Factors Affecting Survival and Mortality Rates among Cancer Patients Hospitalized in the ICU

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Abstract

Background: Due to their underlying cancer, comorbidities, and critical illness, cancer patients admitted to intensive care units (ICUs) encounter particular difficulties.

Objective: Assess the variables affecting the outcomes and discharge status of cancer patients admitted to the intensive care unit (ICU) at Warith International Cancer Institute (WICI) in Karbala, Iraq.

Methodology: A retrospective observational study conducted at WICI involving all cancer patients admitted to the ICU between August 2021 and March 2024. Comorbidities, cancer-related traits, ICU interventions, complications, and outcomes were among the data that were taken from electronic medical records. SPSS was used for statistical analysis. Bivariate analyses were performed to identify factors associated with mortality, and significant factors were entered into a binary logistic regression model. A p-value of less than 0.05 was considered statistically significant.

Results: 24.8% of 113 patients died in the intensive care unit. Higher APACHE II scores, neutropenia, acute renal failure, illness progression, mechanical ventilation, hypotension, tachycardia, and pulmonary aspergillosis were all substantially linked to mortality.

Conclusion: these results emphasize the necessity of early detection of high-risk individuals and targeted interventions to improve outcomes in environments with limited resources.

Keywords: Intensive Care Unit, Cancer Patients, Mortality, Iraq, Factors Associated, Predictors.

1. Introduction

The management of cancer patients requiring intensive care unit (ICU) admission involves a complicated interplay of problems, including the underlying malignancy, accompanying comorbidities, and the urgent illness demanding intense care (García de Herreros et al., 2024). There have historically been discussions regarding the suitability of intensive interventions in this population due to the poor prognosis for cancer patients admitted to the intensive care unit (Martos-Benítez et al., 2020). But developments in critical care and oncology have forced a reassessment of these presumptions, emphasizing the necessity of a sophisticated knowledge of the variables affecting ICU outcomes in cancer patients, which is essential for making well-informed therapeutic decisions (Koutsoukou, 2017). Significant advancements in supportive care and cancer treatments over the past few decades have enhanced survival rates, which has led to a rise in the number of cancer patients admitted to intensive care units. A study that examined data from the "Medical Information Mart for Intensive Care" (MIMIC-III) database between 2002 and 2011 found that cancer patients admitted to the ICU had a 30% lower 28-day mortality rate, indicating improved results over time (van der Zee et al., 2022). This increase underlines the significance of reassessing ICU admission criteria and prognosis expectations for this patient group. In the Middle East, especially Iraq, the provision of critical care to cancer patients is compounded by unique problems. ICU end-of-life care methods are greatly influenced by cultural, religious, and systemic variables. Organizational structure, misconceptions about end-of-life care, and the influence of intensive care units on providing adequate palliative care in Middle Eastern nations were among the obstacles found in a systematic study by Almalki et al. (2024). Additionally, financial constraints and limited healthcare infrastructure further hinder the delivery of comprehensive cancer care (Azoulay et al., 2011).

1.1. Objective of the Study

1. The purpose of this study is to evaluate the variables affecting the outcomes and discharge status of cancer patients hospitalized to the intensive care unit (ICU) at Warith International Cancer Institute (WICI).
2. The specific goals are to ascertain the rates of survival and death among those cancer patients, examine the connections between comorbidities, symptoms, laboratory results and ICU outcomes, treatment modalities, and ICU morbidity and mortality rate.

2. Methodology

Using a retrospective observational design, this study examined cancer patients who had been admitted to the intensive care unit (ICU) at the WICI in Karbala, Iraq.

2.1.Setting of the Study

The intensive care unit (ICU) at the WICI in Karbala, Iraq was chosen to conduct the study.

2.2.Sample of the Study

For this study, a total of 113 patients (65 males and 48 female) were included in the study.

2.3.Study Instruments

Data were extracted from the electronic medical records (EMRs) maintained by WICI and anonymized and entered into a validated electronic database using Microsoft Excel then a standardized Case Report Form was developed and validated for use in data abstraction to ensure consistency and minimize potential errors. Each patient record was assigned a unique study code to protect confidentiality, and data access was limited to authorize research personnel only. Full patients' data is available with the corresponding author upon request.

2.4. Data Collection

The data were collected through the utilization of the developed case report form after the validity and reliability are estimated. The variables collected from electronic medical records included comorbidities including diabetes mellitus, hypertension, dyslipidemia, chronic obstructive pulmonary disease (COPD), renal and cardiac disease, thyroid dysfunction, hypoalbuminemia, and cirrhosis. The APACHE II score was recorded to quantify illness severity. Additional clinical data included neutropenia, anemia, and acute renal failure at ICU admission, surgical history within the preceding 30 days, and antibiotic use within the prior 48 hours.

