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Survival Outcomes in Ovarian and Uterine Cancer Patients Receiving Neoadjuvant Chemotherapy: A Retrospective Comparison of Inpatient Versus Outpatient Settings

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ABSTRACT

Objectives: Chemotherapy administration has largely shifted from inpatient to outpatient settings, offering benefits like increased patient comfort, fewer hospitalizations, and reduced costs. However, inpatient care remains crucial for patients needing direct observation, intensive side effect management, or those with significant medical comorbidities. Despite clinicians using their judgment and available guidelines to determine the best treatment setting, there's a notable scarcity of literature on outcomes between these settings, especially within gynecologic oncology. This study aimed to evaluate the survival differences of patients with endometrial and ovarian cancer who received neoadjuvant chemotherapy (NACT) in either outpatient or inpatient settings.

Methods: We identified and reviewed charts for 146 endometrial or ovarian cancer patients treated with NACT at Montefiore Medical Center between 2010 and 2023. This cohort comprised 47 patients in the inpatient group and 99 in the outpatient group.

Results: Our findings indicated that the inpatient group had a higher mean ECOG performance status, received fewer chemotherapy cycles, and were less likely to undergo surgery. While initial analysis suggested poorer survival for the inpatient group ($p = 0.019$), this difference became statistically insignificant after controlling for various confounders.

Conclusions: Despite initial indications of poorer outcomes for inpatient NACT, this difference was not statistically significant once confounding factors were addressed. These results provide important reassurance that inpatient chemotherapy, when clinically indicated, does not lead to inferior oncologic outcomes. Further research is essential to better understand optimal chemotherapy delivery and to identify and address obstacles to patient care.

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Introduction

Uterine cancer is the most prevalent gynecologic cancer in the United States with an estimated almost 70,000 new cases to be diagnosed in 2025 [1]. The 5-year survival for uterine cancer is favorable at 81% with regional metastasis decreasing this rate to 69% and distant metastasis decreasing to 17% [1]. The first-line treatment for advanced uterine cancer is cytoreductive surgery and adjuvant chemotherapy if indicated [2,3]. There are fewer treatment options for more advanced cases or those not eligible for surgical resection, one being neoadjuvant chemotherapy (NACT) [4].

Ovarian cancer has a poorer survival rate than that of uterine cancer, with a 5-year survival of early-stage cancer being 47.6%. Ovarian cancers have an overall poorer prognosis due to the lack of screening methods and minimal early clinical signs with higher likelihood the disease will be diagnosed in its later stages [5]. In advanced cases, providers must decide whether primary debulking surgery or neoadjuvant chemotherapy is the favorable option. This decision is complex and considers several factors including the patients' personal goals, risk of perioperative morbidity and predicted success of debulking surgery [6]. Current literature displays better overall survival with NACT when there are distant metastases, extra pelvic masses greater than 4 cm, or if surgery is not expected to result in optimal debulking [6].

The transition from chemotherapy administration in the hospital setting to the outpatient or ambulatory setting has increased since the 1970s [7,8]. Outpatient chemotherapy is often preferred due to its lower cost, greater convenience, and patient familiarity [9,10]. However, certain clinical scenarios necessitate inpatient chemotherapy administration. These include patients with serious medical comorbidities, those requiring close monitoring, dose escalation, or specialized hospital-based administration protocols

[10]. Patients with higher risk for chemotherapy-related toxicities also benefit from inpatient administration, as it allows for quicker interventions when these toxicities arise [10]. Prior studies have found higher ECOG performance statuses (ECOG-PS) correlate to an increased risk for these toxicities, suggesting this clinical measurement could help decide between inpatient and outpatient administration [11,12]. Despite the need for inpatient chemotherapy in certain populations, there is a gap in the literature examining whether the setting of administrations (inpatient vs. outpatient) influences survival. Clinicians and healthcare teams work with existing guidelines to determine whether inpatient or outpatient chemotherapy is favorable although there is little data reassuring providers that choosing inpatient chemotherapy in these medically complex patients does not worsen outcomes.

