Journal on Oncology

www.journalononcology.org

Research Article

Open Access, Volume 4

Advanced Life Support in Oncology Intensive Care Units: A Prospective Observational Study

Rebeca Veneziani de Souza Santos[1]; Guilherme Gonçalves Ferrigolli[1]; Dayane Gomes da Silva[1]; Edielle de Sant´Anna Melo[2]; Luciana Gioli Pereira[1,2]*

[1]Albert Einstein Faculty of Health Sciences, School of Medicine, São Paulo, Brazil.

[2]Department of Intensive Care, Municipal Hospital Dr. Gilson de Cássia Marques de Carvalho, Brazilian Israeli Beneficent Society Albert Einstein, São Paulo, Brazil.

Abstract

Introduction: The survival rate of cancer patients has increased in recent decades, leading to a growing number of admissions to Intensive Care Units (ICUs) and artificial life support, often with questionable indications. Our aim was to evaluate the context of advanced life support in a public oncology hospital and the outcomes of patients.

Objective: To assess causes of admission of oncology patients to the ICU and outcomes during hospitalization.

Method: We conducted a prospective observational study in the Intensive Care Unit of Dr. Gilson de Cássia Marques de Carvalho Municipal Hospital. Adult patients with a cancer diagnosis requiring intensive care were included consecutively. Clinical data, severity scores, indication of invasive procedures, indication of palliative care and costs related to hospitalization were collected. The evaluated outcomes were ICU length of stay, indication of palliative care during ICU stay, and all-cause mortality.

Results: A total of 113 oncology patients admitted to the ICU were included in the study, with a mean age of 60 years and 60.2% male. The main reasons for admission were organic dysfunction or clinical complications, accounting for 72.6% of cases. Most patients required intensive support (61.9%) and utilized invasive devices (76.1%). Palliative care was indicated for 40(35.4%) patients. In the non-palliative care group, the mortality rate was 10.3%, and in the palliative care group, it was 42.2% ($p<0.001$). The median ICU length of stay was 3 [2-6] days, and the total ICU mortality was 23%.

Conclusion: The high prevalence of palliative care recommendations in the ICU may indicate an inappropriate use of intensive care resources for these patients.

Keywords: Oncology; Intensive care; Palliative care; Costs; Mortality.

Manuscript Information: *Received: Nov 13, 2024; Accepted: Dec 03, 2024; Published: Dec 10, 2024*

Correspondance: *Luciana Gioli Pereira, Department of Intensive Care, Municipal Hospital Dr. Gilson de Cássia Marques de Carvalho, Brazilian Israeli Beneficent Society Albert Einstein, São Paulo, Brazil. Email: luciana.gioli@einstein.br*

Citation: *Santos RVDS, Ferrigolli GG, Silva DGD, Melo EDSA, Pereira LG. Advanced Life Support in Oncology Intensive Care Units: A Prospective Observational Study. J Oncology. 2024; 4(2): 1162.*

Introduction

Over the past decades, cancer has emerged as a challenge for global public health, affecting approximately one in five individuals throughout their lifetimes, according to estimates from the Global Cancer Observatory [1-3]. This scenario is compounded by reductions in fertility rates and infant mortality, contributing to population aging and a gradual increase in deaths related to chronic diseases [4].

Medicine, in turn, has witnessed significant advancements in cancer diagnosis and treatment, resulting in substantial increases in patient survival. However, these advancements bring forth new clinical and ethical challenges, particularly in the complex environment of Intensive Care Units (ICUs). A recent analysis conducted at the MD Anderson Cancer Center, encompassing nearly 8,000 hospital admissions, revealed that 14.1% were associated with cancer. These patients exhibited higher rates of hospital mortality, readmission, and length of stay compared to their counterparts without this diagnosis [5-7].

This reality is no different in the Brazilian context, although literature on the subject is scarce. There has been an increase in hospitalization costs associated with the performance of invasive and uncomfortable procedures [8]. Concerns about the quality of life of these patients under intensive care also raise the dilemma of how to significantly extend their lives [9,10].