Cancer-related variables comprised the type and stage of cancer, disease status (stable, progressive, or regressive), and recent receipt of radiotherapy or immunotherapy. Treatment history was also recorded, including whether patients were treatment-naïve, had received neoadjuvant or adjuvant chemotherapy, or were on first-line or subsequent lines of chemotherapy. Data on hematopoietic stem cell transplantation (HSCT) and chemotherapy for acute hematological malignancies were also collected.
ICU-related variables included type and timing of mechanical ventilation.

Vital signs upon admission, including blood pressure, heart rate, oxygen saturation, and body temperature, were documented, as were laboratory parameters such as white blood cell count, hemoglobin, albumin, and other relevant biochemical indices. ICU-acquired complications were recorded, including primary bacteremia, ventilator-associated pneumonia (VAP), pulmonary aspergillosis and new-onset neutropenia.

2.5. Validity of the Instruments

A content validity of the study instrument conducted through a group of experts who have more than 10 years of experience in nursing field.

2.6. Statistical analysis

Statistical analyses were performed using SPSS software, version 26. Descriptive statistics were calculated to summarize clinical characteristics. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using means, standard deviations, medians, and interquartile ranges, depending on the distribution.

Bivariate analyses were conducted to assess associations between discharge status (alive or deceased) and independent variables. The Chi-square test was used for categorical variables, and non-parametric tests such as the Mann–Whitney U test and Kruskal–Wallis's test were applied for continuous variables not normally distributed. A p-value of less than 0.05 was considered statistically significant.

Multivariate analysis was conducted using binary logistic regression to identify independent predictors of ICU mortality. Variables with a p-value less than 0.05 in the bivariate analysis were included in the regression model. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to assess the strength of associations.

3. Results

Table 1: Association between medical conditions and ICU mortality among cancer patients

		Frequency	Mortality		P. value
			No	Yes	
Comorbidities	Hypertension	36	29	7	0.369 [a]
	Diabetes mellitus	23	18	5	0.705 [c]
	Dyslipidemia	2	0	2	0.060 [c]
	Thyroids disease	8	6	2	1.000 [c]
	Cardiac disease	13	11	2	0.513 [c]

	Chronic renal insufficiency	2	2	0	1.000 [c]
	Hypoalbuminemia	10	8	2	1.000 [c]
	Cirrhosis	4	3	1	1.000 [c]
	COPD	1	1	0	1.000 [c]
APACHE II Score	Mean (SD)	15.02 (7.12)	13.81 6.95)	18.68 (6.43)	**0.001** [b]
	Min - Max	3 - 44	3 - 44	7 - 35	
Neutropenia at ICU admission	No	94	76	18	**0.006** [a]
	Yes	19	9	10	
Anemia at ICU admission	No	56	46	10	0.127 [a]
	Yes	57	39	18	
Acute renal failure at ICU admission	No	108	84	24	**0.013** [c]
	Yes	5	1	4	
Surgery in the previous 30 days:	No	42	27	15	**0.045** [a]
	Yes	71	58	13	
Antibiotics in the previous 48 h	No	14	13	1	0.183 [c]
	Yes	99	72	27	

The bivariate analysis of the factors affecting survival status among patients (Table 1) showed none of the chronic comorbidities assessed were significantly associated with ICU mortality ($p > 0.05$) (Table 1). Therefore, higher APACHE II scores, the presence of neutropenia, and acute renal failure at admission were all significantly associated with increased mortality ($p < 0.05$). Conversely, a recent surgical history was associated with improved survival. Yet, no significant association was found between recent antibiotic use and mortality.

