Research Square

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Pregnancy during and after cancer treatment: a retrospective single-center study

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Abstract

Background

Pregnancy in women with a history of cancer or a new cancer diagnosis presents challenges for both oncological treatment and obstetric management. This study aimed to compare maternal, obstetric, and neonatal outcomes between cancer survivors and women diagnosed with cancer during pregnancy.

Methods

This retrospective single-center study included 36 women with cancer who were managed at a tertiary perinatology center between 2018 and 2025. Twenty-four patients had been diagnosed and treated before pregnancy, while 12 were diagnosed during pregnancy. Clinical characteristics, cancer types, treatment modalities, pregnancy complications, and fetal and neonatal outcomes were obtained from medical records. Continuous variables were compared using the independent-samples t-test and categorical variables using the Pearson chi-square test. A p value < 0.05 was considered statistically significant.

Results

Maternal age was similar between cancer survivors and women diagnosed during pregnancy (35 ± 5 vs. 35 ± 6 years, p = 0.90). Maternal complications did not differ significantly between the groups (20.8% vs. 16.7%, p = 0.766). Cesarean delivery was the predominant mode of delivery (75.0% vs. 60.0%, p = 0.420). After excluding pregnancy terminations, delivery before 34 weeks occurred in 12.5% of cancer survivors and 8.3% of women diagnosed during pregnancy. Mean birth weight was 3166 ± 591 g and 2784 ± 562 g, respectively (p = 0.15). Neonatal intensive care unit admission rates were similar (26.7% vs. 27.3%), while the 5-minute Apgar score was significantly lower among infants born to cancer survivors (8 vs. 9, p < 0.001).

Conclusions

Maternal and neonatal outcomes were generally favorable in both cancer survivors and women diagnosed with cancer during pregnancy. Similar rates of maternal complications, early preterm delivery, and neonatal intensive care unit admission suggest that favorable pregnancy outcomes can be achieved with individualized multidisciplinary management. Avoiding unnecessary early delivery when maternal condition and cancer treatment allow may further improve neonatal outcomes.

Background

Cancer complicates approximately 1 in every 1000 pregnancies [1, 7]. Improvements in cancer diagnosis and treatment have increased survival among women of reproductive age, while delayed childbearing has increased the clinical overlap between pregnancy and cancer [3, 4]. In addition, noninvasive prenatal testing (NIPT) may incidentally suggest an occult maternal malignancy through discordant cell-free DNA findings [2].

Management of cancer during pregnancy requires careful consideration of both maternal oncologic treatment and fetal well-being. These patients are best managed by a multidisciplinary team including a perinatologist, oncologist, obstetrician, and neonatologist [3, 4, 13].

This study aimed to investigate obstetric and perinatal outcomes among patients diagnosed with cancer during pregnancy and cancer survivors managed at a single tertiary center.

Methods

This retrospective study included 36 patients who were diagnosed with cancer either before or during pregnancy and were managed at the Marmara University Perinatology Department between 2018 and 2025. Twenty four of patients were diagnosed and treated before pregnancy whereas twelve of them were diagnosed and treated during pregnancy.

Patients' clinical characteristics, cancer types, treatment modalities, pregnancy complications, and fetal outcomes were obtained from medical records. Missing information was obtained by contacting the patients directly.

Patients whose information could not be obtained and those whose diagnosis could not be confirmed were excluded from the study.

Statistical analyses were performed using SPSS version 31.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all variables. Continuous variables were expressed as mean ± standard deviation (SD) or median (minimum–maximum), depending on data distribution assessed using the Shapiro–Wilk test. Categorical variables were presented as frequencies and percentages. Comparative analyses between the study groups (pre-pregnancy vs. during/post-pregnancy diagnosis) were conducted using the independent samples t-test for continuous variables and the Pearson chi-square test for categorical variables. All tests were two-tailed, and a p value of < 0.05 was considered statistically significant. The study was approved by the Marmara University Faculty of Medicine Ethics Committee for Non-Drug and Non-Medical Device Research (protocol code: 09.2026.26–0296; meeting date: 27 March 2026; decision date: 27 April 2026).