Considering this panorama, the growing survival of patients undergoing oncological treatment and, consequently, the eventual need for ICU admission during the disease, we present data from an oncology ICU at a municipal hospital within the Brazilian Unified Health System (SUS) in São Paulo. Our hypothesis is that the correct indication of intensive care and palliative care for critically ill oncology patients can improve quality of life and optimize ICU resources.

Objective

We have investigated the utilization of advanced life support interventions and their association with outcomes in oncology patients admitted to the Intensive Care Unit (ICU) of a public hospital, focusing on the causes of admission, length of ICU stays, utilization of invasive procedures, indication of palliative care, costs related to hospitalization and all-cause mortality.

Materials and methods

Population and study design

This was an observational, prospective study conducted in the Intensive Care Unit of Dr. Gilson de Cássia Marques de Carvalho Municipal Hospital (Vila Santa Catarina Municipal Hospital). The period analyzed was from June 2020 to August 2021. The study was approved by the Research Ethics Committee of Hospital Israelita Albert Einstein under registration number CONEP (CAAE): 29649420.2.0000.0071. Data analysis was carried out in an aggregated way so that the secrecy and privacy of the data were respected throughout the process. Informed consent was obtained from the patients or their legal guardians. Data were analyzed in an aggregated and anonymized manner. The entire study was performed according to current legislation in Brazil, and in accordance with the declaration of Helsinki.

Eligibility criteria

Adult patients over 18 years old, with a known oncological diagnosis, who were admitted to the ICU for any reason were considered for the study. The exclusion criterion was refusal to participate expressed by the patient or legal guardian.

Outcomes

The primary outcomes were indication for palliative care and all-cause mortality, while secondary outcomes included length of stay in the ICU, utilization of intensive support and invasive devices, and total costs of hospitalizations.

Data collection

REDCap form [11] was utilized for data collection of the variables of interest: socio-demographic data, medical history, oncological diagnosis and disease staging, ECOG [Eastern Cooperative Oncology Group] performance status [12], reason for ICU admission, need for invasive support during hospitalization [mechanical ventilation, dialysis, vasoactive drugs among others], complementary exams, length of stay, clinical-surgical outcomes, costs and all-cause mortality. Severity scores such as SAPS3 [13], and APACHE II [14] were calculated using laboratory exams and available data. All patients had their ONCOSCORE [15] calculated.

Statistical analysis

The variables were described using absolute and relative frequencies for qualitative variables and means and standard deviations or medians and quartiles, as well as minimum and maximum values for quantitative variables [16]. The relationships between palliative care and patient outcomes were investigated using chi-square tests for qualitative variables and Mann-Whitney non-parametric tests for quantitative variables. Analyses were performed using the SPSS program [17] considering a significance level of 5%.

Results

A total of 113 oncology patients admitted to the ICU for any reason were included. The mean age of the patients was 60.6 years (standard deviation 13.2 years), ranging from 23 to 87 years at the time of ICU admission, comprising 60.2% (68) males (Table 1).

Regarding the reasons for ICU admission, 82(72.6%) patients were admitted due to organic dysfunction or clinical complications such as infections (including COVID-19), hemodynamic alterations, respiratory failure, neurological changes, among other reasons, and 31(27.4%) patients post-elective or urgent surgery. Seventy (61.9%) patients required some form of intensive support, and 86(76.1%) utilized at least one type of invasive device during ICU stay (Table 2).

The most frequent oncological diagnoses among these patients were: 19(16.8%) colorectal cancer, 17(15.0%) lung cancer, 11(9.7%) bladder cancer, and 10(8.8%) pancreatic cancer (Table 1). Regarding staging, 47(41.6%) patients presented with in situ disease, and 66 (58.4%) with metastatic disease. Upon admission to the ICU, 38 (33.6%) patients had an ECOG score greater than or equal to 3 (Table 1).

Severity/mortality scores were calculated for patients with complete data (Table 3). The APACHE II score was obtained for the majority (92.0%) of patients and ranged from 2 to 38 points, with a median of 12 points (first quartile 8; third quartile 19 points), with the probability of ICU mortality for these patients ranging from 3.8 to 88.4%, with a median of 14.6% (first quartile 8.7%; third quartile 32.2%). Regarding the outcomes of all analyzed patients, 26(23.0%) progressed to death, and 87(77.0%) were discharged from the ICU.