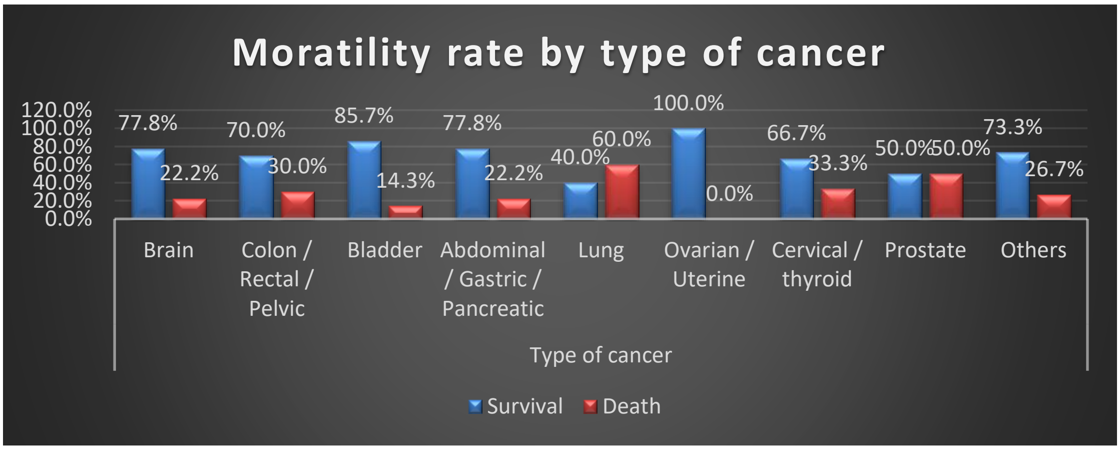

Figure 1: Mortality rate by type of cancer

Figure 1 illustrates the distribution of ICU mortality rates according to cancer type among the study population. Survival rates varied across malignancies, with bladder and ovarian/uterine cancers showing the most favorable outcomes, while lung and prostate cancers had the highest mortality proportions.

Table 2: Association between cancer-related characteristics and ICU mortality among cancer patients

		Mortality		p-value
		No	Yes	
Stage of cancer	Stage II	54 81.8%	12 18.2%	**0.054** [a]
	Stage III - IV	31 66.0%	16 34.0%	
Disease status	Stable - Regression	67 83.8%	13 16.3%	**0.001** [a]
	Progression	18 54.5%	15 45.5%	
Radiotherapy in the previous 7 days	No	79 75.2%	26 24.8%	1.000 [b]
	Yes	6 75.0%	2 25.0%	
Immunotherapy in the previous 7 days	No	81 75.0%	27 25.0%	1.000 [b]
	Yes	4 80.0%	1 20.0%	

The results showed that among cancer-specific variables, disease progression at ICU admission was the only factor significantly associated with mortality (Table 2). The stage of cancer showed a tendency toward higher mortality in advanced stages, with differences approaching statistical significance. Recent radiotherapy or immunotherapy within the seven days preceding admission did not show any significant association with mortality, as survival rates were similar between treated and untreated patients.

Table 3: Association between oncologic treatments and ICU Mortality among cancer patients

		Mortality		p-value
		No	Yes	
Treatment	No	42 87.5%	6 12.5%	**0.014** [b]
	Yes	43 66.2%	22 33.8%	
Neoadjuvant chemotherapy	No	72 75.8%	23 24.2%	0.769 [b]
	Yes	13 72.2%	5 27.8%	
Adjuvant chemotherapy	No	50 82.0%	11 18.0%	0.072 [a]
	Yes	35 67.3%	17 32.7%	
First line chemotherapy	No	41 89.1%	5 10.9%	**0.007** [b]
	Yes	44 65.7%	23 34.3%	
Second and subsequent lines	No	68 80.0%	17 20.0%	**0.048** [a]

	Yes	17 60.7%	11 39.3%	
Chemotherapy for acute hematological malignancy	No	83 74.8%	28 25.2%	1.000 [b]
	Yes	2 100.0%	0 0.0%	
HSCT	No	84 75.0%	28 25.0%	1.000 [b]
	Yes	1 100.0%	0 0.0%	

Additionally, whereas neoadjuvant and adjuvant chemotherapy did not approach statistical significance, prior oncologic treatment demonstrated a significant link with death (Table 3). First-line chemotherapy and second or subsequent lines of chemotherapy were substantially related with greater mortality, while chemotherapy for acute hematologic malignancies and hematopoietic stem cell transplantation (HSCT) showed no connection.

Table 4: Association between need for mechanical ventilation and ICU Mortality among cancer patients

Mechanical ventilation: Onset of mechanical ventilation	No mechanical ventilation	73 96.1%	3 3.9%	**0.000** [a]
	Mechanical ventilation in the first 24 h of admission	10 33.3%	20 66.7%	
	Mechanical ventilation after 24 h of admission	2 28.6%	5 71.4%	
Mechanical ventilation: Onset of mechanical ventilation	No	73 96.1%	3 3.9%	**0.000** [b]
	Yes	12 32.4%	25 67.6%	

a) *Chi-square test; b) Man-Whitney test; Bold significance set at 5%*

Mechanical ventilation was significantly associated with mortality, and patients requiring ventilation, whether within or after the first 24 hours, had markedly higher death rates compared to those who did not require it (Table 4).

