Cancer patients admitted to intensive care unit – a six-year retrospective analysis

Onkologičtí pacienti přijatí na jednotku intenzivní péče – šestiletá retrospektivní analýza

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Summary

Background: Literature about critically ill cancer patients admitted to intensive care units (ICUs) is scarce. The decision to recommend ICU admission is complex and usually involves many subjective factors, making it an intricate issue for both medical oncologists and intensive care physicians. As oncologic and supportive measure treatments improve, a question that becomes increasingly relevant is which patients should be admitted to the ICU, as the natural history of cancer is clearly shifting and newer admission parameters should be established. ***Material and methods:*** We performed a retrospective analysis of all patients with a diagnosed malignancy admitted to our ICU from 2008 to 2014. Data were collected from electronic medical records and analyzed to establish factors associated with outcomes including length of stay, complications, mechanical ventilation requirements, and mortality. ***Results:*** We surveyed a total of 165 consecutive patients, of which 79 (47.9%) were female and 86 (52.1%) were male. Patients with solid tumors (N = 93) were significantly older than those with non-solid tumors (N = 68) (60.12 ± 15.86 vs. 45.43 ± 17.42 years; P < 0.001). The most common reason for ICU admission was respiratory failure (55.76%), followed by septic shock (21.82%). Mechanical ventilation was strongly associated with mortality (P < 0.001), with 98.2% of deaths occurring in ventilated patients. Complications during ICU stay were associated with significantly longer length of stay (P < 0.001), particularly for patients with solid tumors. ***Conclusion:*** Given the high heterogeneity of cancer patients, it is difficult to establish definitive guidelines for ICU admission. Our findings demonstrate that traditional criteria such as age or tumor type alone should not determine ICU admission decisions. Instead, decisions should be based on comprehensive clinical judgment for each individual case. Further studies are warranted to develop evidence-based guidelines for critically ill cancer patients.

Key words

cancer – critical care – intensive care unit – mechanical ventilation – mortality – oncology

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Souhrn

Východiska: Literatura o onkologických pacientech v kritickém stavu přijatých na jednotky intenzivní péče (JIP) je velmi omezená. Rozhodnutí doporučit přijetí na JIP je složité a obvykle zahrnuje mnoho subjektivních faktorů, což z něj činí složitou otázku jak pro onkology, tak pro lékaře intenzivní péče. Se zlepšením onkologické a podpůrné léčby se stále více dostává do popředí otázka, kteří pacienti by měli být na JIP přijati, protože přirozený průběh onkologického onemocnění se zjevně mění a je třeba stanovit nové parametry pro přijetí. ***Materiál a metody:*** Provedli jsme retrospektivní analýzu všech pacientů s diagnostikovaným zhoubným nádorem přijatých na naši JIP v letech 2008–2014. Data byla shromážděna z elektronických zdravotních záznamů a analyzována s cílem určit faktory souvisejících s výsledky, vč. délky pobytu, komplikací, požadavků na mechanickou ventilaci a mortality. ***Výsledky:*** Zkoumali jsme celkem 165 po sobě jdoucích pacientů, z nichž 79 (47,9 %) byly ženy a 86 (52,1 %) muži. Pacienti se solidními nádory (n = 93) byli významně starší než pacienti s ostatními nádory (n = 68) (60,12 ± 15,86 vs. 45,43 ± 17,42 let; p < 0,001). Nejčastějším důvodem přijetí na JIP bylo respirační selhání (55,76 %), následované septickým šokem (21,82 %). Mezi mechanickou ventilací a mortalitou byla silná spojitost (p < 0,001), přičemž k 98,2 % úmrtím došlo u ventilovaných pacientů. Komplikace během pobytu na JIP byly spojeny s významně delším trváním pobytu (p < 0,001), zejména u pacientů se solidními nádory. ***Závěr:*** Vzhledem k vysoké heterogenitě onkologických pacientů je obtížné stanovit definitivní pokyny pro přijetí na JIP. Naše zjištění ukazují, že tradiční kritéria, jako je věk nebo typ nádoru, by sama o sobě o přijetí na JIP neměla rozhodovat. Místo toho by rozhodnutí mělo být založeno na komplexním klinickém posouzení každého jednotlivého případu. K vypracování doporučených postupů založených na důkazech pro onkologické pacienty v kritickém stavu je zapotřebí dalších studií.