During intensive treatment, 35.4% (40) of patients started exclusive palliative care in the ICU, and 5(4.4%) patients were already admitted in this condition. In the non-palliative care group, the mortality rate was 10.3%, and in the palliative care group, it was 42.2% (p<0.001). We observed differences between patients who died and those who were discharged regarding all severity scores as shown in (Table 5). The medians of the scores for patients who died during ICU stay are significantly higher than the medians of patients who were discharged.

Comparing patients who started palliative care in the ICU and non-palliative patients, we have significant differences regarding SAPS 3 scores (p=0.003), SAPS 3 ICU mortality probability (p=0.003), OncoScore (p=0.034), and APACHE II ICU mortality probability (p=0.001). The medians of the scores for patients who started palliative care in the ICU are significantly higher than the medians of non-palliative patients (Table 6).

ICU hospitalization costs were obtained for 87 (77.0%) patients. These ranged from R$ 237.48 to R$ 287,58.51. The cost of total hospitalization time for 89 (78.8%) patients ranged from R$ 951.78 to R$ 478,807.34. We did not observe significant differences between the groups without and with palliative care regarding ICU hospitalization cost (p=0.943) and total hospitalization cost (p=0.609) as described in (Table 4).

Table 1: Baseline clinical characteristics of oncology patients admitted to the ICU for any reasons (n=113).

Sociodemographic data	
Male, n(%) Age, years (mean±SD)	68 (60,2%) 60,6±13,2
Oncological diagnosis	*n(%)*
Lung	17(15,0%)
Breast	6 (5,3%)
Stomach	7(6,2%)
Esophagus	6(5,3%)
Colorectal	19(16,8%)
Liver	1(0,9%)
Prostate	5(4,4%)
Cervix	3(2,7%)
Ovary	3(2,7%)
Endometrium	1(0,9%)
Kidney	7(6,2%)
Bladder	11(9,7%)
Others	27(23,9%)
Staging	*n(%)*
In situ	47(41,6%)
Metastatic	66(58,4%)
ECOG	*n(%)*
0	5(4,4%)
1	49(43,4%)
2	18(15,9%)
3	19(16,8%)
4	19(16,8%)
Unknown	3(2,7%)
Comorbidities #	*n(%)*
Hypertension	54(47,8%)
Diabetes mellitus	26(23,0%)
Dyslipidemia	15(13,3%)
Chronic obstructive pulmonary disease (COPD)	7(6,2%)
Arrhythmia	3(2,7%)
Coronary artery disease (CAD)	9(8,0%)
Heart failure (HF)	3(2,7%)
Obesity	7(6,2%)
Others	40(35,4%)
Hábitos	
Smoking	
No	58(51,3%)
Yes	19(16,8%)
Ex-smoker	36(31,9%)
Alcohol consumption	
No	83(73,5%)
Yes (occasional/social)	8(7,1%)
Yes (daily)	3(2,7%)
Ex-drinker	19(16,8%)
Drug use	
No	112(99,1%)
Yes	1(0,9%)

Table 2: Reason for admission to the ICU, need for intensive support, and devices during hospitalization (n=113).

Reason for admission to the ICU	***n(%)***
Infection (any site)	20(17,7%)
Hemodynamic/cardiovascular alteration	27(23,9%)
Respiratory failure	18(15,9%)
Neurological alteration	8(7,1%)
Postoperative	31(27,4%)
Other reasons	7(6,2%)
COVID-19	2(1,8%)
Other reasons for admission to the ICU	*n(%)*
Renal failure	4(3,5%)
Symptom control	1(0,9%)
Ogilvie syndrome	1(0,9%)
Vomiting	1(0,9%)

