Outcomes for Patients With Cancer Admitted to the ICU Requiring Ventilatory Support
Results From a Prospective Multicenter Study

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BACKGROUND: This study was undertaken to evaluate the clinical characteristics and outcomes of patients with cancer requiring nonpalliative ventilatory support.

METHODS: This was a secondary analysis of a prospective cohort study conducted in 28 Brazilian ICUs evaluating adult patients with cancer requiring invasive mechanical ventilation (MV) or noninvasive ventilation (NIV) during the first 48 h of their ICU stay. We used logistic regression to identify the variables associated with hospital mortality.

RESULTS: Of 717 patients, 263 (37%) (solid tumors = 227; hematologic malignancies = 36) received ventilatory support. NIV was initially used in 85 patients (32%), and 178 (68%) received MV. Additionally, NIV followed by MV occurred in 45 patients (53%). Hospital mortality rates were 67% in all patients, 40% in patients receiving NIV only, 69% when NIV was followed by MV, and 73% in patients receiving MV only ($P < .001$). Adjusting for the type of admission, newly diagnosed malignancy (OR, 3.59; 95% CI, 1.28-10.10), recurrent or progressive malignancy (OR, 3.67; 95% CI, 1.25-10.81), tumoral airway involvement (OR, 4.04; 95% CI, 1.30-12.56), performance status (PS) 2 to 4 (OR, 2.39; 95% CI, 1.24-4.59), NIV followed by MV (OR, 3.00; 95% CI, 1.09-8.18), MV as initial ventilatory strategy (OR, 3.53; 95% CI, 1.45-8.60), and Sequential Organ Failure Assessment score (each point except the respiratory domain) (OR, 1.15; 95% CI, 1.03-1.29) were associated with hospital mortality. Hospital survival in patients with good PS and nonprogressive malignancy and without tumoral airway involvement was 53%. Conversely, patients with poor functional capacity and cancer progression had unfavorable outcomes.

CONCLUSIONS: Patients with cancer with good PS and nonprogressive disease requiring ventilatory support should receive full intensive care, because one-half of these patients survive. On the other hand, provision of palliative care should be considered the main goal for patients with poor PS and progressive underlying malignancy. CHEST 2014; 146(2):257-266

Acute respiratory failure (ARF) with the need for ventilatory support is a frequent complication and a significant reason for admission to ICUs.[1] During the course of critical illness, up to 65% of all patients will need invasive mechanical ventilation (MV) or noninvasive ventilation (NIV).[2,3] Moreover, ventilatory support is the major organ supportive therapy carried out in critically ill patients with cancer.[4-8] The main common causes of respiratory failure in patients with malignancies are infections, direct tumoral involvement of the respiratory system, cancer-related medical disorders, and anticancer drug-induced respiratory distress.[9] As a consequence of the underlying disease or complications, ARF in patients with cancer in the ICU has been considered for many years to be poorly responsive to supportive care and to be associated with high mortality.[10,11] Nevertheless, advances in critical care and oncology, as well as a more appropriate selection of patients, have improved these outcomes substantially. However, information on the prognosis of patients with malignancies who are mechanically ventilated usually comes from single-center studies carried out in specialized ICUs. Additionally, studies using databases of patients in the general ICU[12,13] usually have limited information regarding cancer and

its treatment-related aspects.[14] The identification of factors associated with outcomes in this setting may aid physicians, patients, and families in deciding goals and treatment directives. Thus, the aim of the current study was to describe the clinical outcomes and prognostic factors in critically ill patients with cancer requiring ventilatory support early in the course of their ICU stay.

Materials and Methods

Design, Setting, and Eligibility Criteria

This study was a secondary analysis of a multicenter prospective cohort study conducted in 28 Brazilian ICUs (e-Appendix 1) between August 1 and September 30, 2007.[15] The study was strictly observational, and every clinical decision (including the decision to start, change the modality, or cease the ventilatory support) was at the discretion of attending physicians. The Comitê de Ética em Pesquisa of Instituto Nacional de Câncer (No. 013/07) approved the study, as did local institutional review boards at all the other participating sites and the Brazilian National Ethics Committee. Informed consent was waived because of the observational character of the trial.

In the current study, all adult patients (≥ 18 years old) with a definite diagnosis of cancer and who required ventilatory support (invasive MV or NIV) for ≥ 24 h during the first 48 h of ICU admission to the participating ICUs were evaluated. Patients in complete cancer remission for > 5 years and readmissions were not considered.