A number of ICU-related problems, such as hypotension, hyperthermia, tachypnea, tachycardia, neutropenia established during ICU stay, primary bacteremia, and pulmonary aspergillosis, were substantially associated with increased mortality. There was no significant correlation seen between death and other sequelae, including desaturation, tumor lysis syndrome, pleural effusion, pneumothorax, and pulmonary embolism.

Table 5: Binary logistic regression analysis for predictors of ICU mortality among cancer patients

Linear Model

		B	S.E.	p-value	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Step 1	APACHE II Score	0.055	0.045	0.217	1.057	0.968	1.153
	Neutropenia at ICU admission	-1.302	1.059	0.219	0.272	0.034	2.169
	Surgery in the previous 30 days:	0.259	0.720	0.719	1.295	0.316	5.311
	Stage of cancer	0.988	0.971	0.309	2.685	0.401	17.996
	Disease status	0.567	0.914	0.535	1.763	0.294	10.569
	Treatment	0.170	1.220	0.889	1.185	0.108	12.951
	Adjuvant chemotherapy	-1.822	0.961	0.058	0.162	0.025	1.063
	First line chemotherapy	1.451	1.455	0.318	4.269	0.247	73.889
	Second and subsequent lines	-0.051	0.964	0.958	0.950	0.144	6.288
	Complication at ICU: Hypotension	2.244	0.716	0.002	9.434	2.318	38.395
	Complication at ICU: Hyperthermia	1.238	0.960	0.197	3.449	0.526	22.632
	Complication at ICU: Tachypnea	1.126	0.764	0.141	3.083	0.689	13.789
	Complication at ICU: Primary bacteremia	-0.695	0.938	0.459	0.499	0.079	3.140
	Complication at ICU: Pulmonary aspergillosis	0.705	0.748	0.346	2.023	0.467	8.771
	Neutropenia developed in the ICU	2.228	1.185	0.060	9.282	0.911	94.615
	Constant	-7.769	2.500	0.002	0.000		

Forward WALD Model

		B	S.E.	p-value	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Step 2	Disease status	1.548	0.512	0.002	4.704	1.724	12.833
	Complication at ICU: Hypotension	1.840	0.504	0.000	6.298	2.346	16.911
	Constant	-4.016	0.848	0.000	0.018		

a. Variable(s) entered on step 1: APACHE II Score, Neutropenia at ICU admission, Surgery in the previous 30 days:, Stage of cancer, Disease status, Treatment, Adjuvant chemotherapy, First line chemotherapy, Second and subsequent lines, Complication at ICU: Hypotension, Complication at ICU: Hyperthermia, Complication at ICU: Tachypnea, Complication at ICU: Primary bacteremia, Complication at ICU: Pulmonary aspergillosis, Neutropenia developed in the ICU.

As a final step in the analysis, a binary logistic regression analysis evaluating factors independently associated with ICU mortality among cancer patients was enrolled. Two modelling approaches were employed: a full linear model and a forward stepwise (Wald) model to determine the most significant predictors (Table 5).

In the full linear model, hypotension during ICU stay was the only variable that reached clear statistical significance (B = 2.244, p = 0.002), and it was strongly associated with increased mortality, with an adjusted OR of 9.434 (95% CI: 2.318–38.395). The forward stepwise (Wald) model identified two variables that were independently and significantly associated with ICU mortality, noting disease progression (B = 1.548, p = 0.002), and hypotension during ICU admission (B = 1.840, p < 0.001) that was associated with a more than six-fold increase in the odds of death (OR = 6.298, 95% CI: 2.346–16.911).

4. Discussion

When analyzing the results obtained, ICU admissions were influenced by the phases of the disease, indicating that all cancer patients including those with curable cases and those with severe diseases may eventually need critical care. According to our findings, cancer ICU patients have a wide range of comorbid diseases in addition to their illness, from more serious conditions like cirrhosis and COPD to more prevalent chronic conditions like diabetes and hypertension. APACHE II scores also showed variation in the degree of illness, suggesting that ICU admissions may be made to treat patients with severe physiological impairment or to monitor stable postoperative patients. These findings are consistent with those of Koutsoukou (2017), who listed a number of factors that influence the choice to admit cancer patients to the intensive care unit. Furthermore, it was noted that the study population frequently experienced hematological abnormalities, indicating that cancer and its treatment have detrimental effects on bone marrow function (Laconi et al., 2020).