Grouping of reasons for ICU admission	*n(%)*
Postoperative	31(27,4%)
Organ dysfunction/clinical complications	82(72,6%)
Need for intensive support	*n(%)*
No	43(38,1%)
Yes	70(61,9%)
Intensive support used	*n(%)*
Vasoactive drug	54(47,8%)
Mechanical ventilation	30(26,5%)
Renal replacement therapy	13(11,5%)
Sedation	35(31,0%)
Inotropic	5(4,4%)
Neuromuscular blockade	9(8,0%)
Full anticoagulation	9(8,0%)
Invasive devices in the ICU	*n(%)*
No	27(23,9%)
Yes	86(76,1%)
Devices used	*n(%)*
Orotracheal tube	31(27,4%)
Indwelling urinary catheter	64(56,6%)
Central venous catheter	54(47,8%)
Nasoenteral or nasogastric tube	32(28,3%)
Invasive blood pressure monitoring	44(38,9%)
Drains	13(11,5%)

Table 3: Severity/mortality scores of oncology patients admitted to the ICU for any reasons (n=113).

Score	
SAPS 3	(n=59)
mean (SD)	61,5 (16,4)
median (Q1; Q3)	65,0 (51,0; 73,0)
min; max	25,0; 94,0
Probability of ICU mortality (SAPS 3)	(n=59)
mean (SD)	51,9 (28,9)
median (Q1; Q3)	60,2 (26,4; 76,3)
min; max	1,5; 95,1
SOFA	(n=46)
mean (SD)	5,3 (3,8)
median (Q1; Q3)	5,0 (2,0; 8,0)
min; max	0,0; 14,0
OncoScore	(n=113)
mean (SD)	4,1 (2,3)
median (Q1; Q3)	4,0 (3,0; 6,0)
min; max	0,0; 9,0
APACHE II	(n=104)
mean (SD)	14,3 (7,7)
median (Q1; Q3)	12,0 (8,0; 19,0)
min; max	2,0; 38,0
Probability of ICU mortality (APACHE II)	(n=104)
mean (SD)	23,9 (20,2)
median (Q1; Q3)	14,6 (8,7; 32,2)
min; max	3,8; 88,4
Probability of ICU mortality, adjusted for admission diagnosis (APACHE II)	(n=90)
mean (SD)	25,0 (22,2)
median (Q1; Q3)	17,8 (9,1; 33,9)
min; max	1,0; 89,5

SD: Standard Deviation; Q1: First Quartile; Q3: Third Quartile; N: Number of Patients. The Most Appropriate Descriptive Statistics are Underlined.

Table 4: Outcomes of oncology patients admitted to the ICU for any reasons (n=113).

Outcomes	
Exclusive palliative care	n(%)
No	68(60,2%)
Yes	45(39,8%)
ICU outcome	
Death (only in ICU)	26(23,0%)
Transfer to ward	81(71,7%)
Discharged home	6(5,3%)
Death during ICU stay	
No	87(77,0%)
Yes	26(23,0%)
Hospital length of stay	
mean (SD)	16,1(16,4)
median (Q1; Q3)	11,0(6,0; 20,0)
min; max	0,0; 114,0
ICU length of stay	
mean (SD)	4,8(6,7)
median (Q1; Q3)	3,0 (2,0; 6,0)
min; max	0,0; 58,0
Cost of hospitalization: total amount (R$)	(n=89)
mean (SD)	61207,53(75683,99)
median (Q1; Q3)	39564,08(24163,40; 66541,80)
min; max	951,78; 478807,34
Cost of hospitalization: ICU cost (R$)	(n=87)
mean (SD)	29326,28 (42048,49)
median (Q1; Q3)	14304,14(8995,69; 33367,71)
min; max	237,48; 287858,51

SD: Standard Deviation; Q1: First Quartile; Q3: Third Quartile; N: Number of Patients; the Most Appropriate Descriptive Statistics are Underlined.

Table 5: Severity scores according to clinical outcome of oncology patients admitted to the ICU for any reasons.

