Treatment Patterns, Outcomes, and Costs for Bowel Obstruction in Ovarian Cancer

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Objective: The aim of this study was to assess treatment patterns, outcomes, and costs for bowel obstruction in ovarian cancer.

Methods/Materials: All patients with stage II to IV ovarian cancer who were admitted for bowel obstruction greater than or equal to 6 months after cancer diagnosis from 2000 to 2011 were identified from the Surveillance, Epidemiology, and End Results registry–Medicare database. Management strategies and outcomes of bowel obstruction were compared.

Results: Among 1397 women with bowel obstruction, 562 (40%) underwent surgery, and 154 (11%) had a gastrostomy or jejunostomy (G/J) tube placed. Thirty-four percent of patients who underwent surgery subsequently received chemotherapy, compared with 8% of those managed with a G/J tube (odds ratio, 4.8; 95% confidence interval [CI], 2.7–8.8). Thirty-day complications were higher for patients in the surgery group compared with those in the tube group (69% vs 46%; odds ratio, 2.5; 95% CI, 1.8–3.7), as were mean adjusted 30-day total costs ($28,872 vs $18,528, $P < 0.001$). Median survival was greater for women who underwent surgery compared with those who had a G/J tube (5.3 vs 1.2 months; adjusted hazard ratio, 0.31; 95% CI, 0.25–0.38). The median survival of patients in whom surgical correction failed and required G/J tube placement during the same inpatient admission was 2.6 months. Women who received postintervention chemotherapy had improved survival compared with those who did not in both the surgery (17.0 vs 2.8 months, $P < 0.001$) and G/J tube (5.7 vs 1.0 months, $P < 0.001$) groups.

Conclusions: In women with ovarian cancer who develop bowel obstruction, surgery may benefit a subset of patients, likely related to the ability to receive subsequent chemotherapy. Efforts to identify those who derive no benefit may reduce unnecessary laparotomy, along with its associated complications and costs. Given this population's limited survival, patient preferences should be evaluated in future studies assessing the management of bowel obstruction.

Key Words: Ovarian cancer, Bowel obstruction, Surgery, Gastrostomy tube, Survival

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Ovarian cancer is the leading cause of gynecologic cancer–related mortality in the United States, with an estimated 14,240 deaths in 2016.[1] Although most patients with advanced ovarian cancer achieve clinical remission after primary therapy, long-term cure rates languish between 20% and 30%, and most relapse.[2] A common sequela of recurrence is intestinal obstruction, with an estimated incidence of 20% to 50% in this setting.[3,4]

Bowel obstruction occurs secondary to extrinsic or intrinsic compression from tumor or edema, postoperative adhesions, or impaired bowel mobility due to tumor infiltration of the nervous plexus or mesentery.[5] Initially, treatment consists of conservative measures, such as bowel rest, nasogastric tube placement, and intravenous hydration. Patients whose obstruction is not resolved with conservative therapy generally require surgery or the insertion of a gastrostomy or jejunostomy (G/J) tube.[6–8] Surgical options include resection of the obstruction site with reanastomosis, intestinal bypass, or diversion with stomal formation.[8,9] Gastrostomy or jejunostomy tubes provide an alternative for decompression purposes and are associated with improved symptoms and quality of life (QOL). They can be placed percutaneously, surgically, or endoscopically.[7,10–12]

The delivery of value-based and patient-centered care is currently the focus of various national medical societies and is considered central to improving outcomes in medicine. The American Society of Clinical Oncology, through its value framework, assesses the value of cancer treatment based on clinical benefit, toxicity, and improvements in patient symptoms or QOL in the context of cost.[13] Efforts to provide patient-centered care, especially in clinical settings with limited survival, should focus on achieving a balance between the invasiveness of treatment, survival prolongation, and the risk of perioperative complications.[14]

The decision for surgery or placement of a G/J tube is based on multiple factors, such as the presence of single-site or multisite obstruction, previous chemotherapy response, and performance status.[9,15] However, this is subjective and provider dependent, and there is no consensus regarding what criteria render a patient a good operative candidate.[16] Some studies have shown a survival advantage for women who undergo surgical intervention, whereas others have not.[4,17,18] In addition, studies have been limited by their small sample size and the fact that they represent single-institution nonrandomized experiences.[3,8–10,17–20] As such, no standard management of bowel obstruction in this population exists, with treatment options varying across providers and centers and leading to different outcomes. The objective of our study was thus to assess outcomes of patients who were treated with either surgery or placement of a G/J tube for cancer-related bowel obstruction, using a population-based database. We sought to compare these 2 management strategies because they likely represented treatment of terminal obstructions that were not amenable to conservative management.