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Data Collection and Processing

We used a specific and standardized case report form to collect the study data. Demographic, clinical, and laboratory data included age, sex, hospital location before ICU admission, main reasons for ICU admission and for the need for ventilatory support, comorbidities, performance status (PS) (Eastern Cooperative Oncology Group scale),[16] results determined by the Simplified Acute Physiology Score (third version) (SAPS 3),[17] the Sequential Organ Failure Assessment (SOFA) score,[18] and cancer- and treatment-related information. The Adult Comorbidity Evaluation-27 was used to evaluate comorbid diseases and conditions according to the severity of organ decompensation and prognostic impact.[19] An overall comorbidity score (none, mild, moderate, or severe) was attributed based on the highest-ranked single ailment. Patients with hematologic malignancies were categorized as low grade or high grade.[20] Neutropenia was defined as a neutrophil count < 500/mm³. For the purposes of the current study, we classified patients according to the used ventilatory strategy into three groups: NIV only (patients exclusively ventilated with NIV), MV only (patients who were initially intubated for MV), and NIV followed by MV (when MV was used in those who initially received NIV, regardless of the indication). Sepsis and ARDS were diagnosed according to the current definitions during the study period.[21,22] Cancer was considered to be a direct reason for MV in the case of bilateral metastatic nodules, carcinomatous lymphangitis, or tumoral masses resulting in airway obstruction, lung compression, or atelectasis. Vital status at hospital discharge was the main outcome of interest.

Statistical Analysis

We used standard descriptive statistics to describe the study population. Continuous variables were reported as mean ± SD or median (25%-75% interquartile range) as appropriate. We performed univariate and multivariate logistic regression to identify factors associated with hospital mortality.[23] Linearity between each continuous variable and the dependent variable was demonstrated using locally weighted scatterplot smoothing.[23] In the case of nonlinearity, the variable was stratified according to the inflection points and clinical significance. For categorical variables with multiple levels, the reference level was attributed to the one with the lowest probability of the dependent variable. Variables yielding P values < .2 by univariate analysis and those considered clinically relevant were entered into the multivariate analysis to estimate the independent association of each covariate with the dependent variable. To control for biases regarding the probability of NIV use as an initial modality of ventilatory support, we fitted a propensity score that included cancer status, SOFA score, admission to an exclusive oncologic ICU, respiratory rate, and cardiogenic pulmonary edema as a reason for

NIV.[24] The results of the multivariate analysis were summarized as ORs and respective 95% CIs. Possible interactions were tested. The model's calibration was assessed using the Hosmer-Lemeshow goodness-of-fit test.[23] With this test, P values > .05 indicate a good fit for the model. For all other analyses, two-tailed P values < .05 were considered statistically significant.

Results

Characteristics of the Study Population

Of the 717 patients admitted to the 28 participating ICUs, 263 (37%) fulfilled the eligibility criteria, and these constituted the study population (Fig 1). The median patient inclusion from each center was six (25%-75%, 4-13; range, 1-33). Two hundred twenty-seven patients (86%) had solid tumors, and 36 patients (14%) had hematologic malignancies. Ventilatory support was required more frequently by patients with hematologic malignancies (36 of 50 patients [72%]) than by patients with solid tumors (227 of 667 patients [34%]) (OR, 4.98; 95% CI, 2.54-9.92; P < .001).

The patients' main characteristics are depicted in Table 1. The most frequent types of cancer were lower GI (n = 33 [13%]), lung (n = 31 [12%]), breast (n = 23 [9%]), upper GI (n = 23 [9%]), urogenital (n = 22 [8%]), head and neck (n = 20 [8%]), pancreas/liver/biliary tract (n = 20 [8%]), brain (n = 15 [6%]), lymphomas (n = 14 [6%]), leukemias (n = 11 [4%]), gynecologic (n = 9 [3%]), multiple myeloma (n = 8 [3%]), and others (n = 34 [13%]). Nine patients (3%) underwent bone marrow transplant (autologous = 7; allogenic = 2).