	ICU Outcome Discharge (n=68)	Death (n=45)	p-value
SAPS 3 score	(n=43)	(n=16)	**<0,001**
median (Q1; Q3)	58,0 (49,0; 69,0)	73,0 (69,0; 84,0)	
min; max	25,0; 84,0	46,0; 94,0	
Probability of ICU mortality (SAPS 3)	(n=43)	(n=16)	**<0,001**
median (Q1; Q3)	42,9 (22,4; 68,9)	76,3 (68,9; 89,5)	
min; max	1,5; 89,5	17,1; 95,1	
SOFA score	(n=31)	(n=15)	**0,011**
median (Q1; Q3)	4,0 (1,0; 7,0)	5,0 (5,0; 11,0)	
min; max	0,0; 10,0	2,0; 14,0	
OncoScore			**<0,001**
median (Q1; Q3)	3,0 (2,0; 5,0)	6,0 (5,0; 8,0)	
min; max	0,0; 8,0	2,0; 9,0	
APACHE II score	(n=79)	(n=25)	**0,001**
median (Q1; Q3)	11,0 (8,0; 16,0)	22,0 (13,0; 26,0)	
min; max	2,0; 31,0	5,0; 38,0	
Probability of ICU mortality (APACHE II)	(n=79)	(n=25)	**0,001**
median (Q1; Q3)	12,9 (8,7; 23,5)	42,4 (16,5; 56,9)	
min; max	3,8; 73,3	5,8; 88,4	
Probability of ICU Mortality, adjusted for admission diagnosis (APACHE II)	(n=68)	(n=22)	**<0,001**
median (Q1; Q3)	12,9 (7,9; 24,4)	40,7 (18,7; 66,5)	
min; max	1,0; 81,2	8,5; 89,5	

Q1: First Quartile; Q3: Third Quartile; N: Number of Patients; ¥: Mann-Whitney Tests.

Table 6: Severity scores according to clinical outcome of oncology patients admitted to the ICU for any reasons.

	Palliative Care		p-value
	Non-palliative (n=68)	**Initiated in ICU**	
SAPS 3 score	(n=35)	(n=22)	**0,003**
median (Q1; Q3)	57,0 (40,0; 71,0)	69,0 (63,0; 82,0)	
min; max	25,0; 84,0	49,0; 94,0	
Probability of ICU mortality (SAPS 3)	(n=35)	(n=22)	**0,003**
median (Q1; Q3)	40,4 (9,3; 72,8)	68,9 (55,4; 87,8)	
min; max	1,5; 89,5	22,4; 95,1	
SOFA score	(n=29)	(n=17)	0,337
median (Q1; Q3)	4,0 (2,0; 7,0)	5,0 (4,0; 9,0)	
min; max	0,0; 14,0	0,0; 13,0	
OncoScore			0,034
median (Q1; Q3)	3,0 (2,0; 5,0)	4,0 (3,0; 6,5)	
min; max	0,0; 9,0	1,0; 9,0	
APACHE II score	(n=61)	(n=38)	0,186
median (Q1; Q3)	12,0 (8,0; 18,0)	13,5 (10,0; 24,0)	
min; max	2,0; 31,0	5,0; 38,0	
Probability of ICU mortality (APACHE II)	(n=61)	(n=38)	0,186

median (Q1; Q3)	14,6 (8,7; 29,1)	17,6 (11,3; 49,7)	
min; max	3,8; 73,3	5,8; 88,4	
Probability of ICU Mortality, adjusted for admission diagnosis (APACHE II)	(n=54)	(n=34)	0,001
median (Q1; Q3)	12,4 (7,1; 24,9)	26,5 (12,9; 56,7)	
min; max	1,0; 68,2	6,7; 89,5	

Q1: First Quartile; Q3: Third Quartile; N: Number of Patients; ¥: Mann-Whitney Tests.

Discussion

This observational study, conducted in a public hospital in São Paulo, aimed to evaluate the context of advanced life support and the outcomes of oncology patients admitted to the ICU. Among the results obtained, we observed that most ICU admissions were due to organ dysfunctions or clinical complications, totaling 72.6% of the cases. Most patients required intensive support (61.9%) and utilized invasive devices (76.1%) during their stay. Palliative care was indicated for 45 patients (39.8%), and the ICU mortality rate was 23%.

Data from the literature supports these findings, highlighting the close association between cancer and vulnerability to acute events. For instance, Thiery et al. emphasized the need for careful evaluation of the risks and benefits of admitting critically ill oncology patients to the ICU, due to their significant mortality rate and use of ventilatory, hemodynamic, and renal support [18,19].