MATERIALS AND METHODS

Data Source

We conducted a retrospective population-based cohort study of patients with ovarian cancer using the linked Surveillance, Epidemiology, and End Results (SEER) registry–Medicare database. Institutional review board approval was obtained. The SEER registry of the National Cancer Institute contains approximately 97% of all incident cancer cases from tumor registries that cover 26% of the US population.[21] The Medicare claims that the database includes billed claims and services data on patients with Medicare parts A (inpatient) and B (outpatient). Claims include all inpatient hospitalizations, outpatient visits, physician and supplier data, and drugs administered.[22] The SEER-Medicare linked database was developed by matching the records of 93% of persons older than 65 years in the SEER registry to the Medicare claims database.[22,23] We used a combination of *International Classification of Diseases, Ninth Revision* (*ICD-9*) diagnosis codes, *Common Procedural Terminology* codes, and Healthcare Common Procedure Coding System codes to identify relevant covariates, treatments, and outcomes, which are shown in Supplementary Tables S1 and S2, http://links.lww.com/IGC/A478.

Cohort Selection

We identified a total of 39,382 patients with ovarian cancer (*ICD-9* code 183.0) who were given a diagnosis from January 1, 2000, to December 31, 2011. A flow diagram detailing excluded and included patients is shown in Supplementary Figure S1, http://links.lww.com/IGC/A479. We sequentially excluded 582 patients who did not have matching birth dates in SEER and Medicare; 12,802 who were 65 years or younger; 2875 with stage I disease; 3438 without pathologic confirmation or who were given a diagnosis at autopsy or by death certificate; 2914 with borderline, germ cell, or stromal tumors; and 6605 who either did not have full Medicare parts A and B coverage or had HMO enrolment from 12 months before diagnosis till death or till the end of the follow-up period (December 31, 2013). Of the remaining women, 1397 had an inpatient diagnosis of bowel obstruction (*ICD-9* codes 560.0, 560.8, 560.81, 560.89, and 560.9) greater than or equal to 6 months after cancer diagnosis. We chose a 6-month limit because we did not want to include patients whose bowel obstruction may have been a complication of their primary treatment. Patients in the final cohort who had a G/J tube inserted or underwent a surgical intervention were identified, comprising our study population. Hospital or physician claims for G/J tube procedures were used to identify tube placement. We considered claims for excision of small or large intestine, exploratory laparotomy/laparoscopy, gastroenterostomy, enteroenterostomy, lysis of adhesions, ileostomy, jejunostomy, and colostomy as indicating surgical therapy (Supplementary Table S1). Among the patients who underwent surgery, those who had a tube placed during the same inpatient admission were considered to have a failed surgical correction attempt. They were included in the surgery group.

Covariates

Patient and tumor characteristics were collected from SEER. Demographic variables assessed included age, marital status, race or ethnicity, area of residence, year of diagnosis, percentage of high school graduates in census tract, median household income in census tract, and region of treatment. We used the Klabunde modification of the Charlson comorbidity index to assess patient comorbidity, using claims in

TABLE 1. Characteristics of patients treated with surgery or a G/J tube (N = 716)