The goal of this study is to analyze the association between NACT administration settings (inpatient vs. outpatient) and survival outcomes of patients with ovarian and uterine cancer. We hypothesize that while patients receiving inpatient chemotherapy may present with worse baseline clinical profiles and lower initial survival probabilities, after controlling for confounders—including comorbidities and ECOG-PS—there will be no significant difference in survival outcomes between inpatient and outpatient settings. We also aim to highlight the distinct clinical characteristics of patients selected for inpatient chemotherapy and provide reassurance that this setting, when clinical indicated, does not compromise outcomes.

Methods

Setting: A retrospective cohort study was conducted at Montefiore Medical Center with patients who received care between January 2010 and December 2023.

Study Population: The study cohort includes patients with a confirmed diagnosis of uterine or ovarian cancer who received at least one cycle of neoadjuvant chemotherapy (NACT) during the defined study period. Patients were excluded if they had no history of uterine or ovarian cancer, were diagnosed with dual primary cancers, or did not receive NACT.

Data Collection: After IRB approval, patient data was extracted from electronic health records as well as data extraction using ATLAS, a web-based data extraction tool that allows for cohort building. Eligible cases were identified with chemotherapy infusion records and oncologic ICD-10 diagnostic codes within ATLAS. For each patient, data was abstracted on demographics (age, race, BMI, ECOG-PS, Charlson Comorbidity Index (CCI)), disease characteristics (baseline CA-125, histology, cancer stage), treatment course (number of chemotherapy infusions, surgery characteristics), treatment setting (inpatient or outpatient), and survival outcomes.

Data Analysis: All statistical analyses were conducted using R software, version 4.5.0 (R Foundation for Statistical Computing, Vienna, Austria). Baseline demographic and clinical characteristics were summarized and stratified by the location of chemotherapy administration (inpatient vs. outpatient). Group comparisons were performed using the chi-squared test for categorical variables and independent samples t-tests for continuous variables, as appropriate. Overall survival was defined as the time from diagnosis to death from any cause. Patients who were alive at their last follow-up appointment were censored at the date of their last clinical encounter. Overall survival was estimated using the Kaplan-Meier method, and differences in survival distributions were assessed with the log-rank test. Survival analyses were conducted for the overall cohort stratified by chemotherapy location, and separately within uterine and ovarian cancer groups. Median survival range was reported for each chemotherapy location in the overall cohort. A multivariable Cox proportional hazards regression model was used to evaluate the association between chemotherapy location and overall survival, adjusting for age, ECOG-PS, CCI, baseline CA-125 level, and surgical status for the full cohort only (uterine cohort + ovarian cohort). Hazard ratios (HR) and corresponding 95% confidence intervals were reported. A p-value < 0.05 was considered statistically significant. This study was approved by the Institutional Review Board at Albert Einstein College of Medicine (IRB# 2020-11418). All data were collected in accordance with institutional privacy guidelines and HIPAA regulations. Patient data were fully de-identified prior to analysis to protect confidentiality.

Results

A total of 146 patients were included with 47 (32%) receiving inpatient chemotherapy and 99 (68%) receiving outpatient chemotherapy (Table 1). Age, BMI, baseline CA-125, surgical characteristics, and distribution of race were statistically similar between inpatient and outpatient chemotherapy cohorts. The ECOG-PS was significantly different between the two cohorts with the inpatient chemotherapy group having a higher proportion of classes 2-4 ($p = 0.005$). The average ECOG-PS for the inpatient group was higher than that of the outpatient group (1.63 vs. 1.00, $p < 0.001$). The inpatient chemotherapy cohort also received fewer total chemotherapy cycles (7.55 vs. 10.35, $p = 0.018$).