Klíčová slova

nádorové onemocnění – kritická péče – jednotka intenzivní péče – mechanická ventilace – mortalita – onkologie

Introduction

Cancer patients experiencing life-threatening complications often require intensive care for optimal management. However, literature about critically ill cancer patients admitted to intensive care units (ICUs) remains limited despite growing clinical relevance. The decision to recommend ICU admission is complex [1] and usually involves many subjective factors, making it an intricate issue for both medical oncologists and intensive care physicians. Historically, many independent reasons have been cited for refusing to admit cancer patients to ICUs, including limited bed availability, resource allocation concerns, and ICU physician seniority [2].

During the past decades, cancer survival rates have improved exponentially due to better strategies in both early [3,4] and advanced disease settings [5,6], thus changing the natural course of many malignancies. Recent advances in targeted therapies, immunotherapy, and precision medicine have revolutionized cancer care, resulting in unprecedented survival rates even for previously fatal malignancies [7–9]. As a consequence, a logical question that becomes increasingly relevant is which cancer patients should be admitted to the ICU, as the natural history of the disease is clearly shifting and newer admission parameters need to be established.

Traditionally, cancer patients were often denied ICU admission based on assumptions of poor prognosis and limited benefit from intensive care interventions. However, contemporary studies have shown that selected cancer patients can benefit substantially from ICU care, with improving survival rates over time [10–12]. A large multicenter study by Azoulay et al. (2019) demonstrated that ICU mortality for cancer patients has decreased from approximately 50% in the 1990s to 20-30% in recent years [13]. Factors such as performance status, extent of disease, response to therapy, comorbidities, and the nature of the acute illness are increasingly recognized as more relevant prognostic indicators than the mere presence of cancer [14,15].

The changing landscape of cancer care has prompted a reevaluation of ICU triage decisions for cancer patients. Recent consensus guidelines suggest that „ICU trial" periods may benefit patients with uncertain prognosis, allowing time-limited intensive care with reassessment after 3–5 days [16,17]. Furthermore, early integration of palliative care specialists in ICU decision-making has been shown to improve both quality of care and resource utilization [18].

Despite these advances, significant variation remains in ICU admission practices for cancer patients across different institutions and countries. While some centers have developed specialized oncologic ICUs, others continue to apply restrictive admission policies based on outdated outcome data [19]. This inconsistency highlights the need for contemporary, evidence-based guidelines that reflect the improved prognosis of many cancer patients in the modern era.

The aim of this study was to perform a retrospective analysis of all patients with a diagnosed malignancy admitted to our ICU from 2008 to 2014 in order to establish factors associated with outcomes and to contribute to the development of evidence-based guidelines for ICU admission of cancer patients.

Methods

Study design and patient population

A retrospective cohort study was conducted by reviewing the electronic medical records of all adult patients admitted to the ICU at Hospital Santo Antonio, Blumenau, Santa Catarina, Brazil, from January 2008 to December 2014. Every adult patient was screened, and those diagnosed with a malignancy (either previously or during inpatient care) were included in the study.

Data collection

For each eligible patient, we collected demographic data including age and gender, type of malignancy (categorized

as solid or non-solid tumors), reason for ICU admission, length of ICU stay, development of complications (with particular focus on need for dialysis), requirement for mechanical ventilation, and outcome (ICU discharge or death).

Statistical analysis

Data were organized in tables containing absolute and relative frequencies, means, standard deviations, and estimates with 95% confidence intervals. To compare the frequencies within a distribution, we used the Chi-square adherence test. To compare tumor types with respect to continuous variables (length of stay and age), we used the Student's t-test for independent samples.

To compare the subgroups formed by the association of variables „type of tumor" and „complication" in the analysis of quantitative variables (length of stay and age), we used two-factor ANOVA. To correlate the length of stay with patient age, we used Pearson's linear correlation test. The associations between mechanical ventilation and complications, as well as between mechanical ventilation and outcome, were analyzed using the Chi-square independence test.