Characteristic	Total (N = 716), n (%)	Surgery Group (N = 562), n (%)	G/J Tube Group (N = 154), n (%)	*P*
Age, y				
66–70	270 (38)	210 (78)	60 (22)	0.48
71–75	221 (31)	170 (77)	51 (23)	
76–80	158 (22)	131 (83)	27 (17)	
≥81	67 (9)	51 (76)	16 (24)	
Race				
White	624 (87)	487 (78)	137 (22)	0.45
Other	92(13)	75 (82)	17 (18)	
Year of diagnosis				
2000–2003	284 (40)	228 (80)	56 (20)	0.48
2004–2007	252 (35)	198 (79)	54 (21)	
2008–2011	180 (25)	136 (76)	44 (24)	
Region of treatment				
Northeast	175 (24)	132 (75)	43 (25)	0.03
Midwest	76 (11)	53 (70)	23 (30)	
South	183 (26)	141 (77)	42 (23)	
West	282 (39)	236 (84)	46 (16)	
Marital status*				
Married	387 (55)	301 (78)	86 (22)	0.73
Unmarried	312 (45)	246 (79)	66 (21)	
Median income, census tract				
Lowest quartile	179 (25)	143 (80)	36 (20)	0.40
Second quartile	179 (25)	147 (82)	32 (18)	
Third quartile	179 (25)	136 (76)	43 (24)	
Highest quartile	179 (25)	136 (76)	43 (24)	
% High school graduates, census tract				
Lowest quartile	179 (25)	139 (78)	40 (22)	0.60
Second quartile	179 (25)	147 (82)	32 (18)	
Third quartile	179 (25)	138 (77)	41 (23)	
Highest quartile	179 (25)	138 (77)	41 (23)	
Area of residence				
Urban	96 (13)	82 (85)	14 (15)	0.08
Metropolitan/rural	620 (87)	480 (77)	140 (23)	
Charlson comorbidity index				
0	529 (74)	416 (79)	113 (21)	0.60
1	143 (20)	114 (80)	29 (20)	
≥2	44 (6)	32 (73)	12 (27)	
FIGO stage†				
II	48 (7)	37 (77)	11 (23)	
III	426 (63)	344 (81)	82 (19)	
IV	203 (30)	150 (74)	53 (26)	0.14

(Continued on next page)

TABLE 1. *(Continued)*

Characteristic	Total (N = 716), n (%)	Surgery Group (N = 562), n (%)	G/J Tube Group (N = 154), n (%)	*P*
Histology				
Serous	514 (72)	399 (78)	115 (22)	0.63
Endometrioid/clear cell/mucinous	62 (9)	51 (82)	11 (18)	
Other adenocarcinoma	140 (20)	112 (80)	28 (20)	
Tumor grade				
1/2	107 (15)	82 (77)	25 (23)	0.86
3	420 (59)	332 (79)	88 (21)	
Unknown	189 (26)	148 (78)	41 (22)	
Initial cancer treatment				
Neoadjuvant chemotherapy	181 (26)	133 (74)	48 (27)	0.07
Primary debulking surgery	527 (74)	422 (80)	105 (20)	

*Data missing for 17 patients.
†Data missing for 39 patients.
FIGO, International Federation of Gynecology and Obstetrics.

the 12 months before cancer diagnosis.[24,25] Initial treatment at the time of ovarian cancer diagnosis was categorized as either primary debulking surgery or neoadjuvant chemotherapy. Tumor covariates included stage, grade, and histology. Chemotherapy administration was identified using relevant Healthcare Common Procedure Coding System codes for the following drugs: cisplatin, carboplatin, paclitaxel, docetaxel, gemcitabine, cyclophosphamide, topotecan, doxorubicin, and bevacizumab. Hospice care was identified using hospice service codes (Supplementary Table S1). Complications were derived with modifications from a previous study and included cardiac, respiratory, hematologic, renal, wound, and thromboembolic complications (Supplementary Table S2).[26]

Statistical Analysis

Outcomes were analyzed and compared between patients who had G/J tube placement and those who had a surgical intervention. The primary outcome was survival. Secondary outcomes were postintervention chemotherapy, hospice, 30-day complications, and 30-day costs. Categorical variables were compared using the χ^2 test, and continuous variables were compared using the Mann-Whitney *U* test. The index date was defined as the date of G/J tube insertion or surgery for the G/J tube and surgery groups, respectively. Survival was defined as the time interval from the index date to the date of death or last follow-up. The Kaplan-Meier method was used to estimate survival rates, which were compared using the log-rank test. A multivariable Cox proportional hazards regression model was used to calculate differences in survival, after adjusting for variables that were clinically relevant or significantly associated with survival on univariate analysis. Mean 30-day total costs from the date of admission for bowel obstruction were calculated. Costs included all inpatient and outpatient insurance payments incurred and were adjusted for inflation to 2014 US dollars.[27] Because of the skewed and nonnormal distribution of cost, a generalized linear model with log link and gamma distribution was used to adjust for covariates associated with cost variability. All statistical tests were 2-sided, with a $P < 0.05$ considered significant. Analysis was performed using SAS 9.4 software (SAS Institute, Cary, NC).