Table 1: Demographic and Clinical Characteristics of Combined Cohort

Characteristics	Total Cohort (n=146)*	Received inpatient chemotherapy (n=47)*	Did not receive inpatient chemotherapy (n=99)*	p-value
Age (SD)	65.82 (11.01)	63.43 (11.85)	66.95 (10.46)	0.071
BMI (SD)	31.32 (10.14)	33.14 (11.49)	30.46 (9.37)	0.137
Race (%)				
White	22 (15)	6 (13)	16 (16)	
Black/African American	69 (47)	24 (51)	45 (46)	
Hispanic/Latinx	27 (19)	11 (23)	16 (16)	
Asian	7 (5)	2 (4)	5 (5)	
Other, not specified	21 (14)	4 (9)	17 (17)	
CCI (SD)	8.38 (2.20)	8.39 (2.15)	8.37 (2.23)	0.952
ECOG-PS (%)				0.005

0	35 (24)	6 (13)	29 (30)	
1	63 (44)	16 (35)	47 (48)	
2	31 (22)	15 (33)	16 (16)	
3	12 (8)	7 (15)	5 (5)	
4	3 (2)	2 (4)	1 (1)	
Ca-125 (SD)	1685.90 (2852.34)	1856.67 (2262.59)	1604.00 (3103.12)	0.619
Surgical Characteristics				0.054
Never underwent surgery (%)	93 (64)	38 (81)	55 (56)	
Hysterectomy with ovarian presentation (%)	28 (19)	7 (15)	21 (21)	
Unilateral oophorectomy (%)	3 (2)	0 (0)	3 (3)	
Bilateral oophorectomy (%)	5 (3)	1 (2)	4 (4)	
Hysterectomy w/ BSO (%)	12 (8)	1 (2)	11 (11)	
Hysterectomy w/ BSO + pelvic lymph nodes (%)	0 (0)	0 (0)	0 (0)	
Hysterectomy w/ BSO + pelvic + para-aortic lymph nodes (%)	5 (3)	0 (0)	5 (5)	
Total cycles chemotherapy (SD)	9.45 (6.70)	7.55 (5.50)	10.35 (7.05)	0.018

Demographic and Clinical Characteristics of Combined Cohort. Data are presented as n (%) or mean (standard deviation). Abbreviations: SD, standard deviation; BMI, body mass index; CCI, Charleson Comorbidity Index; BSO, bilateral salpingectomy. *Values indicate the maximum number of patients with available data for the given cohort. Percentages within each characteristic may not sum to 100% due to missing data for some patients.

In the uterine cohort (n = 64 patients), 20 patients received inpatient chemotherapy and 44 received outpatient chemotherapy (Table 2). Most patients were diagnosed with stage IV disease (85%) and serous histology (62%). There were no significant differences in stage, histology, baseline CA-125, surgical characteristics, or total chemotherapy cycles between inpatient and outpatient groups ($p > 0.05$).

Table 2: Clinical Characteristics of Uterine Cohort

Characteristics	Total Cohort (n=64)*	Received inpatient chemotherapy (n=20)*	Did not receive inpatient chemotherapy (n=44)*	p-value
Uterine Cancer Stage (%)				0.197
Stage II	2 (3)	0 (0)	2 (5)	
Stage III	7 (12)	0 (0)	7 (17)	
Stage IV	50 (85)	17 (100)	33 (79)	
Uterine Histology (%)				0.267
Serous	33 (62)	14 (78)	19 (54)	
Endometrioid	13 (25)	2 (11)	11 (31)	
Carcinosarcoma	5 (9)	2 (11)	3 (9)	
Uterine Sarcoma	2 (4)	0 (0)	2 (6)	
Mean Ca-125 (SD)	1660.20 (3492.08)	1993.52 (2577.99)	1505.17 (3862.32)	0.609
Surgical Characteristics				0.907)
Never underwent surgery (%)	44 (69)	15 (75)	29 (66)	
Hysterectomy with ovarian presentation (%)	13 (20.3)	3 (15)	10 (22.7)	
Unilateral oophorectomy (%)	1 (1)	0 (0)	1 (2)	
Bilateral oophorectomy (%)	2 (3)	1 (5)	1 (2)	
Hysterectomy w/ BSO (%)	3 (5)	1 (5)	2 (5)	