Figure 1 – *Study flowchart. MV = mechanical ventilation; NIV = noninvasive ventilation.*

Patients were admitted to the ICU after a median of 3 (0-11) days following hospital admission. There were 175 medical admissions (67%); 48 patients (18%) and 40 patients (15%) had undergone scheduled and emergency surgical procedures, respectively. The main sources of admission were the ward/floor (133 [44%]), operating/recovery rooms (n = 81 [31%]), ED (n = 49 [19%]), and step-down units (n = 18 [7%]).

Ventilatory Support

Invasive MV was initially used in 178 patients (68%), and 85 (32%) received NIV as ventilatory support. Table 2 depicts the main reasons for ventilatory support in the patients. The presence of sepsis, ARDS, and tumoral involvement were the main causes of ventilatory support and were also significant risk factors for hospital mortality in the univariate analysis. Table 3 summarizes the patients' characteristics according to the initial ventilatory strategy. As expected, patients undergoing initial invasive MV had increased disease severity (higher SAPS 3 and SOFA scores, greater use of dialysis and vasopressors, and higher lactate concentrations), longer ventilatory support requirements, and increased ICU and hospital mortality.

Invasive MV was used subsequently in 45 patients (53%) initially ventilated with NIV. The use of MV was more frequent in patients with septic shock (P < .001), ARDS (P = .013), and a respiratory rate ≥ 35 breaths/min (P = .017) during the first day of NIV (e-Table 1).

Outcome Analysis

Hospital mortality rates were 67% in all patients, 40% in NIV-only group patients, 69% when NIV was followed by MV, and 73% in MV-only group patients (P < .001). End-of-life decisions were taken in 21% of the patients.

Table 1 depicts the factors associated with hospital mortality in the univariate analysis of the entire population. Male sex, admission due to a medical condition, disease severity (SAPS 3 and SOFA scores and use of vasopressors), metastatic solid tumor, high-grade hematologic disease, cancer active or in progression, PS 2 to 4, presence of comorbidities, low Pao_2/Fio_2 ratios, and only use of MV, as well as the need for MV after an NIV trial were associated with hospital mortality.
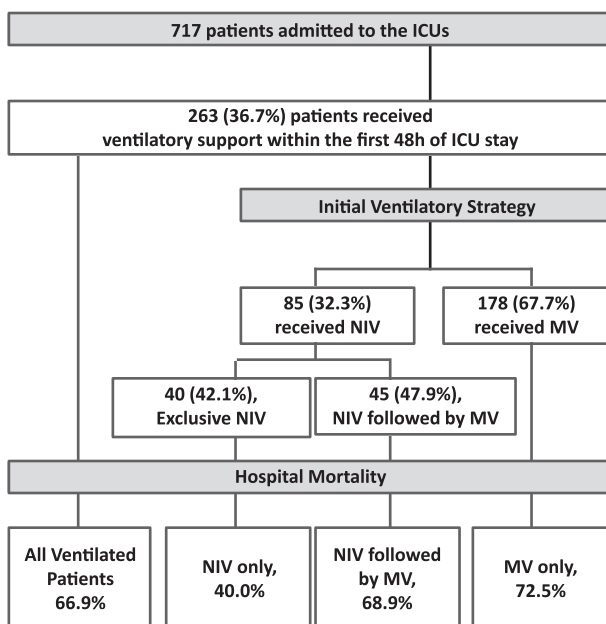
TABLE 1] Patients' Characteristics and Univariate Analysis of Predictors of Hospital Mortality