RESULTS

We identified 1397 patients with stage II to IV ovarian cancer who were admitted for bowel obstruction greater than or equal to 6 months after cancer diagnosis from 2000 to 2011. Five hundred sixty-two (40%) underwent an attempt at surgical correction, 154 (11%) were initially treated with G/J tube placement, and 681 (49%) received none of the above. Among the patients who underwent surgery, 80 had a tube placed during the same inpatient admission and were considered to have a failed surgical correction attempt. These patients were analyzed as part of the surgery group. Baseline demographics and tumor characteristics were similar between patients who had surgery and those who underwent tube placement (Table 1). Among the women who were treated with a G/J tube, 45% were placed endoscopically, 26% were inserted surgically, and 29% were placed percutaneously. Among the patients who underwent a surgical intervention, 35% of the cases were performed by gynecologic oncologists, and 65% were performed by general surgeons or surgical oncologists.

The median duration from cancer diagnosis to bowel obstruction was 21 months for the cohort, with a range of 6 to 155 months. There was no significant difference in that time interval between the surgery and G/J tube groups (21 vs 21 months, $P = 0.68$). There was also no difference in median hospital length of stay (13 vs 11 days, $P = 0.06$); however, median time from admission to surgery was 2 days compared with 6 days for G/J tube placement ($P < 0.001$). Median survival was greater for patients who had surgery compared

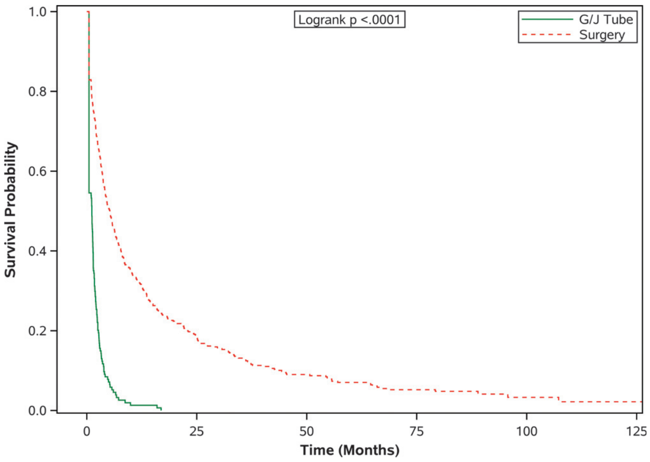

FIGURE 1. Gastrostomy/jejunostomy tube versus surgery: overall survival.

with those who had G/J tube placement (5.3 [95% CI, 4.2–6.0] vs 1.2 [95% CI, 0.5–1.3] months; hazard ratio, 0.27; 95% CI, 0.22–0.33; $P < 0.001$) (Fig. 1). On multivariable analysis, this difference remained significant (adjusted hazard ratio, 0.31; 95% CI, 0.25–0.38; $P < 0.001$) (Table 2). The median survival of the 80 women in whom surgical correction failed and had a tube placed during the same inpatient admission was 2.6 months (95% CI, 2.0–3.2). There were no differences in demographics or tumor characteristics between those patients and patients who had a successful surgical correction (data not shown).

The overall rate of 30-day complications was higher in women who underwent surgery compared with those who had tube placement (69% vs 46%; odds ratio [OR], 2.5; 95% CI, 1.8–3.7), with an increased rate of events across several morbidity categories (Table 3). Fifteen percent (n = 83) of the patients who had surgery subsequently received total parenteral nutrition, compared with 16% (n = 25) of those who had a G/J tube (OR, 0.89; 95% CI, 0.55–1.46). Patients treated with a G/J tube had a higher rate of hospice admission within 30 days of their intervention compared with those treated surgically (57% vs 19%; OR, 5.8; 95% CI, 4.0–8.5), with a shorter median time to hospice (6 vs 104 days, respectively; $P < 0.001$).