Hysterectomy w/ BSO + pelvic lymph nodes (%)	0 (0)	0 (0)	0 (0)	
Hysterectomy w/ BSO + pelvic + para-aortic lymph nodes (%)	1 (2)	0 (0)	1 (2)	
Mean total cycles chemotherapy (SD)	8.00 (4.60)	8.70 (5.07)	7.68 (4.39)	0.416

Clinical Characteristics of Uterine Cohort. Data are presented as n (%) or mean (standard deviation). Abbreviations: SD, standard deviation; BSO, bilateral salpingectomy. *Values indicate the maximum number of patients with available data for the given cohort. Percentages within each characteristic may not sum to 100% due to missing data for some patients.

In the ovarian cohort (n = 79 patients), 27 patients received inpatient chemotherapy and 52 received outpatient chemotherapy (Table 3). Most patients were diagnosed with stage III disease (59%) and serous histology (99%). Inpatient chemotherapy patients were less likely to have undergone surgery (85% vs 48%, p = 0.021) and received fewer chemotherapy cycles (6.7 vs 12.6, p = 0.001).

Table 3: Clinical Characteristics of Ovarian Cohort

Characteristics	Total Cohort (n=79)*	Received inpatient chemotherapy (n=27)*	Did not receive inpatient chemotherapy (n=52)*	p-value
Ovarian Cancer Stage (%)				1.00
Stage II	0 (0)	0 (0)	0 (0)	
Stage III	42 (59)	15 (58)	27 (60)	
Stage IV	29 (41)	11 (42)	18 (40)	
Ovarian Histology (%)				1.00
Serous	69 (99)	22 (100)	47 (98)	
Endometrioid	0 (0)	0 (0)	0 (0)	
Carcinosarcoma	1 (1)	0 (0)	1 (2)	
Mean Ca-125 (SD)	1729.95 (2302.46)	1755.30 (2043.40)	1716.79 (2445.14)	0.944
Surgical Characteristics				0.021
Never underwent surgery (%)	48 (61)	23 (85)	25 (48)	
Hysterectomy with ovarian presentation (%)	15 (19)	4 (15)	11 (21)	
Unilateral oophorectomy (%)	2 (3)	0 (0)	2 (4)	
Bilateral oophorectomy (%)	3 (4)	0 (0)	3 (6)	
Hysterectomy w/ BSO (%)	8 (10)	0 (0)	8 (15)	
Hysterectomy w/ BSO + pelvic lymph nodes (%)	0 (0)	0 (0)	0 (0)	
Hysterectomy w/ BSO + pelvic + para-aortic lymph nodes (%)	3 (4)	0 (0)	3 (6)	
Mean total cycles chemotherapy (SD)	10.61 (7.93)	6.70 (5.75)	12.63 (8.19)	0.001

Clinical Characteristics of Ovarian Cohort. Data are presented as n (%) or mean (standard deviation). Abbreviations: SD, standard deviation; BSO, bilateral salpingectomy.

*Values indicate the maximum number of patients with available data for the given cohort. Percentages within each characteristic may not sum to 100% due to missing data for some patients.

Kaplan-Meier survival analysis of the full cohort demonstrated a significant difference in overall survival between inpatient and outpatient groups (p = 0.019, Figure 1). Throughout the entire study time, the inpatient chemotherapy group demonstrated worse survival probabilities. In the ovarian cohort, there was no significant difference in the overall survival for the inpatient group compared to the outpatient group (p = 0.095, Figure 2). However, the survival curve showed increased survival for the outpatient group in the first 20 months but converged later in the study. The uterine cohort also showed no significant difference in overall survival (p = 0.15, Figure 3). Median survival was 37.6 months for the outpatient group and 31.8 months for the inpatient group (Table 4).