Variables	All Patients (N = 263)	Survivors (n = 87 [33%])	Nonsurvivors (n = 176 [67%])	OR (95% CI)	P Value
Age, y	62.0 ± 15.7	62.9 ± 17.8	61.6 ± 14.5	0.99 (0.98-1.01)	.520
Male sex	125 (48)	32 (37)	93 (53)	1.92 (1.14-3.26)	.020
Hospital stay before ICU admission, d	3 (0-11)	2 (0-8)	4 (0-13)	1.01 (0.99-1.03)	.114
Medical admission	175 (67)	43 (49)	132 (74)	3.07 (1.79-5.28)	<.001
SAPS 3 score, points	64.4 ± 17.4	55.9 ± 15.6	68.6 ± 16.8	1.05 (1.03-1.07)	<.001
SOFA on the first day of ICU, points	10 (8-14)	9 (7-11)	11 (8-14)	1.19 (1.10-1.29)	<.001
SOFA on the first day of ICU, excluding respiratory points	8 (6-10)	7 (5-9)	9 (7-12)	1.22 (1.11-1.33)	<.001
Type of cancer					
Locoregional solid tumor	144 (55)	62 (71)	82 (47)	1.00	.001
Metastatic solid tumor	83 (32)	16 (18)	67 (38)	3.17 (1.67-5.99)	...
Low-grade hematologic malignancy	13 (5)	6 (7)	7 (4)	0.88 (0.28-2.76)	...
High-grade hematologic malignancy	23 (9)	3 (3)	20 (11)	5.04 (1.43-7.04)	...
Cancer status					
Controlled/remission	29 (11)	14 (16)	15 (9)	1.00	.029
Active: newly diagnosed	138 (52)	50 (57)	88 (50)	1.64 (0.73-3.68)	...
Active: recurrence/progression	96 (37)	23 (26)	73 (41)	2.96 (1.25-7.04)	...
Performance status					
0-1	100 (38)	48 (55)	52 (30)	1.00	<.001
2-4	163 (62)	39 (45)	124 (70)	2.94 (1.72-5.00)	...
Neutropenia	27 (10)	5 (6)	22 (13)	2.35 (0.86-6.42)	.129
COPD	40 (15)	15 (17)	25 (14)	0.80 (0.40-1.60)	.644
Comorbidity score, ACE-27					
None/mild	120 (46)	48 (55)	52 (30)	1.00	<.001
Moderate/severe	143 (54)	39 (45)	124 (70)	2.94 (1.72-5.00)	...
Dialysis	19 (7)	4 (5)	15 (9)	1.93 (0.62-6.01)	.317
Vasopressors	98 (37)	23 (26)	75 (43)	2.07 (1.18-3.63)	.016
Ventilatory strategy category					
NIV only	40 (15)	24 (28)	16 (9)	1.00	.001
NIV followed by MV	45 (17)	10 (11)	31 (18)	3.32 (1.36-8.12)	...
MV only	178 (68)	49 (56)	129 (73)	3.95 (1.94-8.06)	...

(Continued)

TABLE 1] (continued)

Variables	All Patients (N = 263)	Survivors (n = 87 [33%])	Nonsurvivors (n = 176 [67%])	OR (95% CI)	P Value
Blood gas analysis					
Pao_2/Fio_2	236 (138-324)	256 (188-326)	212 (130-323)	0.98 (0.96-1.00)	.044
$Paco_2$, mm Hg	38 (31-46)	38 (31-46)	38 (31-47)	0.99 (0.97-1.01)	.81
Hco_3, mmol/L	20.1 (16.6-23.5)	20.7 (18.0-23.6)	20.0 (15.6-23.6)	0.98 (0.94-1.02)	.254
Lactate, mmol/L	2.1 (1.3-3.5)	2.5 (1.3-3.3)	2.0 (1.3-3.7)	1.05 (0.96-1.14)	.609
Outcome data					
ICU LOS, d	7 (4-16)	7 (4-16)	7 (5-12)	...	.344
Hospital LOS, d	19 (10-36)	19 (10-36)	20 (14-35)	...	.1532
Duration of ventilatory support, d	5 (2-12)	3 (1-7)	6 (3-13)	...	<.001
End-of-life decisions	55 (21)	0	55 (31)	...	<.001
ICU mortality	142 (54)	...	...	...	...
Hospital mortality	176 (67)	...	...	...	...

Data are presented as mean ± SD, median (25%-75% interquartile range), or No. (%). ACE-27 = Adult Comorbidity Evaluation; LOS = length of stay; MV = mechanical ventilation; NIV = noninvasive ventilation; SAPS = Simplified Acute Physiology Score; SOFA = Sequential Organ Failure Assessment.

Table 4 shows the multivariate logistic regression of variables related to hospital death. Medical admission, active underlying malignancy newly diagnosed, underlying malignancy in recurrence or progression, tumor as reason for ventilatory support, poor PS, NIV followed by MV, use of invasive MV only, and higher SOFA scores (each point except the respiratory domain, which was removed from the calculation of the score to avoid collinearity with other respiratory variables in the statistical analysis.) were independently associated with hospital mortality.

To evaluate the mortality in different and frequent clinical scenarios, Fig 2 further explores the combination of the factors associated with death in multivariate analysis. Of note, hospital survival in patients with good PS and without cancer recurrence or tumoral airway involvement was 53%.