In all tests, results were considered statistically significant when the P-value was less than 0.05. Statistical analyses were performed using appropriate statistical software.

Results

Demographic and clinical characteristics

We surveyed a total of 165 consecutive patients of which 79 (47.9%) were female and 86 (52.1%) were male. According to the Chi-square test, both sexes presented with equivalent frequencies (P = 0.5858).

Of the 165 patients, 93 (56.4%) had solid tumors, 68 (41.2%) had non-solid tumors (hematological malignancies), and 4 (2.4%) had undisclosed tumor types.

Length of stay and age by tumor type

The types of tumor, when compared by the Student's t-test for independent samples, showed no significant differences with respect to the length of stay in the ICU (8.8 ± 12.04 days for solid tumors vs. 6.26 ± 7.55 days for non-solid tumors; P = 0.1042). However, patients in the solid tumor group were significantly older than those in the non-solid tumor group (60.12 ± 15.86 years vs. 45.43 ± 17.42 years; P < 0.001) (Tab. 1).

We also performed the Pearson correlation test between length of stay in days and age, which yielded a correlation of 16.2% (P = 0.03). This correlation was considered non-existent because R < 20%. Thus, the length of stay of patients in the ICU was not substantially correlated with age (Tab. 2).

Tab. 1. Comparison between the types of tumor: „solid" and „non-solid" with respect to length of stay and age of patients.

Characteristic	Solid (N = 93)	Non-solid (N = 68)	P-value
length of stay (days)	8.8 ± 12.04	6.26 ± 7.55	0.1042
age (years)	60.12 ± 15.86	45.43 ± 17.42	< 0.001**

*Student's t-test for independent groups. Data presented as mean ± standard deviation (SD).
**Statistically significant difference (P < 0.05).

Tab. 2. Pearson linear correlation between length of stay and patient age.

Variables	Mean ± SD	Correlation (R)	P-value
length of stay (days)	8.8 ± 12.04	16.2%	0.03*
age (years)	60.12 ± 15.86		

Pearson's correlation coefficient (R) = 0.162. Although statistically significant (P < 0.05), the correlation is considered clinically negligible as R < 0.20 (correlation strength < 20%).

Complications and mechanical ventilation

According to the Chi-square independence test performed (Tab. 3), there was no significant association between mechanical ventilation and renal failure requiring dialysis (P = 0.8992).

Tab. 3. Association between mechanical ventilation and complications of patients.

Mechanical Ventilation	Complication (dialysis)	No complication	Total	P-value
yes	25 (86.2%)	116 (85.3%)	141 (85.5%)	0.8992
no	4 (13.8%)	20 (14.7%)	24 (14.5%)	
total	29 (100%)	136 (100%)	165 (100%)	

Chi-square test of independence. Data presented as N (%). No significant association between mechanical ventilation and need for dialysis was found (P = 0.8992).

Tab. 4. Association between mechanical ventilation and outcome of hospitalization.

Mechanical Ventilation	ICU discharge	Death	Total	P-value
yes	34 (60.7%)	107 (98.2%)	141 (85.5%)	< 0.001**
no	22 (39.3%)	2 (1.8%)	24 (14.5%)	
total	56 (100%)	109 (100%)	165 (100%)	

*Chi-square test of independence, data presented as N (%).
**Highly significant association between mechanical ventilation and mortality (P < 0.001), with 98.2% of deaths occurring in ventilated patients.
ICU – intensive care unit

Tab. 5. Association between reasons for admission and type of tumor.