Analyzing the severity scores of patients who died during ICU hospitalization, we found that they were significantly higher compared to patients who were discharged, corroborating recent studies such as those by Puxty et al. (2014) and Darmon et al. (2019), which associate high scores with worse outcomes. This correlation, found in patients with compromised functional status (ECOG 3-4) and high scores, reinforces the use of these scores as prognostic tools. They not only identify patients at higher risk of death early but also guide targeted interventions, such as symptom relief alternatives in patients with poor prognosis [20,21].

Furthermore, we observed that patients in palliative care had higher mortality rates compared to those not in palliative care. This association may indicate a bias in the indication of intensive support for patients with poor prognosis. Indeed, other studies suggest the need to weigh the risks and benefits associated with invasive support and the prolongation of suffering and deterioration in the quality of life of oncology patients [22,23].

In an article published in the European Journal of Cancer in 2008, Penel et al. discussed methods to optimize the allocation of resources associated with the care of oncology patients in the ICU, including identifying which patients benefit most from intensive measures and what economically viable alternatives exist. However, in our study, there was no significant difference in hospitalization costs between palliative and non-palliative patients.

We speculate that this may be related to the similar severity of both groups, as well as the possible inappropriate indication of intensive support for patients with a high ECOG score. On the other hand, it is questioned whether supportive care is a way to reduce costs, a finding that reflects the complexity of the clinical management of critically ill oncology patients, regardless of the therapeutic plan outlined for them [24].

Additionally, Earle et al. analyzed various administrative indicators to discuss cost and efficiency in the care of oncology patients at the end of life. They addressed not only the reduction of unnecessary costs associated with avoidable hospitalizations, such as for patients who do not benefit from intensive care but receive it at the expense of comfort and symptom management [25].

Limitations

Our study has several limitations that should be acknowledged. Firstly, the small sample size may limit the generalizability of our findings, as it may not be representative of the broader population of oncologic patients in Intensive Care Units (ICUs). Secondly, the observational nature of the study precludes the establishment of causality, allowing only for the identification of associations rather than direct cause-and-effect relationships. Lastly, being a unicenter study, the results may reflect institution-specific practices and patient characteristics, which might not be applicable to other settings or geographic regions. These factors necessitate caution in interpreting the results and highlight the need for further research with larger, multicenter cohorts to validate our findings.

Conclusion

The high utilization of intensive support and invasive devices, coupled with considerable mortality, underscores the need for a thorough evaluation of ICU admission for oncology patients. This study highlights the complexity of managing oncology patients in the ICU, emphasizing the importance of severity scores in indicating intensive support and predicting associated outcomes. Early inclusion of palliative care may improve quality of life and optimize ICU resources, emphasizing the importance of well-defined protocols for admission and integration of palliative care. Furthermore, we suggest the need for a priority discussion on palliative approaches and symptom control for patients in advanced stages of the disease.

Disclosures: All authors report no relationships that could be construed as a conflict of interest. All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

Funding declaration: This research didn't receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Ferlay JCM, Soerjomataram I, Parkin DM, Piñeros M, Znaor A, et al. Cancer statistics for the year 2020: An overview. International Journal of Cancer. 2021.

2. Sung HFJ, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: Globocan Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: A Cancer Journal for Clinicians. 2021; 71: 209-49.

3. Câncer Ind. Estimativa 2023: Incidência de câncer no Brasil. Rio de Janeiro: INCA. 2022; 160.

4. Wild CPWE, Stewart BW. Editor. World Cancer Report: Cancer Research for Cancer Prevention: International Agency for Research on Cancer. 2020.

5. Wallace SKRNK, Waller DK, Ensor JE, Haque SA, Price KJ, et al. Two Decades of ICU Utilization and Hospital Outcomes in a Comprehensive Cancer Center. Critical Care Medicine. 2016; 44: 926-33.

6. Morrison RSMDE. Palliative care. New England Journal of Medicine. 2004; 350: 2582-90.

7. Numico GZC, Ippoliti R, Rossi M, Traverso E, Antonuzzo A, et al. The hospital care of patients with cancer: A retrospective analysis of the characteristics of their hospital stay in comparison with other medical conditions. European Journal of Cancer. 2020; 139: 99-106.