Women in the surgery group were more likely to receive subsequent chemotherapy compared with those in the tube group: 34% versus 8% (OR, 4.8; 95% CI, 2.7–8.8). For patients receiving chemotherapy within 6 months of their intervention, median time to chemotherapy was 42 days for the surgery group and 23 days for the G/J tube group ($P < 0.001$). Among patients who had surgery, median survival was greater among those who received subsequent chemotherapy compared with those who did not: 17.0 (95% CI, 13.6–22.0) versus 2.8 (95% CI, 2.3–3.4) months, $P < 0.001$. Similarly, patients who had a G/J tube placed and received subsequent chemotherapy also had a higher median survival compared with those who did not: 5.7 (95% CI, 1.8–8.7) versus 1.0 (95% CI, 0.5–1.2) months, $P < 0.001$ (Fig. 2). Treatment region and histology were associated with postoperative chemotherapy administration among women who underwent surgery. When combining patients who had surgery or a G/J tube, there was also a nonsignificant trend toward higher chemotherapy administration among patients who were younger and had less comorbidity (Table 4).

Mean 30-day total costs were $26,647 for the entire cohort (95% CI, $24,949–$28,345). Patients in the surgery group had higher mean 30-day total costs compared with those in the tube group: $28,872 (95% CI, $26,893–$30,851) versus $18,528 (95% CI, $15,647–$21,409), $P \leq 0.001$. After adjusting for region of care, education, area of residency, and tumor grade, mean costs were still higher for the surgery group:

TABLE 2. Multivariate Cox proportional hazard analysis for survival

Variable	Hazard Ratio	95% CI	*P*
G/J tube	Reference		<0.001
Surgery	0.31	0.25–0.38	
Age, y			0.76
66–70	Reference	0.87–1.27	
71–75	1.05	0.89–1.34	
76–80	1.09	0.86–1.52	
≥81	1.14		
Charlson comorbidity index			0.21
0	Reference		
1	1.15	0.95–1.40	
≥2	1.23	0.89–1.70	
Tumor grade			0.51
1/2	Reference		
3	0.98	0.78–1.24	
Unknown	0.88	0.67–1.15	
FIGO stage			0.41
II	Reference		
III	1.33	0.95–1.87	
IV	1.36	0.94–1.95	
Unknown	1.35	0.83–2.20	
Histology			0.03
Serous	Reference		
Endometrioid/clear cell	0.73	0.51–1.05	
Mucinous	1.69	1.08–2.66	
Other adenocarcinoma	0.98	0.79–1.20	
Initial cancer treatment			0.008
Neoadjuvant chemotherapy	Reference		
Primary debulking surgery	0.77	0.63–0.93	
Chemotherapy after intervention			<0.001
No	Reference		
Yes	0.39	0.32–0.47	

FIGO, International Federation of Gynecology and Obstetrics.

TABLE 3. 30-day complications after surgery or G/J tube placement

Complication Type	Surgery Group (N = 562), n (%)	G/J Tube Group (N = 154), n (%)	OR	95% CI	*P*
Cardiac	115 (21)	…	5.4	2.4–11.9	<0.001
Respiratory	179 (32)	17 (11)	3.8	2.2–6.4	<0.001
Venous thromboembolism	53 (10)	13 (8)	1.1	0.6–2.1	0.71
Wound infection	73 (13)	…	11.3	2.6–46.8	<0.001
Other infections	149 (27)	35 (23)	1.2	0.8–1.9	0.34
Hematologic	118 (15)	18 (12)	2.0	1.2–3.4	0.009
Renal	111 (20)	19 (12)	1.7	1.0–2.9	0.03
Other complications	79 (14)	…	8.2	2.6–26.4	<0.001
Patients with at least 1 complication	385 (69)	71 (46)	2.5	1.8–3.7	<0.001

Ellipses are used to show that cell contents were suppressed because of n < 11 for confidentiality.