Reason for ICU admission	Solid (N = 93)	Non-solid (N = 68)	Non-informed (N = 4)	Total (N = 165)	P-value
respiratory failure	49 (52.69%)	40 (58.82%)	3 (75%)	92 (55.76%)	0.087
septic shock	20 (21.51%)	16 (23.53%)	–	36 (21.82%)	
hypovolemic shock	6 (6.45%)	4 (5.88%)	–	10 (6.06%)	
acute renal failure	6 (6.45%)	4 (5.88%)	–	10 (6.06%)	
sepsis	4 (4.3%)	–	–	4 (2.42%)	
febrile neutropenia	1 (1.08%)	2 (2.94%)	–	3 (1.82%)	
acute worsening of chronic renal failure	2 (2.15%)	–	–	2 (1.21%)	
intestinal obstruction	2 (2.15%)	–	–	2 (1.21%)	
loss of consciousness	–	1 (1.47%)	1 (25%)	2 (1.21%)	
ischemic stroke	1 (1.08%)	–	–	1 (0.61%)	
convulsion	–	1 (1.47%)	–	1 (0.61%)	
hypertensive crisis	1 (1.08%)	–	–	1 (0.61%)	
acute myocardial infarction	1 (1.08%)	–	–	1 (0.61%)	
total	93 (100%)	68 (100%)	4 (100%)	165 (100%)	

Chi-square test of independence. Data presented as N (%). No significant association was found between reason for ICU admission and tumor type (P = 0.087).
ICU – intensive care unit

One of our most important findings is that mechanical ventilation was directly associated with mortality (P < 0.001) (Tab. 4). Of the 109 patients who died, 107 (98.2%) required mechanical ventilation.

Reasons for ICU admission

As shown in Tab. 5, the reasons for ICU admission were not significantly associated with the type of tumor (P > 0.05), meaning no specific type of cancer was more likely to need intensive care at any point of the disease.

Complications, length of stay, and age

The analysis performed by two-factor ANOVA showed the following results (Tab. 6):

1. Patients with complications had significantly longer ICU stays than those without complications (P < 0.001). This effect was more pronounced in patients with solid tumors (20.82 ± 25.74 days) compared to those with non-solid tumors (7.44 ± 6.89 days).
2. The age of patients was equivalent in those with and without complications (P = 0.392). However, patients with solid tumors were significantly older than those with non-solid tumors across both complication groups (P = 0.002).

Clinical standards based solely on the presence of malignancy are outdated and should not be used in contemporary practice. We propose that no single criterion such as age or stage of disease should be taken as absolute. Instead, decisions should be based on comprehensive clinical judgment for each indi-

vidual case, taking into account factors such as performance status, comorbidities, cancer prognosis, response to oncologic treatment, and the nature and reversibility of the acute illness.

Conclusion

Our six-year retrospective analysis of cancer patients admitted to the ICU demonstrates that mechanical ventilation is strongly associated with mortality in this population. We found no correlation between age and length of ICU stay, suggesting that age alone should not be a determining factor for ICU admission. The reasons for ICU admission were similar between solid and non-solid tumor patients, indicating that the type of malignancy does not predispose patients to specific acute complications requiring intensive care.

Based on our findings, we recommend that ICU admission decisions for cancer patients should be individualized, taking into account multiple factors rather than relying on single criteria such as age or type of malignancy. Further prospective studies with larger cohorts and more detailed clinical parameters are warranted to develop evidence-based guidelines for the selection of cancer patients who are likely to benefit from intensive care.

Tab. 6. Comparison between patient groups with and without complications and type of solid tumor by two-factor ANOVA regarding the length of stay in days and age in years.

	Solid tumors (N = 93)	Non-solid tumors (N = 68)	P-value (tumor type)
Length of stay (days)			
with complications	11 (20.82 ± 25.74)	16 (7.44 ± 6.89)	< 0.001**
without complications	82 (7.18 ± 7.79)	52 (5.9 ± 7.77)	
P-value (complication status)	< 0.001**		
Age (years)			
with complications	11 (53.36 ± 19.94)	16 (46.63 ± 17.52)	0.392
without complications	82 (61.02 ± 15.16)	52 (45.06 ± 17.55)	
P-value (tumor type)	0.002**		

*Two-factor ANOVA. Data presented as N (mean ± standard deviation).

**Statistically significant difference (P < 0.05).

Key findings: 1) Patients with complications had significantly longer ICU stays compared to those without complications (P < 0.001); 2) this effect was more pronounced in patients with solid tumors (20.82 vs 7.18 days); 3) patient age was not significantly different based on complication status (P = 0.392); 4) patients with solid tumors were significantly older than those with non-solid tumors (P = 0.002).

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