Table 4: Median Survival for Combined Cohort

Group	Death by any cause	Median Survival (months)	95% CI (Lower)	95% CI (Upper)
Outpatient (n = 97)	38	37.6	28.1	NA
Inpatient (n = 45)	20	31.8	12.0	NA

Median Survival for Combined Cohort. Survival calculated as time from diagnosis to death by any cause. The upper limit of the 95% confidence interval could not be calculated since a large portion of patients are censored (alive but lost to follow up).

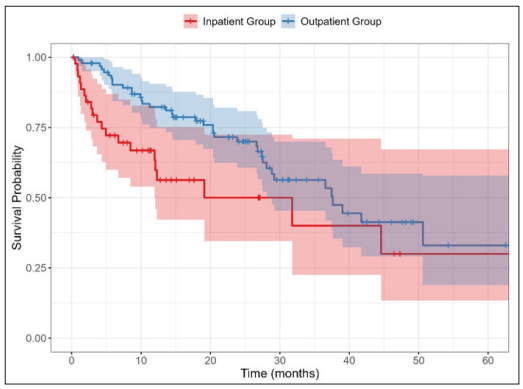

Figure 1: Survival Analysis for Combined Cohort

Survival Analysis for Combined Cohort. Kaplan-Meier overall survival curves for the combined cohort of patients with uterine or ovarian cancer in patients who received NACT. The red line represents patients who received NACT in the inpatient setting. The blue line represents patients who received NACT in the outpatient setting. The p-value for the log-rank test is 0.019.

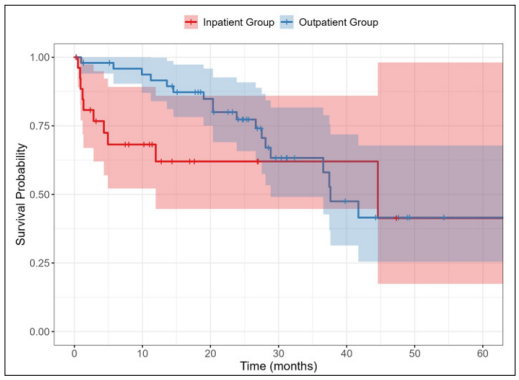

Figure 2: Survival Analysis for Ovarian Cohort

Survival Analysis for Ovarian Cohort. Kaplan-Meier overall survival curves for the ovarian cohort. The ovarian cohort includes patients with ovarian cancer who received NACT. The red line represents patients who received NACT in the inpatient setting. The blue line represents patients who received NACT in the outpatient setting. The p-value for the log-rank test is 0.095.

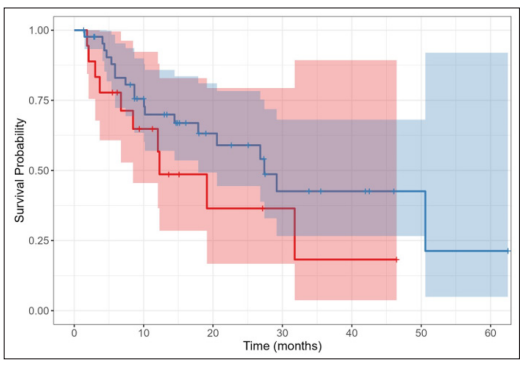

Figure 3: Survival Analysis for Uterine Cohort

Survival Analysis for Uterine Cohort. Kaplan-Meier overall survival curves for the uterine cohort. The uterine cohort includes patients with uterine cancer who received NACT. The red line represents patients who received NACT in the inpatient setting. The blue line represents patients who received NACT in the outpatient setting. The p-value for the log-rank test is 0.150.