\$27,545 (95% CI, \$25,823–\$29,382) versus \$19,660 (95% CI, \$17,331–\$22,302), $P < 0.001$.

DISCUSSION

Bowel obstruction is a significant complication of recurrent ovarian cancer that frequently heralds a preterminal event. Because no formal management guidelines exist and the preponderance of literature lies in small and single-institution studies, we sought to use a population-based database to assess treatment patterns and outcomes. In our analysis, surgery was associated with longer survival, higher rates of subsequent chemotherapy administration, and a longer time to hospice compared with G/J tube insertion, albeit with a higher rate of complications and higher treatment costs.

Eleven percent of patients with bowel obstruction in our cohort were treated with G/J tube placement initially, and 40% underwent a surgical intervention, of which 14% had a failed attempt to relieve the obstruction. The remaining patients received conservative measures. These rates are in alignment with single-institution analyses. In a review of patients with multiple tumor types complicated by obstruction, 24% had a tube placed, and 34% underwent surgical intervention.[15] Other studies assessing patients with ovarian cancer have shown a 38% surgical intervention rate, with 16% to 49% of patients having unsuccessful palliation.[9,19,28]

Although surgery was associated with improved survival, we were not able to account for selection bias. Patients with favorable prognostic factors may have been more likely to be selected for surgery.[18] Median reported survivals of patients who have undergone surgery for obstruction range from 4.5 to 8.4 months.[3,6,8,9,15,16,20] On the other hand, our results showed that, in cases where surgical correction was unsuccessful and where a G/J tube was subsequently placed, survival outcomes were clinically more comparable with those who had a G/J tube inserted initially. Indeed, in 1 study, the median survival of women who had an unsuccessful correction attempt was 3.5 months.[9] Although no consensus exists on which patients are good candidates for surgical intervention, several attempts have been made to address this question. Some reports could not identify any prognostic factors, whereas others cited some of the following as significant: palpable abdominopelvic masses,

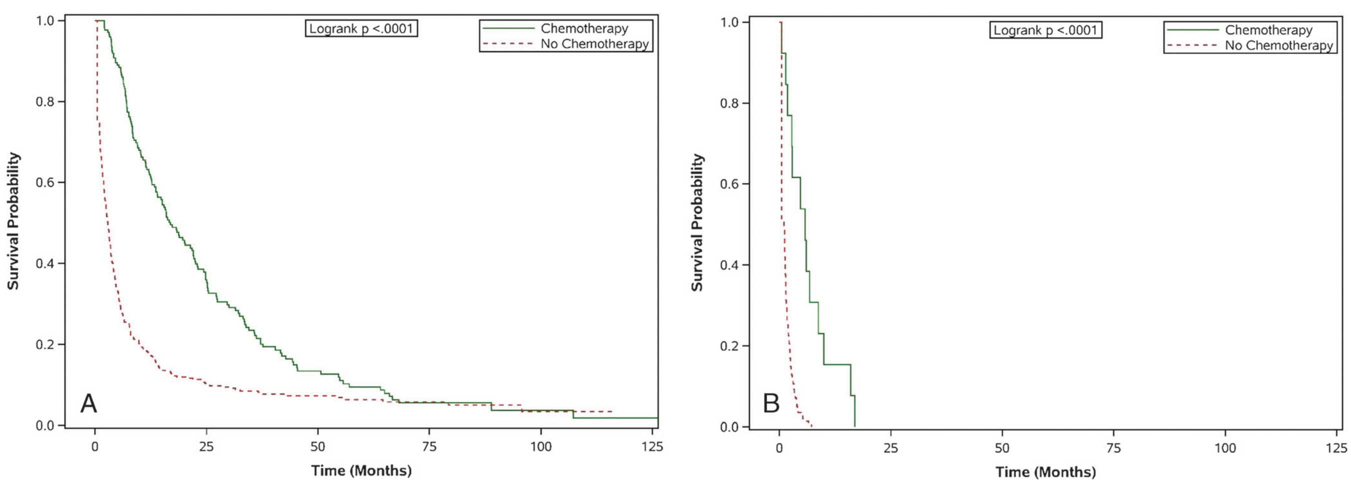

FIGURE 2. A, Surgery group, chemotherapy versus no chemotherapy: overall survival. B, Gastrostomy/jejunostomy group, chemotherapy versus no chemotherapy: overall survival.