Discussion

In the current study, we demonstrated that patients with cancer requiring ventilatory support who were admitted to ICUs may have reasonable mortality rates, especially when they have good PS and nonprogressive disease. Moreover, we determined important independent predictors of mortality in these patients, which can assist physicians in decisions relating to patients' management and the counseling of patients and families. ICU refusal of patients merely because of a cancer diagnosis is no longer supported. Previous studies have demonstrated that mortality rates in critically ill patients with cancer are not substantially different from those of other patients in the ICU with similar disease severity and other comorbidities such as heart failure, liver cirrhosis, or other severe chronic diseases.[5,25]

The variables associated with hospital mortality in the multivariate analysis may be grouped into characteristics related to cancer, PS, and severity of organ failure. In the first group, as reported previously,[10,26,27] patients with recurrent or progressive disease and direct involvement of the respiratory tract by tumor had increased mortality (Fig 2). Moreover, the occurrence of tumor-caused ARF is relatively infrequent (8%-11% in other series[4] and 12% in the patients in this study) and may be caused by neck or mediastinal bulky neoplastic disease leading to airway compression or by disseminated parenchymal disease, or lymphangitis. Either way, it is usually associated with increased mortality, except when caused by tumors highly responsive to chemotherapy.[4]

The severity of acute physiologic alterations and organ dysfunctions are other major determinants of short-term mortality,[28-30] as demonstrated in our study by the

TABLE 2] Main Reasons for the Need for Ventilatory Support

Variables	All Patients (N = 263)	Survivors (n = 87 [33%])	Nonsurvivors (n = 176 [67%])	OR (95% CI)	P Value
Severe sepsis/septic shock	169 (64)	47 (54)	122 (69)	1.92 (1.13-3.27)	.022
ARDS	80 (30)	17 (20)	63 (36)	2.30 (1.24-4.24)	.011
Tumor	32 (12)	5 (6)	27 (15)	2.97 (1.10-8.01)	.032
Coma	27 (10)	9 (10)	18 (10)	0.99 (0.42-2.23)	.999
Cardiogenic pulmonary edema	11 (4)	8 (9)	3 (2)	0.17 (0.04-0.66)	.007
Cardiopulmonary arrest	10 (4)	2 (2)	8 (5)	2.02 (0.42-9.74)	.505
Pulmonary embolism	9 (3)	0	9 (5)	...	.032
Hemoptysis/alveolar hemorrhage	4 (2)	1 (1)	3 (2)	1.49 (0.15-14.55)	.999
COPD exacerbation	4 (2)	1 (1)	3 (2)	1.49 (0.15-14.55)	.999
Other/Unknown	27 (10)	16 (18)	11 (6)	0.30 (0.13-0.70)	.004

Data are presented as No. (%).

SOFA score (excluding respiratory domain) on the first day of ICU stay. Other studies have also demonstrated that changes in the number of organ failures over the first few ICU days are closely correlated with survival.[31] Taccone et al[32] reported that the mortality rate is comparable between patients with solid cancer and general patients (27%) in the ICU. However, taking into consideration only patients presenting with more than three organ failures, mortality was higher in patients with cancer. In our study, when combined with poor disease control and compromised PS, the presence of extrarespiratory organ failures is clearly associated with mortality rates (Fig 2). In this particular high-risk group of patients, early recognition before the onset or the worsening of organ failures and provision of close monitoring and support (including early ICU referral) are essential.[6,33] It is also worth emphasizing that all the clinical predictors identified in our study as independently associated with hospital mortality are easily available and may help health personnel identify patients who may benefit from intensive care and protect others from the inappropriate use of aggressive therapies.

The nonpalliative use of NIV in patients in the ICU with cancer was assessed in our study. We observed that 53% of patients who initially received NIV were later intubated and submitted to invasive MV. Mortality rates in these patients were substantially higher in comparison with those who were ventilated with NIV only (69% vs 40%), and a subsequent need for MV after an NIV trial was independently associated with worse outcomes. Such findings are comparable to those of previous reports.[14,28] Moreover, in our study, patients with sepsis, ARDS, and a respiratory rate ≥ 35 breaths/min at baseline were more prone to be subsequently intubated after an initial trial of NIV, which suggests that the decision to offer NIV in these cases should be more judicious.