Multivariable analysis was conducted for the full cohort only (Table 5). Multivariable analysis adjusting for age, ECOG-PS, CCI, CA-125, and surgery status was not significant, but showed a trend towards worse survival for patients receiving inpatient chemotherapy (HR = 1.68, p = 0.085). ECOG-PS of 3 compared to ECOG-PS of 0 was associated with worse survival (HR = 3.15, p = 0.022).

Table 5: Multivariate Cox Regression Analysis of Overall Survival for Combined Cohort

Characteristic	Hazard Ratio	95% CI	P-value
Location of chemo			
Outpatient	1.00		Ref
Inpatient	1.677	[0.931, 3.020]	0.085
Age	1.009	[0.982, 1.040]	0.528
Baseline Ca-125	1.000	[1.000, 1.000]	0.658
Performance Status			
ECOG-PS 0	1.000		Ref
ECOG-PS 1	1.085	[0.530, 2.220]	0.824
ECOG-PS 2	0.894	[0.377, 2.120]	0.799
ECOG-PS 3	3.147	[1.180, 8.410]	0.022
ECOG-PS 4	0.969	[0.115, 8.190]	0.977
Charlson Comorbidity Index			
Mild: 0-1	1.000		Ref
Moderate: 3-4	--	--	--
Severe: 5+	1.000	[0.134, 7.440]	1.000
Surgery			
No Surgery	1.000		Ref
Underwent surgery	0.605	[0.333, 1.100]	0.098

Multivariate Cox Regression Analysis of Overall Survival for Combined Cohort. Hazard ratios (HR) with 95% confidence intervals (CI) and p-values are shown. “Ref” indicates the reference category for each variable. The “Moderate: 3-4" category for Charlson Comorbidity Index has no reported HR or CI due to there being zero patients in this group.

Discussion

We found that patients who received inpatient NACT had a higher average ECOG-PS, indicating a lower level of functioning in their activities of daily living and physical abilities. This is consistent with the idea that patients for whom inpatient chemotherapy are beneficial are those with pre-existing comorbidities or risk factors necessitating increased monitoring while undergoing chemotherapy [9,10]. Prior studies have explored the correlation between higher ECOG-PS and chemotherapy-related toxicities. Both Watanabe et al and Garg et al found patients with higher ECOG-PS had a higher likelihood of developing hematologic toxicities following the initiation for chemotherapy for colorectal and breast cancer, respectively [11,12]. These results support the rationale for selecting inpatient chemotherapy for patients with higher ECOG-PS to facilitate closer monitoring and immediate management of adverse effects.

We also observed that patients in the inpatient group were less likely to undergo surgery and underwent fewer total cycles of chemotherapy. Patients with ovarian or endometrial cancer oftentimes undergo debulking surgery when cancer has spread to sites within the abdominal cavity. The goal is to remove as much visible cancer as possible with an optimal debulking (surgery leaves behind no tumors greater than 1 cm) resulting a better prognosis compared to cancer being left in the body [13,14]. If the care team determines a debulking surgery would not benefit the patient or improve their outcome, the decision is made for chemotherapy only or alternatively, palliative or hospice care if those criteria are met [6,15-17]. Generally, patients who do not undergo debulking surgery are those with medical comorbidities increasing the risks of surgery, or extensive disease for which primary debulking would be insufficient to remove disease [17-19]. This is consistent with the population that is more likely to receive inpatient chemotherapy, and offers an explanation for fewer patients undergoing surgery. The total number of chemotherapy cycles a patient receives is also dependent on a wide range of factors. A patient’s chemotherapy may be held between cycles due to low cell counts or intolerable side effects [20]. Prior studies have found patients discontinue chemotherapy altogether for reasons ranging from side effects, performance status decline and progression of disease [21-23]. This is consistent with the population that is more likely to receive inpatient chemotherapy and suggests why this group had a lower number of total chemotherapy cycles compared to the outpatient group.