The patterns and diagnoses of cancer patients hospitalized to the intensive care unit, for example, vary widely. According to Lajouanie et al. (2025), the majority of malignancies were brain tumors, which explains the significant risk of immediate neurological problems linked to this type of tumor that further necessitates ICU admission. Additionally, as noted by Walsh et al. (2015), gastrointestinal cancers were also prevalent, indicating their high frequency among Iraqis and their tendency for perioperative ICU treatment. (Boutry et al., 2022) In line with Xing et al. (2020) and Darmon et al. (2019), who emphasize the need for ICU admissions for patients looking forward to positive long-term treatment modalities, our results also demonstrated that ICU admissions were not restricted to end-stage disease or palliative approaches, but rather for potentially favorable long-term outcomes, such as stabilizing patients with vital sign abnormalities (Welch & Hurst, 2019).

The ICU mortality rate for cancer patients in our study was 24.8%, which is in line with global statistics. Bosch-Compte et al. (2023) in Spain (24%) and Ostermann et al. (2020) in England (26.4%) reported similar results. Inci & Zbib (2024), Pérez-Crespo et al. (2021) (37.9%), and Soares et al. (2010) (32.7%) reported higher rates in Turkey (58%) (Azoulay et al., 2011). Despite being significantly reduced, the mortality rate at WICI is still high, confirming the considerable danger that cancer patients in the intensive care unit confront and supporting additional research into the causes of these results.

Additionally, the inferential testing revealed that risks linked to mortality included high APACHE II scores, acute renal failure, neutropenia, and previous oncologic treatment. Inci & Zbib (2024) and Bosch-Compte et al. (2023) found similar results (Koo et al., 2020), and Taccone et al. (2009) and Soares et al. (2010) highlighted the consequences of organ failure. Similarly, Darmon et al. (2019) and Azoulay et al. (2011) linked recent chemotherapy and progressing disease with a worse prognosis, while Bosch-Compte et al. (2023) likewise connected neutropenia at admission to worse outcomes. Other important factors that affected mortality included bacteremia, pulmonary aspergillosis, hemodynamic instability (hypotension), and mechanical ventilation. These findings are in line with those of Inci & Zbib (2024), Soares et al. (2010), and Pérez-Crespo et al. (2021), who discovered that aberrant vital signs and mechanical ventilation were predictive of poor outcomes. Only two independent predictors—disease progression and hypotension during ICU stay—remained significant in multivariate analysis. According to Azoulay et al. (2011) and Pérez-Crespo et al. (2021), disease progression increased mortality odds by 4.7-fold (p = 0.002), whereas hypotension increased mortality risk by 6.2-fold, supporting the prognostic weight of circulatory instability. Age, gender, cancer type, and stage—factors previously found to be predictive in other research (Elmore et al., 2021). did not demonstrate significance in this group, indicating that physiological deterioration and disease trajectory, rather than baseline demographics, are the primary determinants of ICU outcomes.

5. Conclusions

The outcomes of this study, which evaluated 113 cancer patients in total, were significant. The overall ICU death rate was 24.8%, whereas the survival rate was found to be 75.2%. Multiple characteristics were shown to be related with death, including high APACHE II scores, acute renal failure at admission, neutropenia, and prior oncological treatment. Furthermore, it was discovered that infectious complications such as bacteremia and pulmonary aspergillus's, mechanical ventilation, and vital sign instability such as hypotension, hyperthermia, tachypnea, and tachycardia were related with death in ICU cancer patients.

Additionally, examining the binary logistic regression data, we found that two independent predictors of high mortality are the progression of the disease and hypotension throughout the ICU stay.

Cancer patients at WICI had a high ICU death rate. These results emphasize the necessity of early detection of high-risk patients and focused interventions to enhance ICU outcomes in oncology settings with limited resources.

6. Recommendations

This study highlights the need for better care strategies for cancer patients in intensive care. It's recommended that ICU teams work closely across specialties to regularly assess each patient's condition and make well-informed decisions about discharge. By focusing early on treatable issues like infections or unstable vital signs, healthcare providers can improve recovery chances. It's also important that ICU staff receive continuous training on managing cancer-related complications and supporting patients nearing end-of-life. Hospitals should develop clear guidelines for admitting and discharging cancer patients from the ICU, and include palliative care specialists in daily ICU discussions, especially for patients with limited chances of recovery. Looking ahead, more in-depth studies involving multiple hospitals are needed to confirm these findings, and to better understand how ICU stays affect cancer patients' long-term health and quality of life.

7. Conflict of Interest Statement

The authors declare no conflicts of interest relevant to the content of this study.
No financial relationships, personal interests, or affiliations influenced the research design, analysis, interpretation, or reporting of the findings.

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