TABLE 4. Factors associated with chemotherapy administration

	Surgery			All Patients (Surgery or G/J Tube)		
	Chemotherapy			Chemotherapy		
Characteristic	**No, n (%)**	**Yes, n (%)**	***P***	**No, n (%)**	**Yes, n (%)**	***P***
Age, y						
66–70	135 (64)	75 (36)	0.11	187 (69)	83 (31)	0.06
71–75	122 (72)	48 (28)		170 (77)	51 (23)	
76–80	91 (70)	40 (31)		117 (74)	41 (26)	
≥81	40 (80)	11 (20)		56 (84)	11 (16)	
Race						
White	340 (70)	147 (30)	0.43	465 (75)	159 (25)	0.43
Other	49 (65)	26 (35)		65 (71)	27 (29)	
Year of diagnosis						
2000–2003	162 (71)	66 (29)	0.69	214 (75)	70 (25)	0.70
2004–2007	133 (67)	65 (33)		182 (72)	70 (28)	
2008–2011	94 (69)	42 (31)		134 (74)	46 (26)	
Region of treatment						
Northeast	88 (67)	44 (33)	0.003	125 (71)	50 (29)	0.001
Midwest	38 (72)	15 (28)		60 (79)	16 (21)	
South	114 (81)	27 (19)		154 (84)	29 (16)	
West	149 (63)	87 (37)		191 (67)	91 (32)	
Marital status*						
Married	202 (67)	99 (33)	0.18	276 (71)	111 (29)	0.05
Unmarried	178 (72)	68 (27)		243 (78)	69 (22)	
Median income, census tract						
Lowest quartile	101 (71)	42 (29)	0.25	134 (75)	45 (25)	0.20
Second quartile	107 (73)	40 (27)		138 (77)	41 (23)	
Third quartile	96 (71)	40 (29)		136 (76)	43 (24)	
Highest quartile	88 (62)	51 (38)		122 (68)	57 (32)	
% High school graduates, census tract						
Lowest quartile	89 (64)	50 (36)	0.29	123 (79)	56 (21)	0.16
Second quartile	99 (67)	48 (33)		130 (73)	49 (27)	
Third quartile	99 (72)	39 (28)		136 (76)	43 (24)	
Highest quartile	102 (74)	36 (26)		141 (79)	38 (21)	
Area of residence						
Urban	58 (71)	24 (29)	0.75	72 (75)	24 (25)	0.81
Metropolitan/rural	331 (69)	149 (31)		458 (74)	162 (26)	
Charlson comorbidity index						
0	282 (68)	134 (32)	0.07	386 (73)	143 (27)	0.07
1	79 (69)	35 (31)		105 (73)	38 (27)	
≥2	…	…		…	…	
Histology						
Serous	269 (67)	130 (33)	0.02	373 (73)	141 (27)	0.04
Endometrioid/clear cell/mucinous	31 (61)	20 (39)		42 (67)	20 (32)	
Other adenocarcinoma	89 (80)	23 (21)		115 (82)	25 (18)	

(Continued on next page)

TABLE 4. *(Continued)*

Characteristic	Surgery: Chemotherapy No, n (%)	Surgery: Chemotherapy Yes, n (%)	Surgery: *P*	All Patients (Surgery or G/J Tube): Chemotherapy No, n (%)	All Patients (Surgery or G/J Tube): Chemotherapy Yes, n (%)	All Patients (Surgery or G/J Tube): *P*
FIGO stage†						
II	26 (70)	11 (30)	0.79	37 (77)	11 (26)	0.79
III	238 (69)	106 (31)		315 (74)	111 (26)	
IV	101 (67)	49 (33)		147 (72)	56 (28)	
Tumor grade						
1/2	56 (68)	26 (31)	0.51	80 (75)	27 (25)	0.56
3	225 (68)	107 (32)		305 (73)	115 (27)	
Unknown	108 (73)	40 (27)		145 (77)	44 (23)	
Initial cancer treatment						
Neoadjuvant chemotherapy	96 (72)	37 (28)	0.34	139 (77)	42 (23)	0.28
Primary debulking surgery	286 (68)	136 (32)		383 (73)	144 (27)	