Results

The most common cancer diagnosed during pregnancy was breast cancer (25%), whereas the most frequent malignancies among cancer survivors were papillary thyroid cancer (33%), Hodgkin lymphoma

(12.5%), and chronic myeloid leukemia (12%), respectively. The most commonly diagnosed cancer subgroup was hematologic malignancies (ALL, Hodgkin lymphoma, CML, cutaneous T-cell lymphoma) (2%5), central nervous system (CNS) tumors (2%2) and thyroid malignancies (7%) overall, respectively.

Patients' age, clinical characteristics, fetal and maternal complications and outcomes are given in Table 1, comparison of cancer survivors and cancer patients are given in Table 2.. Comparison of Clinical, Obstetric, Fetal, Neonatal, and Treatment Characteristics According to Study Groups are given in Table 3.

Table 1
Maternal, Obstetric, Fetal, Neonatal Characteristics and Oncologic Treatment

Category	Variable	Mean ± SD, Median (Min–Max) / n (%)
Maternal characteristics	Age (years), mean ± SD	35 ± 6, 34 (23–47)
	Gravidity median (min-max)	3 (1–7)
	Parity	2 (1–4)
	Abortus	1 (1–5)
	Ectopic pregnancy	2 (2–2)
	Screening present, n (%)	23 (63.9)
	Maternal pregnancy complications (present), n (%)	7 (19.4)
	GDM,n (%)	2 (5.6)
	HELLP syndrome, n (%)	1 (2.8)
	Hypertension, n (%)	1 (2.8)
	Placenta previa, n (%)	1 (2.8)
Obstetric characteristics	Gestational age at diagnosis (weeks), mean ± SD	33 ± 6, 32 (21–44)
	Diagnosis week, mean ± SD	28 ± 8, 28 (10–43)
	Gestational week of complication, mean ± SD	24 ± 6, 24 (12–35)
	Delivery week, n (%)	36.36 ± 4.05, 38.00 (23.00–42.00)
	Mode of delivery (Cesarean section), n (%)	18 (69.2)
Fetal characteristics, n (%)	Fetal anomaly (present)	6 (16.7)
	Cardiac anomaly	3 (8.3)
	Intrauterine growth restriction (IUGR)	1 (2.8)
	Renal anomaly	1 (2.8)
	Gastrointestinal anomaly	1 (2.8)

Data are presented as mean ± standard deviation (SD), median (minimum–maximum), or number (percentage), as appropriate. GDM: gestational diabetes mellitus; HELLP: hemolysis, elevated liver enzymes, and low platelet count; IUGR: intrauterine growth restriction; NICU: neonatal intensive care unit

Category	Variable	Mean ± SD, Median (Min–Max) / n (%)
Neonatal characteristics, n (%)	Birth weight (g)	3033 ± 598, 3070 (1600–3850)
	Neonatal outcome – Healthy, n (%)	16 (61.5)
	NICU admission, n (%)	7 (26.9)
	Exitus, n (%)	3 (11.5)
Oncologic treatment, n (%)	Systemic treatment only	12 (33.3)
	Local treatment only	16 (44.4)
	Combined systemic and local treatment	6 (16.7)
	Observation only	2 (5.6)

Data are presented as mean ± standard deviation (SD), median (minimum–maximum), or number (percentage), as appropriate. GDM: gestational diabetes mellitus; HELLP: hemolysis, elevated liver enzymes, and low platelet count; IUGR: intrauterine growth restriction; NICU: neonatal intensive care unit

Table 2
Diagnosis and Oncologic Treatment Characteristics of the Study Population

Section	Variable	Category	Pre-pregnancy	During pregnancy	p value
Maternal characteristics	Age (years), mean ± SD	–	35 ± 5	35 ± 6	0.90
	Screening result, n (%)	Absent	7 (29.2)	6 (50.0)	0.220
		Present	17 (70.8)	6 (50.0)	
	Maternal pregnancy complications, n (%)	Absent	19 (79.2)	10 (83.3)	0.766
		Present	5 (20.8)	2 (16.7)	
	Type of maternal complication, n (%)	GDM	2 (8.3)	0 (0.0)	0.238
		HELLP	0 (0.0)	1 (8.3)	
		Hypertension	0 (0.0)	1 (8.3)	
		Placenta previa	1 (4.2)	0 (0.0)	
Obstetric characteristics	Gestational age (weeks), mean ± SD	–	33 ± 5	33 ± 6	1.00
	Diagnosis week, mean ± SD	–	26 ± 8	31 ± 7	0.08
	Gestational week at admission, mean ± SD	–	18.43 ± 8.18	18.75 ± 5.94	0.91
	Mode of delivery, n (%)	Vaginal (NVD)	4 (25.0)	4 (40.0)	0.420
		Cesarean section	12 (75.0)	6 (60.0)	
Fetal characteristics	Fetal anomaly (binary), n (%)	Absent	18 (75.0)	12 (100.0)	0.058
		Present	6 (25.0)	0 (0.0)	

