopy that was positive (green).

TABLE 1

Demographic and clinicopathologic characteristics of safety net and tertiary referral center patients

	Safety net (*n* = 103)[a]	Tertiary referral center (*n* = 130)[a]	*p* value
Age			NS
Median	58.5	65	
Gender			NS
Female	39 (38%)	52 (40%)	
Male	64 (62%)	78 (60%)	
US citizenship			<0.001
US citizen	66 (64%)	79 (61%)	
Non-US citizen	27 (26%)	3 (2%)	
Insurance			<0.001
Private	4 (4%)	70 (54%)	
Government	46 (45%)	52 (40%)	
Hospital card	10 (10%)	0 (0%)	
Uninsured	43 (41%)	7 (6%)	
Race/ethnicity			<0.001
Black/African American	31 (31%)	35 (27%)	
Hispanic White	38 (37%)	18 (14%)	
Non-Hispanic White	15 (15%)	66 (51%)	
Asian	17 (17%)	11 (8%)	
PCP			<0.001
Yes	43 (42%)	100 (77%)	
No	43 (42%)	23 (18%)	
EUS T Staging			NS
T2	29 (28%)	43 (33%)	
T3	11 (10%)	23 (18%)	
T4	7 (7%)	6 (4%)	
Not available	56 (55%)	58(45%)	
Clinically node positive			NS
Yes	28 (27%)	48 (37%)	
No	19 (18%)	26 (20%)	
Not available	56 (55%)	56 (43%)	
Signet ring cells on biopsy			NS
Yes	72 (70%)	101 (76%)	
No	29 (30%)	26 (18%)	
Differentiation			NS
Poorly differentiated	46 (45%)	56 (43%)	
Moderately differentiated	9 (9%)	15 (11%)	
Well differentiated	1 (1%)	1 (1%)	
Not available	47 (45%)	58 (45%)	
Lauren classification			NS

	Safety net (n = 103)[a]	Tertiary referral center (n = 130)[a]	p value
Intestinal	11 (11%)	7 (5%)	
Diffuse/mixed	34 (33%)	28 (22%)	
Not available	58 (66%)	95 (73%)	
Location			0.04
Proximal	33 (32%)	58 (47%)	
Distal	70 (68%)	70 (53%)	

Note: NS, not significant (p >0.05).

Abbreviations: DL, diagnostic laparoscopy; PCP, primary care provider.

[a]Columns may not all total due to missing values.

TABLE 2

Demographic and clinicopathologic factors associated with use of laparoscopy

	Overall (*n* = 233)*	**DL (*n* = 69)***	**No DL (*n* = 164)***	**Univariate *p* value**
Age				
Median	62	58	64	
Gender				NS
Female	90 (39%)	28 (41%)	62 (38%)	
Male	143 (61%)	41 (59%)	102 (62%)	
Hospital setting				0.002
Tertiary referral center	130 (56%)	28 (41%)	102 (62%)	
Safety net	103 (44%)	41 (59%)	62 (38%)	
Insurance				0.037
Private	74 (32%)	17 (25%)	57 (35%)	
Government	97 (42%)	36 (52%)	61 (37%)	
Hospital card	10 (4%)	0 (0%)	10 (6%)	
Uninsured	50 (21%)	16 (23%)	34 (21%)	
Race/ethnicity				<0.001
Black/African American	65 (28%)	17 (25%)	48 (29%)	
Hispanic White	56 (24%)	22 (32%)	34 (21%)	
Non-Hispanic White	81 (35%)	11 (16%)	70 (43%)	
Asian	28 (12%)	17 (25%)	11 (7%)	
EUS nodal staging				NS
Positive	76 (33%)	31 (45%)	45 (27%)	
Negative	45 (19%)	12 (17%)	33 (20%)	
Not available	112 (48%)	26 (41%)	86 (59%)	
EUS T staging				NS
T2	72 (31%)	23 (33%)	49 (30%)	
T3	34 (15%)	11 (16%)	23 (14%)	
T4	13 (6%)	9 (13%)	4 (2%)	
Not available	114 (49%)	26 (38%)	88 (54%)	
Signet ring cells on biopsy				0.001

	Overall (n = 233)*	DL (n = 69)*	No DL (n = 164)*	Univariate p value
Yes	55 (24%)	26 (38%)	29 (18%)	
No	173 (74%)	42 (61%)	131 (80%)	
Differentiation				0.012
Poorly differentiated	102 (44%)	48 (69%)	54 (33%)	
Moderately differentiated	24 (10%)	4 (6%)	20 (12%)	
Well differentiated	2 (1%)	0 (0%)	2 (1%)	
Not available	105 (45%)	17 (25%)	88 (54%)	
Lauren classification on biopsy				NS
Intestinal	18 (8%)	10 (15%)	8 (5%)	
Diffuse/mixed	62 (26%)	29 (42%)	33 (20%)	
Not available	153 (66%)	30 (43%)	123 (75%)	
Location				0.016
Proximal	91 (39%)	19 (28%)	72 (44%)	
Distal	140 (61%)	50 (72%)	90 (56%)	

Abbreviations: DL, diagnostic laparoscopy; EUS, endoscopic ultrasound.

*Columns may not all total due to missing values.

TABLE 3

Multivariate logistic regression—use of diagnostic laparoscopy[b]

	Number of patients (%, total = 233)	Odds ratio (95% CI)	*p* value
Hospital setting			
Tertiary referral center	130 (56%)	Reference	
Safety net	103 (44%)	2.24 (0.77–6.49)	0.14
Insurance[a]			
Private	74 (32%)	Reference	
Government	97 (42%)	1.30 (0.62–2.72)	0.49
Uninsured	50 (21%)	0.48 (0.28–0.79)	<0.01
Race/ethnicity			
Non-Hispanic White	81 (35%)	Reference	
Hispanic White	56 (24%)	1.90 (0.93–3.88)	0.08
African American	81 (35%)	6.87 (1.39–33.83)	0.02
Asian	28 (12%)	3.12 (1.53–6.37)	<0.01
Signet ring cells on biopsy			
No	173 (74%)	Reference	
Yes	55 (24%)	3.14 (1.72–5.70)	<0.01
Location			
Proximal	91 (39%)	Reference	
Distal	140 (61%)	1.62 (1.26–2.08)	<0.01

Note: Hosmer-Lemeshow *p*-value: 0.54. C-statistic: 0.76.

[a]Hospital card insurance ($n = 10$) was excluded from the multivariable analysis because of collinearity.

[b]Differentiation not included due to significant amount of missing data.

TABLE 4

Multimodality management of locally advanced gastric cancer

	No DL (n = 164)[a]	**Negative DL (n = 44)**[a]	**Positive DL (n = 24)**[a]
Multimodal therapy?			
Yes	103 (63%)	34 (77%)	8 (33%)
Inclusive of surgery	86 (52%)	30 (68%)	5 (21%)
Inclusive of chemotherapy	103 (63%)	34 (77%)	8 (33%)
Inclusive of radiation	20 (12%)	6 (14%)	3 (13%)
No	60 (37%)	10 (23%)	16 (67%)
Chemotherapy only	23 (14%)	3 (7%)	9 (38%)
Radiation only	1 (1%)	0 (0%)	0 (0%)
Surgery only	24 (15%)	6 (14%)	0 (0%)
No treatment	12 (7%)	1 (2%)	7 (30%)

Note: NS, not significant (p >0.05).

Abbreviation: DL, diagnostic laparoscopy.

[a]Columns may not all total due to missing values.