Ellipses were used to show that cell contents were suppressed because of n < 11 for confidentiality.
*Data missing for 17 patients.
†Data missing for 39 patients.
FIGO, International Federation of Gynecology and Obstetrics.

preoperative weight loss of greater than 9 kg, peritoneal carcinomatosis, low albumin, and leukocytosis.[9,15,19,29,30] Multifocal obstruction and significant ascites are 2 variables that have been associated with unsuccessful surgery in more than 1 study.[15,19,30] We could not assess these prognostic factors in our analysis because of the lack of relevant diagnostic codes, which is a limitation. However, among the demographic and tumor characteristics that we did assess, none were found to be predictive of getting surgery or a G/J tube except for region of treatment (Table 1). We also compared the 80 patients who had unsuccessful surgical correction with those who had a successful correction. We found no differences in demographic or tumor variables (data not shown) and thus could not identify any predictors of successful surgical outcome.

Even when surgery is successful, reobstruction rates are high, ranging from 10% to 60%.[9] The insertion of a G/J tube is an alternative management strategy, especially for patients who are deemed poor surgical candidates by their providers or who elect to not undergo surgery.[12] It allows palliation of symptoms and limited oral intake and is associated with improvement in QOL.[11] Median reported survival for women who had a tube placed after bowel obstruction ranges from 1 to 2 months.[7,10,12] Limited data exist on hospice outcomes after G/J tube placement for ovarian cancer, with only 1 study reporting that 30% of patients were referred to hospice after intervention.[10]

Postintervention chemotherapy administration was significantly associated with survival in both the surgery and G/J tube groups in our analysis. This emphasizes the importance of identifying patients who not only are candidates for surgery but also are eligible for postoperative chemotherapy. Our data suggest that these patients may derive the most clinical benefit and are consistent with the limited literature on this topic. In a study assessing surgical patients, postoperative chemotherapy was associated with prolonged survival (9.2 vs 2.4 months, $P < 0.01$), with successful surgical palliation leading to a higher rate of chemotherapeutic administration.[9] In another report, chemotherapy after G-tube placement was also associated with improved survival (5.6 vs 1.1 months, $P < 0.001$); however, no predictors of post–tube chemotherapy were identified.[10] In our analysis, treatment in the northeast/west and tumor histology were associated with chemotherapy administration after surgery. We could not assess for predictors after G/J tube insertion because of the low number of patients who received chemotherapy after that intervention. However, when we combined both subgroups, there was a trend toward higher postintervention chemotherapy administration among younger patients and those who had low comorbidity.

Limitations of our study include the potential for selection and reporting bias, which is inherent to retrospective, population-based cohort analyses. Because the database we used does not include patients who are 65 years or younger, our results may not reflect outcomes for younger women. Furthermore, some data suggest that patients with large bowel obstructions have different outcomes compared with those with small bowel obstruction.[9,15] Because of the lack of specificity of diagnosis codes, we could not analyze those outcomes separately and could not assess outcomes such as short bowel syndrome, which may significantly impact QOL.[31] The strengths of our analysis include its large sample size and the length of the study period (12 years). Medicare claims data have been shown to have high concordance with medical records for surgery and chemotherapy.[32] In addition, the SEER-Medicare database captures a broad geographic area, which allowed us to assess patterns and outcomes on a national level.[22]

In conclusion, in women with ovarian cancer who develop bowel obstruction, surgery may benefit a subset of patients, likely related to the ability to receive subsequent chemotherapy. Further efforts are needed to identify those unlikely to derive any significant benefit, which may reduce the rate of unnecessary laparotomy. Importantly, despite showing improved survival in our study, surgical intervention was associated with a higher risk of complications and higher costs. Efforts to provide value-based care, in line with the American Society of Clinical Oncology value framework, should focus on achieving a balance between treatment invasiveness, life prolongation, the risk of perioperative morbidity, and the impact on QOL. Given the limited survival outcomes of this population, patient preferences should be evaluated in future studies assessing the management of bowel obstruction.

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