† *Multiple response analysis: patients may have received more than one treatment modality. Systemic treatment includes chemotherapy, targeted therapy, and hormonal therapy; local treatment includes surgery, radiotherapy, and radioactive iodine. Each patient was assigned to only one oncologic treatment group*

Section	Variable	Category	Pre-pregnancy	During pregnancy	p value
	Type of fetal anomaly, n (%)	Cardiac	3 (12.5)	0 (0.0)	0.463
		IUGR	1 (4.2)	0 (0.0)	
		Renal	1 (4.2)	0 (0.0)	
		Gastrointestinal	1 (4.2)	0 (0.0)	
Neonatal characteristics	Birth weight (g)	–	3166 ± 591	2784 ± 562	0.15
	APGAR score (5 min), n (%)	–	8.0 ± 0.0	9.0 ± 0.0	< 0.001
	Neonatal outcome, n (%)	Healthy	11 (73.3)	5 (45.5)	0.087
		NICU	4 (26.7)	3 (27.3)	
		Exitus	0 (0.0)	3 (27.3)	
Treatment characteristics	Oncologic treatment (OT), n (%)	Systemic only	6 (25.0)	6 (50.0)	0.131
		Local only	14 (58.3)	2 (16.7)	
		Combined	3 (12.5)	3 (25.0)	
		Observation	1 (4.2)	1 (8.3)	
	Any oncologic treatment, n (%)	Present	23 (95.8)	11 (91.7)	0.131

† *Multiple response analysis: patients may have received more than one treatment modality. Systemic treatment includes chemotherapy, targeted therapy, and hormonal therapy; local treatment includes surgery, radiotherapy, and radioactive iodine. Each patient was assigned to only one oncologic treatment group*

Table 3
Comparison of Clinical, Obstetric, Fetal, Neonatal, and Treatment Characteristics According to Study Groups

Section	Variable	Category	Pre-pregnancy	During pregnancy	p value
Maternal characteristics	Age (years), mean ± SD	–	35 ± 5	35 ± 6	0.90
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	Type of maternal complication, n (%)	GDM	2 (8.3)	0 (0.0)	0.238
		HELLP	0 (0.0)	1 (8.3)	
		Hypertension	0 (0.0)	1 (8.3)	
		Placenta previa	1 (4.2)	0 (0.0)	
Obstetric characteristics	Gestational age (weeks), mean ± SD	–	33 ± 5	33 ± 6	1.00
	Diagnosis week, mean ± SD	–	26 ± 8	31 ± 7	0.08
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		Present	6 (25.0)	0 (0.0)	
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		Local only	14 (58.3)	2 (16.7)	
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		Observation	1 (4.2)	1 (8.3)	
	Any oncologic treatment, n (%)	Present	23 (95.8)	11 (91.7)	0.131

Continuous variables are presented as mean ± standard deviation (SD), and categorical variables as number (percentage). Continuous variables were compared using the independent samples t-test, and categorical variables using Pearson's chi-square test.

Maternal age did not differ significantly between cancer survivors (35 ± 5 years) and patients diagnosed with cancer during pregnancy (35 ± 6 years; p = 0.90). Thirty-three percent of cancer survivors were nulliparous, compared with 17% of women diagnosed with cancer during pregnancy. Gestational age at first hospital admission was also similar between the groups (approximately 18 weeks). Maternal pregnancy complications did not differ significantly between the groups (p > 0.05), and gestational diabetes was the most frequent maternal complication overall (5.6%). Mean gestational age at cancer diagnosis was 28 ± 8 weeks. Local treatment was the most common treatment approach (44.4%), followed by systemic treatment (33.3%). Three pregnancies in women diagnosed with cancer during pregnancy were terminated after chemotherapy or to facilitate continuation of oncologic treatment, in accordance with patient preference. One patient with a brain tumor died after surgery during pregnancy, and one pregnancy ended in miscarriage before 10 weeks. Seventy-five percent of cancer survivors and 60% of patients diagnosed with cancer during pregnancy delivered by cesarean section. After excluding pregnancy terminations, delivery before 34 weeks occurred in 12.5% of cancer survivors and 8.3% of patients diagnosed with cancer during pregnancy.