The use of NIV has been increasing significantly in patients with cancer, and its use had a protective effect in most,[13,14,31,34] but not all,[29,35] studies. It is possible that delayed intubation in this severely ill subgroup of patients may have accounted for their grim prognosis, because it is recognized as an independent risk factor for the use of MV after NIV.[9,36] However, very few studies adjusted the association of NIV as initial ventilatory support according to disease severity,[13,31,35] as we did in the current study using a propensity score. When corrected for disease severity and baseline characteristics, the use of NIV is commonly reported to be beneficial.[16,28] Nonetheless, our study was not specifically designed to evaluate the clinical scenarios of NIV use and risk factors for NIV failure. The need for invasive MV after an NIV trial in patients with cancer is a complex phenomenon that incorporates the variables relating to the underlying malignancy, the acute complication leading to the need for ventilatory support, and the patient's evolution during the first days of NIV support. In addition, the decision to start, cease, or change the ventilatory strategy was left to the discretion of the attending team. Therefore, the results of the current study preclude us from drawing definite recommendations to choose the most appropriate ventilatory strategy for patients with cancer and respiratory failure.

TABLE 3] Patients' Characteristics and Outcomes According to the Initial Ventilatory Strategy

Variables	Invasive MV (n = 178 [68%])	NIV (n = 85 [32%])	P Value
Age, y	62.0 ± 14.7	62.0 ± 17.2	.994
Male sex	83 (47)	42 (49)	.771
Hospital stay before ICU admission, d	3 (0-11)	3 (0-10)	.701
Medical admission	109 (61)	66 (78)	.012
SAPS 3 score, points	64.9 ± 17.5	63.3 ± 17.4	.507
SOFA on the first day of ICU, points	11 (8-14)	9 (7-11)	<.001
SOFA on the first day of ICU, excluding respiratory points	9 (7-12)	7 (5-9)	<.001
Type of cancer			
Locoregional solid tumor	111 (62)	33 (39)	.001
Metastatic solid tumor	47 (26)	36 (42)	...
Low-grade hematologic malignancy	5 (3)	8 (9)	...
High-grade hematologic malignancy	15 (8)	8 (9)	...
Cancer status			
Controlled/remission	20 (11)	9 (11)	.387
Active: newly diagnosed	98(55)	40 (47)	...
Active: recurrence/progression	60 (34)	36 (42)	...
Performance status			
0-1	66 (37)	34 (40)	.748
2-4	112 (63)	51 (60)	...
Neutropenia	19 (11)	14 (17)	.259
Comorbidity score (ACE-27)			
None/mild	82 (46)	38 (45)	.940
Moderate/severe	96 (54)	47 (55)	...
COPD	26 (15)	14 (17)	...
Dialysis	43 (24)	9 (11)	.016
Vasopressors	142 (75)	36 (42)	<.001
Reasons for ventilatory support			
Severe sepsis/septic shock	116 (65)	53 (62)	.758
ARDS	64 (36)	16 (18)	.007
Tumor	18 (10)	14 (16)	.203
Pulmonary embolism	6 (3)	3 (4)	.999
Cardiogenic pulmonary edema	2 (1)	9 (11)	.001
Blood gas analysis			
Pao_2/Fio_2	232 (127-327)	241 (180-315)	.147
$Paco_2$, mm Hg	39 (31-47)	36 (30-45)	.296
Hco_3, mmol/L	19.5 (15.9-23.0)	21.0 (18.4-24.0)	.030
Lactate, mmol/L	2.4 (1.4-4.1)	1.9 (1.3-2.8)	.045
Outcome data			
ICU LOS, d	9 (5-19)	6 (3-12)	.001
Hospital LOS, d	20 (10-37)	19 (11-34)	.655
Duration of ventilatory support, d	6 (3-13)	3 (1-6)	<.001
End-of-life decisions	33 (19)	22 (26)	.227
ICU mortality	110 (62)	32 (38)	<.001
Hospital mortality	129 (73)	47 (55)	.009

Data are presented as mean ± SD, median (25%-75% interquartile range), or No. (%). See Table 1 for expansion of abbreviations.