8. Vincent FSM, Mokart D, Lemiale V, Bruneel F, Boubaya M, et al. Grrr-OH: Groupe de recherche respiratoire en réanimation en Onco-Hématologie. In-hospital and day-120 survival of critically ill solid cancer patients after discharge of the intensive care units: results of a retrospective multicenter study - A Groupe de recherche respiratoire en réanimation en Onco-Hématologie (Grrr-OH) study. Annals of Intensive Care. 2018; 8: 40.

9. Taniwaki LSUJPL, Rodrigues de Souza PM, Lobato Prado B. Timing of palliative care access and outcomes of advanced cancer patients referred to an inpatient palliative care consultation team in Brazil. Palliative and Supportive Care. 2019; 17: 425-30.

10. Sullivan DRCB, Lapidus JA, Ganzini L, Hansen L, Carney PA, et al. Association of Early Palliative Care Use With Survival and Place of Death Among Patients With Advanced Lung Cancer Receiving Care in the Veterans Health Administration. JAMA Oncology. 2019; 5: 1702-9.

11. Harris PATR, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. REDCap Consortium. The REDCap consortium: Building an international community of software platform partners. Journal of Biomedical Informatics. 2019; 95: 103-208.

12. Al. MMORHCDCTe. Toxicity and response criteria of the Eastern Cooperative Oncology Group. American Journal of Clinical Oncology. 1982; 5: 649-56.

13. Moreno RPMPG, Almeida E, Jordan B, Bauer P, Campos RA, et al. SAPS 3 Investigators. SAPS 3 - From evaluation of the patient to evaluation of the intensive care unit. Part 2: Development of a prognostic model for hospital mortality at ICU admission. Intensive Care Medicine. 2005; 31: 1345-55.

14. Vincent JLMR, Takala J, Willatts S, De Mendonça A, Bruining H, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. Intensive Care Medicine. 1996; 22: 707-10.

15. Knaus WADEA, Wagner DP, et al. APACHE II: A severity of disease classification system. Critical Care Medicine. 1985; 13: 818-29.

16. Altman DG. Practical Statistics for Medical Research. 1st Edition ed. New York: Chapman and Hall/CRC. 1990.

17. Corp I. IBM SPSS Statistics for Windows, Version 29.0. Armonk, NY: IBM Corp. 2022.

18. Azoulay ESM, Darmon M, Benoit D, Pastores S, Afessa B. Intensive care of the cancer patient: Recent achievements and remaining challenges. Annals of Intensive Care. 2011; 1: 5.

19. Thiéry GAE, Darmon M, Ciroldi M, De Miranda S, Lévy V, et al. Outcome of cancer patients considered for intensive care unit admission: A hospital-wide prospective study. Journal of Clinical Oncology. 2005; 23: 4406-13.

20. Darmon MBA, Georges Q, Soares, M, Jeon K, Oeyen S, et al. Changes in critically ill cancer patients' short-term outcome over the last decades: Results of systematic review with meta-analysis on individual data. Intensive Care Medicine. 2019; 45: 977-87.

21. Puxty KMP, Quasim T, Kinsella J, Morrison D. Survival in solid cancer patients following intensive care unit admission. Intensive Care Medicine. 2014; 40: 1409-28.

22. Haun MWES, Rücker G, Friederich HC, Villalobos M, Thomas M, et al. Early palliative care for adults with advanced cancer. Cochrane Database of Systematic Reviews. 2017; 6: CD011129.

23. Hui DKSH, Roquemore J, Dev R, Chisholm G, Bruera E. Impact of timing and setting of palliative care referral on quality of end-of-life care in cancer patients. Cancer. 2014; 120: 1743-9.

24. Penel NFS, Bonneterre J. How to design a cost-effective protocol for patients admitted to intensive care unit with a cancer? European. Journal of Cancer. 2008; 44: 475-82.

25. Earle CCPER, Lai B, Weeks JC, Ayanian JZ, Block S. Identifying potential indicators of the quality of end-of-life cancer care from administrative data. Journal of Clinical Oncology. 2003; 1(6): 1133-8.