Our study revealed an increased survival probability for patients who received NACT in the outpatient setting compared to the inpatient setting for the total cohort, and median survival was higher for the outpatient group after unadjusted analysis. However, with further analysis controlling for potential confounders variables, such as ECOG-PS and CCI, we found no significant survival difference between the two groups. This is consistent with our hypothesis and demonstrates that the factors contributing to patient survival are wide-ranging and cannot be explained by treatment setting alone. Existing studies have displayed the numerous factors contributing to patient outcomes and survival in ovarian and endometrial cancer such as ECOGPS, CCI, age, BMI, and CA-125, though there are no existing studies exploring the contribution of treatment setting (inpatient vs. outpatient) to survival outcomes for patients [16,24-28]. Our findings help

address an important gap in the literature and provide reassurance that inpatient chemotherapy—when selected appropriately based on clinical need—does not inherently worsen outcomes. This supports continued flexibility in chemotherapy administration approaches and reinforces the need for individualized decision-making that prioritizes patient safety, comorbid conditions, and supportive care needs.

This study has limitations. First, as a single-institution study focusing only on patients who underwent neoadjuvant chemotherapy, a relatively small cohort of 147 patients limited its power. This sample size could have obscured findings that could have been evident in a larger cohort, leading to our conclusion of no significant difference in survival probabilities in the two treatment settings. The retrospective cohort design introduces the potential for provider selection bias. The decision to administer NACT in the inpatient versus outpatient setting was not randomized but instead based on clinical judgment, patient preferences, and institutional protocols, which could have introduced systematic differences between the groups. We did not extract data on specific reasons for administering inpatient NACT. Including this data would have increased the specificity of our analysis and potentially allowed us to draw conclusions about the factors that contribute to a team's decision to administer inpatient NACT.

Finally, while an ECOG-PS of 3 statistically predicted worse survival compared to an ECOG-PS of 0 in the combined cohort—which aligns with expectations for lower functional status—we found no statistically significant difference when comparing survival in patients with an ECOG-PS of 4 to an ECOG-PS of 0. This outcome is unexpected as an ECOG-PS of 4 indicates a lower level of functioning than an ECOG-PS of 3 and therefore should also correlate with a lower survival probability when compared to an ECOG-PS of 0. The large confidence interval suggests the result may be limited by power due to a small sample size.
This study also has several strengths. We looked at a diverse cohort in Bronx, NY. Our cohort spanned a wide range of racial and ethnic backgrounds, making our findings generalizable to a wider public population. We looked at almost 13 years of patients who received care at this institution. Having such a large time span allowed us to capture a broader range of clinical events such as recurrence or death, which can strengthen the statistical power of our findings over time.

Another strength of this study is how it addresses a specific need at our institution, where we must submit a request to administer inpatient chemotherapy. Oftentimes, these requests are denied, citing reasons surrounding the futility of administering chemotherapy to a patient so ill they require hospitalization. Understanding the need for inpatient chemotherapy administration in specific patients, treatment teams are met with this barrier to care. The results of this study suggest that inpatient chemotherapy does not result in worse outcomes compared to the outpatient setting and can serve as support for physicians requesting inpatient chemotherapy administration for their patients.

Conclusion

This study aimed to determine the association between neoadjuvant chemotherapy setting (inpatient vs. outpatient) and survival outcomes amongst patients with endometrial and ovarian cancer. While unadjusted analysis suggested poorer survival outcomes amongst patients in the inpatient setting, adjustment for confounding variables (age, baseline CA-125, ECOG-PS, CCI) revealed no significant difference in survival outcome between groups. These results provide important reassurance that inpatient chemotherapy, when clinically indicated, does not result in inferior oncologic outcomes. As the healthcare system continues to shift toward outpatient cancer care, it remains crucial to preserve access to inpatient chemotherapy for certain patients. Further research should focus on the specific clinical indicators that best predict benefit from inpatient chemotherapy compared to outpatient, and on evaluating these findings in larger, prospective cohorts.

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