TABLE 4] Multivariate Analysis of Predictors of Hospital Mortality in all Patients in Need of Ventilatory Support (N = 263)

Variables	Coefficients	OR (95% CI)	P Value
Medical admission			
No	...	1.00	...
Yes	1.534	4.64 (2.22-9.71)	<.001
Cancer status			
Controlled/remission	...	1.00	...
Active: newly diagnosed	1.279	3.59 (1.28-10.10)	.015
Active: recurrence/progression	1.301	3.67 (1.25-10.81)	.018
Tumor as a reason for ventilatory support	1.395	4.04 (1.30-12.56)	.016
Performance status			
0-1	...	1.00	...
2-4	0.870	2.39 (1.24-4.59)	.009
Ventilatory strategy category			
NIV only	...	1.00	...
NIV followed by MV	1.091	3.00 (1.09-8.18)	.034
MV only	1.260	3.53 (1.45-8.60)	.006
Pao_2/Fio_2			
≥300	...	1.00	...
150 to <300	−0.073	0.93 (0.46-1.88)	.839
<150	0.462	1.59 (0.67-3.79)	.297
SOFA on the first day of ICU, excluding respiratory points	0.145	1.15 (1.03-1.29)	.015
Propensity score for the use of NIV	−0.014	0.99 (0.97-1.01)	.203
Constant	−3.842	...	...

Hosmer-Lemeshow goodness-of-fit ($\chi^2 = 7.169$; $P = .519$). See Table 1 for expansion of abbreviations.
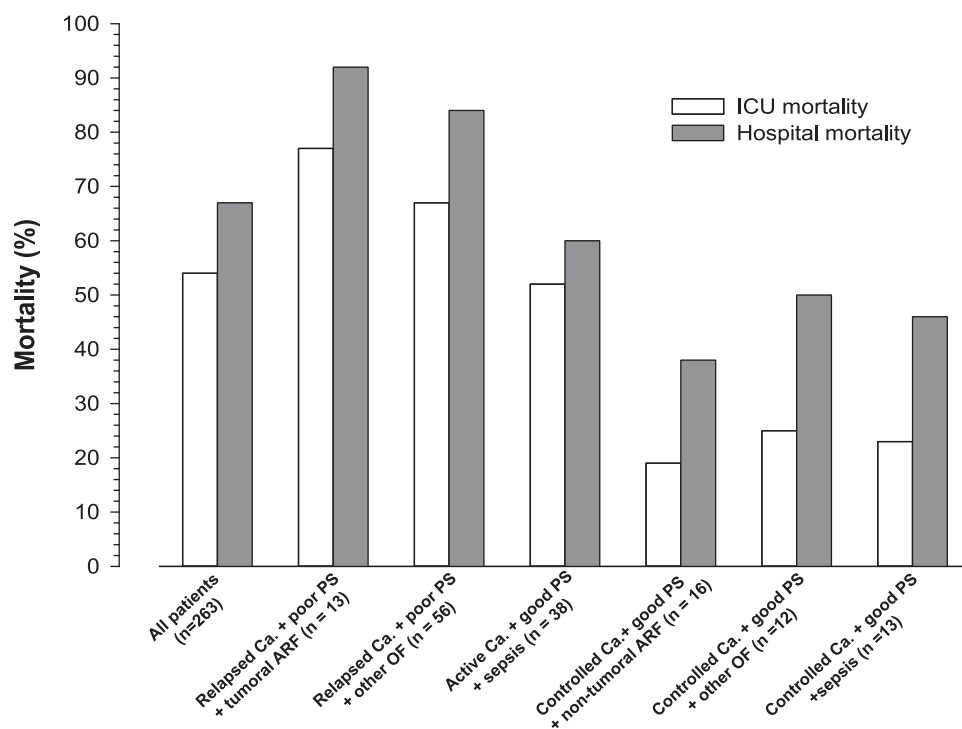

Figure 2 – ICU and hospital mortality rates for the different subgroups of patients with cancer and need for ventilatory support. ARF = acute respiratory failure; Ca = cancer; OF = organ failure; PS = performance status.

As a secondary analysis, the current study has some inherent additional limitations. Patients with hematologic malignancies and those who have undergone a bone marrow transplant were underrepresented. Therefore, caution is needed when extrapolating our results to these subgroups of patients. On the other hand, because most of the included patients were admitted to general ICUs, the external validity of our results may be more significant compared with studies carried out in oncology-specialized ICUs.

Conclusions

In conclusion, mortality rates in critically ill patients with cancer requiring ventilatory support remain relatively high. Patients with good PS and nonprogressive disease requiring ventilatory support should receive full intensive care, because one-half of these patients survive. On the other hand, the provision of palliative care should be considered the main goal for patients with poor PS and progressive underlying malignancy.

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