Although mean birth weight was similar among cancer survivors and patients diagnosed with cancer during pregnancy (3166 ± 591 g vs. 2784 ± 562 g, respectively; p = 0.15), the 5-minute Apgar score was

lower in cancer survivors ($p < 0.001$).

Discussion

The coexistence of pregnancy and malignancy remains uncommon but is increasingly relevant in contemporary clinical practice as more women delay childbearing and survival after cancer improves among women of reproductive age [3, 4]. In this single-center cohort, we compared obstetric and neonatal outcomes between women diagnosed with cancer prior to pregnancy and those diagnosed during pregnancy.

The distribution of malignancies in our cohort was broadly consistent with previous reports. Breast cancer was the most common malignancy diagnosed during pregnancy, whereas thyroid cancer and hematologic malignancies were more frequent among cancer survivors [6, 12].

Although maternal age did not differ significantly between the groups, the higher proportion of nulliparous women among cancer survivors may suggest a greater tendency toward planned conception. This may be related to the increasing use of fertility preservation strategies and assisted reproductive techniques, together with deliberate pregnancy planning aimed at achieving favorable obstetric outcomes without compromising maternal health or long-term oncologic safety [5].

Consistent with previous reports, cesarean section was the predominant mode of delivery in our cohort. Increased cesarean rates have been described in both cancer survivors and pregnancies complicated by active malignancy and may reflect planned obstetric management, clinician preference, and concerns regarding maternal oncologic status rather than strict obstetric indications [6, 8, 12]. This tendency may represent a cautious multidisciplinary approach aimed at optimizing maternal safety while maintaining favorable perinatal outcomes.

After excluding pregnancy terminations, delivery before 34 weeks occurred in 12.5% of patients diagnosed before pregnancy and 8.3% of those diagnosed during pregnancy. These rates exceed the approximately 2.8% early preterm birth rate (< 34 weeks) reported in population-level data [9]. Previous cancer-in-pregnancy cohorts reported substantially higher overall preterm delivery rates: 58.6% in the study by Lataifeh et al. [10] and 54.2% in the study by Van Calsteren et al. [11]. In a Turkish single-center cohort, Davutoğlu et al. [12] reported delivery before 34 weeks in 8.8% of cancer survivors and 29.1% of women diagnosed with cancer during pregnancy.

Importantly, a considerable proportion of preterm deliveries reported in patients with cancer are iatrogenic. Van Calsteren et al. reported that 89.7% of preterm deliveries were iatrogenic [11], while Davutoğlu et al. reported that maternal cancer was the indication for delivery in 77.7% of patients who delivered before 34 weeks [12]. The higher rates of iatrogenic preterm delivery reported in earlier studies may reflect previous management strategies in which early delivery was more frequently considered necessary to allow maternal cancer treatment. This change in clinical practice was also demonstrated by de Haan et al., who reported a 9% reduction in iatrogenic preterm deliveries for every 5-year period (RR

0.91, 95% CI 0.84–0.98) [6]. With advances in cancer treatment during pregnancy and increasing evidence regarding the safety of several treatment modalities, the need for early delivery to initiate or continue maternal treatment has decreased. More recent recommendations therefore emphasize continuation of pregnancy and avoidance of iatrogenic preterm delivery whenever maternal and oncologic conditions allow [13].

Neonatal outcomes were generally favorable in our cohort. NICU admission rates were similar between cancer survivors and patients diagnosed during pregnancy (26.7% vs. 27.3%, respectively), with no significant difference between the groups. Previous studies reported higher NICU admission rates, particularly among patients diagnosed with cancer during pregnancy. Davutoğlu et al. reported NICU admission rates of 8.8% in cancer survivors and 32.2% in patients diagnosed during pregnancy, with most admissions related to prematurity [12]. Similarly, de Haan et al. reported a NICU admission rate of 41% in a large international cohort [6], while Van Calsteren et al. reported a rate of 51.2%, mainly due to prematurity [11]. In the study by de Haan et al., NICU admissions decreased over time, with a 9% reduction for every 5-year period (RR 0.91, 95% CI 0.83–0.99), in parallel with reductions in preterm and iatrogenic preterm deliveries [6]. The lower NICU admission rate in our patients diagnosed during pregnancy compared with previous studies may therefore be related to the lower rate of early preterm delivery in our cohort. These findings also support avoiding iatrogenic preterm delivery whenever maternal condition and cancer treatment allow.

Maternal complications were relatively uncommon in our cohort and did not differ significantly between cancer survivors and patients diagnosed during pregnancy (20.8% vs. 16.7%, respectively; p = 0.766). The most frequent complications were gestational diabetes and hypertensive disorders. However, our findings differ from those of a large nationwide study including 64,506 pregnant cancer survivors in the United States. Rubens et al. reported increased risks of severe maternal morbidity (aOR 2.00, 95% CI 1.66–2.41), preterm labor (aOR 1.55, 95% CI 1.36–1.76), cesarean delivery (aOR 1.27, 95% CI 1.19–1.37), preeclampsia (aOR 1.18, 95% CI 1.02–1.36), postpartum infection (aOR 1.68, 95% CI 1.21–2.33), and venous thromboembolism (aOR 3.62, 95% CI 2.69–4.88) among cancer survivors compared with women without cancer [14]. The absence of a significant difference in maternal complications in our cohort may be related to the relatively small sample size and differences in patient and cancer characteristics. In addition, close follow-up and multidisciplinary management in a tertiary center may have contributed to the relatively favorable maternal outcomes observed in our patients.

An important strength of our study is the comparison of patients diagnosed with cancer prior to pregnancy with those diagnosed during pregnancy, allowing the evaluation of maternal and neonatal outcomes according to the timing of cancer diagnosis. The evaluation of maternal and neonatal outcomes together, including early preterm delivery, NICU admission, and maternal complications, provides a comprehensive assessment of pregnancy outcomes in these patients. In addition, the exclusion of pregnancy terminations from the analysis of preterm birth allowed a more accurate evaluation of early preterm delivery. Management of the patients in a tertiary referral center with multidisciplinary follow-up is another strength of the study.

Despite these strengths, several limitations should be acknowledged. The retrospective design and relatively small sample size limited the statistical power of the study and may have prevented the detection of significant differences between the groups. Furthermore, the inclusion of different cancer types, stages, and treatment modalities resulted in clinical heterogeneity. The small number of patients also limited subgroup analyses according to cancer type and treatment modality. Long-term neonatal and childhood outcomes were not evaluated. Moreover, as this was a single-center study conducted in a tertiary referral hospital, the results may not be generalizable to the overall population.

Conclusions

In conclusion, generally favorable maternal and neonatal outcomes were observed both in cancer survivors and in patients diagnosed with cancer during pregnancy. Although early preterm birth rates were higher than those reported in the general population, they were lower than those reported in several previous studies of cancer patients. The relatively lower rate of early preterm delivery may reflect recent changes in cancer management during pregnancy, with increasing efforts to continue pregnancy and avoid unnecessary iatrogenic prematurity whenever oncologically possible. NICU admission rates were similar between the two groups, and maternal complications did not differ significantly. These findings support the importance of multidisciplinary management and individualized pregnancy planning to achieve favorable maternal and neonatal outcomes while maintaining appropriate oncological care.

Abbreviations

CNS
central nervous system
GDM
gestational diabetes mellitus
HELLP
hemolysis, elevated liver enzymes, and low platelet count
IUGR
intrauterine growth restriction
NICU
neonatal intensive care unit
NIPT
noninvasive prenatal testing
SD
standard deviation.

Declarations

Declarations

Ethics approval and consent to participate

The study was approved by the Marmara University Faculty of Medicine Ethics Committee for Non-Drug and Non-Medical Device Research (protocol code: 09.2026.26–0296; meeting date: 27 March 2026; decision date: 27 April 2026). The approved project was entitled “Evaluation of Pregnancy During and After Cancer Treatment.”

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

GK: Conceptualization, Investigation, Data curation, Writing - original draft, Writing - review & editing. MA: Methodology, Investigation, Validation, Writing - review & editing. EST: Investigation, Data curation, Writing - review & editing. EEB: Conceptualization, Supervision, Methodology, Writing - review & editing. All authors read and approved the final manuscript.

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Not applicable.

Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to patient confidentiality and privacy considerations. However, the data are available from the corresponding author upon reasonable request.

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